

Digitized by the Internet Archive
in 2010 with funding from
University of Toronto

http://www.archive.org/details/railwayage40newy

Railway age

FORTIETH QUARTO VOLUME

229

From January 1, 1906, to June 30, 1906

RAILROAD GAZETTE

A JOURNAL OF TRANSPORTATION, ENGINEERING AND RAILROAD NEWS

(Established in April, 1856)

FIFTY-FIRST YEAR

106961
20.12.10

NEW YORK - - 83 FULTON STREET

1906

INDEX

Fortieth Quarto Volume—January 1, 1906, to June 30, 1906

AUTHORS

Akerlind, A. G., 602
Arkenburgh, W. H., 348
Armour, J. Ogden, 64, 93, 106 (G. N. S.)

Baker, Ray Stannard, 186
Bakewell, Allan, 10
Ball, H. F., 702
Barnum, M. K., 143
Basford, G. M., 581
Bennett, L. E., 21, 178, 226, 550
Betts, E. E., 166, 167
Beuhring, W. D., 447
Boardman, Bradford, 593
Brazier, F. W., 669
Brown, W. C., 533
Buker, J. E., 662

Campbell, G. M., 365
Campbell, G. M., 313
Cantillon, W. D., 85
Carter, F. W., 189
Caruthers, C. H., 116, 655
Chaffee, E. F., 668
Churchward, J. G., 508
Clausen, L. R., 488
Corey, F. B., 352
Corey, H. T., 386
Cozad, William S., 391
Crawford, Thomas F., 8, 32
Creelman, James, 519
Crowley, C. J., 285
Currier, W. W., 402

Davison Ralph C., 245, 593
De Kando K., 414, 425
Dewsnup, Prof. E. R., 160, 216
Dixon, Frank Haigh, 83
Drake, W. A., 398
Dudley, S. W., 521

Evans, William P., 460

Faulkner, E. O., 436, 474
Foraker, Joseph B., 232
Fowler George L., 274, 359, 641, 667, 700

Goodchild, A. A., 65
Goodwin, John M., 79
Gordon, Reginald, 648
Goss, Prof. W. F. M., 699
Griffin, P. H., 580

Hadley, Arthur T., 199
Hatt, Prof. W. K., 670
Henderson, George R., 10, 38, 94, 112, 125
Hild, F. W., 556
Hill, J. J., 3 (G. N. S.), 494
Hitt, Rodney, 259
Howe, Malverd A., 502
Hoy, W. W., 501, 547
Hungerford, W. C., 92
Hutchins, F. Lincoln, 119
Hutton, Prof. F. R., 368

Isaacs, John D., 606

Jamieson, R. R., 235
Johnson, Henry, 8

Kennedy, William P., 605
Ketcham, C. H., 79
Killam, Hon. A. C., 510
King, Charles R., 54
Koyl, C. Herschel, 589
Kruttschnitt, Julius, 436

Lamme, B. G., 302, 379
Leighty, J. R., 125
Lewis, H. W., 487
Lodge, Henry Cabot, 180
Low, Theodore, 348
Luten, Daniel B., 402

McCrea, James, 154
McDill, George D., 464
McHattie, Thomas, 520
McHenry, E. H., 197
McKeen, W. R., Jr., 652
Macaulay, John, 170 (G. N. S.)
MacCart, W. A., 141
Marpole, R., 237
Meekere, Royal, 71
Mellen, Charles S., 322, 439
Merrell, G. W., 297
Miller, E. A., 701
Miller, S. F., 91
Mitchell, Thomas W., 541
Moseley, E. A., 670
Muhlfeld, J. E., 175, 655

North, Edward P., 78

Ommelange, E., 164
Osgood, J. O., 43

Paley, W. B., 167, 554
Parsons, William Barclay, 204
Pedrick, W. E., 45
Philips, J. H., 356
Pratt, C. M., 530
Prouty, Hon. Charles A., 329

Rankin, Hugh, 270
Ray, Charles F., 402
Raymond, William G., 297
Reeve, Sidney A., 172
Resseman, P. W., 402
Rice, E. W., Jr., 10
Rice, George S., 406
Richards, R. C., 476
Roosevelt, Theodore, 183
Rowe, Charles E., 8.

Seley, C. A., 700
Slack, F. T., 401
Smith, Frank Fairer, 34
Smith, Harry C., 404
Soper, George A., 74 (G. N. S.)
Spangler, W. N., 301
Spera, Ing. Comm. Giuseppe, 185, 712
Sprague Frank J., 8, 10, 328
Stockall, Arthur, 47
Stickney, A. B., 120, 358
Stuart, J. C., 619
Stubbs, J. C., 592
Stucki, A., 173, 600
Swain, Prof. G. F., 407
Symons, W. E., 572

Temple, E. B., 199
Tinker, George H., 299
Townley, Calvert, 327

Vaughan, H. H., 423

Waldo, Fullerton L., 200, 399
Waldron, J. M., 472
Wallace, John F., 134, 203, 382
Warne, Frank, Julian, 377
Wells, M. E., 62
West, George W., 700
Whinery, S., 245, 322
Whyte, William, 235
Wilgus, W. J., 10, 308, 374
Wille, H. V., 644
Winkel, M. A., 545
Worthington, B. A., 148
Wynne, J. H., 135

GENERAL INDEX

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus‡; General News Section References thus* (G. N. S.).]

A

Accidents:
A., T. & S. F., Derailment, 75 (G. N. S.)
Baker Bridge Collision, 49†, 146†
British, in 1905, 125 (G. N. S.)
Brooklyn Elevated, 91*
Claims (See Claims)
Cleckheaton, Eng., Lancashire & Yorkshire, 65 (G. N. S.)
Collision in Spite of Automatic Stop, 32, 319† (G. N. S.)
Defective Equipment and Carelessness, 208
Denver & Rio Grande, Adobe, Colo., 293†, 313, 348‡
Duration of Delays Should be Announced, 445†
Gov't Bulletins, No. 17, 97†, 110; No. 18, 466†, 478
Grade Crossing; Engine Backward, 100†
Great Central (England), 86 (G. N. S.)
Great Eastern of England, 244†
How to Avoid Them, 14, 187, 208, 432
Injuries to Employees, 187, 208, 432
Injuries to Passengers, 14
L. & N., Louisville, Ky., 157 (G. N. S.)
Metropolitan District of London, 319†
Midland Ry., England, 465†
Monthly Summaries, Dec., 1905, 76†, 95; Jan., 1906, 171†, 191; Feb., 1906, 319†, 343; Mar., 1906, 420†, 437; Apr., 1906, 515† 530; May, 1906, 659†, 688
Newspaper Accounts of, 124†
Penna. R. R., Clover Creek Junction, 481, 489†, 519‡
Photograph of a Collision, 94* (G. N. S.)
Prussian State Railroads, 95
S. A. L. at Blaney, 193†
Weak Cars in Passenger Trains, 172‡
Wheels, Bad, 561†
Acme Chain Hoist, 48*
Acme Machinery Co.:
Rotary Thread Rolling Machine, 113*
Acme Metallic Weather-Strip, 170* (G. N. S.)
Advance Information of Presidential Utterances, 471‡
Advertising: Technical Publicity Assoc., 109 (G. N. S.)
Africa:
Cape to Cairo, 39 (G. N. S.), 132 (G. N. S.)
Air Brake (See Brake)
Allis-Chalmers Co.:
Elec. Equip., L. & N. Shops, 231
Flat Car, 100-Ton Capacity, 456*
American Car & Foundry Company:
Steel Cars for the London Underground, 23 (G. N. S.)
American Eng. & M. of W. Assoc.:
Convention Exhibits, 341
American Locomotive Co.:
Advantages of Four-Cyl. Bal. Comp., 252
American, C. of N. J., 56*
Consol. Loco., N. Y. Cent. Lines, 613
Pacific Locomotive B. & O., 617
Pennsylvania, Atlantic Type Loco., 17*
Pennsylvania, Consolidation Type Loco., 17*
Pennsylvania, Prairie Type Loco., 17*
American Railway Association:
Semi-Annual Meeting, 448
American Railway Engineering and Maintenance of Way Association:
Convention; Committee Reports, 332*
Convention Exhibits, 341
American Railway Master Mechanics' Association:
Committee Reports, 673
Committee Work, 610†
Convention, 657†, 690†
Convention, Address of President Ball, 702*
Convention Plans, 1906, 106*
Convention Exhibits, 639, 690, 671*, Inset
Conventions, Topical Discussions, 699
Convention Programme, 616
Reports of Committees, 693
American Railway Signal Company:
Electric Semaphore, 312*
American Society for Testing Materials:
Annual Meeting, 714
American Society of Mechanical Engineers:
Prof. Hutton's Resignation, 368
Anderson Automatic Valve and Water Column, 654*
Annual Meetings (See Corporation Names)
Annual Reports (See Corporation Names)
Anthracite Coal Strike Commission:
Report, 370†
Arabia, New Railroads in, 488
Arch (See Bridge)
Armour Car Lines, 64, 106, 186*, 58 (G. N. S.), 93 (G. N. S.)
Ashpit:
Arrangement at Term. Yard, 141*
Handling Engines at, 639
Handling Plant:
A., T. & S. F., Argentine, Kan., 656*
Association (See Association Names):
Assoc. of Ry. Tel. Supts., Annual Convention, 711
A., T. & S. F.:
Ash-Handling Plant, 656*
Ruling Grades, 441†, 451*
A., T. & S. F.—(*Continued*):
Altitudes and Day and Night, Chicago to California, shown Graphically, 549*
Bal. Comp. Locomotive, 647*
Derailment, 75 (G. N. S.)
Rebates on Coal, 223‡
Reinforced Concrete Elevated Roadway at Oklahoma City, 364*
Tie Removals and Renewals, 474
Atlantic Coast Line R. R.:
Phosphate Cars, 577*
Atlantic Coast Line System, Mileage of, 467†
Automobile:
Fast Time at Ormond, 101†
Pennsylvania, Automobile Highway, 87 (G. N. S.)
Prussian State Railroads, Stage Service, 113
Testing Plant, Purdue University, 92*

B

Baggage:
Check for Baggage on Storage, 500*
Smashing, 492†
Baker Street & Waterloo, 82 (G. N. S.), 101 (G. N. S.), 118* (G. N. S.)
Baldwin Locomotive Works:
Atlantic Type Loco. Pennsylvania, 16*
Balanced Compound Locomotives, 609†, 644*
Output in Five Months, 169 (G. N. S.)
Pacific Locomotive for Southern Ry., 715*
Baltimore & Ohio:
All-Electric Interlocking at Elsmere Junction, 481*
Electric Locomotives, 617*
Mallet Compound Locomotive, 617*
Motive Power Equipment, 616*
Pacific Locomotive, 617*
Pier at Locust Point, 110 (G. N. S.)
Refrigerator Car, 565*
Switching Locomotive, 616†
West Virginia Coal Shippers, 66 (G. N. S.)
Bearing (See Side Bearing)
Beecham Car Transcribing System, 114*
Bessemer & Lake Erie:
Annual Report, 513†, 517†*
Blaw Collapsible Steel Centering for Concrete Culverts, 151* (G. N. S.)
Blower, Sturtevant High-Pressure, 32* (G. N. S.)
Boiler (See Locomotive Boiler)
Bolivia:
Proposed Railroads in, 66 (G. N. S.)
Bolt, "Bull Dog" Lock-Nut, 184* (G. N. S.)
Boston & Maine:
Annual Report, 4†
Compared with N. Y., N. H. & H., 4†
Pensions, 3 (G. N. S.)
Boundless West, The, 592
Brake:
Buffalo Forged Steel Fulcrum for Vanderbilt Brake-Beam, 183* (G. N. S.)
Davis Solid Truss Brake-Beam, 619*
Sauvage Air-Brake, Test of, 359*
Straight-Air, General Elec. Co., 144*
Tests of Brake-Beams, 691‡*
Westinghouse "K" Triple Valve, 314*
What Stops a Moving Train, 521
Brakeman (See Employee)
"Break the Railroads' Throttling Grip," 492†
Bridge:
C. & E. I., Reinforced Concrete, 388*
East River, N. Y. City, 1†
"Horseshoe" Concrete Arches, 402*
Housatonic River, N. Y., N. H. & H., 323*
Manhattan, New York City, 489†, 490†
L. E. & W., Wabash River, 520*
Nor. Pac., at Bismarck, N. Dak., 174*, 197‡
Reinforced Concrete Highway, C., C., C. & St. L., 496*
Reinforced Concrete Trestle, C., B. & Q., 713*
Scherzer Bascule, 82 (G. N. S.)
Strauss Bascule Bridges, 286*
Trestle, Denver, Northwestern & Pacific, 503*
Brill (J. G.) Co.:
Dining Car, Rural Tramway, Buenos Ayres, 498*
Strang Gasolene-Electric Motor Car, 169†, 188*
British (See also England):
Accidents in 1905, 125 (G. N. S.)
Loco. Engineering in 1905, 41 (G. N. S.)
Brooklyn Rapid Transit:
Accident at Power House, 445†
Brooklyn Subway, 274*
Brotherhood of Locomotive Engineers:
Protest to N. Y. State R. R. Commission, 196†
Brown Sphinx Company:
Switch Stand, 82* (G. N. S.)
Brown, William H., 198*
Buenos Ayres, Dining Car for Rural Tramway, 498*
Buffalo Brake-Beam Co.:
Forged Steel Fulcrum, 183* (G. N. S.)
Business Situation (See also Finance):
Boundless West, 592
Hill (J. J.) on, 3 (G. N. S.)
Outlook for 1906, 29†
Butler Drawbar Attachment Company:
Piper Friction Draft Rigging, 119*

C

Canada:
Hill System Extensions, 491† 494, 513†, 657†
Proposed Subsidies, 185 (G. N. S.)
Railroad Notes, 119, 458, 487, 495, 560, 608
Railroad Regulation, 510
Canada Car Company:
New Shops at Montreal, 584*
Canadian Pacific:
Ruling Grades, 441†, 451*
Superheated Steam on, 417†, 423
Ticket for Passage Around the World, 31 (G. N. S.)
Train Statistics, 65*
Winnipeg Shops, 40*
Year's Problems Epitomized, 235, 242†
Canals:
Panama (See Panama Canal)
Sault Ste. Marie, 604*
Teltow, Germany, 177 (G. N. S.)
Cape to Cairo Railroad, 39, 132 (G. N. S.)
Cars:
All-Steel, Maintenance Economy of, 203*
All-Steel Postal, Harriman Lines, 687*
Auto (See Motor Car)
Box 50-Ton as a Standard, 572
Box, Rock Island and 'Frisco 40-Ton, 561†, 568*
Box, Steel-Frame, 80,000 lb., C. & E. I., 60*
Building in 1905, 26†, 98†
Cafe-Smoking and Dining, C., B. & Q., 207*
Combination Wood and Steel Passenger, Southern Railway, 686*
Dining and Cafe-Smoking, C., B. & Q., 207*
Dining, Rural Tramway, Buenos Ayres, 498*
Disinfecting Apparatus for, 216*
Elec. Motor, Paris-Orleans Suburban Service, 239*
Flat, 100-Ton, for Allis-Chalmers Co., 456*
Gasolene (See Motor Car)
Gondola, All-Steel Drop-Bottom, St. L. & S. F., 310*
Gondola, Ralston Drop-Bottom, 236*
Goodwin, Evolution of, 289*
Harriman Lines' Equipment Clearing House, 58
Hospital, Lehigh Valley, 42*
Lighting (See Lighting)
Maint., Comp. Cast Steel and Wood, 604
Maintenance Economy of All-Steel, 203*
Motor (See Motor Car)
Observation, D. & R. G., 601*
Ore., C. & North-Western, 108*
Phosphate, A. C. L., 577*
Postal, Harriman Lines, All-Steel, 687*
Rail Motor (See Motor Car)
Ralston Dump, and Steel Underframe, 236*
Refrigerator, B. & O., 565
Refrigerator, in Arkansas and Georgia, 50 (G. N. S.)
Repair Pool, Harriman Lines, 58
Steel Castings, Use of, 600*
Steel-Frame 80,000-lb. Box, C. & E. I., 60*
Tank, for Milk, 24
Use of Pressed Steel, 26†, 98†
Weak Cars in Passenger Trains, 172‡
Wheel (See Wheel)
Whitewashing, Central London Railway, 481*
Car Ferry Lines of American Railroads, 593*
Car Heating:
Electric, for New York Central Suburban Cars, 40* (G. N. S.)
Car Lines (See Private Car Lines)
Car Service (See also Interstate Commerce Commission):
Beecham Car Transcribing System, 114*
Betts Car Reporting System, 434*
Card Way Bill, 501*
Demurrage Managers' Annual Meeting, 527
Detention of Cars in Yards, 163, 613
Diversion of Cars, 49, 138, 501* (G. N. S.)
Freight Car Handling by Station Agents, 167
Harriman Lines' Equipment Clearing House, 58
Industrial Railroads and, 141
Interchange of Freight Cars, Chicago Roads, 393†
N. Y., N. H. & H., Reduced Detention of Cars, 513†
Per Diem 25 Cents, 374
Private Cars and the Fruit Industry, 58, 186* (G. N. S.)
Prussian State R. R.'s Car Shortage, 132
Reports of Assoc. of Trans. Officers' Committee, 500
Russia, Car Shortage, 83, 139
Car Shortage (See Car Service)
Card Index Systems in a Motive Power Office, 135*, 146†
Cardwell Draft Gear and Rocker Side Bearing, 581*
Cassatt (A. J.) and Rebates, 519
Whitewashing Car, 481*

Central London Railway:
Whitewashing Car, 481*
Central R. R. of New Jersey:
Heavy Eight-Wheeled Passenger Locomotive, 56†
Cherry Tree & Dixonville R. R., Fleming Summit Loop, 259*
Chesapeake & Ohio:
Decision on Coal Contract with N. Y., N. H. & H., 170†, 194†
Double Tracking, 648
Chicago:
Traction Situation, 442†
Chicago & Eastern Illinois:
Daily Train Tonnage Chart, 80*
Dolton Yard, 254*
Improvement During 1905, 254*
Manual Block Signals, Elec. Control, 499*
Reinforced Concrete Bridges, 388*
Steel Frame 80,000 lb. Box Car, 60*
Chicago & North Western:
Betts Car Reporting System, 434*
Ore Cars, 108*
Chicago, Burlington & Quincy:
Association of Operating Officers, 562†
Dining and Cafe Smoking Cars, 207*
Reinforced Concrete Trestle, 713*
Chicago City Railway, 442†
Chicago, Indiana & Southern, 544*
Chicago, Milwaukee & St. Paul:
Compound Locomotives, 417†
Flat Car for Allis-Chalmers Co., 456*
Pacific Extension, 45
Chicago, Rock Island & Pacific:
Bal. Comp., Locomotive, 617*
Car, Standard 40-Ton Box, 561†, 568*
Gulf Extensions, 393†
Reinforced Concrete Elevated Roadway at Oklahoma City, 364*
Silvis Freight Yard, 448*
Chicago, Rock Island & Pacific (See also Rock Island System):
Yoakum System, 369†
Chicago Southern:
Newell Grade Separation, 12*
Chicago Subway, 454, 539†
Coal Loading Facilities, 408*
Chicago Union Traction, 442†
Chimney Reinforced Concrete, 73 (G. N. S.)
China:
Railroad Magnates in, 103
Chuck (See Machine Tools)
Cinder Pit (See Ash Pit)
Claims: How to Avoid Accidents, 14, 187, 208, 432
Cleveland, Cincinnati, Chicago & St. Louis:
Annual Report, 469†*
Reinforced Concrete Highway Bridges, 496*
Clyde Steamship Lines, 57 (G. N. S.)
Coal (See Fuel)
Coal and Oil Traffic Inquiry (See Interstate Commerce Commission)
College (See Names)
Colorado Springs & Cripple Creek District:
Seniority of Employees, 100†
Columbia Creosoting Company, Shirley Plant, 241†, 282*
Concrete:
Blaw Collapsible Steel Centering for Culverts, 151* (G. N. S.)
Effect of Sea Water on, 98†, 170 (G. N. S.)
Investigation of Nat. Board on Fuels and Structural Materials, 342
Concrete, Reinforced:
C. & E. I. Bridges, 388*
Chimney, 73 (G. N. S.)
Cinder Bin, A. T. & S. F., 656*
Elevated Roadway, Oklahoma City, 364*
Highway Bridges, C., C., C. & St. L., 496*
"Horseshoe" Concrete Arches, 402*
N. Y., C. & St. L. Improvements at Cleveland, Ohio, 299*
Trestle, C., B. & Q., 713*
Conley Frog, 58* (G. N. S.)
Consolidated (See N. Y., N. H. & H.)
Consolidated Car Heating Co.:
Electric Heaters for New York Central Suburban Cars, 40* (G. N. S.)
McElroy Automatic Car Lighting System, 590*
Conveying Machinery (See Hoisting & Conveying)
Creosote (See Timber)
Crops (See Grain)
Cuba
Railroad System, 411*
Culvert, Concrete, Blaw Collapsible Steel Centering, 151* (G. N. S.)
Cylinders:
Cast Steel, 416*

D

Damage (See Claims)
Davis Pressed Steel Company:
Brake Beam, 619*
Delaware & Hudson:
Annual Report, 320
Gasolene Electric Car, 93, 126* (G. N. S.)
Ten Wheel Locomotive, 102*
Delaware, Lackawanna & Western:
Annual Report, 192†*
Automatic Block Signals, 86 (G. N. S.)
Switches and Signals at Newark, N. J., 330*
Third Track Work at Scranton, Pa., 270*
Tunnel Through Bergen Hill, 356*
Delayage (See Car Service)
Demurrage (See Car Service)
Denver & Rio Grande
Collision near Adobe, Colo., 293‡, 315, 348‡
Observation Cars, 601*
Passenger Station at Grand Junction, Colo., 422*
Depots: Northwestern & Pacific, 503*
Detector, Hayes Lifting, 82* (G. N. S.)
Differentials (See Freight Rates, Passenger Rates)
Discipline (See also Employee):
Buehring System, 371†, 386, 447‡
Enginemen, 26†
Improving by Recognizing Good Service, 447‡
Mechanical Department, 655
Seniority Rule, 371†, 386, 447
Disinfecting Apparatus for Cars, 216*
Division Engineer, Work of the, 154, 166, 215
Docks:
B. & O., Locust Point, 110 (G. N. S.)
Destruction of Creosoted Piles, 531*
Door, Ritter Horizontal Folding, 33*, (G. N. S.)
Draft Gear:
Cardwell Friction, 581*
Functions of a Good, 173
McCord, 367*
Piper Friction Draft Rigging, 119*
Drill, Moore Track, 184* (G. N. S.)

E

Earnings, Railroad (See also Corporate Names)
Aggregate of Electric Railway, 450
Monthly Returns, Oct., 1905, 52†
Russian Railroads, 75 (G. N. S.)
Education:
Character of Correspondence School Teaching, 317†
College Courses in Railroading, 160
German R. R. Employees, 532
Germany, Higher Technical, 608
Railroad Colleges, Need of, 160
Railroad Courses at New York University, 40 (G. N. S.)
School for Section Bosses, 185 (G. N. S.)
Shop Apprentices, So. Pac., 735†
Univ. of Ill., Ry. Engineering, 124†
Electric Properties Co., 145 (G. N. S.)
Electric Railroads (See also Electrified Steam):
Accounting, 346†
Aggregate Earnings, 450
England, 24 (G. N. S.)
Interurban, Advantage to Farmers, 170 (G. N. S.)
Interurban Connecting Link, Pennsylvania to Michigan, 46
New England, Acquisition by Steam Railroads, 345†
N. Y., N. H. & H., Acquisitions, 100†, 345†, 537†
Review of Year from Interurban Standpoint, 43
Technical Considerations in Electric Railway Engineering, 189
Electric Traction (See also Locomotive, Electric):
A. C. Track Circuits, New York Subway, 472*
A Matter of Standardization, Grand Central Terminal Electrification, 8
Cab Arrangements on Electric Trains, 321‡
Freight Traffic on English Tramways, 65 (G. N. S.)
Inter-Pole Railway Motor, 560
Insulator Pin, "Smith-Grip," 185* (G. N. S.)
Power Transmission, Long Island R. R., 570
Single-Phase A. C. and D. C. Systems, 8
Single-Phase Equipment, Anderson, South Carolina, 157 (G. N. S.)
Single Phase Equipment, Rich. & Ches. Bay Ry., 660
Single-Phase Equip., Warren & Jamestown, 157*
Systems for Heavy Railroad Service, 302*, 318†, 327, 370†, 374‡
Electrified Steam Railroads:
Electric Traction for Trunk Lines, 414, 425
England, 3 (G. N. S.), 65 (G. N. S.), 75 (G. N. S.)
Erie, 644
Metropolitan District Railway, 67 (G. N. S.)
New York Central (See N. Y. Cent.)
N. Y., N. H. & H., Joint Steam and Elec. Service, 439
N. Y., N. H. & H. (See N. Y., N. H. & H.)
Paris Orleans Suburban Line, 239*
Power Transmission, Long Island R. R., 570
West Jersey & Seashore, 560
Electrolysis, Destruction of Water Pipes by, 71*, 56
Employee (See also Train Rules):
Buehring System, 371†, 386, 447‡
Col. Springs & Cripple Creek Dist., Seniority, 100†
Discipline (See Discipline)
Enginemen & Firemen, Working Hours in France, 660
Engineman, Working Hour Limits, 146†
Germany, "Railroaders' Union," 253
Individual Effort and Piece Work Systems, 611†
Instruction Car Attendance, N. Y., N. H. & H., 111†
Instruction for Shop Apprentices, 73†
Intoxicants, Hungarian State R. R.'s, 236, 292
Local Freight Agent, 85, 91, 167
Long Service on an English Road, 244
Mechanical Department, 655
Negligence, Change in Law, 689†
Operator Sleeping, 348†
Pensions, B. & M., 3 (G. N. S.)
Pensions, Penna. R. R., 10 (G. N. S.)
Piece Work in Shops, 391†
Running Past Signals, 1
School for Section Bosses, 185 (G. N. S.)
Seniority Rule, 371†, 386, 447‡
Signal Operator, Duties, 293‡
Station Agent on the Chicago, 92, 98, 545
Timemaster's Duties, 91†, 101
Trainmen, Excessive Hours, 193†
Wages Increase, N. Y., N. H. & H., 63 (G. N. S.)
Engine (See Locomotive)
Engine House:
Erie at Hammond, Ind., 619*
Improved Facilities, 619*
Penna. R. R., at East Altoona, 250*
England (See also British, London)
Tunnel Under the English Channel, 439
English Visitor, 33

F

Erie R. R.:
Electrification from Rochester to Mount Morris, 644
Passenger Traffic via 23d St. Ferry, 516†
Piece Work in Shops, 391*
Exports and Imports:
English Import Rates on Agricultural Produce, 157 (G. N. S.)
In 1905, 16 (G. N. S.)

Fast Trains and Runs:
Atlantic City Camden Record Run, 672
Automobile Record; Comparison, 101†
Comparison with English, 33‡
England, in 1840, 167
Oakland to New York in 71 hrs. 27 min., 472, 499
Prussia, High Speed Experiments in, 191
Record of the Twentieth Century Limited, 163 (G. N. S.)
Year's Record of the Pennsylvania Special, 672
Federal (See Government)
Ferry (See Car Ferry)
Files, Numbering of Forms, 119
Finance:
Advance Information of Presidential Utterances, 471‡
Banker-Directors, 64 (G. N. S.), 194†
Bond Issues in 1905, 25 (G. N. S.)
Bond Purchases by Savings Banks, 417†
Collateral Trust Mortgage, 541
Incorporation Law in Michigan, 5†
New Phases of Railroad Finance, 99†
N. Y., N. H. & H., Convertible Debentures, 25†
Ownership of Stocks of Competing Roads by Same Individual, 148‡
Pennsylvania French Loan, 684
Persistency of Railroad Values, 515†
Phase of Railroad Bonding, 318†
Railroads Bonds in the Savings Banks, 2†
Railroad Building Without Bonds, 513†
Railroad Officers' Investments, 527, 561†
Street Railway Capitalization, 442*
Summary of Annual Reports, 28†
Fireman (See Employee)
Flange (See Wheel)
Florida East Coast R. R.:
Key West Extension, 404*
Flue Cleaning Machine, Ryerson, 24* (G. N. S.)
Football, Railroad Traffic Due to, 5†
Forestry (See Timber)
Forrer, Dr. Ludwig, 168
France:
Working Hours of Enginemen and Firemen, 660
Franklin Moore Co., Acme Chain Hoist, 48*
Freight
Traffic on English Tramways, 65 (G. N. S.)
Prompt Handling of Competitive Freight, 235
Freight Agents; Protest of Wool Buyers, 444†
Freight House; Wabash, at Chicago, 401*
Freight Rates (See also Government Rate Regulation; also Interstate Commerce Commission; also State R. R. Commissions)
C., B. & Q. Fined, 125 (G. N. S.), 184 (G. N. S.)
Cotton Goods to Denver; Reason for Lower Rate, 97†
Garfield Report, 465†, 480, 528
Hay Rate Case, 516†
Illegal Commissions to Refrigerator Car Co., 163 (G. N. S.)
Imprisonment for Rate Cutters, 184 (G. N. S.) 689†
Indictments for Rebating on Sugar, 139 (G. N. S.)
Injunctions Must be Specific, 223
Iowa, Vermont and Prussia Compared, 329
N. Y., N. H. & H. and Steamship Lines, 15 (G. N. S.)
Ownership of Stocks of Competing Roads by Same Individual, 148‡
President Cassatt and Rebates, 519
Right to Route Your Freight, 66 (G. N. S.), 294‡
Freight Yards (See Yards and Terminals)
Frog, Conley, 58* (G. N. S.)
Fuel:
Anthracite Coal Strike of 1902, 377
Anthracite Output for March, 120 (G. N. S.)
Anthracite Strike Comm. Report, 370†
Anthracite Oil Trade; Investigation, 102 (G. N. S.), 118 (G. N. S.), 147, 378‡, 551, 606, 683, 712
Coal Handling, Chicago Subway, 408*
Coal Pusher for Locomotive Tender, 15*
Coal Roads; Tonnage Carried, 538‡
Coal Strike, 119 (G. N. S.), 410
Coal Traffic, 538
Coal, Yearly Anthracite Shipments, 49 (G. N. S.)
Engineman's Trip Ticket, 66*
Rifled Pipe for Petroleum Oil, 606*
Tests at the University of Illinois, 139 (G. N. S.)

G

Gasolene Car (See Motor Car)
General Electric Co.
A. C. D. C. Systems, 8
Annual Report, 28
Single Phase A. C. Motor, 86* (G. N. S.)
Single Phase Equipment, Anderson, S. C. Car, 157 (G. N. S.)
Single Phase Equipment, Milwaukee Electric Light, 61 (G. N. S.)
Single Phase Equipment, Rich. & Ches. Bay Ry. 660
Steam Turbine Driven Lighting Unit, 71* (G. N. S.)
Street Car Brake, 144*
General Railway Signal Co.
Combination Relay and Crossing Bell, 81* (G. N. S.)

GENERAL INDEX—Continued.

[*Illustrated articles are indicated thus* *; *Editorials thus* †; *Contributions thus* ‡; *General News Section References thus* (G. N. S.)]

Germany:
Higher Technical Education in, 608
German Railroad Education, Prizes for Improvements, 347†
Gibb, Sir George, Portrait of (G. N. S.)
Gill Automatic Operations Call Bell, The (G. N. S.)
Goodwin Car Location of, 289*
Golden Anderson Valve Specialty Co:
Valve and Water Column, 661*
Gould System
Development, 394†
Mileage, 467†
Gov't Control of R. R.'s
Canada, 510
Freight Rates (See Gov't Regulation)
Wisconsin in 1874, Cost of (G. N. S.)
Gov't Ownership:
Chicago, 102 (G. N. S.)
Italy, 185
Japan, 94, 175 (G. N. S.)
Government Rate Regulation (See also Freight Rates; Interstate Commerce Commission):
Adams (Brooks) on, 317†
Cotton Goods to Denver, Reason for Lower Rate, 97†
Difficulties and Danger of, 145†, 180
Essentials in Rate Regulation, 71†
Hepburn Bill (See Hepburn Bill)
Iowa, Vermont and Prussia Compared, 329
Ohio, Two Cent Fare, 121†, 145†, 154
President Stickney on Rate Legislation, 120
Progress of, 346†
Senator Lodge on, 145†, 180
Stickney (A. B.) on, 345†, 358
Washington Correspondence, 13, 40, 60, 91, 103, 139, 154, 216, 240, 309, 323, 354, 390, 399, 437, 450, 512, 531
Wright (C. D.) on, 196†
Grade Separation:
Massachusetts, 319†
N. Y., C. & St. L., at Cleveland, Ohio, 299*
Wabash & Chicago Southern, at Newell, Ill., 12*
Grades of Transcontinental Lines, 441†, 451*
Grain (See also Exports and Imports):
Canadian Shipments, 50 (G. N. S.)
Crops in the Canadian Northwest, 40 (G. N. S.)
Lake Flour Tonnage, 48
Russia, Carrying Grain in Bulk, 540†
Visible Supplies, 1899-1906, 83
Grand Trunk:
Locomotive Efficiency, Tests, 520
Grand Trunk Pacific:
Prince Rupert, 58 (G. N. S.)
Status, 119
Great Britain (See British)
Great India Peninsula Railway:
Steam Motor Car, 75 (G. N. S.)
Great Northern Railway:
Canadian Extensions, 491†, 494, 513†, 657†
Ruling Grades, 441†, 451*
Station at Sioux Falls, 439*
Gulf, Routes to, 50†

H

Halifax & South-Western, 564†
Harriman Lines:
Comp. Cost Repairing Steel and Wooden Cars, 604
Equipment Clearing House, 58
Interlocking Signals on, 164 (G. N. S.)
Maintenance Economy of All-Steel Cars, 203*
Standard All-Steel 60 Ft. Postal Car, 687*
Harriman System, Mileage of, 467†
Hawley System, Mileage of, 467†
Hayden (N. L.) Manufacturing Co.:
Mechanical Stoker, 210*
Hayes Track Appliance Co.:
Lifting Derail, 82* (G. N. S.)
Hepburn Bill (See also Washington Correspondence), 196, 418†, 131 (G. N. S.), Correspondence, 666
Catechism, 441†
Mellen (C. S.) on, 322
President Hadley on, 38, 217
Senator Long on, 154†
Text, 533; Taft's Speech, 217†, 232
Heroism, Medal for, 632
High Duty, Award for, 632
Metz Saw & Tool Co.:
Steel Saw, 368*
Hill System, Mileage of, 467†
Hoffmann (A. L.) Pneumatic Wrench, 57 (G. N. S.)
Hoisting and Conveying:
Acme Chain Hoist, 48*
Electric Winding Drum Hoists, 81* (G. N. S.)
Hose
Comparison of Air and Steam Hose and Couplings, 289
M. C. B. Air Brake Hose Best? 447†
House on Rails
Hutton, L. R. R. Location, 368
Hydraulic (See Machine Tools)

I

Illinois Central:
Annual Report
Illinois Tunnel Co. (See Chicago Subway)
Immigration, Transportation of Passenger Business, 65
Imports (See Exports and Imports)
India
Standard Locomotive for, 342
Industrial Railroads and Car Service, 141
Insubordination (See Discipline)
Insect, M. M. and M. C. B. Association Circular, June 22
Interborough Rapid Transit Co. (See Manhattan Elevated, N. Y. Subway)
Interlocking (See Signals, Interlocking)
Interstate Commerce Commission:
Car and Oil Traffic Investigation, 102 (G. N. S.), 118 (G. N. S.), 129, 138, 561, 606, 684, 712
Cotton Goods to Denver, Reason for Lower Rate, 97†
N. Y., N. H. & H., and Steamship Lines, 132 (G. N. S.)
Rate Decisions, 3 (G. N. S.), 9 (G. N. S.), 31 (G. N. S.), 65 (G. N. S.), 85 (G. N. S.), 102 (G. N. S.), 117 (G. N. S.), 163 (G. N. S.)
Rates on Oil from Pittsburg to New England, 1905
Rate Making Powers (See Gov't Rate Regulation)
Selection of, 67 (G. N. S.)
Testimony, Self Incriminatory, 544†
Iron and Steel
Canadian Production in 1905, 50 (G. N. S.)
Cast Steel, Development of, 75†
Effect of Nitrogen on, 140
Malleable Cast Iron, Manufacture and Physical Properties, 602*
Pig Iron and Rail Production in 1905, 140
Pig Iron in Germany, 172†
Product for in 1905, 48
Steel Rail Outlook for 1906, 70
Italy:
Government Railroad Monopoly, 185, 712
Traffic Troubles, 281

J

Japan:
Government Ownership, 94, 175 (G. N. S.)
John Fritz Medal, Award, 85
Johns Manville (H. W.) Co., Fire and Acid Proof Smoke Jacks, 50* (G. N. S.)
"Jungle, The," 538

K

Kalamazoo Railway Supply Company
Moore Track Drill, 184* (G. N. S.)
Root Locomotive Spring Snow Scraper, 184* (G. N. S.)
Kansas City, Mexico & Orient, 495†
Key West Extension of the Florida East Coast, 401*
Kohn (Koby) Rail Joint, 284*, 716*
Korea:
Railroads and Foreign Enterprises in, 226*
Körting Brothers
Disinfecting Apparatus, 216*
Kuhn, Loeb & Co.: Retirement from Boards of Directors, 194†, 64 (G. N. S.)

L

Labor (See Trade Unions)
Lake Erie & Western:
Wabash River Bridge, 520*
Lake Shore & Michigan Southern:
Annual Report, 372*
Lake Superior & Southwestern (See Wisconsin Central)
Lamps (See Signals; also Lighting)
Leaves From a Railroad Officer's Note Book, 501, 547
Legal Decisions (See also Interstate Commerce Commission):
Coal Contract, N. Y., N. H. & H. and C. & O., 170†, 194†
Monthly Records: Dec., 1905, 38; Jan., 1906, 164; Mar., 1906, 363; Apr., 1906, 464
N. Y. C. & H. R., Park Avenue Damage Cases, 121
Legislation (See also Gov't Rate Regulation):
Elsberg Bill, 169 (G. N. S.)
Negligence, Employees, Change in Law, 689†
N. Y. State, New R. R. Laws, 579
Lehigh Valley
Hospital Car, 42*
Interlocking Without Detector Bars, 487*
Lighting
McElroy Automatic, 590*
Pintsch Inverted Mantle, 87* (G. N. S.)
Steam Turbine Generator, 74* (G. N. S.)
Train, by Electricity in England, 15 (G. N. S.)
Lincoln Elec. Mfg. Co., Variable Speed Motor, 509*
Locomotive
American, Coal of N. J., 56*
Atlantic, De Glehn Four-Bal. Comp., 17*
Atlantic, Four-Cylinder Balanced Comp., 16*
Atlantic, N. Y. C. & H. R., 642*
Atlantic, Vauclain Bal. Comp., C., R. I. & P., 647*
Backward, Decline in so Running, 100†
Bal. Comp., Gen., 644*
British Locomotive Engineering in 1905, 41, (G. N. S.)
Compound, Colorado, 4-Cyl. Bal., Penna., 16*
Compound, C., M. & St. P., 417†
Consolidation, N. Y. Cent. Lines, 613*
Consolidation, Penn., 210*
Consolidation, with Walschaert Valve Gear, 17*
Cost of Operation, 10, 18*, 94*, 112, 125†
Efficiency, Comparative, 520

Locomotive (*Continued*)
Efficiency of Modern Locomotives, 441†, 460
Light Wheel, Penna. R. R., 642*
Light Wheel, Penna. R. R., in 1875, 641*
Experimental for the Louisville & Nashville, 195*
Failures of, 143
Four Cylinder Bal. Comp., Advantages of, 252
Four Cylinder Bal. Comp., Origin of, 53*
Four Cylinder Bal. Comp., Penn., Canada, 16*
Harriman Lines Equipment Clearing House, 58
Historic Penna. R. R., 1860, 655*
India, Standard for, 342
Large Electric and Steam, 175
Mallet Comp., B. & O., 617*
Mexico, 116†
Old Print of 1828, 292*
Pacific, B. & O., 617*
Pacific, Mex. Cent., 642
Pacific, Southern Ry., 715*
Pacific, Vauclain Balanced Compound, A. T. & S. F., 647*
Pennsylvania R. R. Tests, 122†
Prairie, Simple, Penna. R. R., 17*
Purdue Driver, Loco. Burst in 1868, 139*
Repair Pits, Harriman Lines, 58
Steam Loco. Efficiency Compared With Other Motive Powers, 565†
Stoker (See Stoker)
Superheater (See Superheater)
Switching, B. & O., 616*
Ten Wheel, D. & H. Young Valves, 102*
Ten Wheel, Vauclain Balanced Compound, N. Y., N. H. & H., 647*
Valve (See Valve & Valve Gear)
Vauclain Comp., 609†, 644*
Water Scoops, New Design, 132* (G. N. S.)
Whistle Nuisance, 659†
Locomotive, Electric, 116
B. & O., 617*
Compared with Steam, 563†
Large Electric and Steam Locos., 175
N. Y. C. & H. R., 178* (G. N. S.), 648*
N. Y., N. H. & H., A. C., D. C., 303*, 379*
Operation During a Snowstorm, 152* 183
St. Clair Tunnel Company, 68*
Locomotive, Freight
B. & O., Mallet Comp., 617*
D. & H. 10-Wheel, 102*
N. Y. Cent. Lines, Consolidation, 613*
Pennsylvania, Consolidation, 17*, 210*
Locomotive, Passenger:
A., T. & S. F., Pacific, Bal. Comp., 647*
B. & O., Pacific, 617*
Cent. of N. J., American, 56*
C., R. I. & P., Atlantic, Bal. Comp., 647*
Mich. Cent., Pacific, 642*
N. Y. C. & H. R., Atlantic, 642*
N. Y., N. H. & H., Ten-Wheel, Bal. Comp, 647*
Pennsylvania, Atlantic, 17*
Penna. R. R., Eight-Wheel, in 1875, 641*
Penna., Eight-Wheel, 642*
Pennsylvania, Prairie, 17*
Recent Development of American, 641*
Southern Ry., Pacific, 715*
Locomotive Boiler:
British View of Large, 508
Care of, 62*, 101†
Cracked and Leaky Mud Rings, 638
Locomotive Handling at Terminals, 141*
Locomotive Performance (See also Fast Trains and Runs):
Engine Failures, 143
Statistics, 611†
Locomotive Rating:
Efficiency of Modern Loco., 441† 460
London:
Tube Railways, 82, 161, 118* (G. N. S.)
London Underground (See Underground Elec. of London)
Long Island R. R.:
Annual Report, 564†*
New Passenger Ferryboats, 24 (G. N. S.)
Power Transmission Line and Third Rail System, 570*
Louisville & Nashville:
Electrical Equipment, South Louisville Shops, 230
Lumber (See Timber; also Ties)
Lunkenheimer Co.:
Locomotive Blow Off Valve, 37* (G. N. S.)

M

McCord & Co.
McCord Draft Gear, 367*
Machine Tools (See also Pneumatic Tools)
Boring Mill Attachment for Lathe, 2* (G. N. S.)
Driving Wheel Lathe, 118*, 455*
High Duty Saw, 368*
Hydraulic Wheel Press, 455*
Lathe Driven by Lincoln Motor, 509*
Locomotive Rod Boring Machine, 455*
Pipe Threading and Cutting, 168*
Rolling Machine, Acme Rotary Thread, 113*
Rolling Machine, Reciprocating Screw-Thread, 215*
Shaper Driven by Lincoln Motor, 509*
Magistrate, Attitude of One Toward a Railroad, 445†
Mail Service, Foreign, 291
Maint. of Way:
C. & O. Double Tracking, 648
Reinforced Concrete Elevated Roadway, 364*
Manhattan Elevated:
Damage Suits, 686
Manila & Dagupan R. R., 40 (G. N. S.)

Masonry (See Concrete)
Master Car Builders' Association:
Committee Work, 610†
Convention, 657†, 658†, 662, 690†
Convention, Address of Secretary Mosely, 670
Convention Exhibits, 639, 690, 671*, Inset
Convention Plans, 1906, 106*
Convention Programme, 592
Convention, Topical Discussions, 667
Reports of Committees, 624*
Master Mechanics' Assoc. (See Am. Ry. M. M. Assoc.)
Maumee Bay Straight Channel, 2 (G. N. S.)
Mechanical Stoker (See Stoker, Mechanical)
Meeting (See Corporate Names)
Michigan:
Annual Report of the Railroad Commissioner, 44
Incorporation Laws, 5†
Valuation of Railroad Property in, 23 (G. N. S.), 58 (G. N. S.), 353
Michigan Central:
Annual Report, 320†
Detroit River Tunnel, 149*, 184*
Pacific Type Passenger Locomotive, 642*
Milwaukee Ry. & Light., Equipment, 64 (G. N. S.)
Mines:
Motive Power in, 116*
Minneapolis, St. Paul & Sault Ste. Marie:
Thief River Falls Extension, 82*
Missouri Pacific:
Annual Report, 369,† 373†
New East Bottoms Yard, at Kansas City, 474*
Monorail:
Proposed Road to Coney Island, 17 (G. N. S.)
Motive Power, Officer, 581
Motive Power Office, Card Index System for, 135*, 146†
Motor:
General Electric Single-Phase, 86* (G. N. S.)
Inter Pole Railway, 560
Lincoln Variable Speed, 509*
Westinghouse Electric, 684*
Westinghouse Type S. A. Variable Speed Auxiliary Pole, 64* (G. N. S.)
Motor Car:
Gasolene Car for Interurban Service, 556*
Gasolene-Electric, D. & H., 93, 126* (G. N. S.)
Gasolene, When Advantageous, 605
Lower Passenger Fares, 490†
Steam, Halsey, 598*
Steam, Great India Peninsula Railway, 75 (G. N. S.)
Strang Gasolene-Electric, 169†, 188*
Union Pacific No. 7, 410*, 609†, 653
Muck Rake and the Panama Canal, 398‡
Municipal Ownership (See Government Ownership)

N

National Association of Car Service Managers:
Annual Meeting, 527
National Association of Railway Commissioners:
Annual Convention, 354, 385
Naugatuck Railroad:
History, 147†
New Jersey Short Line:
Strauss Trunnion Bascule over the Rahway River, 287*
New York Central & Hudson River:
All-Electric Signaling at New York, 705*
Annual Report, 445†*
Atlantic Type Passenger Locomotive, 642
Coal and Oil Traffic Inquiry, 606
Electric Locomotives, 648*, 178* (G. N. S.)
Elec. Loco., Test of, in Snowstorm, 152*, 183
Eleventh Avenue Freight Tracks, 242†
Fleming Summit Loop, 259*
New Haven and the Grand Central Terminal, 8
Park Avenue Damage Cases 121†
Signal Arrangements for Electric Zone, 36, 40, 705*
Station Platform Canopies, 495*
Tax on Freight Cars, 158 (G. N. S.)
New York Cent. Lines:
Consolidation Locomotive for, 613*
New York, Chicago & St. Louis:
Annual Report, 470†*
Grade Separation at Cleveland, Ohio, 299*
New York City:
East River Bridges, 1†
Manhattan Bridge, 489†, 490†
New York New Haven & Hartford:
A. C. D. C. Locomotive, 303*, 379*
Acquisition of Electric Lines, 100†, 537†
Annual Report, 4†
Bal. Comp. Locomotive, 647*
Compared with Boston & Maine, 4
Convertible Debentures, 25†
Decision on Coal Contract with C. & O., 170†, 194†
Electrification and the Grand Central Terminal, 8
Football Game Traffic, 5†
Housatonic R. R., History, 147†
Joint Steam and Electric Service, 139
Naugatuck R. R., History, 147†
Rate War with Steamship Lines, 15 (G. N. S.)
Rebuilding the Housatonic River Bridge, 323*
Reduced Detention of Cars, 513†, 613
Two Cent Fare, 169†, 217†
Wages Increased, 63 (G. N. S.)
New York Ontario & Western:
Two Cent Passenger Rates, 218†, 293†, 297†
New York Subway:
A. C. Track Circuits, 472*
Sanitary Inspection of, 71 (G. N. S.)
Test of Power Station Engines 143*
Views of George S. Rice, 106
New York University, Railroad Courses at, 10 (G. N. S.)
Nicaragua, Proposed Railroad, 2 (G. N. S.)
Niles-Bement-Pond Co.:
Driving Wheel Lathe, N. Y. C. & H. R., 118*
Hydraulic Wheel Press, 455*
Locomotive Rod Boring Machine, 455*
Standard Driving Wheel Lathe, 455*
North Shore Railroad, Earthquake Effects, 145 (G. N. S.)
Northern Pacific R. R.:
Bismarck Bridge, 174*, 197‡
Ruling Grades, 441†, 451*
Nova Scotia:
Report on Railroads 564†
Nut (See Bolt)

O

Officer (See also Organization):
Division Engineer, Work of the, 134, 166, 215
Motive Power, 581
Oil (See Fuel)
Oregon R. R. & Navigation Company:
Telephones on Telegraph Wires, 111
Organization:
Committee Work, M. C. B. and M. M., 610†
Burlington Association of Operating Officers, 562†
Owen & Northern (See Wisconsin Central)

P

Pacific Coast Railway Club:
March Meeting, 464
Panama Canal, 200*:
Controversy and Conditions, 398
Loading Equipment for, 78†*
Muck Rake and, 398‡
Purchases; Testimony Before Senate Committee, 63 (G. N. S.)
Sea Level vs. Lock, 182
Some Phases of the Problem, 382
Wallace (J. F.) Before the Senate Committee, 134, 193† 203
Panama Railroad, 200*
Pass (See also Gov't Rate Regulation):
Canton-Hankow Ry., 41* (G. N. S.)
Effects of Abolition, 15 (G. N. S.), 33 (G. N. S.)
Evils and Benefits, 26†
Passenger Rates (See also Interstate Commerce Commission):
Motor Cars; Lower Fares, 490†
N. Y., N. H. & H., 169†, 217†, 293, 297
Ohio, Two-Cent Fare, 121†, 145†, 154
Two-Cent, N. Y., O. & W., 218†, 293†, 297‡
Passenger Service, How to Improve, 237
Passenger Traffic:
Additional Trains, 516†
New York City, 345†
Passing (?) of the Steam Locomotive, 563†
Peel, Sir Frederick, 704*
Pension (See Employee)
Pennsylvania Company:
Annual Report, 468†*
Pennsylvania Railroad:
Annual Report, 219†*
Coal and Oil Traffic Investigation, 102 (G. N. S.), 118 (G. N. S.), 527, 538†, 561†, 683, 712
Class K, Pass. Loco., 1882, 642*
Collision near Clover Creek Junction, 481, 489†, 519‡
East Altoona Engine Terminal, 259*
Eight-Wheel Locomotive, 642*
Eight-Wheel Passenger Locomotive, 1875, 641*
Electrification, West Jersey & Seashore, 560
Experimental Locomotives for the, 16*
Extension to New York and Long Island, 349* 374*, 522*
Fleming Summit Loop, 259*
French Loan, 684
Historic Locomotives, 655*
Investigation, 561
Locomotive Tests, 122†
Mileage Tickets, 444†
New York Terminal, 121†, 127*, 522
Passenger Traffic, 151 (G. N. S.)
Pensions, 75 (G. N. S.)
Smoke Prevention, 219†
Water Works, 117 (N. G. S.)
Year's Record of the Pennsylvania Special, 672
Pennsylvania System, Mileage of, 467†
Peoria & Pekin Union:
New Gravity Yard, 546*
Per Diem (See Car Service)
Permanent Way (See Maintenance of Way)
Perpetual Motion at Last, 83* (G. N. S.)
Persistency of Railroad Values, 81†
Petroleum Fields in Northeast Russia, 172‡
Philadelphia & Reading:
Atlantic City Camden Record Run, 672
Philadelphia & Western, 88 (G. N. S.)
Philippine Islands:
Bids for Building Railroads in, 25 (G. N. S.)
New Construction, 188
Railroad Projects in, 21† (G. N. S.)
Picked up on the Road, 511
Pier (See Docks)
Pile (See Timber)
Pipe:
Anderson Stand Pipe Valve, 654*
Destruction by Electrolysis, 7*, 36
Rifled for Pumping Heavy Grade Fuel Oil, 606*
Threading and Cutting Machine, Wreland 168*
Wyckoff Wood Pipe, 2** (G. N. S.)
Pittsburg & Lake Erie:
Annual Report, 513†, 515†*
Pittsburg, Cincinnati, Chicago & St. Louis:
Annual Report, 397†
Removal of Bulger Tunnel, 462*
Pooling Locomotives (See Locomotive)
Pneumatic Tools
Hoeumatic Wrench, 7 (G. N. S.)
Pressed Steel Car Company:
All Steel Drop Bottom Gondola, St. L. & S. F., 310*
Annual Report, 196
Private Car Lines, Armour, 64, 106, 186*, 58 (G. N. S.), 93 (G. N. S.)
"Progress of Steam," Old Print, 292*
Prosperity (See Business Situation)
Prussian State Railroads:
Earnings and Expenses, 191
Gov't Engineer Attached to Consulate in New York, 284
Publicity Bureau in Chicago, 51 (G. N. S.)
Purdue University:
Automobile Testing Plant, 92*
Historic Locomotive, 139*
Work on Mech. Properties of Timber, 670

R

Rail:
Bonding, Tinned Channel Pins, 169 (G. N. S.)
First T Rail? 477*
Production in 1905, 140
Shavings Cut From, by Wheel Flanges, 241*, 245‡, 296†, 322*
Specifications for, 280
Third Rail, Effect of Sleet, 384*
Third-Rail in Snowstorm, 152*, 183
Third-Rail System, Long Island R. R., 570*
Rail Joint:
Kohn Insulated, 716*
Kohn, "Solid Base," 284*
Stanford, 41* (G. N. S.)
Railroads:
American, Impressions of a South African Railroad Officer, 501, 547
Mileage of the World, 125, 658†
Relations to the Public, 445†, 476
Routes to the Gulf, 50†
Value of Statistics, 65*
Railroad Commissions (See State R. R. Commissions)
Railroad Conditions (See Business Situation; Finance)
Railroad Officers' Investments, 561†
Railroad Systems of the United States, 467†
Railway Lock-Nut Co., "Bull-Dog" Lock-Nut, 184*, (G. N. S.)
Railway Signal Association:
January Meeting, 46, 348
March Meeting, 316, 348
May Meeting, 485
Revised Constitution, 302
Ralston Steel Car Co.:
Drop-Bottom Gondola Car, 236*
Rating (See Locomotive Rating)
Rebates (See Freight Rates; Government Rate Regulation)
Refrigerator Car Lines (See Private Car Lines)
Reinforced Concrete (See Concrete, Reinforced)
Reports, Annual (See Individual Co.)
Review of the Railroad Year, 3†
Richmond & Chesapeake Bay Railway:
Single-Phase Equipment for, 660
Right of Way Records, Filing of, 348‡*
Right to Route, Your Freight, 66 (G. N. S.), 294†
Rock Island Company:
Dividend Passed, 25†
Rock Island System (See also C., R. I. & P.; also St. L. & S. F.):
Mileage, 467†
Roof, Knee-brace Problem, Graphical Solution of, 502*
Roundhouse (See Engine House)
Rules (See Accidents; Discipline; Employee; Signals; Train Rules)
Russia:
Carrying Grain in Bulk, 540†
Electric Traction in St. Petersburg, 57 (G. N. S.)
Petroleum Fields in the Northeast, 172‡
Railroad Earnings, 75 (G. N. S.)
Strikes, 124‡
Rutland R. R.:
Annual Report, 396†*
Ryerson, J. E., & Son, Flue Cleaning Machine, 24* (G. N. S.)

S

St. Clair Tunnel Company:
Electric Locomotives and Power Equipment 12, 68*
St. Louis & San Francisco:
All Steel Drop Bottom Gondola Cars, 310*
Car, Standard, 40 Ton Box, 561†, 568*
Dividend Passed, 146†
Gulf Extensions, 393†
Retrenchment, 146†
Yoakum System, 369†
Safety Car Heating & Lighting Co.:
Inverted Mantle Pintsch Lamp 87* (G. N. S.)
Safety Appliance (See also Brake)
San Francisco Earthquake, 117†, 440
Sauvage Safety Brake Co.:
Test of Air Brake, 560*
Savings Banks:
Railroad Bonds in, 2
Saw (See Machine Tool)
Scherzer Rolling Lift Bridge Company:
Bascule Bridges, 87* (G. N. S.)
Schools (See Names)
Self Incrimination, 511†
Shed (See Station)
Ships:
Foreign Mail Service, 291
Increase in Size of Cunard Steamships, 58*
Subsidies, 71, 77
Shops:
Canadian Pacific, Winnipeg, 107
Electrical Equipment, South Louisville Shops of L. & N. & Nashville, 230*
Individual Effort and Piece Work in Machine Shops, 611†
Machine Practice, 313, 365
Pennsylvania R. R., East Altoona, 259*
Piece Work, 291*
Shop Savings, 25†
Siam
Railroads and Transportation, 550*
Side Bearing, Cardwell Rocker, 581*

GENERAL INDEX—Continued.

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus ; General News Section References thus (G. N. S.).]*

Signal:
Color Blindness, 494
Combination Relay and Crossing Bell, 81* (G. N. S.)
Desk Signal Enclosed, 537*, 541
Destruction of Pole Line Wires, 43
Norman Danger Automatic, 537*, 541
Rail Bonding, Tinned Channel Pins, 100 (G. N. S.)
Semaphore Arm, Upward Indication, 488, 537†, 541
Storage Batteries, Charging from Q. C. Circuits; Mercury Arc Rectifier, 348*, 352
Signals, Block:
C. & E. I., Chicago Division, 254*
Collision in Spite of Automatic Stop, 33 (G. N. S.), 319
D., L. & W., 86 (G. N. S.)
Distant Signals at Junctions, 85
Electric Semaphore, "American," 312*
Green Lights for "Proceed" at Night, 108
Legislation, 516†
Manual, Line Control, C. & E. I., 499*
Massachusetts State Railroad Commission Recommendations, 49†, 54, 59
N. Y. C. & H. R., Electric Zone, 36, 40, 705*
Operators' Duties, 293†
Position of, at Junctions, 85
Progress During 1905, 97†, 104
Proposed Block System Law in Massachusetts, 23 (G. N. S.)
Southern Pacific, 343*
Union Pacific, 343*
Signal, Interlocking:
All Electric at Council Bluffs, 574
Approach and Detector Locking, 347†
B. & O., Elsmere Junction, 481*
D., L. & W., at Newark, 330*
Harriman Lines, 164 (G. N. S.)
New York Central All Electric at New York, 705*
Switch Signal Practice on Leading Roads, 43*
Taylor All Electric at Council Bluffs, 574*
Track Circuits in Place of Detector Bars, 301, 316, 487*
Simplon Tunnel, 24, 297
Experimental Electrical Equipment, 124†
First Passenger Train, 106
"Smith Grip" Insulator Pin, 185* (G. N. S.)
Smoke Jacks, "Transite" Asbestos, 50* (G. N. S.)
Smoke Prevention, 219†
Snow Scraper, Rear Locomotive, 184* (G. N. S.)
Société Alsacienne de Constructions Mecaniques:
De Glehn Compound Loco., Penna. R. R., 17*
South America:
New Railroads in, 40 (G. N. S.)
South Eastern Railway (England), History, 554*
Southern Railway:
Annual Report, 55*
Combination Wood and Steel Passenger Car, 686*
Pacific Locomotive, 715*
Southern Railway System, Mileage of, 467†
Southern Pacific:
Annual Report, 76†*
Automatic Block Signals for, 343*
Earthquake Relief Work, 499
New Station at Alameda Mole, 223*
Ruling Grades, 441†, 451*
Santa Barbara Station, 298*
Spain
Railroad System, 409
Spark Pit (See Ash Pit)
Spike:
Deterioration in Black Oak Ties, 125‡*
Sprague Electric Company:
Electric Winding Drum Hoist, 81* (G. N. S.)
Standard Code (See Train Rules)
Standard Engineering Co.:
Standard Wieland Pipe Threading and Cutting Machine, 168*
Standard Oil Company:
Garfield Report, 465†, 480, 528
Stanford Rail Joint, 41* (G. N. S.)
State Ownership (See Government Ownership)
State R. R. Commissions (See also Government Rate Regulation):
Illinois, Annual Report, 195†
Infirmities of, 395†
Kansas Rate Reduction, 50 (G. N. S.)
Mass., Annual Report, 49†, 54, 59
Mass., Whistle Nuisance, 659
Mich., Annual Report, 44
Missouri, 557†
Nat. Assoc. of Ry. Commissioners, 354, 385
North Carolina, 420†
Ohio, 250
Recent Legislation, 83
Station (See also Yards and Terminals, also Freight House):
D. & R. G., Grand Junction, Colo., 422*
El Paso (Texas), 61*
Great Northern at Sioux Falls, 439*
Penna. R. R., New York, 121†, 127*, 705*
Platforms (See New York Central, Penna.)
So. Pac., Alameda Mole, 223*
So. Pac., Santa Barbara, Cal., 298*
Tickets to (See), 613
Wabash Pittsburg Terminal, Pittsburg, 427*
Washington, D. C., Union, 109 (G. N. S.)
Stattler, Valve
Steam (See Steel)
Steel, Iron &
Steel Trade (See Railroads)
Steel, Tipan
Stokers, Mechanical:
Hayden, 210*
Storage Battery (See Signals)
Strang Gasolene Electric Rail Motor Car, 169†, 188*
Strauss Bascule Bridges, 286*
Street Railway (See also Electric Railroad):
Capitalization, 442†
Chicago Traction Situation, 442†
Duration of Delays Should be Announced, 445†
Municipal Ownership, Chicago, 102 (G. N. S.)
New York City Rapid Transit, 109 (G. N. S.)
St. Petersburg, 57 (G. N. S.)
Subway (See Subway)
Washington Street Subway, Boston, 86*
Strike:
Coal, 110 (G. N. S.), 410
On Italian Railroad, 71 (G. N. S.)
Paternity of, 370†
Russia, 122†
Sturtevant (B. F.) Co.:
High-Pressure Blower, 32* (G. N. S.)
Subsidies, Shipping, 71, 77‡
Subway
Brooklyn, 274*
London Tramway, 132*
London, 25 (G. N. S.), 82 (G. N. S.), 101 (G. N. S.)
Tunnel Under the Seine in Paris, 164*
Washington Street, Boston, 86*
Superheater
Canadian Pacific, 417†, 423
Use on American Locomotives, 418†
Switch:
Brown Switch Stand, 82* (G. N. S.)
D., L. & W., at Newark, N. J., 330*
Targets, Shapes of, 43*
Systems, Railroad, of the United States, 467†

T

Taxation:
Evolution of Railroad Taxes, 295†
Michigan, 23 (G. N. S.), 58 (G. N. S.), 353
New York Central Cars, 158 (G. N. S.)
Technical Publicity Association:
Annual Meeting, 109 (G. N. S.)
Telegraph:
Gilt-Alexander Operators' Call Bell, 17 (G. N. S.)
Telephones on O., R. & N. Telegraph Wires, 111
Railroad Operation Without, 52†
Telephone
Bavarian State Railroads, 57 (G. N. S.)
Competition, 516†
On O., R. & N. Telegraph Wires, 111
Temiskaming & Northern Ontario, 316
Tender, Coal Pusher for, 45*
Terminal District, Operation of a, 79
Testimony, Self-Incriminatory, 514†
Texas & Pacific:
Annual Report, 420†
Thief River Falls Extension, M., St. P. & S. Ste. M., 82*
Third Rail (See Rail)
Ticket:
Around the World, Can. Pac., 31 (G. N. S.)
Collectors in Addition to Conductors, 170†
Mileage, Penna. R. R., 444†
Station Platform Tickets, 613
Tie (See also Timber):
Deterioration of Spikes in Black Oak, 125‡*
Lodgepole Pine from the Yellowstone, 82 (G. N. S.)
Preservation on the Southern Pacific and the Santa Fe, 436
Record of Removals and Renewals, A., T. & S. F., 474
Supply and Demand, 243†
Timber (See also Tie):
Creosote Preservation, 241†, 282*
Destruction of Creosoted Piles, 531*
Lumber Cut of the United States in 1905, 532
Planning for Ties, 243†
Work at Purdue University, 670
Tires (See Wheel)
Toledo & Ohio Central:
Ralston Drop-Bottom Gondola Car, 236*
Toledo Ohio, Maumee Bay Straight Channel, 2 (G. N. S.)
Tonnage Rating (See Locomotive Rating)
Tool (See Machine Tools; Pneumatic Tools).
Manipulation of Tool Steel, 47
Townsend (Chas. E.) on Railroad Abuses, 492†
Tractive (See Locomotive Rating)
Trades U
Brotherhood of Loco. Engineers, 196†
Traffic (See Freight; Passenger)
Outlook for 1906, 296
Train:
Handling in Bush Terminal District, 79
Statistics, Can. Pac., 65*
Train Despatching Association:
Annual Convention, 514
Train Lighting (See Lighting)
Train Load (See Locomotive Rating)
Train Robberies, 205, 24 (G. N. S.)
Train Rules (See Employee)
Buehring System, 371, 386, 447
Flagging in Fog, 165†
Revised Standard Code, 458
Running Past Signals, 13
Seniority Rule, 707, 786, 447
Train Shed (See Station)
Train Tonnage, Daily Car, C. & E. I., 890*
Trains (See Electric Railroad; Street Railways)
Trans Andine Railroad, 50 (G. N. S.)
Transatlantic Passenger Business, 65
Transcontinental Lines, Ruling Grades, 441†, 451*
Trestle (See Bridge)
Triple Valve (See Brakes)
Trolleys (See Electric Railroads)
Truck
Steel Castings, Use of, 600*
Tunnel
Bulger, P., C. C. & St. L., 462*
D., L. & W., Bergen Hill, 356*
D., L. & W., Nay Aug, 279*
Denver Northwestern & Pacific, 503*
Detroit River, Michigan Central, 149*, 184*
English Channel, 133
Lackawanna & Wyoming Valley at Scranton, Pa., 31*
Sarnia, Ont., Westinghouse Equipment for, 12, 68*
Simplon (See Simplon Tunnel)
Subway (See Subway)

U

Underwood (H. B.) & Co.
Boring Mill Attachment for Lathe, 2* (G. N. S.)
Underground Electric of London:
Election of Officers, 13
Steel Cars, 23 (G. N. S.)
Union Pacific:
All Electric Interlocking, Council Bluffs, 574*
Automatic Block Signals for, 343*
Motor Car, No. 7, 410*, 609*, 653
Ruling Grades, 441†, 451*
Union Switch & Signal Company
All Electric Interlocking, B. & O., at Elsmere Junction, 481*
United States Steel Corporation
Annual Report, 31 (G. N. S.), 296†
Report for Quarter, 125 (G. N. S.)
Universities (See Names)
University of Illinois:
School of Ry. Engineering, 124†

V

Valve (See Finance)
Valve (See also Brakes)
Anderson Automatic, and Water Column, 654*
Lunkenheimer Locomotive Blow Off, 3* (G. N. S.)
Setting Valves with Walschaert Valve Gear, 8‡
Young, on D. & H. Locomotive, 102*
Vandalia Railroad:
Annual Report, 421†
Vanderbilt System, Mileage of, 467†
Viaduct (See Bridge)
Von Borries, August, 281
Von Thielen, Karl, 192

W

Wabash:
Eastern Improvements, 427*
Freight House at Chicago, 400*
Newell Grade Separation, 12*
Wabash-Pittsburg Terminal:
Improvements in Pittsburg District, 427*
Walker, J. W., Ritter Horizontal Folding Door, 33* (G. N. S.)
Walschaert Valve Gear:
Service on Penna. R. R., 32†
Setting Valves with, 8
Warren & Jamestown Single-Phase Railway, 157*
Washington Correspondence, 13, 40, 60, 91, 103, 139, 154, 216, 240, 309, 323, 354, 390, 399, 437, 459, 512, 531
Washington Street Subway, Boston, 86*
Water
Penna. R. R. Water Works, 117 (G. N. S.)
Water Column, Anderson Self-Adjusting, 654*
Water Softening, 589
Waterbury Farrel Foundry & Machine Co.:
Reciprocating Screw-Thread Rolling Machine, 215†
Weather Strip, Acme Metallic, 170* (G. N. S.)
West Jersey & Seashore:
Electrification, 560
Western Maryland:
Extension from Cherry Run to Cumberland, 245*
Western Pacific:
States, 252*
Terminals at Oakland, 70*
Westingbouse, Church, Kerr & Co.:
Insulator Pin, 185* (G. N. S.)
Westinghouse Elec. & Mfg. Co.:
Electric Motors, 684*
Single-Phase Equipment for Sarnia Tunnel, 42, 68*
Subsidiary Company in Russia, 57 (G. N. S.)
Variable Speed Auxiliary-Pole Motors, 64* (G. N. S.)
Westinghouse, George, Awarded John Fritz Medal, 85
Westinghouse "K" Triple Valve, 314*
Westinghouse, New Company, 145 (G. N. S.)
Wheel:
Cast Iron, 600
Chilled, a Manufacturer's Standpoint, 580
Failures of, 561†
Flat Wear of Driving Wheel Tires, 610†
Shavings Cut from the Rail, 241†, 245*, 296‡, 322
Slivers Cut by Switch Point from, 511*
Tires, Method of Turning, N. Y. C. & H. R., 118*
Wear of Driving Wheel Flanges on Curves, 398
Whitney Self-Adjusting Chill, 190*

Wheeling & Lake Erie:
Annual Report, 321†
Earnings, 148‡, 310
Improvements, 430*
Whistle Nuisance, 659†
Whitney Self-Adjusting Chill, 190*
Window: Acme Weather Strip, 170* (G. N. S.)
Wire (See Signal; also Telegraph)
Wisconsin Central:
Duluth Extension, 484*
Wood (See Timber)
Works (See Shops)
Wyckoff, A., & Son Co., Wood Pipe, 24* (G. N. S.)

Y

Yards and Terminals:
C. & E. I., at Dolton, Ill., 254*
C., R. I. & P., Silvis, Ill., 448*
Good Work in a Poor Yard, 102†
Mo. Pac. at Kansas City, 474*
New York Freight, Map of, 354*
Pennsylvania R. R., at East Altoona, 259*
Pennsylvania R. R. at New York, 121†, 127*, 522*
Yards and Terminals - (*Continued*):
Pennsylvania R. R., New York and Long Island, 349*, 374*
Peoria & Pekin Union, 546*
So. Pacific, Alameda Mole, 223*
Wabash-Pittsburg Terminal, Pittsburg, 427*
Western Pac., Oakland, Cal., 70*
Year 1905, Review of, 3†
Yerkes, Charles T., 1 (G. N. S.)
Yoakum System, 369†
Young Men's Christian Association:
W. C. Brown on the Railroad Y. M. C. A., 533

NEW PUBLICATIONS.

Adjustment of the Engineer's Transit and Level, 613
Biographical Directory of the Railway Officials of America, 77
Building Code, 296
Car Distributor, 52
Directory of Directors in the City of New York, 613
Earning Power of Railroads, 197
Electric Transmission of Water Power, 540
Engineering Experiment Station of the University of Illinois, 612
Heart of the Railroad Problem, 421
High-Tension Power Transmission, 612
Manual of Recommended Practice for Railway Engineering and Maintenance of Way, 124
Manual of Statistics, 1906, 540
Modern Locomotive Engineering, 6
Morton Memorial, 471
Poor's Railroad Manual Appendix and Diary, 613
Practical Electrical Railway Handbook, 1906, 222
Questions and Answers, 519
Railways of the Future, 519
Railway Signal Association, 101
Rapid Transit in New York City and other Great Cities, 222
Reinforced Concrete, 244
Steam Turbines, 373
Structural Engineering Tables, 244
Twentieth Century Machine Shop Practice, 1906, 540
Welfare Work, 101

PERSONAL.

[*Portraits are indicated thus*; All references are to the General News Section.*]

Abbott, James, 83
Aishton, Richard H., 35*
Beard, Edward J., 83
Beckwith, Frank, 35
Boardman, Francis, 35
Boswell, R. E., 147
Bower, L. F., 126*
Bowles, F. T., 52
Bradfield, J. P., 179
Brown, W. C., 152*
Brown, W. H. (See Gen. Index.)
Buck, W. F., 127
Buckelew, James, 18
Burnett, H. C., 127*
Cameron, J. R., 59.
Cantillon, W. D., 43*
Carson, H. M., 112
Colby, Albert Ladd, 68
Copeland, Edward L., 10*
Crockett, J. O., 112
Crowley, P. E., 179*
Duane, W. M., 141*
Eldredge, F. C., 187
Fairlamb, J. F., 76*
Firth, Charles, 165*
Forrer, Dr. Ludwig (See Gen. Index)
Gardner, W. A., 34*
Gibb, Sir George (See Gen. Index)
Gower, H., 11*
Greig, A. S., 120
Grice, E. W., 187
Gross, Robert J., 140*
Guppy, R. T., 141
Handy, Edward A., 68*
Hardin, A. T., 179*
Hendricks, J. T., 26
Hibbitts, Frank N., 153
Houghton, H. F., 153
Hovey, W. G., 186*
Howe, W. K., 186*
Hyndman, F. T., 153
Isaacs, John Dove, 19*
James, C. M., 18
Jansen, William B., 10*
Kittredge, George W., 112*
Laing, O. M., 120
Layton, Byron, 187
Marshall, W. H., 42*
Maxwell, W. C., 18
Meister, C. L., 121
More, D. S., 18
Morgan, Dwight C., 19*
Morse, W. E., 43*
Muchnic, Charles M., 103*
Neff, Nettleton, 26*
Parker, A. D., 26
Pitcairn, Robert, 159
Salmon, W. W., 186*.
Sebastian, John, 96*
Smith, A. H., 179*
Smith, C. F., 179*
Sperry, H. M., 186*
Stapp, G. H., 5
Taylor, B. E., 10*
Taylor, W. D., 27*
Temple, E. B., 96
Thian, P. E., 18*
Throop, W. B., 83
Tisdale, A. A., 172
Van Winkle, J. Q., 153
Votaw, J. E., 76
Wheaton, L. H., 44
Williamson, F. E., 95
Willsie, A. N., 133
Wright, Robert C., 76
Young, S. M., 186*

OBITUARY.

[*Portraits are indicated thus*; All references are to the General News Section.*]

Bacon, Marshal L., 34*
Bennett, C. M., 126
Bork, Wilhelm, 111
Brill, G. Martin, 111*
Collins, Benjamin, 126
Coxe, Alexander B., 51
Croes, J. J. R., 88
Cudworth, W. J., 178
Dougherty, John, 4
Duke, Francis J., 17
Dunn, W. M. S., 126
Erwin, Robert G., 17
Foot, George, 26
Frost, Homer F., 17
Holliday, R. L., 158
Hovey, J. P., 4
Howard, James L., 139
Howe, Samuel O., 88
Lewis, W. H., 152
Little, George W., 67
Logue, William S., 140
Miller, Henry V., 26
Miller, Robert, 95*
Parkhurst, Henry W., 111*
Peel, Sir Frederick (See Gen. Index.)
Reynolds, E. R., 4
Rouse, Henry C., 133*
Serrell, Gen. E. W., 132
Spriggs, George B., 4
Thomas, J. W., 51
Thorne, William S., 4
Von Borries, A. (See Gen. Index.)
Von Thielen, Karl (See Gen. Index.)
Webb, F. W., 178
Wilder, Edward, 4
Wood, Matthew P., 4
Yerkes, Chas. T. (See Gen. Index.)

ELECTIONS AND APPOINTMENTS.

[*All references are to the General News Section.*]

Alabama Great Southern, 147, 153
Annapolis, Washington & Baltimore, 10, 52
Argentine Central, 153
Astoria & Columbia River (Corvallis & Eastern), 153
Atchison, Topeka & Santa Fe, 10, 52, 112, 133
Atchison, Topeka & Santa Fe (Coast Lines), 51
Atlanta & West Point, 52
Atlanta, Birmingham & Atlantic, 179
Atlantic & Birmingham, 52, 96
Atlantic & Birmingham Air Line, 164
Atlantic & North Carolina, 27
Atlantic Coast Line, 5, 68, 88, 104
Augusta & Florida, 68
Baltimore & Ohio, 171
Bangor & Aroostook, 140, 180
Beaumont, Sour Lake & Western, 112, 172, 172
Bessemer & Lake Erie, 147
Birmingham & Atlantic, 147
Blaney & Southern, 140
Boston & Albany, 147, 165, 172
Boyne City, Gaylord & Alpena, 68, 171, 172, 172
Brockville, Westport & Northwestern, 104
Brookhaven & Pearl River, 178, 179
Buckhannon & Northern, 51
Buffalo & Susquehanna, 18
Buffalo, Bradford & Kane, [illegible]
Canadian Northern, 10, 1[illegible]9, 83
Canadian Pacific, 5, 27, 5[illegible]83, 96, 187
Central Indiana, 83
Central New England, 5[illegible]104, 153
Central of Georgia, 5, 83
Central Vermont, 172
Charleston & Western Carolina, 104
Chattanooga Southern, 1[illegible]3
Chesapeake & Ohio, 83[illegible]87
Chesterfield & Lancaster, 18
Chicago & Alton, 11, 2[illegible]59, 68
Chicago & North Western, 26, 27, 27[illegible]
Chicago, Anamosa & Southern, 52
Chicago, Burlington & Quincy, 5, [illegible]52, 59, 96, 104, 13[illegible]140, 1[illegible]5, 165, 171, [illegible]
Chicago, Cincinnati & Louisville, 4[illegible]27, 27, 51, 52, 5[illegible]140
Chicago Great Western, 147
Chicago, Indiana & Southern, 14[illegible]140, 159, 159, 172, 187
Chicago, Indianapolis & Louisville, 10, 172
Chicago, Lake Shore & Eastern, 133
Chicago, Milwaukee & St. Paul, 104, 112, 127, 159, 165, 187
Chicago, Peoria & St. Louis of Illinois, 112
Chicago, Rock Island & Pacific, 11, 11, 18, 43, 43, 52, 83, 88, 121[illegible]139, 153, 164, 172, 172
Chicago, St. Paul, Minneapolis & Omaha, 26
Chicago Terminal Transfer, 76, 76, 76
Cincinnati, Hamilton & Dayton, 4, 5, 11, 76
Cincinnati, New Orleans & Texas Pacific, 147, 153
Cleveland & Ma[illegible]140
Cleveland, Cincinnati, Chicago & St. Louis, 26, 43, 83, 112, 153, 159
Coal & Coke, 96, 121, 121, 121
Colorado & Southern, 13, 68, 155
Colorado Southern, New Orleans & Pa[illegible]51
Colorado Spri[illegible] & Cripple Creek Dist[illegible]2, 52
Colorado & Wyoming, 148
Columbia, Newberry & Laurens, 179
Columbus & Southern, 179
Cripple Creek Central, 152
Cumberland Valley, 96, 180
Delaware & Hudson, 140
Delaware, Lackawanna & Western, 18, 121, 133, 133
Denver & Rio Grande, 10, 18, 96, 172

ELECTIONS AND APPOINTMENTS—Continued.

[*The references are to the General News Section.*]

Denver, Enid & Gulf, 96, 43, 96
Denver, Northwestern & Pacific, 52, 121, 143
Des Moines, Iowa Falls & Northern, 43, 52, 52

East Broad Top, 18
East Carolina, 46
East Tennessee & Western North Carolina, 52
El Oro Mining & Railway Co., 179
Erie, 5, 11, 43, 52, 96, 127, 172
Evansville & Terre Haute, 83, 104, 180

Flint River & Gulf, 187
Flint River & Northeastern, 18, 187
Florida, 18
Florida West Shore, 180
Fort Worth & Denver City, 52

Gainesville & Gulf, 68
Galveston, Harrisburg & San Antonio, 96
Georgetown & Western, 52
Georgia, Florida & Alabama, 68, 172, 172
Grand Rapids & Indiana, 140, 140, 147, 178
Grand Trunk, 104, 140, 147, 164, 165, 172, 179
Grand Trunk Pacific, 26, 172
Great Northern, 18, 52, 104, 165, 180
Great Northern of Canada, 52
Gulf & Ship Island, 11
Gulf, Colorado & Santa Fe, 187

Halifax & Southwestern, 43
Hocking Valley, 26
Houston & Texas Central, 5
Huntington & Broad Top Mountain, 19

Illinois Central, 43, 133
Indiana Harbor, 10, 18, 68, 140
Interoceanic of Mexico, 121
Iowa Central, 10

Kansas City, Mexico & Orient, 172
Kansas City Southern, 11, 11, 127, 140, 140, 172, 180

La Crosse & Southeastern, 52
Lake Erie & Western, 18, 27
Lake Shore & Michigan Southern, 18, 43, 52, 68, 140, 147, 187
Lehigh & New England, 11
Lehigh Valley, 4, 43, 52, 88, 104, 112, 127, 153, 165, 165
Little Rock & Hot Springs Western, 5
Long Island, 172, 172
Louisiana & Arkansas, 96
Louisiana & Northwest, 52
Louisiana & Pacific, 153
Louisville & Nashville, 76, 88, 96
Louisville, Henderson & St. Louis, 83

Marcellus & Otisco Lake, 127
Metropolitan Street Railway, 140
Mexican Central, 18, 27, 52, 89, 141, 153, 159, 180
Mexican Pacific, 88
Michigan Central, 10, 52, 140
Midland Valley, 10
Millen & Southwestern, 180
Minneapolis, St. Paul & Sault Ste. Marie, 10, 18, 172
Minnesota Railroad & Warehouse Commission, 19
Mississippi Eastern, 10
Missouri & Illinois Bridge & Belt, 10
Missouri & Louisiana, 10
Missouri, Kansas & Texas, 52, 104, 140, 153, 165
Missouri, Kansas & Texas of Texas, 104
Missouri, Oklahoma & Gulf, 140, 141
Missouri Pacific, 27, 89, 88, 112, 121, 127, 133, 141, 147
Missouri River & Northwestern, 5, 141
Missouri Southern, 52
Mobile, Jackson & Kansas City, 5, 140
Montana, 152

Nashville, Chattanooga & St. Louis, 59, 76, 127
National of Mexico, 112, 172, 172, 179
National Lines of Mexico, 10, 18
New Orleans & Northeastern, 121, 141
New York & Harlem, 52
New York Central & Hudson River, 27, 27, 52, 88, 76, 96, 96, 104, 112, 121, 153, 179
New York Central Lines, 152, 165
New York, Chicago & St. Louis, 27, 43
New York, New Haven & Hartford, 11, 59, 153, 153
Norfolk & Southern, 26, 76
Northern Central, 104
Northern Pacific, 5

Ohio River & Western, 18, 52, 52, 172
Oregon Railroad & Navigation, 121, 127, 180

Panama, 178
Pan-American, 59
Pennsylvania, 19, 43, 59, 68, 76, 96, 104, 127, 147, 159, 172
Pennsylvania Lines West, 5, 27, 76, 140, 147, 153
Peoria & Pekin Terminal, 52
Pere Marquette, 4, 5, 43, 59, 172
Philadelphia & Reading, 43, 96
Philadelphia, Baltimore & Washington, 5, 68, 172
Pittsburg & Lake Erie, 26, 27, 27, 76, 96, 187
Pittsburg, Allegheny & McKees Rocks, 11
Pittsburg, Shawmut & Northern, 141, 147
Pullman Company, 159

Quebec Central, 52, 52

Raleigh & Western, 147
Richmond, Fredericksburg & Potomac, 52, 52
Rio Grande, Sierra Madre & Pacific, 140
Rio Grande Western, 26, 96
Rock Island Company, 43, 52, 112

St. Joseph & Grand Island, 11
St. Louis & San Francisco, 18, 52, 59, 68, 83, 112, 129, 179
St. Louis, Brownsville & Mexico, 18
St. Louis, Iron Mountain & Southern, 76, 96, 153
St. Louis, Rocky Mountain & Pacific, 52
St. Louis Southwestern, 159
San Antonio & Arkansas Pass, 68
San Pedro, Los Angeles & Salt Lake, 4
Santa Fe Central, 52
Seaboard Air Line, 52, 104, 153, 159
Sierra & California, 141
Sonora, 180
South & Western, 11,
Southern, 5, 11, 68, 76, 76, 133, 165, 178, 179
Southern Indiana, 11
Southern Pacific, 69, 104, 121
Southern Pacific & Oregon Short Line, 59
Southern Pacific-Atlantic System, 43

Tacoma Eastern, 11, 140
Tennessee, 52
Texarkana & Fort Smith, 172
Texas & Gulf, 127, 127, 140, 140, 140
Texas & New Orleans, 96
Texas & Pacific, 11
Tidewater, 18, 27
Toronto Valley, 52, 52
Toledo & Indiana, 141
Toledo & Western, 52
Toledo, St. Louis & Western, 11, 83
Farmington Valley, 153
Tonopah & Goldfield, 52
Trinity & Brazos Valley, 59, 96

Union & Glenn Springs, 26
Union Pacific, 26, 68, 104, 112, 112

Vera Cruz & Pacific, 5

Wabash, 26, 43, 96, 133, 141, 172, 172, 172
Wabash Pittsburg Terminal, 26
Washington & Columbia River, 172
Washington County, 11
Western Maryland, 18
Western Pacific, 43, 88
Wheeling & Lake Erie, 5, 59, 69, 112, 133, 133
White Pass & Yukon, 52
Wisconsin & Michigan, 180

RAILROAD CONSTRUCTION.

[*Maps are indicated thus*: All references are to the General News Section.*]

Abilene Northern, 160
Abilene Railroad, 54
Adirondack & St. Lawrence, 136
Alabama & Mississippi, 13
Alabama Central, 160
Alabama Great Southern, 28
Alabama Roads, 13
Alabama Western, 46
Alaska, Manatee & Gulf Coast, 114
Alaska Central, 98, 160, 188
Alaska Pacific Railway & Terminal, 174
Alaska Railroad, 46
Alberta & Flathead, 98
Albuquerque & [illegible], 54
Allentown, Tamaqua & Ashland (Electric), 71
American Asiatic Railway, 149
American Hayti Co., 174
American of Porto Rico, 37, 78
Apalachicola Northern, 54, 188
Argentine Central, 136, 149
Arizona & California, 6
Arizona Midland, 174
Arkansas Anthracite & Western, 150
Arkansas Valley, 60
Asheboro, Barkerville & Fort George, 78
Ashville Loop, 149
Ashville Southern, 13, 37
Atchison, Topeka & Santa Fe, 6, 27, 28, 98, 122, 149, 160, 166, 188
Atlanta & St. Andrew's Bay, 188
Atlanta, Birmingham & Atlantic, 188
Atlanta & Western, 6
Atlantic Coast Line, 160
Augusta & Columbia, 46
Augusta & Lake City, 28
Augusta & [illegible], 54
Augusta & Northwestern, 188
Augusta, Monroe & Oakland (Electric), 78

Baltimore & Ohio, 27, 46, 78, 149, 155
Baltimore, Frederick & Hagerstown (Electric), 149, 155
Baton Rouge, Hammond & Eastern, 106
Beaumont & Great Northern, 160
Beaumont, Sour Lake & Western, 71
Beaumont Terminal, 28
Bella Coola & Fraser Lake, 78
Bessemer & Lake Erie, 6
Big Fork & Northern (Minnesota & International), 54
Big Horn (C., B. & Q.), 13, 188
Birmingham & Southwestern, 54
Birmingham, Columbus & St. Andrews Bay, 28
Black Mountain, 71
Boston & Maine, 181
Boston & Rhode Island Electric, 28, 46
Boston Elevated, 174, 188
Boston Subways, 37
Bowling Green & Western, 98
Brunson Railway, 160
British Columbia Roads, 71
Bronx, Yonkers & White Plains (Electric), 114
Brooklyn Rapid Transit, 78, 98, 106, 181
Brookville & Mahoning, 71
Brownsville, Hidalgo & Northern, 37
Brush Creek & Crows Run, 114, 128
Buffalo & Lackawanna Traction, 181
Buffalo & Susquehanna, 13
Buffalo, Lake Erie & Niagara, 160, 174
Buffalo, Lockport & Rochester (Electric), 161
Buffalo Subway, 54
Burns Ferry, Brownell & Chester, 28
Butte County, 21

Cairo & Kentucky Valley, 188
Cairo & [illegible]s, 122, 136
Cairo, Mayfield & Nashville, 106
California & Oregon Coast, 174
California Roads, 28, 54, 188
Calumet, Hammond & Southeastern, 188
Canadian Northern, 37
Canadian Northern, 71, 98, 122, 129, 136, 142, 166
Canadian Pacific, 21, 29, 46, 54, 60, 71, 91, 98, 106, 114, 123, 129, 149
Canadian Roads, 60, 71, 78, 114
Canaveral, Yaggy River & Pacific (Southern Pacific), 27
Canyon City, [illegible] & Royal Gorge Interurban, 114
Cape Charles, 114
Cardenas & Juca[illegible]
Carson & Colorad[illegible]
Carthagensville & W[illegible]n, 47
Central & Southeast[illegible], 161
Central Arkansas, 60
Central California [illegible]on, 47
Central of Georgia, [illegible] 161
Central of Louisiana, 2[illegible]
Central of New Jersey, 146
Central Ontario Railway, 60
Charleston Parkersburg & Western, 21, 47
Chattanooga, Anderson & Atlantic, 37
Chattanooga Northern, 88
Cherokee Union & Spartanburg, 136
Cherryvale, Oklahoma & Texas, 136
Chesapeake & Ohio, 123, 136
Chesterfield & Lancaster, 13, 37, 54
Chester, Perryville & Ste. Genevieve, 91
Chicago & Alton, 13
Chicago & Illinois Western, 21
Chicago & North Western, 91, 114, 123, 143, 181, 188
Chicago & Southern Traction, 47
Chicago, Burlington & Quincy, 13, 47, 91, 149, 174, 189
Chicago Great Western, 91
Chicago, Indianapolis & Louisville, 29, 47, 78
Chicago, Kalamazoo & Eastern, 37
Chicago, Lake Shore & South Bend (Electric), 6
Chicago, Milwaukee & St. Paul, 13, 37, 55, 91, 98, 123, 143, 149, 161
Chicago, Milwaukee & St. Paul of Washington, 29
Chicago Roads, 166
Chicago, Rock Island & Gulf, 7
Chicago, Rock Island & Pacific, 13, 60, 114, 123, 136, 149, 155, 161, 174, 189
Chicago Subway, 161
Cincinnati & Columbus Traction, 155
Cincinnati, Georgetown & Portsmouth, 21
Cincinnati, New Orleans & Texas Pacific, 91
Cincinnati Roads, 106
Cleveland, Ashland & Mansfield (Electric), 149, 161
Cleveland, Cincinnati, Chicago & St. Louis, 7, 37, 61, 155, 166
Cleveland, Youngstown & Eastern, 181
Coal River, 7
Cobalt Range, 106, 181
College City & Southern, 106
Colorado & Southeastern, 114, 143
Colorado & Southern, 71, 161
Colorado Roads, 123
Colorado, Texas & Mexico, 71
Columbus City & Ocmee, 37
Columbus, New Albany & Johnstown Traction, 174, 189
Conemaugh & Blacklick, 143
Conway Coast & Western, 7
Co-Operative Construction, 106
Copper River, 167*
Copper River & Telkwa, 78
Copper Valley, 130
Council City & Solomon River, 7
Crawford Bay & St. Marys, 123
Crawfordsville & Northwestern, 61
Cuba Eastern, 47
Cuba Railroad, 37
Cuba Railroads, 167
Cumberland & Northern, 136
Cynthiana & Claysville, 143

Danbury & Port Chester, 167
Danville & Scottsville, 114
Davis & Turner Falls, 155
Dawson, Grand Forks & Stewart River, 78
Deering Southwestern, 13
Delaware & Eastern, 7
Delaware & Hudson, 55, 161, 174
Delaware, Lackawanna & Western, 47, 71, 155
Denver & Kansas Northern, 143
Denver & Rio Grande, 78, 181
Denver, Enid & Gulf, 7, 29
Denver, Kansas & Gulf (D., E. & G.), 7
Denver, Laramie & Northwestern, 98
Denver Northern (Electric), 143
Denver, Northwestern & Pacific, 13, 61
Denver, Terminal, 61
Deschutes, 61
Detroit & Adrian Traction Co., 106
Detroit & Grand Rapids, 181
Detroit Roads, 78
Detroit, Toledo & Ironton, 181
Detroit Terminal Railroad, 29
Dover & South Bound, 47
Dublin & Southwestern, 149, 189
Duluth, Missabe & Northern, 7
Duluth, Rainy Lake & Winnipeg, 91
Duluth, St. Cloud, Glencoe & Mankato, 7
Durango Central, 13
Durham & Charlotte, 175
Durham & Southern, 175

East Central, 106
Eastern Railway, 129
Eastern Ohio Traction, 181
East Liverpool Traction, 61, 143
East Side Viaduct, 167, 181
Edgewater Connecting, 98
Edmonton & Athabasca, 115
El Dorado & Western, 111, 115
Elgin & DuPage (Electric), 166
Elk Short Line, 106
Elmira Electric, 71
Erie, 37, 47, 71, 106, 181, 189
Erie, Cambridge Springs, Union & Corry (Electric), 181
Erie, London & Tilsonburg (Electric), 98
Esquimalt & Nanaimo, 13

Fayette Valley, 71
Flint River & Gulf, 175
Florida Railway, 161
Fort Smith, Indian Territory & Texas, 136
Franklin Southeastern, 143
Fremont, Elkhorn & Missouri Valley, 143
Frisco, Oklahoma & Texas, 189

Gainesville & Gulf, 129
Gainesville Midland, 13
Galveston, Beaumont & Northeastern, 98
Gassaway, Elk River & Huttonville, 129
Gates City Terminal, 155
Georgia & Florida, 161
Georgia, Florida & Alabama, 149, 161, 175
Georgian Bay & Seaboard, 189
Georgia Northern, 136, 149
Georgia Southeastern & Gulf, 161
Gilpin & Clear Creek District, 78
Glen Cove (Long Island), 7
Goshen, South Bend & Chicago (Electric), 143
Grand Rapids Terminal Belt, 13
Grand Trunk, 61
Grand Trunk Pacific, 21, 37, 55, 71, 91, 106, 115, 123, 129, 167
Great Bend & Gulf, 167
Great Mineral of Mexico, 21
Great Northern, 21, 29, 91, 106, 115, 129, 161, 167, 175, 181*
Great Northern of Canada, 7, 115
Great Southern, 61
Great Western, 91
Green River Valley (L. & N.), 13, 37
Guantanamo, Cuba, 37, 78
Gulf & Northwestern, 21, 106*
Gulf & Ship Island, 7, 98, 143, 155, 161
Gulf, Brownwood & Cisco, 71
Gulf, Colorado & Santa Fe, 98, 115
Gulf, Plainville & Northern, 106
Gulfport & Mississippi Coast Traction, 161

Hamilton, Galt & Guelph (Electric), 115
Hampton & Yorktown (Electric), 98
Hanover Railway, 91
Harrisburg & Ohio River, 29
Hartwell & Washington, 115, 129, 143
Hay City & Great Northern, 143
Hidalgo & Northern, 123
Hillcrest Railway, Coal & Coke, 136, 175
Hillsboro & Northeastern, 79, 98
Holston River, 13, 149
Holly & Swink, 61
Holly, Holbrook & Big Bend, 29
Honesdale & Hawley (Erie), 71
Hot Springs, Ouachita & Mena, 136
Hudson & Manhattan Railroad, 143
Hudson River & Eastern Traction, 79, 175

Illinois Central, 7, 47, 71, 136, 181
Illinois, Indiana & Gary, 143
Illinois, Iowa & Minnesota, 7
Illinois Valley Railway (Electric), 123
Indiana, Columbus & Eastern Traction, 123
Indiana Harbor, 7, 47
Indiana Roads, 166
Indiana Southern, 136
Indianapolis & Louisville (C., I. & L.), 47, 79
Indianapolis & Louisville Traction, 37, 61
Indianapolis, Columbus & Southern Traction, 167
Inland Empire, 91
Interborough (New York City), 47
International (Canada), 7
Interoceanic, 37, 161
Interurban, 98
Iowa Transfer Railway, 29, 55

James Bay, 143, 182
Jasper & Eastern, 7, 98
Jefferson City Southern (Southern), 61
Jesup, Lake City & Eastern, 175

Kamloops & Yellowhead Pass, 21, 189
Kamloops, Boundary & Cariboo, 98
Kanawha & West Virginia, 115
Kansas City & Belton, 136
Kansas City, Mexico & Orient, 7, 149
Kansas City Southern, 136
Kansas City, Tulsa & Southwestern, 13
Kansas City, Tulsa, Texas & Gulf, 99
Kansas City Viaduct & Terminal Railway, 29
Kentucky & Southeastern (C., N., O. & T. P.), 91
Kentucky & Tennessee, 115
Kentucky Midland, 71
Kentucky Valley, 99
Kettle Valley Lines, 47, 71, 143, 182, 189
Klondike Mines, 61, 79
Klondike Roads, 143, 155
Knoxville, Sevierville & Newport, 115
Kootenay Central, 115, 182

Lake Erie & Southern, 106
Lake Erie Terminal & Southern (Electric), 123
Lake Shore & Michigan Southern, 61, 106
Lake Shore Electric, 115
Lancaster & Northern, 115
Las Vegas & Tonopah, 115, 175
Laurel Valley, 155
Lee County, 175, 189
Lehigh & Lake Erie, 123, 136
Lehigh Valley, 115, 123, 136
Leroy & Southwestern, 175, 189
Lewiston, Brunswick & Bath (Electric), 149
Liberal & Englewood, 150
Linares & Gulf, 61
Little Falls & Canada Lakes (Electric), 150
Live Oak, Perry & Gulf, 175
Long Island, 7, 143
Lorain & Ashland, 115
Lorain & West Virginia, 106
Lorain Southern, 91
Los Angeles & San Diego Beach (Electric), 91
Los Angeles Interurban (Electric), 155
Louisiana & Arkansas, 79, 137
Louisiana Railway & Navigation Co., 161
Louisiana Roads, 99
Louisville & Atlantic, 189
Louisville & Eastern (Electric), 150
Louisville & Indianapolis Traction, 79
Louisville & Knoxville, 29
Louisville & Nashville, 7, 13, 37, 91, 106, 137, 182
Louisville, Henderson & St. Louis, 92, 123
Louisville, South Pittsburg & Birmingham, 123

McCormick & Columbia River, 61
McCloud River 7
Mackenzie-Mann Roads, 167
Mackenzie Mann System, 137*
Madisonville, Hartford & Eastern, 129, 182
Maine & New Hamushire (Electric), 150
Maine Railroads, 79, 137
Manila Railroad, 175
Manila Railway, 37
Marianna, Brinckley & Western, 189
Marietta & Lake, 137
Marion Railroad, 189
Marsh Fork (Tidewater), 71
Martinez & Contra Costa, 107
Maryland & Pennsylvania, 182
Mattawamkeag & Northern, 150.
Memphis & New Orleans (St. L. & S. F.), 61
Meridian & Tombigbee, 155
Mexican Central, 21, 99
Mexican Roads, 13, 21, 37, 55, 61, 71, 79
Mexican City Roads 99
Michigan Central, 37, 72
Michigan Roads 189
Middletown & Cecilton, 79
Midland & Manitoba, 143
Midland Air Line Railway & Navigation, 47
Midland Central, 137
Midland Railway, 107
Midland Valley, 13, 115
Midway & Vernon, 21
Milwaukee Junction, 189
Milwaukee, Rockford & Eastern, 143
Milwaukee Southern, 137, 182
Minneapolis & St. Louis, 29, 115, 123, 12[illegible] 167
Minneapolis, Red Lake & Manitoba, 21
Minneapolis, St. Paul & Sault Ste. M[illegible] 92, 123, 189
Minnesota, Dakota & Pacific, 29, 12[illegible] 5, 167
Miora Springs, 189
Mississippi Central, 21, 99
Mississippi Eastern, 167
Missippi Garden, 99
Missouri, Arkansas & Southw[illegible]ern, 72
Missouri, Iowa & Nebraska, [illegible]
Missouri, Kansas & Texas, [illegible]9, 107, 123, 150
Missouri Pacific, 99, 115, [illegible]3, 161
Monclova & Pannea, 129
Monongahela Southern, [illegible]
Montana, Tabor & Edr[illegible]ton, 47
Montgomery & Hayne[illegible]lle 79
Morgan's Louisiana [illegible] Texas 5[illegible]
Morgantown & Dunka[illegible]d Valley, 161
Morgantown & Pittsb[illegible]g, 189
Muhlenberg & East[illegible] 137
Muncie & Portland [illegible]raction, 189
Munising, 21

Napierville Junction [illegible]ailway, 175
Nashville & Hunts[illegible] [illegible]
Nashville & Vale[illegible] 107
Nashville, Chatt[illegible]nooga & St. Louis, 107
Natchez & East[illegible]n, 99
National of Mex[illegible]o, 21, 161
Nevada & Californ[illegible]a, 123
Nevada Northern, L[illegible] 17
Nevada Roads, 79, 137
New Jersey Roads (Electric), 13
New Orleans & Baton Rouge (Electric), 189
New Orleans, Crowley & W[illegible]n, 143, 189
Newton & Northwestern, 29
New York & Port Chester [illegible]ad, 155
New York Canadian Pacific, 21, [illegible]
New York Central & Hudson River, 21, 137
New York, Chicago & St. Louis, 123, 150
New York City Rapid Transit Routes, 175
New York City Subways, 79, 168
New York, New Haven & Hartford, 7, 61, 107, 115, 129, 182, 189
New York, Oklahoma & Pacific, 17
New York Roads (Electric), 61, 155
New York Subways, 182
Niagara, St. Catharines & Toronto (Electric), 13
Norfolk & Jamestown Exposition Railway (Electric), 189
Norfolk & Southern, 143
Norfolk & Western, 7, 61, 99, 150
North & South, Texas, 129, 143
North Carolina Roads, 37
North Coast, 55, 99
Northeastern Cuba, 47
Northern Alberta Railway & Coal Company, 79
Northern Pacific, 29, 72, 144, 155, 161, 168
North River Railway, 150, 114
Northwestern Development Company, 107
Nova Scotia Eastern, 168

Oaxaca & Pacific, of Hartford 29
Ohio & Licking Valley, 144
Okanogan Central, 61
Oklahoma City & Shawnee Traction, 144
Oklahoma Western, 14
Omaha, Lincoln & Beatrice, 144
Oregon & Southeastern, 14
Oregon & Washington, 168
Oregon Railroad & Navigation, 99, 123, 137
Oregon Roads, 130
Oregon Short Line, 7, 99, 115, 189
Oregon Water Power & Railway Company, 21
Organ Mountain, 168

Pacific & Eastern, 99, 136
Pacific & Gulf Terminal, 61
Pacific & Idaho Northern, 7, 115
Pacific Coast Railway (Pacific Coast Co.), 21
Pacific Railway (C., M. & St. P., of W.), 29
Pan-American, 7, 37, 168
Paris & Mt. Sterling (Electric), 155
Payette Valley, 155
Peach River & Gulf, 189
Pearl River Valley, 61.
Pecos & Northern Texas, 99, 115.
Peninsula (Electric), 29.
Pennsylvania, 29, 61, 79, 99, 107, 115, 137
Pennsylvania Lines West, 37, 123, 150, 168
Pennsylvania System, 167.
Pennsylvania Roads, 47, 92.
Pensacola, Alabama & Western, 61.
Pescadero Railway & Improvement, 115.
Philadelphia & Reading, 29, 150, 155.
Philadelphia & Western, 99.
Philadelphia, Camden & Inter-City Link, 123
Philadelphia Elevaetd & Subway Co., 115
Philadelphia Rapid Transit, 99, 107, 156
Philippine Railroads, 38
Philippine Railway, 79, 107
Pierre, Rapid City & North-Western (Chicago & North-Western), 72
Pittsburg & Lake Erie, 55, 175
Pittsburg, [illegible] North-Eastern, 144.
Pittsburg, Cincinnati, Chicago & St. Louis 107
Pittsburg, Harmon[illegible]y, Butler & New Castle (Electric), 137
Pittsburg Subway, 175
Pittsburg, Westmoreland & [illegible]
Pittsburg & Southwestern, [illegible] & Somerset, 123 175
Port[illegible] Townsend Southern, 17[illegible]1
Por[illegible] [illegible]6, 1[illegible]

Quebec & Lake St. John, 7
Quebec Midland, 115, 182
Quebec, Montreal & Southern, 79
Quebec Southern, 92

Randolph & Cumberland, 190
Rawley & Southport, 115
Richmond & Chesapeake Bay, 54
Rio Grande, Sierra Madre & Pacific, 21, [illegible]48, 175
Roanoke & Salem Traction, 190
Rochester, Scottsville & Caledonia (Electric), 55
Rockford Railroad, 99
Rock Island, Arkansas & Louisiana (C., R. I. & P.), 14, 150, 190
Rock Island Frisco Terminal, 123
Rockport, Langdon & Northern, 156
Rogers Southwestern, 29

St. Louis & North Arkansas, 29
St. Louis & San Francisco, 61, 123, 1[illegible]0, 168, 190
St. Louis, Brownsville & Mexico, 7, 144
St. Louis, Champaign & Decatur, 156
St. Louis Decatur & Champaign (Electric), 168
St. Louis, Iron Mountain & Southern, 116
St. Louis Manufacturers' Railway 48
St. Louis Southwestern, 30
St. Marys & Western, 72
Sacramento Belt, 190
Salem & Western, 137
Salem, Springfield & Peoria, 137
Salina & Northwestern, 116, 150
Salina, Tipton & Northwestern, 116
Salt Lake & Ogden 21
San Antonio & Aransa Pass [illegible]6
Sandusky, Fremont & Sout[illegible] 108, 116
San Francisco & Northwest[illegible] (A., T. & S. F.), 21
San Francisco, Ida[illegible] & M[illegible]na, 30, 55, 168
San Francisco Roads, 150
San Pedro, Los Angeles [illegible] Salt Lake, 7, 1[illegible]
San Saba Valley, 161, 1[illegible]
Santa Fe & Eastern, [illegible]
Santa Rosa & Northe[illegible] (Electric), 116
Saskatchewan & Alberta, 116
Schenectady & Southwestern, 168
Schoodnic Steam Railway 137
Seaboard Air Line, 55, 137
Seward Peninsula, 55
Shenango Valley Traction, 130
Shreveport, Houston & Gulf, [illegible]
Shreveport, Jonesboro & Na[illegible]38
Shreveport Northeastern, 14
Sierra & Eastern, 38
Somerset, 14, 92
South & Western, 124
South Dakota Central 17
Southeastern [illegible] 116
Southeastern Electric 130
Southern, 21, 38, 48, 61, 79, 99, 108, 124, 137, 144, 175
Southern & Atlantic 48

RAILROAD CONSTRUCTION—Continued.

[*Maps are indicated thus**; *All references are to the General News Section.*]

Southern Pacific, 30, 72, 108, 124, 161, 175, 190
South Side Coal & Iron, 21
Southwestern Traction, 150
Spartanburg & Northern, 18
Spokane & Inland (Electric), 61, 156
Spokane Pend D'Oreille Rapid Transit, 144
Statesboro & Midville, 108
Steubenville & East Liverpool, 116
Stone Canyon, 72
Stoneville & Southwestern, 14
Strathcona Radial Tramway, 130
Sumter & Choctaw, 175
Susquehanna & New York, [illegible] 144
Susquehanna Central, 18
Sugar Creek & [illegible] & E.), 48
Sugar Creek & Ohio Northern, 30

Tampa & Jacksonville, 124
Tampa Northern, 48
Taygarts & Cheat River, 79
Temiskaming & Northern Ontario, 22, 124
Tennessee, 14
Texas Central, 8*, 55
Texas, New Mexico & Pacific, 99
Texas Railway, 99, 116
Texas Roads, 99, 182
Texas Southeastern, 8
Tidewater, 8, 14, 72, 100
Tidewater Development Co., 175
Tioga & Clinton, 116, 130
Toledo, Fort Wayne & Indianapolis, 80
Toledo Railway & Light Co., 182
Toluca & Zihuatanejo (Electric), 38
Toluca, Marquette & Northern, 22
Tombigbee Valley, 116
Topeka & Northwestern, 8
Tonopah & Goldfield, 14
Tonopah & Tidewater, 14, 38
Toronto & York, 124
Trinity & Brazos Valley, 8
Trinity Valley & Northern, 190
Twin City Rapid Transit Co., 182

Union Pacific, 72
Uniontown & Wheeling Short Line, 22, 182
Urbano de Tampico, 62
Utah & Idaho, 150

Valdosta & Nashville, 137
Vancouver & Northwestern, 22
Vancouver, Victoria & Eastern (Great Northern), 22
Vancouver, Westminster & Yukon, 72
Vandalia, 62, 162
Vanderbilt Roads, 80
Vicksburg, Nat[illegible]z & Gulfport, 100
Virginia Air Line, 137, 150
Virginia & Carolina Coast, 55

Wabash, 80, 108, 175, 182
Wabash Pittsburg Terminal, 55
Wadsworth & Western Traction, 162
Washington, Alaska Transportation Railroad Co., 150
Washington, Idaho & Montana, 137
Washington Northern (Union Pacific), 55
Waycross, Baxley & Vidalia, 156
Waynesburg & Washington, 14
Weatherford, Mineral Wells & Northwestern, 92
Western Allegheny, 8, 22
Western Maryland, 8, 55, 124
Western Pacific, 100, 116, 175
Western Texas & Gulf, 55
West Jersey & Seashore (Electric), 8
West Pittsburg & Ellwood City (Electric), 62
West Virginia Midland, 137
Wheeling & Lake Erie, 30, 48, 55
Wichita Mountain & Orient, 137
Wichita Valley, 8, 162
Willamette Valley Traction, 22
Windsor, Essex & Lake Shore, 30
Wisconsin & Northern, 176
Wisconsin Central, 80, 116
Wolfe, Megantic & Lotbiniere, 62
Wolfe River Valley, 182
Wyoming & Northwestern, 190

Yazoo & Mississippi Valley (Ill. Cent.), 8, 56
Yosemite Valley, 80, 100
Youngstown & Ohio River (Electric), 137, 168
Youngstown & Southern (Electric), 8
Yreka Railroad, 116

Zitacuaro & Joconusco, 116

RAILROAD CORPORATION NEWS.

[*All references are to the General News Section.*]

Alabama Great Southern, 116
Allegheny Valley, 80, 80, 100
American Railways Company (Electric), 8
Ames & College, 150
Ann Arbor, 80
Arizona & Utah, 14
Atchison, Topeka & Santa Fe, 22, 38, 48, 62, 72, 100, 124, 138
Atlanta & Charlotte Air Line, 150, 156
Atlanta, Birmingham & Atlantic (Atlantic & Birmingham), 14, 144, 168
Atlantic & Birmingham, 144
Atlantic Coast Line, 22, 48, 62
Aurora, Elgin & Chicago (Electric), 100, 182

Bald Eagle Valley, 124
Baltimore & Ohio, 30, 56, [illegible] 100, 124, 144, 182
Baltimore, Chesapeake & [illegible]
Bay Shore Terminal, [illegible]
Birmingham & Atlantic Railway, [illegible]
Boston & Lowell (B. & M.), 14
Boston & Maine, 72, 182
Boston & New York Air Line, 162, 190
Boston Elevated, 8
Brockville, Westport & Northwestern, 168
Brooklyn & Rockaway Beach, 144
Brooklyn Rapid Transit, 80
Buffalo, Rochester & Pittsburg, 48
Buffalo Southern (Electric), 150

Calumet Electric Street Railway, 162
Canadian Northern, 124
Canadian Pacific, 8, 56, 80, 92, 108, 150
Canastota Northern, 190
Carolina Northern, 72
Central of Georgia, 8, 38, 48
Central Ontario, 124
Charleston & Raleigh, 72
Chesapeake & Ohio, 22, 48, 168
Chicago & Alton, 30, 48, 92, 176
Chicago & Eastern Illinois, 8
Chicago & Northwestern, 62
Chicago, Burlington & Quincy, 138
Chicago, Cincinnati & Louisville, 48, 92
Chicago Elevated Roads, 8, 72
Chicago Great Western, 38, 72, 100
Chicago, Indiana & Southern, 116
Chicago, Milwaukee & St. Paul, 38, 130, 138, 162, 190
Chicago, Milwaukee & St. Paul of Washington, 22
Chicago Railways Co., 176
Chicago, Rock Island & Pacific, 38, 108, 138
Chicago Subway, 156
Chicago Terminal Transfer, 72, 124, 156
Chicago Union Traction, 162, 176
Cincinnati, Hamilton & Chicago, 16
Cincinnati, Hamilton & Dayton, 8, 22, 72, 80, 92, 130, 182
Cincinnati, New Orleans & Texas Pacific, 38, 116
Cleveland & Pittsburg, 30
Cleveland, Cincinnati, Chicago & St. Louis, 30, 130, 182
Cleveland, Painesville & Ashtabula (Electric), 73
Cleveland, [illegible]ville & Eastern (Electric)
Colorado & [illegible] 56, 138
Colorado Southern, [illegible] 138
Colorado Southern, New Orleans & Pacific, [illegible] 108
Columbus, Buckeye Lake & Newark Traction, 162
Consolidated (N. Y., N. H. & H.) Electric Lines, 190
Cumberland Valley, 56

Darien & Western, 150
Dayton, Springfield & Urbana (Electric), 80
Delaware & Eastern, 116
Delaware & Hudson, 30, 62, 72, 150, 182
Delaware, Lackawanna & Western, 72, 156
Denver, Enid & Gulf, 22, 124
Denver, Northwestern & Pacific, 162
Des Moines & Fort Dodge, 162, 176
Detroit, Toledo & Ironton, 22, 80, 144, 182
Detroit Tunnel Co., 150
Detroit United (Electric), 56
Dillsburg & Mechanicsburg, 56
Duluth, South Shore & Atlantic, 62

Eastern Pennsylvania (Electric), 190
East St. Louis & Suburban (Electric), 108
Erie, 48, 108, 138, 168
Exeter, Hampton & Amesbury Street Railway, 150

Fort Wayne, Van Wert & Lima Traction, 116

Georgia & Florida, 156
Georgia Coast & Piedmont, 100
Georgia, Florida & Alabama, 72
Georgia Railway & Electric, 144
Georgia Southern & Florida, 72
Grand Trunk, 72, 130
Grand Trunk Pacific, 72, 156, 182
Great Northern, 22, 56, 62, 80, 144
Great Northern of Canada, 138

Havana Electric, 80
Hocking Valley, 62, 138, 162
Holly River & Addison, 100
Hudson & Manhattan, 84
Hudson Valley, 14, 100, 144

Illinois Central, 22, 48, 100
Indiana, Columbus & Eastern Traction, 130, 162, 190
Indiana Harbor, 116
Indiana, Illinois & Iowa, 100, 108, 116
Interborough Metropolitan, 38, 80, 92
Interborough Rapid Transit, 30, 62, 138, 162, 176, 190
Intercolonial, 56

Kanawha & Michigan (Toledo & Ohio Central), 1[illegible] 162
Kansas City, Mexico & Orient, 80, 116
Kansas City Southern, 8, 92
Kansas City Viaduct & Terminal Company, 30
Kentucky & Ohio Bridge Co., 182
Kentucky & Tennessee, 124
Key West Electric, 190

Lackawanna & Wyoming Valley, 30
Lake Erie & Western, 30
Lake Shore & Michigan Southern, 62, 100
Lehigh Valley, 38, 48, 92, 190
Long Island, 48, 80, 124
Long Island Consolidated Electric, 22
Louisville & Nashville, 62

Macon, Dublin & Savannah, 22
Manila Electric, 38
Maryland, Delaware & Virginia, 158
Mexican Central, 62, 190
Mexican Consolidated Electric, 162
Michigan Central, 92, 150
Michigan United (Electric), 150
Minneapolis & St. Louis, 72, 92, 162, 176
Minneapolis, St. Paul & Sault Ste. Marie, 8, 56, 124, 130
Missouri, Kansas & Texas, 30, 56, 62, 116, 138, 156
Missouri Pacific, 22
Mobile & Ohio, 14, 190
Montana, 138, 162

National of Mexico, 108, 124
Naugatuck, 190
New Bedford & Onset (Electric), 162
New Haven & Northampton, 176
New Jersey & Pennsylvania, 80
New Orleans Great Northern, 108
New York & Northwestern, 150
New York & Queens County (Electric), 190
New York Central & Hudson River, 14, 56, 92, 116
New York, Chicago & St. Louis, 38, 100
New York City Railroad, 62, 176
New York, New Haven & Hartford, 8, 14, 48, 62, 100, 108, 124, 150, 162, 176, 190
New York, Ontario & Western, 48, 190
New York, Philadelphia & Norfolk, 162, 190
Norfolk & Southern, 100
Norfolk & Western, 48
Northern Central, 72
Northern Pacific, 30, 62, 108
Northern Securities Co., 22
Northwestern Terminal, 162

Ocean Shore (Electric), 72
Old Colony (N. Y., N. H. & H.), 130
Oneonta & Mohawk Valley (Electric), 150
Oneonta, Cooperstown & Richfield Springs (Electric), 150
Ottumwa Railway & Light, 14

Pacific, 22
Pacific Coast, 38, 124, 130
Panama Railroad, 56, 138
Pan-American, 80
Pembroke & Southern, 130
Pennsylvania, 8, 22, 38, 48, 80, 100, 108, 156, 182
Pennsylvania & Ohio (Electric), 130, 138
Pennsylvania Company, 48, 150, 176
Pere Marquette, 8, 22, 30, 80, 92, 156, 176
Philadelphia Company, 62, 72, 176
Pittsburg & Allegheny Valley Street Railway, 190
Pittsburg & Lake Erie, 30, 92
Pittsburg, Chartiers & Youghiogheny (P. C. C. & St. Louis and P. & L. E.), 168
Pittsburg, Cincinnati, Chicago & St. Louis, 176
Pittsburg, Shawmut & Northern, 80, 144, 156
Pittsburg, Youngstown & Ashtabula, 22

Quebec, Montreal & Southern, 80

Reading, 38, 162
Rio Grande Western, 56
Rock Island, Arkansas & Louisiana, 14, 38
Rock Island Company, 124, 138

St. Louis & North Arkansas, 80, 168, 190
St. Louis & San Francisco, 48, 56, 80, 144
St. Louis, Rocky Mountain & Pacific, 116
Santa Fe Central, 80
Seaboard Air Line, 156, 176
Southern, 8, 14, 48, 56, 108, 116, 124, 168, 176
Southern Michigan (Electric), 162
Southern Pacific, 56
Springfield & Western (Electric), 150
Stillmore Air Line, 8

Taunton & Buzzard's Bay (Electric), 162
Temiskaming & Northern Ontario, 138
Texas & Gulf, 124
Texas & Pacific, 100
Toledo & Ohio Central, 30
Toledo, Canada Southern & Detroit, 130
Toledo Railway & Terminal, 8, 14, 124
Tonopah & Goldfield, 116, 144
Toronto Railway (Electric), 56, 130
Tri City Railway & Light, 108
Trinity & Brazos Valley, 130, 138
Twin City Rapid Transit, 168

Union Pacific, 30, 56, 62, 124, 138, 168
Union Terminal (Sioux City, Iowa), 80
United Railways Investment Company, 14, 62, 108, 138, 182

Vandalia, 30
Velasco, Brazos & Northern, 162, 176
Virginia & Carolina Coast, 100

Wabash, 56, 130, 176, 182
Washington Branch, 56, 100
West Jersey & Seashore, 80
West Virginia Midland, 100
Wheeling & Lake Erie, 48, 80, 144
Wisconsin Central, 124, 176

Yosemite Valley, 72
Youngstown & Ohio River, 176
Youngstown & Ravenna, 38.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK

BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIALS.

Torpedoes and Surprise Checking 1
The New York City East River Bridges.. 1
Railroad Bonds in the Savings Banks.... 2
A Review of the Railroad Year..... 3
The New England Roads..... 4
Football from the Railroad Viewpoint.... 5
Fairness in Railroad Building Laws..... 5
Southern Railway 5
New Publications 6
Trade Catalogues 7

ILLUSTRATED:

Newell Grade Separation of the Wabash and Chicago Southern..... 12
Experimental Locomotives for Penn. R. R. 16
Philippine Railroad Projects..... 21

CONTRIBUTIONS:

Destruction of Water Pipes by Electrolysis 7
Setting Valves with Walschaert Valve Gear 8
A Difficulty with Distant Signals at Junctions 8
An Open Letter to Mr. Westinghouse.... 8

MISCELLANEOUS:

The Cost of Locomotive Operation..... 10
Washington Correspondence 13
Underground Electric of London, Ltd.... 13
How to Avoid Accidents 14
Foreign Railroad Notes:
Milk in Tank Cars.....
French Advisory Railroad Committee..
Electricity in the Simplon Tunnel..... 24
First Cyprus Railroad .....
German Dining Cars .....

GENERAL NEWS SECTION:

Notes 1
Obituary 4
Meetings and Announcements 4
Elections and Appointments..... 4
Locomotive Building 5
Car Building 5
Bridge Building 6
Railroad Construction 6
Railroad Corporation News..... 8

VOL. XL., No. 1. FRIDAY, JANUARY 5, 1906.

On one of the railroads where tests of the conduct of enginemen in observing signals are constantly being made, the number of tests recorded in the last six months was 1,417, of which 1,413 showed compliance with the rules. Of the other four cases one was that of the engineman of a freight train who ran past an automatic signal indicating stop, and the other three were failures of freight enginemen to make a full stop on running over one torpedo. In all of the four cases the enginemen reduced speed. What punishment, if any, was inflicted, is not reported. For disregarding an automatic signal indicating "stop" some roads, we are informed, make the penalty dismissal, without a hearing—almost. That is to say, the instances where an excuse is accepted are so rare that they may be counted as nil. In this connection, the scarcity of men in all departments of train work at the present time raises an interesting query. When a man, otherwise efficient, is discharged for an offense like this, how soon will it be fair to re-employ him? The mere fact that, after being discharged, he has to come on as a new man is in itself a severe punishment, even if he were to lose no time; and if he is likely to heed the lesson of his mistake, is he not an engineman worth having? It would be of interest to know the attitude of "book discipline" enthusiasts on this question. Another question: Should a man thus discharged and taken back be allowed to continue his relief department benefits, as though his employment had been continuous? Many a superintendent has, no doubt, screwed up his courage to discharge a man, partly by the argument that—thanks to the ease with which employment could be found on another road—the man would not be deprived of a livelihood. But where a "Relief Feature" ties him to a single road this argument loses some of its force. The disregard of the torpedoes raises the question whether it is worth while to maintain two torpedo indications. Why not make the explosion of any number of detonators a signal to at once bring the speed of the train under control? Is not this sufficient for all kinds of obstructions, except those which are invisible? And if an obstruction is invisible—as, for instance, a weak spot in the ballast—does any one ever think of depending on a torpedo to protect trains against it? It is proper to enforce rules, whether they are reasonable or not. For that we have the authority of the United States Supreme Court in the Trans-Missouri Traffic Association. But it is usually the part of wisdom to first make the rules reasonable. With only one torpedo indication, and that not requiring a full stop at a defined point, the detection of negligence or of slipshod compliance with the rule would not be quite so easy as it is to show that, in a given instance, no stop was made. But if the stop (as now required, for one torpedo) is usually unnecessary the energy spent in enforcing it might better be employed in enforcing the under-control rule.

THE NEW YORK CITY EAST RIVER BRIDGES.

During the past two years there has stood in the city of New York a monument of engineering skill and likewise a monumental instance of municipal incapacity. The Williamsburg bridge over East river was completed in December, 1903, and with appropriate ceremonies was delivered to the city and "accepted" by its Mayor. Since then this structure, costing $11,400,000, has been somewhat a convenience to Long Island truck farmers and a few passengers, but no connections have been made, either on the Brooklyn or Manhattan side with the subway or elevated rapid transit systems. When a few weeks ago a vignetted engraving of this noble structure, with both ends fading into nothingness, was shown to the President of the Brooklyn Rapid Transit Company, he exclaimed: "That is the most accurate drawing of our bridge terminals that I have ever seen."

During this two years of disuse, the already congested traffic on the original Brooklyn bridge has been increasing in density. For several hours a day the crush of men, women and young persons at the terminals has been disgusting, for no woman should be so exposed to crowding; and dangerous, for there have been deaths and injuries. The relief intended by the building of the second bridge has not been given because of the incapacity of city officers and the opposition of "civic bodies" to each of the plans proposed—any of which would have immediately relieved and disposed of a shameful condition.

The use of an East river bridge is of two kinds. 1. For teams and persons who cross the river and need no further facilities. 2. As a section of railroad track to be included in the rapid transit system. It happens that each of these two uses accommodates about an equal number of persons. Soon after the Williamsburg bridge

was completed, Mr. Winter, President of the Brooklyn Rapid Transit Company, submitted a plan and a fair money proposition for making the bridge useful, by extending his Brooklyn elevated system to a connection with the new bridge, in such a way as to make a loop in Brooklyn connecting with many stations on its rapid transit lines. For the borough of New York, he proposed a widening of some streets in the slums of the city and an elevated railroad loop from the City Hall terminal to the Williamsburg bridge terminal, distributing passengers at many stations where they could transfer to the city lines—an ideal system of distribution and relief from congestion at the terminals. It met with the usual opposition: The Municipal Art Society—fine arts, not the useful arts—who believed that Baxter street and Delancey street should not be widened and defaced by a transportation system. There were other organizations, called "civic bodies," in opposition. Any active man, with an axe to grind, can make such a paper organization. The Board of Estimate and Apportionment made the mistake of reading public sentiment in these protests, and rejected the plan. Is not this city subway-mad?

A few weeks ago the Bridge Department engineers submitted to the Board of Estimate plans for terminals for the third bridge—named Manhattan Bridge—now in course of construction. These structures are necessary, for about one-half the passengers assemble at the terminals. Mr. Nichols, the chief engineer, had done his work well. The plans were modest in cost, almost uncriticisable in design, and adapted to the needs. At the hearing, the same old civic bodies appeared and opposed. In addition to the art society there was the "Prospect Heights Citizens' Association," the "Transit Reform League," the "Allied Board of Trade," a "Taxpayers' Association," and others. It is only a slight exaggeration to say that the trend of opinion seemed to be that the city should continue to build bridges and hold them useless until the wicked investors in city railways were ready to carry passengers in cars run through from Coney Island to Harlem for one fare. And so the Board returned the terminal plans to the Bridge Department "for reconsideration."

The problem to be solved is not at all a simple one, nevertheless there are now well known enough governing conditions to make further interference by amateur organizations quite unnecessary. The capable engineers we already have, who have for years studied the subject, can soon solve it satisfactorily if they have the chance. It is plain that any system of through cars is impracticable, because this would congest the already busy lines in Brooklyn and New York, and also because combustible cars are especially dangerous in a subway. It is plain that terminal stations are needed at each bridge end. It is also plain that loop lines, in each borough, reaching only far enough to distribute passengers to surface lines and quite near to stations on the elevated and subway is the only rational way of lessening the crowd at the bridge ends. These loops may be either elevated structures or subways or both, depending on the location. Mr. Nichols outlines an excellent plan, and is undoubtedly ready to present it in detail whenever the Board of Estimate call for it. Mr. Winter's proposition was designed for economy in first cost and for safe operation. His plan for street widening and an elevated structure through the poorer part of the city was distinctly for the benefit of that region as well as for the convenience of passengers. It is unsafe to have a sharp grade down to a subway station at the New York end of the Brooklyn bridge. Still, so long as the present indiscriminate subway madness continues, that plan may wait; and possibly the new Bridge Commissioner may encourage his engineers to usurp some of the functions of the Rapid Transit Commission and solve the problem.

RAILROAD BONDS IN THE SAVINGS BANKS.

During the four years from 1900 to 1904 the capital stock per mile outstanding of American railroad companies remained almost stationary and increased only from $30,205 per mile to $30,686 per mile. During the same four years the outstanding bonds of the same corporations increased from $29,967 per mile to $35,418 per mile, or about 18 per cent. This is conclusive proof of an existing "bond period" in railroad financing. In connection with it the matter of the various absorbents of railroad bonds, new and old, is an interesting and fruitful study. Of its many branches, some of them vague and speculative, others visible and determinate, none is more suggestive than the increase of savings bank investment in railroad bonds. It would be instructive, if for no other reason, as showing and measuring the attitude of an immense group of conservative investing institutions toward railroad securities; and a secondary and derived matter of importance is the effect of that attitude on financial methods and policies of the railroad corporations themselves.

As an illustration of the drift of savings bank investment toward railroad bonds let us take the latest returns during two years from New York state and from the three larger states of New England. In 1902 the total resources of the savings banks of the State of New York were $1,191,330,573, of which $151,991,779 was invested in railroad bonds. Corresponding figures for 1903 were $1,238,800,468 and $177,444,223; and for 1904 they were $1,311,993,505 and $196,982,385. Using approximate figures, while the total resources of the New York savings banks increased during the two years $120,662,932, or about 10 per cent., the railroad bond holdings increased $44,990,606, or almost 30 per cent. Massachusetts savings banks had in 1902 resources of $627,959,337 and $93,943,176 in railroad bonds; in 1903 they had $649,437,662 resources and $102,214,285 in railroad bonds; and in 1904 they had $674,644,990 resources and $113,510,243 in railroad bonds. During the two years resources increased somewhat more than 7 per cent., while railroad bond investments increased more than 21 per cent., and, if we were to add street railway bonds, more than 27 per cent. The $82,741,563 savings bank resources of Maine in 1904 and their $35,123,560 of railroad bond investments show an increase for the two years of about 6 per cent. and about 21 per cent. respectively. Corresponding figures for Connecticut are $233,055,954 resources, $82,265,024 railroad bonds, and increases for the two years of about 9 per cent. and somewhat more than 18 per cent. respectively—the latter percentage likely to be increased considerably, now that large groups of street railway bonds in the state have been opened to savings bank purchase by recent legislation.

Taking New York state and the three leading New England states together the showing for 1902 is $2,112,046,622, and for 1904 it is $2,302,436,014, or an increase of resources of about 9 per cent. in two years, while railroad bond investments for the same period grow from $344,337,720 to $427,881,212, or about 24 per cent.—railroad bonds held thus increasing more than two and a half times as rapidly as resources. The last computations give comparisons on a great scale and include probably about two-thirds of all the savings bank assets of the United States which may be estimated roughly at about $3,400,000,000. It should be said, by way of mild qualification, that some of the states return railroad stocks and bonds together; but the amount of stocks held is so relatively small that it may be ignored. The total of outstanding railroad bonds in the whole country is returned as $6,932,996,651. Allowing for private savings banks in the West and South, returns from which are very defective, the total amount of railroad bonds held by American savings banks is probably about $600,000,000, or say 9 per cent. of all bonds outstanding. But the influence of the savings banks as absorbents of railroad bonds goes much further. In some states—Connecticut for example—the same law of investment applies to individual trustees as to the savings banks. How far such laws tend to further absorption of railroad bonds can only be guessed at, but it must be a very potential "digestive" force.

As we depart from the actual figures showing how swiftly railroad bonds are passing to the savings banks the subject broadens outward in several radiants. Thus the investment returns on municipal bonds and on realty mortgages has, on the whole, during the last few years fallen lower proportionately than on first class railroad bonds. The relative annual return may be perhaps fixed as about 3.50 per cent. on municipal bonds of high degree and 3.70 per cent. on railroad bonds of the same general grade. This undoubtedly has shifted savings bank money from municipal into railroad securities. But a more important factor is the extension of state law-making so as to include railroad bonds formerly excluded—this largely as a result of higher railroad credit and such fiscal operations as the refunding of old issues—usually first mortgages—into "consolidated" mortgage bonds issued on a pretty big scale. Naturally this has resulted in lobby work to induce legislatures to admit new issues to the "legal" savings bank lists; and therein lies a very appreciable danger of which state lawmakers should beware. Another trend, worth its passing attention, is the tendency of legislatures more and more to open the securities of roads within the state—a good tendency inasmuch as it may tend to investment in railroad bonds that are more immediately under the savings bank manager's eye, but somewhat perilous in that local favoritism may be pushed too far.

Another branch of this "localization" and of the amplified subject is the legalizing of street railway bonds for savings bank

purchase, now that the street railway has become in so many cases a property outside of speculative investment and venture. Thus during the first year—apparently 1903—when street railway bonds were opened, under certain restrictions, to the Massachusetts savings banks $3,769,594 were taken in that class of security and in 1904 the amount had risen to $6,324,370, an increase of about 70 per cent. In 1904 some thirty electric railway companies of the state had been approved by the Massachusetts savings bank commissioners and their bonds placed on the "admitted" list. Maine admits the bonds of any street railway in the state and first mortgage bonds of street railways in certain other states, and New Hampshire, with restrictions, follows the same rule. Other eastern states, under more general statutes of investment, are even more liberal. Vermont appears to be unique and isolated in excluding both railroad and railway bonds of all kinds. In Connecticut, which adopts in the matter of street railway bonds the "local" idea, is presented the anomaly of savings bank legalization of certain junior street railway bonds while certain underlying senior bonds of constituent railway corporations have been left under the ban—a fiscal paradox showing strikingly the deft hand of the lobbyist.

In summarizing results and tendencies, along with some perils, the steady drift of railroad bonds to the savings banks and trustees, must be accounted a decided moral gain. Apart from its evidence of the higher average value of the American railroad bond, in railroad financing it nods clearly toward conservative bonding. The average railroad corporation will tend more and more toward sane and safe issues of bonds as it comes to realize how important are the savings banks as a bond market; and, *per contra*, there is not much danger that a savings bank will be misled by more liberal statute-making in its judgment of intrinsic and bed-rock values of the bonds which protect the hard-won dollars of the poor. But, quite aside from such considerations, the bond drift to the savings banks is of moment as indexing a new and expanded relation of railroad policy and properties to perhaps the most conservative element of finance—and as vast as it is conservative.

A REVIEW OF THE RAILROAD YEAR.

It is often exceedingly difficult for persons directly and closely connected with great enterprises and with historical movements to get a comprehensive view of them. Their own tasks are highly specialized, and they are so much concerned in the day's work that the events which come under their constant notice are apt to take the form of isolated parts rather than as elements in a comprehensive whole. For that reason it is well to view the remarkable year of 1905—remarkable for many reasons, industrial, commercial and political—from a standpoint a little more remote than is possible in the current record maintained by this journal.

Speaking broadly, the event which stood out most prominently in the previous year, 1904, as possessing permanent historical interest, was the Northern Securities decision, the effect of which was a good deal smaller than was thought at the time in its direct relations to the properties concerned, but was extremely broad and important as an expression of the attitude of the Government towards evasion of the law regarding the operation of parallel lines through the medium of a holding company. Had the Northern Securities Company been sustained, there were groups of carriers all over the country ready to follow its precedent; but in the face of the decision the community of interest method at once gave way again to the competitive method of railroad operation and development. It is fair to say, in view of recent developments, that it would probably have done so anyway, but the decision of the Supreme Court gave the movement a definite date.

The development of competitive building, with particular reference to Pacific Coast extensions, has been one of the great epochs of the year 1905. From a historical point of view, however, it is doubtless secondary in importance to the era of corporate housecleaning inaugurated by President Roosevelt. Throughout the year, without interruption, great corporations have come into the light of publicity one after the other, to explain obscure passages in their history. On February 9 the House of Representatives passed the Esch-Townsend bill creating a court of transportation and providing that a new rate proposed by the Interstate Commerce Commission, after an old rate had been declared unreasonable, should become operative in thirty days, subject to review by this court of transportation sitting as a court of equity. The bill was crude, it was not feasible, it was presumably unconstitutional, and it was inadequate to remedy the real evils which existed. Hence the Senate refused to be stampeded into passing it. But the flood of literature which it brought forward on both sides of the subject has cleared the air, and in place of the general feeling of dissatisfaction with the railroads—the feeling that something was wrong and that the remedy presumably lay in giving an outside body power to fix the vast and complicated schedule of railroad rates throughout the country—it is now clearly understood that unfair preference and discrimination, and not rates in themselves, constitute the evil, and Congress has taken upon itself the task of remedying this state of affairs and will probably not be drawn into the widely accepted fallacies of the early part of the discussion.

In brief, 1905 is remarkable as the year in which the American people have learned infinitely more about their railroads than they ever knew before—a knowledge which seems quite certain to allay the unmistakable hostility towards the railroad corporations that was coming to look like a dangerous element in the national politics.

Turning from this historical feature of the year's progress to the more definite and technical one of the tendency of railroad construction, it will be recollected that three great companies are now definitely committed to extending their lines to the coast. The Grand Trunk Pacific did not date its beginnings from 1905, but actual grading work really belongs to the chronicle of the year, together with the grants of money from the Canadian Government. Contract was let in September to build from Portage la Prairie, near Winnipeg, Manitoba, 275 miles west to Touchwood Hills, Northwest Territories. Some uncertainty still exists with regard to the eastern terminus of this line, but west of the St. Lawrence river it seems reasonably certain that it will extend from Quebec through Winnipeg to Port Simpson, British Columbia, with an extension proposed to Dawson, in the Klondike. During 1905, also, Gould's line, the Western Pacific, was financed by the original sale of $50,000,000 of bonds underwritten at 90, and work has been definitely begun on the road between Salt Lake City and Oakland, approximately 800 miles. The Western Pacific is the new low grade connection from the coast to the junction with the Rio Grande Western at Salt Lake City, the Missouri Pacific reaching the Denver & Rio Grande at Pueblo, Colorado.

In the record of 1905, also, belongs the announced decision of the St. Paul to build to the coast. In our issue of December 15 we called attention to the fact that this system had been in its essence a strong and compact local railroad, and as a suggestion of the number of short and originally independent railroads which it now includes, we spoke of the five companies whose names began with Dubuque, of the nine whose names began with Chicago, and of the 16 which had Milwaukee as their real or alleged starting point, all of which are among the component parts of the present Chicago, Milwaukee & St. Paul. In spite of its splendid local territory northwest of Chicago, reaching as far north as Fargo, N. D., and as far west as Evarts and Chamberlain on the Missouri river in South Dakota, with three other north and south branches from the South Dakota line into North Dakota and multitudinous connections and short branch lines, the St. Paul lacks and realizes its need for the future of the profits which come from a through line and a through line business. We pointed out in the same issue that with a mileage of nearly 7,000 miles the St. Paul carried its typical ton of freight in 1904 only 185 miles, while on the Union Pacific the average haul is 386 miles. From Evarts, the starting point of the St. Paul's new line, to Seattle and Tacoma, its proposed coast terminals, the air line distance is about 1,040 miles, and the actual length of the line to be built will probably be not far from 1,500 miles.

The advance in electrification of steam railroads figured as an important event in 1905, and is sure to figure still more importantly in the next few years. The New York Central made satisfactory tests of its first electric locomotive last May, and has work well in hand on the electrification of its New York suburban zone, which is to be worked by direct-current trains operated under the multiple unit system of control. The determination of the New Haven road to work its trains in and out of the New York terminal by alternating current has been fully discussed in these columns and nothing more need be said at the present time. During the year part of the Long Island suburban electrification in the vicinity of Long Island City was also put in commission, and announcement is now made that the Pennsylvania proposes at once to electrify its Atlantic City connection over the West Jersey & Seashore, on the direct-current system. The old London underground railways, formerly almost intolerable because of smoke and gas, also began working by electricity during the year. The Lancashire & York-

shire, North Eastern and Mersey lines date back to 1904. In this country both the Lackawanna and the Erie are currently supposed to be watching the situation very closely with a view to electrifying part of their New York lines as soon as it seems expedient to do so. The expense of electrification is very great. Its advantages also are very great in congested short-haul passenger territory, and by the respective weighing of cost and advantage it is fair to suppose that each succeeding year will bring out its new crop of ventures, gradually extending from the most congested to the less congested portions of the lines. The obvious field at present is in the vicinity of great cities—New York, Chicago and Philadelphia, and, to a lesser degree, St. Louis and Boston.

Turning again to the broad as against the specific aspects of the railroad year, 1905 stands at the top record of profitableness for the railroads, not only on account of the large gains in gross earnings occasioned by big crops and great general prosperity, but also because the alarming increases in operating expenses, and particularly in the item of conducting transportation, which were characteristic of 1903 and, to a certain degree, of 1904, have been checked in a highly satisfactory manner. For some years fuel cost has been rising dangerously fast. This year it was down again, while the attention which began to be paid to other items in the expense account in 1903 has apparently continued unabated. Without retrenchment, but with care and skill in operation, the increases in the year's net earnings are even more impressive than the increases in gross. This particular branch of the subject cannot be fully treated in a brief abstract of this character. It will be taken up at length and illustrated by diagrams in a subsequent issue.

As would naturally have been expected, in view of the great traffic increases, there was a car shortage in the fall, although equipment bought during the year considerably exceeded all previous records, with a total of 165,455 freight cars, 2,551 passenger cars and 5,491 locomotives. Current orders with the equipment companies have been extremely heavy, one trunk line having placed orders for some five times as many cars as it requires in an ordinary season. It is rather a prospective feature of 1906 than of 1905, although it should be mentioned in this connection that a large number of the cars now on the books could be sold at a considerable profit by the companies which have ordered them if they so cared to sell them, since the capacity of the works for 1906 is about taken up.

The year has been notable for its sales of bonds, which for the second time in the history of the country have exceeded $1,000,000,000, and are reported by conservative financial journals to aggregate about $1,130,000,000, including time extensions, temporary obligations, etc. There has been a fortunate and noteworthy absence of financing of the 1901 order, except in a very few instances. The Cincinnati, Hamilton & Dayton financing was sufficiently bad and is sufficiently fresh in the mind of the reader, so it needs no comment. The new financing of the Belmont syndicate with which it is proposed to consolidate the New York City street railway and the Interborough elevated and subway lines also looks pretty bad, in that the vast sum of common stock to be created, underwritten at 60 per cent., stands for nothing more than capitalization of the future.

Without including a record of street railway progress, except so far as affects steam roads, it must nevertheless be observed that the New Haven road has been largely increasing its holdings in these companies during the year, and as far back as last spring owned something like 60 per cent. of the entire single-track trolley mileage of the State of Connecticut. The recent purchase of the Albany United Traction by the Delaware & Hudson is also noteworthy. As a transaction it seems to point to a general future plan of safeguarding the steam company's interest rather than of any important uses or developments, since the United Traction has no long interurban lines, but furnishes simply the key to the suburban situation in Delaware & Hudson Albany territory by the trackage privilege it grants the Albany & Hudson, Hudson Valley, Schenectady Railway, and the other interurban lines in the district. The first alternating current line of any importance in this country was also opened during 1905—the Indianapolis & Rushville section of the Indianapolis & Cincinnati Traction Company—approximately 50 miles long. Without pausing to go into the subject at length, it may be pointed out that the use of alternating current, with its economies in construction and operation, its avoidance of electrolysis, and other advantages, seems likely to modify in an important degree the relation of steam and electric roads in the near future.

In England, 1905 has been for one thing notable as the year in which the rage for rail motor cars has received a setback. In 1904 the Great Western was turning out steam motor cars as fast as its Swindon works could make them. It now is beginning to doubt their economy, just at the time that continuous experiments are being made, for the first time, in this country. The Union Pacific has put two gasolene motors in service this year; the Alton has built a gasolene-electric car; the Rock Island motive power department has brought out an elaborate report on the subject. But it seems safe to say that we are still some distance from the motor car period of branch line development, if there ever is to be such a period—and it looks further away now than it did last year at this time.

Among the many interesting events during the year which can only be touched on may be mentioned the determination of Mr. Flagler to extend the Florida East Coast Line from Miami to Key West, 126 miles over the Florida Keys; an enterprise as unique as the Central Pacific extension across the waters of Salt Lake, recorded last year. On April 2 the Simplon tunnel connecting Switzerland and Italy was opened for a construction train amid impressive ceremonies. The Chicago freight tunnels, built without the people of the city of Chicago knowing anything about them, were also opened for service during the year. In the spring the Great Northern's two gigantic steamships "Minnesota" and "Dakota" began service to the Orient. Mr. Hill has not hesitated to say that they were highly extravagant to build and are an unsatisfactory investment.

A record of the year will, of course, be incomplete without reference to the International Railway Congress at Washington last May, which brought a great number of highly trained railroad men from all parts of the world and certainly broadened their interests, even though it may not have added much to the specific usefulness of the majority of the delegates present.

Three other unclassified events which belong in the chronicle are the running of 18-hour trains from New York to Chicago on the New York Central and the Pennsylvania and the breaking of speed records by these and other trains; the new organization of the Isthmian Canal Board with the subsequent resignation of Mr. Wallace and the appointment of John F. Stevens as Chief Engineer, and the letting of contracts and actual progress of work on our own New York State barge canal.

The New England Roads.

In the *Railroad Gazette* of Oct. 6 the annual report of the Boston & Maine was reviewed, and occasion was taken to touch briefly on the comparison between that property and the New York, New Haven & Hartford. It is of interest to carry this somewhat farther.

Roughly speaking, the entire railroad traffic of the New England states is in the hands of these two companies, the territory shared dividing naturally at Boston. The New Haven road operates 2,088 miles of main line; the Boston & Maine 2,288, so that the division is very nearly an equal one. Another interesting parallel between the two is the recent establishment of western connections; the New Haven road through the Ontario & Western, the Boston & Maine through the Fitchburg. It is still too soon for any important results to be shown from the Ontario & Western purchase, since much reconstruction of the New Haven connecting lines has been necessary to develop the possibilities of usefulness of the addition. The Boston & Maine, however, has had the Fitchburg since 1901, and it has proved a very valuable investment. The gross earnings of the Boston & Maine for 1901 after its lease of the Fitchburg, were $31,375,620. In 1905 they were $36,800,834, an increase of $5,425,214; while in that same time the increase in the Boston & Maine's fixed charges, including sinking fund, taxes, interest on debt, and rental of leased roads, increased only $131,100. Add to this the amount necessary to continue dividends at the usual rate, an increase of $161,646, the entire amount required to provide for the road's annual dividend disbursements and fixed charge obligations only increased $292,746 in the four years, as compared with the handsome increase in gross earnings shown; the comparison being that the gross income increased over 17 per cent. while its fixed charge and dividend obligations increased less than 3 per cent.

It is characteristic of both the New Haven road and the Boston & Maine that a comparatively small surplus from the year's operation is habitually carried forward. These roads, unlike the western lines, do not have to equip themselves for the startlingly rapid changes in the growth and development of the country. They occupy the oldest and most thickly settled portion of the United States, and their problem of betterment appropriations does not normally extend much beyond full maintenance. Of course, at the

present time the New Haven road is behind in its maintenance and is spending large sums to catch up, in rebuilding its bridges, improving its connections to the Ontario & Western and doing work that had been neglected for several years. Some of this work is logically charged against operating expenses; much of it is logically charged against capital. The Boston & Maine has no such problem at present and is not likely to have in the near future. Hence the fact that its total surplus carried forward is much smaller than the New Haven road's total surplus is not especially significant. On June 30, 1905, the New Haven road carried a balance of $15,118,598 forward to next year's account. The Boston & Maine carried forward $2,494,141. On the New Haven road annual dividends absorbed 95 per cent. of the balance of net income applicable; on the Boston & Maine they absorbed precisely the same proportion.

Gross earnings from operation of the Boston & Maine for the year ending June 30, 1905, were $36,213,245; operating expenses, including a charge of $807,782 for new equipment, were $26,619,740, leaving net earnings from operation $9,593,505; gross income $10,181,094, and net income, after deduction of charges and sinking fund payments, $1,883,572. Gross earnings from freight were somewhere near double those from passenger traffic, and this is peculiarly significant in connection with the Fitchburg lease. Gross earnings from operation on the New Haven road in the same period were $49,981,948; operating expenses were $35,833,023; net earnings from operation were $14,148,925; gross income was $15,372,377, and net income $6,708,052. Until quite recent years, passenger earnings used habitually to exceed freight earnings on this road, but at present freight earnings are slightly in excess and bid fair to become even greater proportionately when the lines are put in shape to handle the traffic that is coming to them. In view of the relative population served by the lines, it is, of course, natural that gross earnings per mile of road should be larger on the New Haven system than on the Boston & Maine, amounting respectively to $23,937 and to $15,826, both of these figures serving to illustrate the surprising traffic density of the country traversed.

Prior to the Fitchburg lease of the Boston & Maine the respective proportion of the gross earnings from freight and from passengers was not so very different from that now existing on the New Haven road. In 1898 freight earnings constituted about 52 per cent. of gross, in 1899 practically the same, in 1900 54 per cent., in 1901, including the first full year's operation of the Fitchburg, nearly 59 per cent., and in 1905 just over 60 per cent. On the New Haven road freight earnings now amount to a little less than 51 per cent. of the total.

This study in comparison naturally leads to the suggestion that with its passenger traffic by no means fully developed, but far more fully developed than the freight traffic, the New Haven road, through its new western connection, may be able within the next few years to increase largely its freight traffic over the least congested portion of its system, and bring all of its lines up to a standard of usefulness and traffic density approaching that of the coast lines.

Last week there met in New York City educators representing 53 American colleges, called together to abate the perils of operation, of the head-on collisions and of the gory wreckage of the game of football. In the penumbra of so august a gathering and with football dividing time—albeit somewhat unequally—at the White House with the rate question, we offer no excuse for throwing fresh light on the fiscal proportions of the sport in railroad traffic. A year or so ago, for the first time in the records of transportation, we were able to give the traffic returns of the New Haven road for the "big" Yale-Harvard game at New Haven. This year we can expand the figures over six years and the same number of "big" games, as will be seen in the table annexed:

Year.		No. one way passengers.	Receipts.
1905.	Yale-Princeton game	30,529	$40,472
1904.	Yale-Harvard game	32,529	53,666
1903.	Yale-Princeton game	32,431	40,826
1902.	Yale-Harvard game	39,349	60,567
1901.	Yale-Princeton game	19,993	22,234
1900.	Yale-Harvard game	24,684	38,879
	Total	179,515	$256,644

More than a quarter million dollars of gross receipts from six annual football games is an item of revenue which the greatest railroad corporation could hardly deem contemptible. And there are some incidental comparisons: They, the New Haven Company, during last year took in from regular and commutation passenger business $20,008,579 gross, or about $54,800 a day. It will be seen from the table that a single game in 1904 very nearly equalled in passenger receipts the daily passenger business on the whole system of 4,245 single track miles, while one year—1902—football receipts went $5,767 better. Or, again, taking the average football receipts from the single yearly game for the six years—$42,774—they signify about four-fifths of the corporation's regular daily passenger receipts for last year. But this is not all: Remembering how each of the large eastern universities plays at least two "big" matches a year and how an out-of-town match depopulates the campus, probably at least 60 per cent. would have to be added for a full season's football traffic by rail. The figures are impressive enough to show the acute interest with which the New Haven corporation—and there are others—must view the present attack on the game though, *per contra*, something must be said as to obstruction of regular traffic and the perils and stress of handling great railroad crowds.

In the State of Michigan the law concerning the organization of railroad corporations is so loosely drawn that there is no requirement whatever as to the time when work shall be begun on a proposed road, and the amount of stock necessary to be subscribed before incorporation is only $500 a mile. Of this only 5 per cent. need be paid in. Thus, a company proposing to build a road five miles long can become a full-fledged corporation on putting into its treasury the sum of $125. This is about what has been done by a company recently incorporated for the alleged purpose of building a road from Dundee to Petersburg, about four miles. The organizers reported $250 paid in, but $200 of this represented the nominal value of their land, so that in reality only 2½ per cent. of their stock was paid up in cash. The matter was brought before the court on the complaint of another road which desired to build but was prevented from so doing by the holdings of the defendant company. The court held that, in order to hold its right to the property and franchise, a company must show in good faith its intention to build. To do away with these incorporations of companies which have no intention of building, but are chartered merely in order to force an unreasonable settlement from another company or prevent the construction of another road, it would seem reasonable, says a Michigan correspondent, to require that a certain amount of work be done each year, to entitle the company to hold its rights, and also to require that the road be completed within a specified length of time, under penalty of the forfeiture of these rights. And our correspondent is right, of course.

Southern Railway.

The present report is the eleventh which has been issued since the reorganization, in 1894. It will be recollected that the Richmond & West Point Terminal Railway & Warehouse Co., which went into insolvency because its existence depended upon its ability to pay the interest on speculative bonds, issued to buy speculative stocks, was the predecessor of the Southern Railway. The South was far removed from its present state of industrial activities in the '80s; the time when most of the component parts of the unwieldy system were gathered together, to be held in the weak hand of an organization that held a bare majority of their stocks. Drexel, Morgan & Co., in 1892, refused to undertake the reorganization, on the ground, flatly expressed, that there was lack of good faith among the contracting parties. The principal asset of the terminal company was the Richmond & Danville Railroad. One party to the controversy claimed that the branch roads had been leased to this company on a highly extravagant basis, the profits accruing to the insiders. The other party accused their adversaries of selling the bonds and stocks of the Georgia company (carrying control of the Central Railroad of Georgia) to the terminal company at a great profit, when buyers and sellers were directors in both companies. It may be said that Mr. Samuel Spencer expressed the matter in as conservative a way as possible when, in a letter to the Macon Chamber of Commerce in 1895, he stated that the consolidation which constituted the present Southern Railway was in part the legitimate and inevitable result of reckless and speculative construction of needless railroads throughout the South and the hopeless struggle to sustain them when built. This struggle in the absence of sufficient traffic produced unreasonable reductions, dishonest rate manipulations and unjust discriminations. At competitive points rates were unduly and secretly reduced, while at non-competitive points they were left undisturbed or possibly increased in the hopes of greater and much needed revenue. Favored individuals grew rich, favored communities apparently prospered, while all others felt outraged and many of them justly so. Mr. Spencer pointed out that railroads under such circumstances must either be consolidated to be worked more cheaply or must be left to starve separately.

Drexel, Morgan & Co. were again appealed to early in 1893, at a time when the principal concerns in the consolidation were in receivers' hands and the country was undergoing a period of general financial stringency. C. H. Coster, George Sherman and Anthony J. Thomas constituted the reorganization committee and their plan was ultimately modified in the spring of 1894 and accepted by the security holders to the extent of over 95 per cent. of the securities involved. This plan provided for the issue by a new company (the Southern Railway) of 120 millions 5 per cent. first consolidated mortgage and collateral trust bonds secured by mortgage and pledge of all the property of the new company; of 60 millions 5 per cent. non-cumulative preferred and of approximately 120 millions common stock. It was estimated that about 101 millions of bonds, 48 millions of preferred stock, and 120 millions of common

stock would be necessary for carrying out the immediate details of the plan, by which the more unwieldy of the properties in the system were to be weeded out and the rest purchased on a compromise basis, in some cases after common stock assessments.

The plan was radical and it was successful. The new common stock was at first looked on as being a somewhat comic part of the scheme, but in the years which have followed the reorganization the South has had the beginnings of an era of great prosperity. As a result, in the fiscal year for which the report is now at hand the company earned a surplus over preferred dividends of $2,151,632, a sum sufficient to have paid about 1¾ per cent. on the common.

The average mileage operated during the fiscal year 1905 was 7,199, an increase of about 35 miles, while gross earnings amounted to $48,145,108, an increase of $3,035,331. The increase in operating expenses and taxes was considerabiy less than the increase in gross earnings, leaving net earnings from operation of $13,062,594, as against $11,994,310 in 1904. It is worthy of note in this connection that along the line of the company during the year there were completed and put in operation 46 textile mills, 34 furniture factories, 38 iron industries, six tanneries, 77 stone quarries and coal mines, 13 cottonseed oil plants, eight fertilizer works and more than 500 smaller industries, while over 250 previously existing plants were enlarged during the year and 54 new industries were under construction at the close of the year. Immigration to, and the investment of outside capital in, the territory served by the Southern lines during the year exceeded any previous year in the history of the company.

Of the total gross earnings, freight contributed $31,775,326 and passengers $12,471,572. Earnings from the latter source increased over 10 per cent., the abnormallly large increase being attributable primarily to St. Louis Fair traffic. In the expense account $6,458,858, or a little over $900 a mile, was spent for maintenance of way and structures, a sum undoubtedly ample for good up-keep of the property, in consideration of the territory traversed. For maintenance of equipment $7,456,736 was spent, and approximately $2,286 per locomotive was spent on repairs and renewals.

Turning to the detail statistics of traffic, the average revenue train load is shown to have increased from 189 to 194 tons. The branch line traffic and the high comparative haulage of manufactures and agricultural products other than grain, as against the traffic in coal and in grain itself, keep the train loads low in the South. Coal constituted only 29 per cent. of the total tonnage in 1905, the next largest single item being that of lumber and logs, 16 per cent., while the total products of agriculture amounted to almost 12 per cent., of which grain contributed less than a third. General merchandise amounted to 7½ per cent. of the total tonnage. The average receipts per freight train mile were 1.83 cents in 1905, as against 1.77 cents in 1904. The average ton mile receipts were .94 cent in 1905, a figure which has remained substantially unchanged for several years. Like the majority of the other roads whose reports we have thus far reviewed, fuel cost was lower in 1905 than in 1904 on the Southern, cost per mile run under this head amounting to 8.36 cents as against 8.93 cents last year. Wages of engineers, firemen and roundhouse men were also smaller, having been reduced from 7.72 cents to 7.57 cents.

Gross earnings per mile of road increased from $6,279 to $6,688, and net earnings per mile of road from $1,669 to $1,814.



Southern Railway.

The principal statistics of the year's operation may be tabulated as follows:

	1905.	1904.
Average mileage	7,199	7,190
Passenger Earnings	$12,471,572	$11,327,683
Freight earnings	31,775,326	30,053,989
Gross earnings	48,145,108	45,147,483
Maint. way and structures	6,458,858	5,722,835
Maint. of equipment	7,456,736	7,263,526
Conducting transportation	18,195,504	17,351,632
Operating expenses and taxes.	35,082,515	33,150,298
Net earnings	13,062,594	11,997,184
Gross income	14,442,065	13,132,728
Net income	5,151,632	4,180,400

NEW PUBLICATIONS.

Modern Locomotive Engineering. By Calvin F. Swingle, M. E. Chicago: Frederick J. Drake & Co., 1905. Leather, 4¾x6¾ in.; illustrated; 630 pages, including index. Price, $3.

This is a plain, practical treatise on the construction, care and management of modern locomotives. Boiler construction as applied to locomotives is dealt with in detail and all the leading types of valves and valve gears are fully described. An entire chapter is devoted to a study of the indicator and its application, and the different types of compound locomotives receive special attention. Locomotive equipment, including electric headlights and mechanical stokers as well as the air-brake are treated more or less at length. Particular attention is given to breakdowns and what to do in cases of emergency. The book is primarily designed for the use of those who are seeking to fit themselves as locomotive engineers. Therefore the elementary features pertaining to the oper-

ation of the locomotive are first taken up, and the discussion gradually progresses through all of the various stages in the making of a first-class engineman. The author has arranged a list of questions at the end of each chapter. The student is thus made to search for the answers, which will always be found in the preceding chapter. By this method the author thinks that the student will be more apt to have the answers fixed in his mind than he would if the answers were ready made for him and inserted after each question.

TRADE CATALOGUES.

Pressed Steel Poles.—Illustrations and descriptions of pressed steel poles made from rolled structural pressed steel are given in a neat pamphlet published by the Pressed Steel Pole Company, Pittsburg, Pa. These poles are now being used for various purposes such as telegraph, telephone, trolley, electric light, and for semaphore and signal work. The Pressed Steel Pole Company also make steel and wood fittings for these poles such as cross-arms, collars, clamps, brackets, steps, etc.

Pneumatic Appliances.—Special Circular No. 55, which is being distributed by the Chicago Pneumatic Tool Company, Chicago, illustrates and describes a number of pneumatic devices specially designed for foundry and concrete block work. Notable among these tools are "Chicago" and "Keller" pneumatic sand rammers and the "Chicago" sand sifters. Illustrations of pneumatic hammers and drills are also shown. Some data in regard to concrete block making such as the proper proportions of materials to use and the method of coloring the same is also given.

Valves.—A pamphlet containing illustrations and price lists of extra heavy valves for pressures above 150 lbs. is being distributed by Jenkins Bros., New York. The valves illustrated include brass globe, check and Y valves, as well as extra heavy iron body globe and angle valves.

The Rodger Ballast Car Co. has just published a pamphlet pointing out the adaptability, economy, simplicity, durability and practicability of the Rodger Ballast Hart Convertible cars. Their principle designs are described and illustrated with half-tones and line drawings.

Graphite.—The January issue of "Graphite," published by the Joseph Dixon Crucible Co., Jersey City, N. J., is just being distributed. It contains a number of interesting articles on graphite and its uses as well as an article by W. H. Wakeman on "The Location and Use of Friction Clutches." The usual amount of amusing and light reading matter is distributed throughout its eight pages.

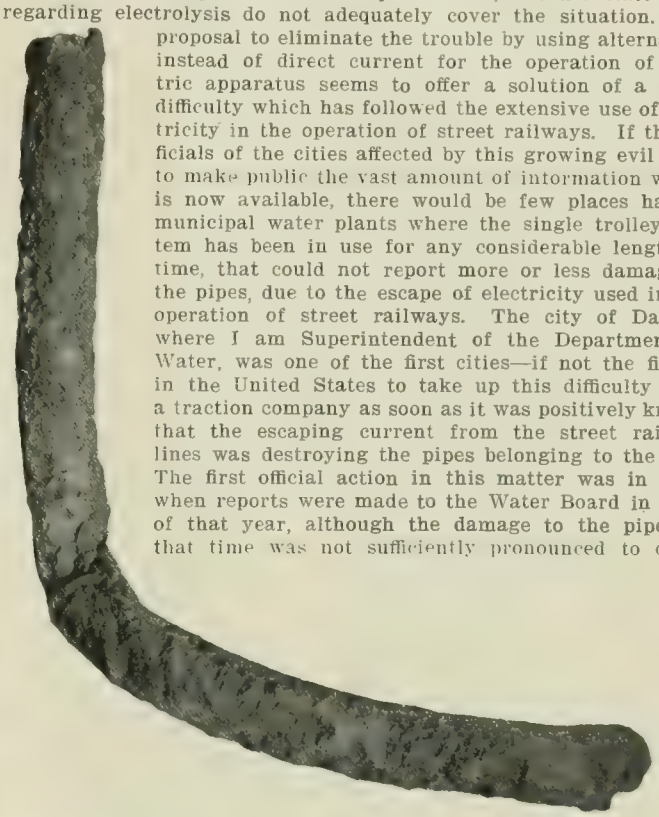
CONTRIBUTIONS

Destruction of Water Pipes by Electrolysis.

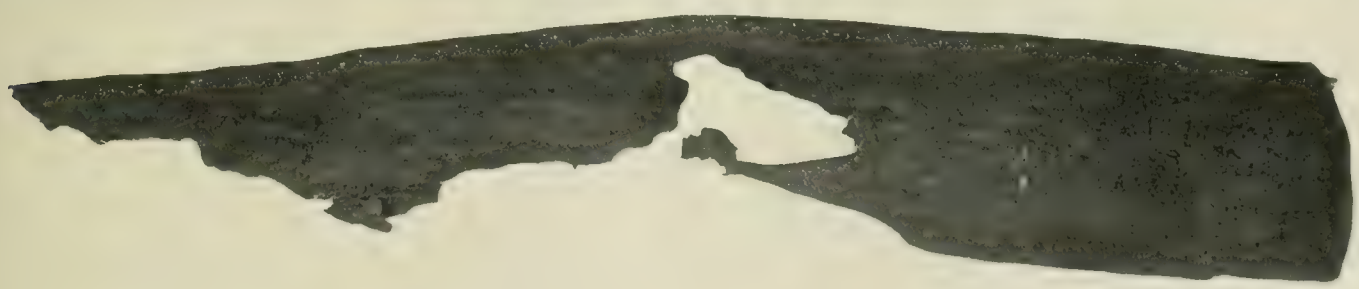
Dayton, Ohio, Dec. 26, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The letter by Mr. Geo. Westinghouse in your issue of December 22 is of great importance to many interests, but his statements regarding electrolysis do not adequately cover the situation. His proposal to eliminate the trouble by using alternating instead of direct current for the operation of electric apparatus seems to offer a solution of a great difficulty which has followed the extensive use of electricity in the operation of street railways. If the officials of the cities affected by this growing evil were to make public the vast amount of information which is now available, there would be few places having municipal water plants where the single trolley system has been in use for any considerable length of time, that could not report more or less damage to the pipes, due to the escape of electricity used in the operation of street railways. The city of Dayton, where I am Superintendent of the Department of Water, was one of the first cities—if not the first—in the United States to take up this difficulty with a traction company as soon as it was positively known that the escaping current from the street railway lines was destroying the pipes belonging to the city. The first official action in this matter was in 1898, when reports were made to the Water Board in July of that year, although the damage to the pipes at that time was not sufficiently pronounced to cause



Lead Service Pipe Removed After 11 Years.



Service Gas Pipe Removed After Three Months.



Pebbles Removed from Under Washington Street Showing Deposits from Cast-Iron and Lead Pipes.

alarm to those in charge of the Water Works Department. Up to that time none of the main lines had burst, due to deterioration by electrolysis, although a number of service branches had already given way and naturally had raised a question of how long it would be before it would be shown that the escaping electric current had weakened the main lines sufficiently to cause them to burst. The great damage to the city mains in the interim has proven that the loss is, if anything, greater than anticipated. Within the last 90 days the city has been obliged to abandon or remove as junk about 1,600 ft. of main line pipe on one street alone, which had been destroyed by the electrolytic action of the street railway current. To avoid excavating under the car tracks in the future when it may again be necessary to make repairs, there has been placed a line of pipe on each side of the street, with short service connections to the curb. These two lines of pipe were not laid with the idea of overcoming the electrolytic difficulty, for the conditions so far as current is concerned have not been perceptiby changed, so that the pipe which has just been put in will in time go through the same course of destruction as the line which was abandoned. Those in charge of municipal water works and who might be required to make such a change as above mentioned on paved streets, can form some idea of the expense involved and of the annoyance and inconvenience to the public. There seems to be no possible way in which the pipe system can be so insulated where direct current is used as to sufficiently control the current to prevent electrolysis, although many devices have been bought and put into use, such as additional bonding, auxiliary wires placed adjacent to the street car rails, and the rails themselves cross bonded and additional overhead return feeders, which expedients have not had the desired effect. The accompanying photographs show the destructive electrolytic effects experienced at Dayton.

CHAS. E. ROWE,
Superintendent, Department of Water, Dayton, Ohio.

Setting Valves with Walschaert Valve Gear.

Harrisburg, Dec. 31, 1905.

To the Editor of the Railroad Gazette:

Referring to your issue of Dec. 29th, in which a criticism of my article, entitled "Setting Valves with a Walschaert Valve Gear," was published. The article was not written with the intention of giving a theoretical discourse on the design and setting of this gear, but primarily to call attention to its direct and indirect motion, which materially lessens the labor of valve setting. I did not endeavor to touch upon every feature and combination of valve stem tram marks, but simply gave two as an illustration of the movements; relying on the fact that any experienced valve man could figure out what would have to be done in other cases.

Contrary to the assumption of my critic I was fully conversant with the facts regarding the ratio of lever arms between the eccentric rod and valve stem, but Mr. Harding has failed to consider that the slip of the "link block" in this case, together with the fact that the "radius rod" does not act directly from link block to valve stem but by another system of levers made more complicated through the alternate position of the fulcrum, will alter the constancy of the ratio 3 to 1. He should also know, from experience, that theoretical changes in link motion do not always give the required results in practice. For this reason it is customary, among railroad valve men, to learn by practice a method that will give them results; and the one-quarter mentioned by me in my article, as added for lost motion, is the amount supposed to cover all causes that tend to throw the valves out of square. It makes no difference what path we pursue as long as we arrive at correct results, but no man will set valves without allowing for some lost motion when making his alterations.

THOMAS F. CRAWFORD.

A Difficulty With Distant Signals at Junctions.

New York, Dec. 26, 1905.

To the Editor of the Railroad Gazette:

Referring to my communication in your issue of Oct. 27th, my suggestion of separate masts or dolls at junctions was based upon the difficulty experienced in finding suitable positions for the distant signals for branch lines, where the sections beyond the point of divergence were so short as to make it imperative to place the signal somewhere in the vicinity of that point of divergence. The difficulty was best overcome by placing the distant signal of one section on the home signal mast of the rear section. This was unsatisfactory because it crowded too many signals on one mast. Hence the idea of using several masts or short dolls spaced as near together as practicable, thereby providing a good position for a distant signal when required. I may say that I reluctantly arrived at this conclusion because it is opposed to the ideal of placing every signal in the same vertical line, relative to the track governed. Is there not under existing conditions a better way of solving the problem? If it be granted that the correct and only positions of the distant signal are 45 deg. and vertical, and this is adopted in practice, the difficulty would be met by making the home signal a three-position signal, using the "caution" and clear positions as distant signal for the next section.

HENRY JOHNSON.

An Open Letter to Mr. Westinghouse.

So your reference to me in your recent letter to the *Railroad Gazette* was "not intended to do Mr. Sprague an injustice"; that is probably the reason why it was written and spread broadcast. Those who have the patience to follow this subject will quite likely reserve to themselves some right of judgment, and will be able to form a correct opinion as to your real motives.

Contrary to your suggestion, I did not forget to mention anything of pertinence, or proper public interest in so far as it concerns my comments on the adoption under existing conditions of a. c. locomotive operation on the New Haven terminal division, but in order to confine myself to that particular case, and to avoid being wrongly, even if with apparent reason, put in a position of antagonism to any rational application or development of the a. c. system, I did omit many things which might with entire truth have been said concerning the special difficulties naturally being experienced in that development, and many other things which my official relations would not permit me to say.

But in spite of my moderation you have made references to my contracts which are incorrect as to fact, and foolishly untrue in inference. Permit me to correct you as to both, for if the public is at all interested in any personal discussion between you and myself, it might as well know the exact state of affairs.

I have at present a contract with the Sprague Electric Company, an extension of one I have had for a number of years, during which time it was an active competitor of the principal electric companies. By this contract it became the owner of my patents, and it has naturally and very properly restricted me from engaging in rival manufacturing, or advising those who are so engaged.

Further, in part liquidation of a royalty agreement covering the use of the "multiple unit" system, I agreed to accept an annual payment during the term of the patents covering that system, if living, and required a guaranty that my name should always be used as designating it, not only by the Sprague Company but by any successor or licensee of it. But whether those patents be used or not, this payment is not affected by a penny's worth, nor by any other act of mine. The contract makes no mention of any railroad corporation, nor is any such intended, and it is a rare order of imagination which would convert the railway and power transmission companies of the country, the customers of the great electrical manufacturers, into corporations which may be classed as unfriendly to them.

This contract, under present conditions, confers upon the officials of the General Electric Company no authority whatsoever, so far as I am concerned, and no man knows better than yourself that I would brook no interference by individual or corporation with my professional opinion or action when engaged as a consulting engineer.

I have in addition a contract with the General Electric Company, a brief one, whose sole provision is a guaranty that the Sprague Company shall fulfill its obligations to me, the chief of which, in my opinion, is the use of my name in connection with all multiple unit apparatus, no matter what the details.

Such is the legal status of my contracts, and it is in no sense altered because the General Electric Company is now the owner of the stock of the Sprague Company, or because it may become its successor in the event of that company's assignment or liquidation. I cannot, therefore, recognize your privilege to interpret these contracts in a light contrary to their spirit, or in any manner other than is mutually acceptable to the present parties to them, even if it may serve your personal purposes to do so.

But assuming, despite your forgetfulness and inaccuracy, that in place of the Sprague Company, the General Electric Company becomes the principal, by whatsoever official action of the Sprague Company, with what poor grace comes your attack on me when by reason of that very fact, because of agreements between your own and the General Electric Company in force for the past ten years, you would become, under like terms, the direct beneficiary of every patent advantage thereby derived, and the indirect beneficiary by my abstention from manufacture.

You have said that I have a "particular personal interest" in my "own form of control," and thereby attempt to differentiate the apparatus built by your company. You are, of course, aware that I have here no monetary interest whatever in its use, and it would have been nearer the truth had you stated I had a pardonable and personal pride in a system absolutely of my creation which has revolutionized electric train operation, a system which you are

widely using, and in whose adoption to your special requirements you have the active aid of my former confidential assistants. Were you as careful to recognize the rights and equities of others as you are tenacious in upholding of your own, you would not let an hour pass before directing in this instance the proper recognition of my name, instead of waiting until the slow and tedious process of law may compel such acknowledgment.

The true inwardness—and the littleness of your reference to me lies in its suggestion that I am not independent enough to pass upon the merits of a proposal submitted to me, or that the New York Central Commission has not accorded your company fair treatment. So far as my friends are concerned I need no defense, for they know that my engineering instincts rise supreme above any personal interest when acting in an advisory capacity, and the New York Central can best answer whether I have maintained the standard which it exacts from all who serve its interests.

A single fact, and not the only one with which you were conversant, should have made you more cautious in your reference to me, for you well knew when you penned your letter that despite your assertion that natural inclination would lead the New York Central Railroad to award contracts, if it could do so on a sufficiently favorable basis, to a manufacturing company whose works are upon its lines, you had been awarded one of the most important contracts in its equipment, that for 27,000 kilowatts of rotary converters, with my full accord and approval.

It is to be regretted that in reflecting upon that commission you seem to have forgotten its composition. Permit me to remind you that as one of its members it has been my pleasure for a considerable portion of the time to be associated with the then vice-president of an organization absolutely controlled by Westinghouse interests, but although we often for a time may have disagreed, in all the deliberations which affected the New York Central interests I have done myself the honor to give him, as I believe he gave me, the credit of recognizing in the highest degree the judicial character of our positions.

As you well know, the decision affecting the present equipment of the New York Central Railroad has nothing whatever to do with future extensions. It was dictated in part by local conditions which are just as distinctive and determinate to-day as when the equipment was decided upon. These reasons have been time and again set forth, and both collectively and individually the Commission has made it clear that its decision was not necessarily to be taken as a precedent, that there was no antagonism to any particular system, and that when the problem of such extensions should come up every possible advantage would be taken of electric developments of any nature and from any source. Hence the attempt to get the New York Central Railroad to abandon matured plans, to terminate its contracts, and to adopt your proposal for a change of its equipment, in so far as such proposal could be influenced by cost comparisons extending to the balance of its system, is without the slightest basis of reason, nor was it helped by estimates which being wide of the facts are utterly worthless.

I find myself, with others, wondering what has caused your somewhat rabid general denunciation. Is it a tardy realization of the importance of my letter, now ten weeks old, or appreciation of its truth, or changes in some of the original intentions of the New Haven Company, or difficulties which have manifested themselves on existing a. c. equipments, or in the carrying out of the New Haven project? Perhaps it was the loss of the Camden and Atlantic City line to a direct current equipment, or an important single-phase road to a rival—but these are the fortunes of war, and a saving sense of humor will prevent an attack of melancholia. Perchance some coolness in the reception of your ex-parte statements, privately circulated a month ago, and now in part made public, has made necessary an attempt to bolster them up, but in any event, your position will hardly be strengthened by over zeal, or misdirection of statement, even when illustrated by exceptional cases of electrolysis, easily avoided and having little bearing upon the general railroad problem.

You take personal offense because I have pointed out some of the difficulties which will naturally characterize the progress of the a. c. development, and the special ones which it challenges in a particular case, and have essayed to make it appear that my opinions were dictated by a spirit of special friendliness to another company. Permit me to inform you that I have on frequent occasions stated that whatever excuse there may have been for the enthusiasm of your engineers—and there was much—there would have been little for those of the General Electric Company for making a similar proposal under like conditions, because they, probably even better than your own men, knew the limiting conditions.

Had the New Haven road restricted its equipment, as seemed to many for the time wise, and for the special reasons adopted in a limited territory direct current operation, it would not, contrary to your statement, have necessarily meant apparatus of General Electric manufacture, for as I have already pointed out an equal right of construction lies with your own company. Nor save on the one question of locomotive pooling was their any need for restriction in the details of apparatus.

I stood in that matter as I hope I may always stand, for what I believe to be the best interests of the public and the electric railroad development, irrespective of any personal interests or business affiliations; and had my criticisms lacked the essential elements of truth and common sense one would have supposed that in the supreme confidence which you profess you would have been content to have awaited the issue, and to have witnessed my discomfiture and the acknowledgment of the error of my ways and opinions, which I think in that event I am broadminded enough to have made. But I have ample reason to believe that, distasteful as my criticisms may have been to some, when measured by public convenience and safety results of importance have already been accomplished, and even more are sure to follow.

The charge that the General Electric Company and myself are engaged in a conspiracy to fasten upon the railway world the direct current system as opposed to the alternating current or any other particular system unduly enhances my importance, and is an amusing product of imagination, or the results of hysteria.

I must remind you that I was probably the first engineer in this country to recommend, in an official report some 15 years ago, the general adoption of alternating current for the transmission of power over long distances, and I have not changed my attitude since. I have also to call your attention to the fact that not only have I steadily advocated higher potentials, but several years ago I publicly expressed the desirability of the development of single phase motors for use on electric railways. And in order that you may not unchallenged appropriate to yourself all initiation in this art, I must not forget to mention the late lamented Charles Van Depoele, whose name you may be familiar with, who in addition to much other admirable pioneer work, some 16 years ago advocated and patented a method of using single phase currents on electric railways.

In instructive contrast to your assumption as to my affinities, it is a curious coincidence that at the very time of the issue of your letter I should have committed myself to a belief in the possibilities, and stated my readiness to assume the responsibility under some circumstances, of a d.c. operation at a potential three times as high as your engineers have fixed in making comparisons between the two systems, a potential which, it is proper to point out, has not yet received the endorsement of your own or the General Electric Company. I therefore can hardly be accused of speaking for either in thus taking this public stand, but rather as the representative, as I have always tried to be, of consistent advance by all lines in an art to which I have devoted my life.

You object to healthy criticism, but in your self-constituted position as universal engineering advisor and mentor, has the New York Central, or its Commission or the General Electric Company been free from such? On the contrary, you have been unsparing in predictions of failure. The use of the particular turbines selected was to be followed by a frightful accident and their replacement by your own, and the locomotives were destined to absolute failure; but the former seem to function satisfactorily, and the latter has a record as yet unequaled by any like piece of apparatus. True, you made no predictions of failure concerning that admirable part of the equipment which your company is to supply, although now so energetic in condemning its use elsewhere.

Your attack on me is misjudged, and is unworthy of your own dignity, for even if your personal qualities do not appeal to the softer side of my nature, and your assumptions do not always carry conviction, I still recognize in you many elements of greatness. It will therefore fail in its purpose, for it will not cost me a single friendship, and will not impair the confidence of my associates, nor do I believe it will adversely impress any fair-minded man though he be a stranger to me. I will go further—it will not affect my appreciation of the many splendid products, or affect my final judgment concerning any developments or proposals of the Westinghouse Company, which will live on even after your dominant personality in its affairs disappears.

Permit me in conclusion to remind you that my work and inventions have been among the stepping stones to your great fortune, and while others, and not I, have reaped the larger material rewards of that pioneer work, I have at least succeeded in impressing my name upon the electric railway development in such indelible fashion that you cannot erase it. It has never stood for doubt, or cowardice or fear of consequences, but always for advancement in which in many important particulars you have followed, not led me.

My engineering convictions and conclusions are my own. They are dictated by no man or corporation. I am not the advocate of the use of any particular system to the exclusion of any other, but rather of higher potentials and the greatest measure of development by whatever means for such system as in any particular case shall, when measured by all conditions of equipment and operation best fulfil the requirements of that case.

That attitude is one which I shall consistently maintain, unchanged by clamor, pressure or disapproval, and so long as I am given life and strength, and retain the confidence of my associates, I shall help carry to success the enterprise which you have so freely

criticized, and thus aid in planting another milestone to mark the advance of electrical accomplishment. FRANK J. SPRAGUE.

New York Central & Hudson River R. R. Co., Grand Central Station.
New York, Jan. 2, 1906.

Mr. Frank J. Sprague, 20 Broad street, New York City.

Dear Mr Sprague: Referring to recent discussions in the public press, in which your name has appeared in connection with decisions of our Electric Traction Commission:

It affords me pleasure to state that the relation that you hold to other interests has always been free and open to me, and that your attitude toward the different bidding companies has been entirely unbiased and impartial, as evidenced by your advocacy of what you have considered to be the apparatus best suited to our needs, no matter by whom manufactured.

Yours sincerely,
W. J. WILGUS,
Vice-President.

Dec. 29, 1905.

General and Sprague Electric Companies, New York City.

Gentlemen: I call your attention to a letter signed by George Westinghouse which appears in the *Railroad Gazette* of December 22d, and is repeated in other journals, in which, referring to my critical attitude concerning the adoption of alternating current locomotives by the New Haven Railroad under existing conditions, he makes the following statement:

"Mr. Sprague forgot to inform the public, probably as he would have done had he had more time, that he is receiving a very large retainer under a contract of years' duration, whereby, though he may become Consulting Engineer for a railroad, yet he cannot do so if, in the opinion of the officials of the General Electric Company, such work or obligation may be in conflict with the interests of that company."

My only contract with the General Electric Company is a brief one, simply guaranteeing the fulfilment of the Sprague Company's obligations to me, and although my contract with the latter company—which bought my patents—is intended to prohibit my engaging in rival manufacture or consultation for a manufacturer engaged in a like business, I am not aware that even if the General Electric Co. has bought the Sprague Co. there is any reasonable ground for assuming that the officials of either company have the remotest right of interference with my legitimate work, for it is only proper for me to say that such attitude would be distinctly opposed to my views.

I beg, therefore, to inquire if there is in your understanding of my contracts any justification for Mr. Westinghouse's inference, or anything which would in your opinion entitle you to such prohibition, or which would interfere in the remotest degree with such action on my part as may be dictated by the very highest interests of my clients.

An early reply will be appreciated.

Very truly yours,
FRANK J. SPRAGUE.

General Electric Company.
Principal office, Schenectady, N. Y.
New York office, 44 Broad street.
Jan. 2, 1906.

Mr. Frank J. Sprague, 20 Broad street, New York.

Dear Sir: Referring to your letter of Dec. 29, 1905, our policy is, as you know, to refrain from entering into a controversy in the newspapers over any particular system advocated either by our companies or by their competitors.

It is solely on account of your personal relations to the various traction interests of the country that we are writing this letter.

There is no reason, so far as the General Electric and Sprague Companies are concerned, why you should not act as Consulting Engineer for any steam railroad or for any power company, nor any reason why you should not give such companies for whom you act as Consulting Engineer such advice as seems to you proper, regardless of whose apparatus is to be used.

The General Electric Company and the Sprague Company are doing their utmost to develop the electrical art along all lines instead of wasting time in personal recriminations. These companies give the best engineering advice of which they are capable on the various propositions which are from time to time submitted to them, and if in any proposals which they may make for the equipment of steam roads, your judgment prompts you to decide in favor of a system which is recommended by their competitors, we feel sure that you will not hesitate for one moment to recommend such system.

The General Electric Company is in the business of manufacturing electrical apparatus, and is prepared to furnish alternating or direct current systems as may be suitable. It has perfected what it believes to be the best alternating current railway system in the world, and wherever the circumstances make the use of such a system desirable, it recommends its adoption in preference to the direct system. The company does not, however, endeavor to force either system on the customer irrespective of the best engineering practice with reference to the special conditions under which the system is to be operated.

Very truly yours,
GENERAL ELECTRIC COMPANY,
By F. W. RICE, JR., *Third Vice-President*
SPRAGUE ELECTRIC COMPANY,
By ALLAN BAKEWELL, *President*

The Cost of Locomotive Operation.

XIX.

BY GEORGE R. HENDERSON.

(*Continued from Vol. XXXIX., page 592.*)

UP-GRADE WORK.

In order to study the effect of speed and loads on up-grade work, let us consider a division 150 miles long and uniformly graded to 1 per cent. We will at present study traffic only one way, that is up-hill, as returning, an engine could take almost any train load within reason. We will assume that the division is equipped with the size of consolidation engines used in developing, Figs. 1 to 10, (see *Railroad Gazette*, March 31, 1905, page 312), weighing 150 tons with tender, and having an available tractive force of 40,000 lbs. As freight trains are ordinarily run at speeds of less than 30 miles an hour, we will study the results at five miles and multiples of 5 up to 30 miles per hour. Table A gives six columns (besides the data headings) for values from 5 to 30 miles, and line one indicates the speed considered. Line two gives the weight of train in tons, back of tender, and is the maximum that the engine can take on a 1 per cent. grade at the speeds indicated. These weights are obtained by superimposing Fig. 8 on Fig. 2 (as has been already explained in connection with these diagrams), and noticing where the intersection of speed lines and curve b c are projected on Fig. 8. Thus we see that while 1,450 tons could be hauled at five miles an hour, only 400 could be taken at 30 miles. (It is necessary to draw additional curves on Fig. 8 below the 1,000-ton curve, but this is readily done by the help of formulæ 4 and 6.)

Line three gives the ton-miles per trip, back of tender, and is simply the weight of trains multiplied by 150, the division length in miles, thus $1{,}450 \times 150 = 217{,}500$ ton-miles. Line four denotes the running time, or 150 divided by the running speed, as in the five-mile column $\frac{150}{5} = 30$ hours. There will always be delays, however, and we have assumed that these will amount to 20 per cent. of the running time, so that line five, the actual time between terminals, is 20 per cent. in excess of line four: thus, $30 \times 1.20 = 36$ hours.

Now, by dividing the distance 150 miles by this latter figure, we obtain the average speed between terminals, shown in line six; as for instance $\frac{150}{36} = 4.2$ miles per hour. Line seven indicates the amount of coal burned per mile for the weight of train and speed given in lines one and two. These values are obtained from Figs. 2 and 8 as explained in the chapter on fuel, being read directly from the diagrams. It will be noticed that at 10 miles an hour, 800 lbs. may be burned per mile, while at lower and higher speeds the value is less. This, of course, assumes that the maximum loads for the different speeds are taken. The coal burned per trip, line eight, is simply the product of line seven, and the distance, thus $500 \times 150 = 75{,}000$ lbs. of coal.

In the chapter on water, we found that we could ordinarily consider the quantity of water in gallons used by a locomotive as three-quarters of the amount of coal burned in pounds, or a consumption of three-quarters of a gallon for every pound of coal. Line nine therefore is uniformly three-fourths of line eight; for example, $75{,}000 \times \frac{3}{4} = 56{,}000$ gal. approximately.

We have now obtained the quantities of coal and water for each trip, and can commence to insert cost values. Line 10 gives the cost of coal per trip, and we will first allow a price of one dollar per ton of 2,000 lbs. Thus the first figure in line eight being 75,000 lbs., or $\frac{75{,}000}{2{,}000} = 37.5$ tons, represents a value of $37.50, and the other values follow in the same manner. We can take water at 10 cents per 1,000 gallons, and figure the amounts for line 11: for instance, 56,000 gal. will be worth $5.60.

When we come to the cost of lubrication, we must refer to the chapter on waste. As we are working upon a freight engine with 21-in. cylinders, the cost of lubrication may be expected to run about $3.06 per 1,000 engine-miles. This gives us $3.06 \times .150 = .50$, or 50 cents per trip. Under our discussion of this subject it was considered that this cost was affected very slightly by the train load and speed (within moderate limits) so that the amount of 50 cents will apply to the several columns selected for line 12.

The cost of supplies (line 13) was stated to approximate 20 cents per trip, which accounts for that value being set in all columns.

Line 14, cost of repairs, is figured on the "Tractive Force Tons

Per Mile." From Fig. 8, at the intersection of the load curves and the speed lines, we find the resistance of the train, including the engine and tender. As this corresponds to the tractive force needed, we obtain directly the figure needed. For instance, 1,450 tons at five miles an hour (including 150 ton engine and tender) on a 1 per cent. grade, require a tractive force of 40,000 lbs., or 20 tons. The allowance (from chapter on repairs) was to be 1 cent per ton tractive force per mile plus 1 cent per engine mile. As the grade is uniform (in the case being considered) there will be 20 tons exerted throughout the trip and we shall have 20 ton miles + 1 engine mile, or 20 + 1 = 21 cents per mile run, and for 150 miles, .21 × 150 = $31.50 for repairs, including general and running repairs. The other values of line 14 are obtained in the same manner. Thus at 25 miles an hour the maximum available tractive force (see Fig. 2) is 20,000 lbs., or 10 tons. So 10 + 1 = 11 cents and .11 × 150 = $16.50, representing the value of repairs for this trip.

Allowance for renewals (line 15) must be taken more or less arbitrarily, and as we previously proposed one cent per engine mile, we have figured this item at $1.50 per trip of 150 miles for all the speeds considered.

Line 16, pay of engineer and fireman, must be taken from our schedules for this item. If we use schedules 3 and 3f we find for this size engine in freight service a rate for enginemen of $4.25 per 100 miles, and for firemen $2.75, a total of $7 for 100 miles or less. The overtime rate is at 10 miles an hour, and as the average speed of the five-mile an hour run is only 4.2 miles per hour, the whole 36 hours occupied will be figured at overtime rates, or 70 cents an hour, so that 36 × 70 = $25.20. At 10 miles an hour (8.3 average speed) we obtain 18 × .70 = $12.60 for the trip, but at higher speeds the rate is uniformly on the mileage basis (as the average speed exceeds 10 miles an hour), or 1.50 × 7.00 = $10.50.

For cost of handling at terminals we found that, including hostling, turning, wiping, inspecting, cleaning fires, firing up and calling, the expense would run about $1.50 per turn, and if we allow 50 cents more for washing out and coaling, we can fill out line 17 by inserting $2 in each column. Line 18 covers the interest allowance, and is deduced as follows: A locomotive such as we have selected will cost in the neighborhood of $18,000, and at 5 per cent. will represent an annual charge of $900. The rate per day is therefore $\frac{900}{360} = \$2.50$, or say 10 cents per hour. This charge goes on whether the engine is on the road or in the house, and if we assume that five hours are needed for turning and running repairs, we get a total for the trip and lay-over of 36 + 5 = 41 hours, and at 10 cents an hour the amount is $4.10. So for the other speeds—at 30 miles an hour, or six hours actual time on the road, we have 6 + 5 = 11, or $1.10.

We now have all the charges entering into the cost of operating the locomotive over our typical division, and by summing the amounts from lines 10 to 18 inclusive we obtain the "locomotive cost" per trip, line 19. It is interesting here to note that this total cost is a maximum at or about 10 miles an hour running time, or 8.3 miles average time on the road, allowing 20 per cent. for delays.

In order to obtain the cost of transportation, however, which is the vital point, we should also include the train supplies, car repairs, and pay of trainmen, as these will vary in accordance with our speed and load. The first of these, "train supplies," will depend partly upon the number of cars in the train, though the largest portion will probably depend more upon the "train mileage" than the "car mileage." We can therefore assume this figure at 1.5 cents per train mile, and this gives us a uniform value of $2.25 per trip for line 20.

Car repairs (line 21) could, perhaps, be omitted from consideration here, as it is presumed that there is a definite amount of traffic to be handled, and consequently a certain amount of car mileage must be made, but in order to complete the estimate of "train charges," a value will be given to this item. One-half cent a car mile is probably a fair average for cost of repairs, and as the average weight of loaded cars is not far from 33 tons, we have .5 ÷ 33 = .015 cent per ton-mile, or 15 cents for 1,000 ton-miles, which value we shall use in our present discussion. In the first column, then, we have 217.5 × .15 = $32.60 (about), and so for the other values—the last column giving 60 × .15 = $9.00 per trip.

Line 22 considers the pay of trainmen (back of engine) and assumes the following rates: Freight conductors, $89.70 per month for 2,600 miles in 26 days; for excess mileage, the same rate is allowed, viz., 3.45 cents per mile. Overtime is allowed whenever the speed is less than 10 miles an hour, and is computed at the rate of one mile for each six minutes overtime. Freight brakemen receive $59.80 per month of 2,600 miles in 26 days, or 2.3 cents per mile for excess mileage, overtime being arranged in the same way as for conductors.

If a train crew is composed of a conductor and two brakemen (as is usual), the combined rate is 3.45 + 2.3 + 2.3 = 8.05 cents per mile, or 80.5 cents per hour. As for the enginemen, the first two schedules will be on the hourly basis, and the remainder on a mileage basis. Thus, 36 × .805 = $28.98 for the five mile column, 18 × .805 = $14.49 for the 10 mile, and 150 × .0805 = $12.08 for the others, where the average speed exceeds 10 miles an hour.

This completes our tabulation, and by adding the figures in lines 19 to 22 inclusive, we obtain the total transportation cost, as far as the train movement is affected by speed and loading at least, as shown by line 23. Track and superintendence expenses are, of course, omitted, as it would be practically impossible to vary these in proportion to individual train loads and speeds, particularly as a definite ton-mileage (all that is offered) must be transported in any case, and the other expenses will be nearly the same, no matter whether the trains are heavy or light.

By line 23 we find that the greatest cost of train is at five miles an hour running speed, and with the heaviest load, though the cost does not decrease in proportion to the latter.

In line 24 the cost per 1,000 ton-miles (back of tender) is obtained by dividing line 23 by line 3, thus $\frac{171.93}{217.5} = .79$ (approximately). This line is of great interest, as it gives the best basis for comparison of costs; it will be observed, however, that it includes the weight of cars, and only covers the operating expenses as noted in the several headings. The total expenses will be nearly three times as great, and if the loading and cars are of equal weight, the total cost per revenue ton-mile will be five or six times as much as shown. But we are here considering the cost of the actual movement of gross tonnage back of the tender. Examination of line 24 indicates that for the conditions assumed, the lowest cost is obtained at 15 miles an hour, though the lower speeds are only slightly greater in cost. As the speed is increased, however, above 15 miles, the expense goes up rapidly, and at 30 miles it is 50 per cent. more than from five to 15 miles per hour. Thus we see why stock and fast freight trains are so much more costly to move than ordinary slow or dead freights, largely owing to the fact that the crews are paid by the mile at high speeds, and the weight of train is reduced to permit the engine to attain the desired velocity. At very slow speeds, the hourly rate comes into the calculations, and again runs up the cost.

TABLE A.—*Maximum Loads, 150 Miles of 1 Per Cent. Grade.*

1. Running speed, miles per hr.	5	10	15	20	25	30
2. W't train, tons bk of tender	1,450	1,430	1,100	800	560	400
3. Ton-mls pr trip, bk of tendr.	217,500	214,500	165,000	120,000	84,000	60,000
4. Runn'g time, hrs. bet. trmnls	30	15	10	7.5	6	5
5. Actual time, hrs. bet. termnls	36	18	12	9	7.2	6
6. Average speed bet. terminals.	4.2	8.3	12.5	16.7	20.8	25
7. Coal burned, lbs. per mile...	500	800	540	400	320	250
8. Coal burned, lbs. per trip....	75,000	120,000	81,000	60,000	48,000	37,500
9. Water used, gallons per trip	56,000	90,000	61,000	45,000	36,000	28,000
10. Cost of coal, per trip.....	$37.50	$60 00	$40.50	$30.00	$24.00	$18.75
11. Cost of water, per trip.....	5.60	9.00	6.10	4.50	3.60	2.80
12. Cost of lubrication, per trip.	.50	.50	.50	.50	.50	.50
13. Cost of supplies	.20	.20	.20	.20	.20	.20
14. Cost of repairs, per trip....	31.50	31.50	26.25	20.20	16.50	14.25
15. Allowance renewals, per trip	1.50	1.50	1.50	1.50	1.50	1.50
16. Pay of enginemen, per trip..	25 20	12.60	10.50	10.50	10.50	10.50
17. Cost of handling, per trip...	2.00	2.00	2.00	2.00	2.00	2.00
18. Interest allowance, per trip..	4.10	2.30	1.70	1.40	1.22	1.10
19. Locomotive, cost per trip....	108.10	119.60	89.25	70 80	60.02	51.60
20. Cost, train supplies, per trip	2.25	2.25	2 25	2.25	2.25	2.25
21. Cost of car repairs, per trip	32.60	32.10	24.80	18.60	12.60	9 00
22. Pay of trainmen, per trip...	28.98	14.49	12.08	12.08	12.08	12.08
23. Cost of movement, per trip..	171.93	168.44	128.38	103.13	86.95	74.93
24. Cost per 1,000 ton-miles, net.	.79	.79	.78	.86	1.03	1.25
25. Million ton miles, per engine, per month	3.82	6.70	6.98	6.18	4.96	3.92

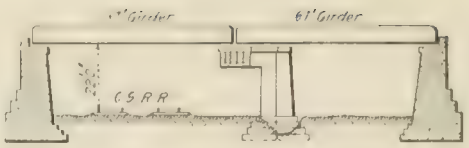
While line 25 is not entirely rational, it is of a good deal of interest. By not being rational we mean that a division of 1 per cent. up grade in one direction would necessarily return its engines down hill, and they could take heavy trains and make high speeds without being dependent upon the power of the locomotive. The values given in this line have been obtained by dividing the number of hours in a month of 30 days (720 hours) by the hours needed for a trip and lay over, in order to get the trips per month that could be made on the schedule considered, and multiplying by line 3 the ton-miles per trip, and dividing, of course, by 1,000,000. Thus for column under five miles an hour we have $\frac{720}{41} \times \frac{217,500}{1,000,000} = 3.82$ million ton-miles per engine per month, and it is evident that this merely indicates the "rate" of doing work while ascending the grade—the down-hill movement would alter these figures very considerably; still, as we are considering up-hill traffic only, it is interesting to compare the various rates of producing ton mileage. The most important point to notice is that at 15 miles an hour running time (12.5 miles average speed) we are able to produce the greatest amount of transportation per engine in service, and this is also the schedule for minimum cost. Under the conditions which have been assumed therefore, if we run at 15 miles an hour, we not only do the work cheapest, but get the most of it done.

It will also be observed that while a running schedule of five miles an hour will maintain the cost of transportation at practically the same figure, but little more than half the transportation will be produced, and that with long hours and tired-out crews, whereas the 15 mile schedule will bring the trains to the end of their runs in good time.

It must not be taken for granted that this condition will obtain

for all combinations of costs, pay and profiles, but it is significant that actual tests on several important roads have confirmed these figures. (Later we will estimate other profiles in order to compare the results.)

(To be continued.)



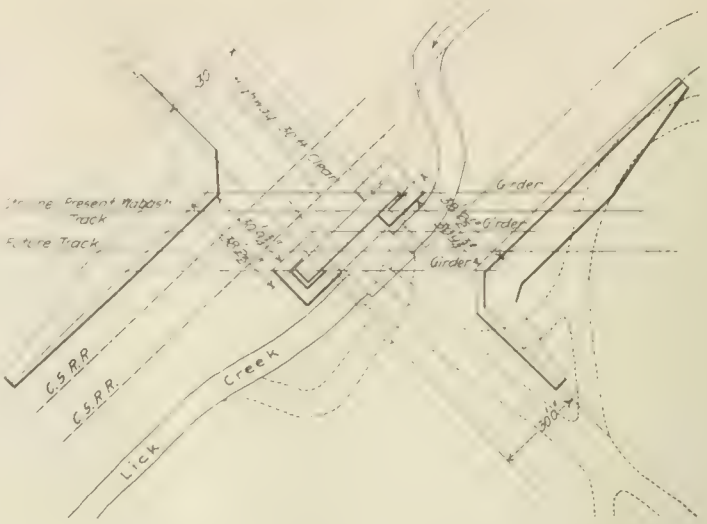
Longitudinal Section.

Newell Grade Separation of the Wabash and Chicago Southern.

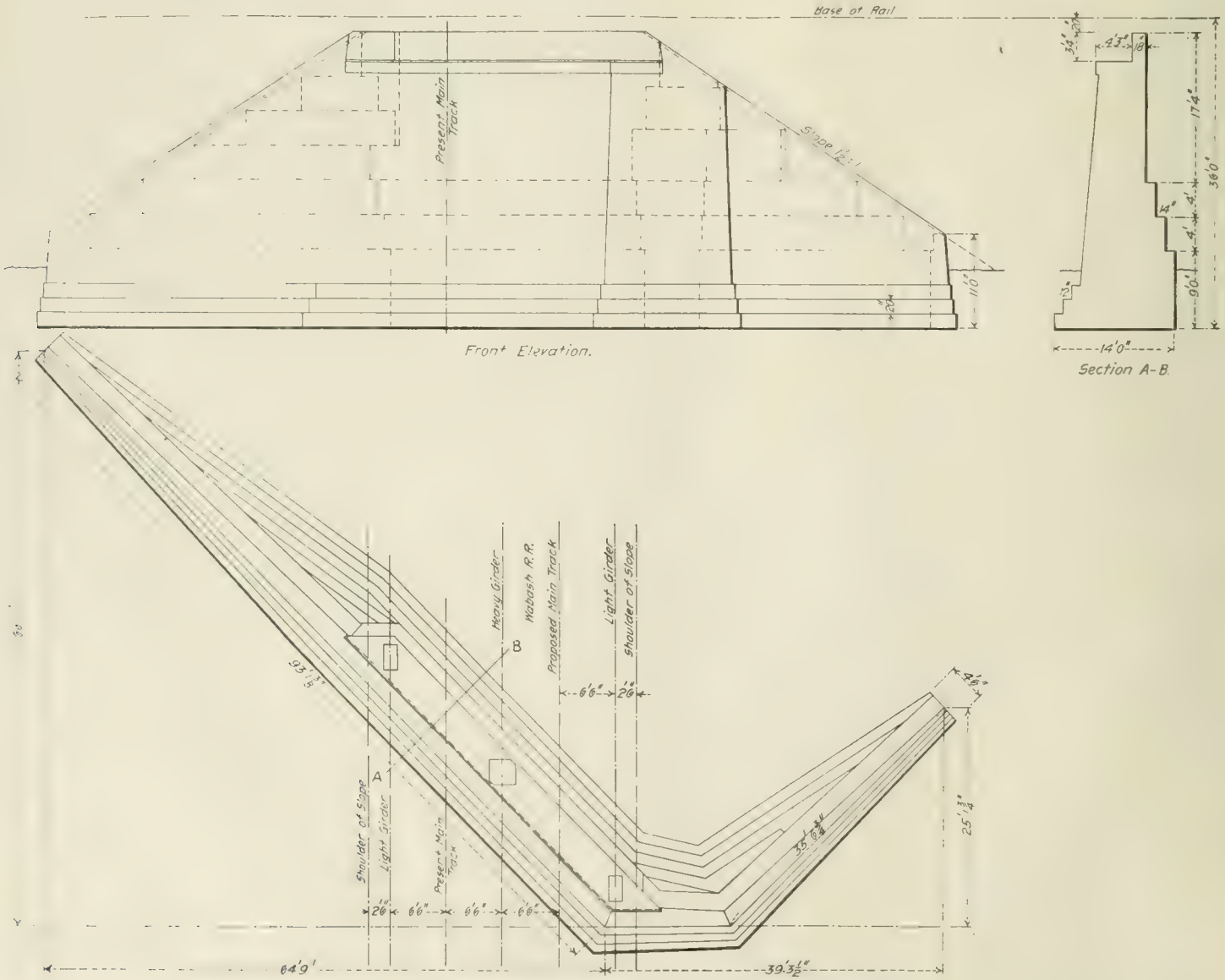
An interesting bit of overhead crossing work is being done by the Wabash at Newell, Ill., about 3½ miles east of Danville. The line of the Chicago Southern, the new road being built from Chicago to Terre Haute by the same interests that own the Southern Indiana, crosses the Wabash at this point and the latter is raising its grade in order to permit the new line to go beneath it.

From the situation plan shown herewith it will be seen that there is a highway crossing the Chicago Southern at right angles, and the Wabash occupies a skew relation to both. The original intention was to put in straight abutments and a solid pier and have the highway run around them. Work was begun on the abutments before the plans were changed to their present form, which provide for a straight highway passing through a 30-ft. opening in the pier. This accounts for the peculiarly shaped wing walls.

To support the track girders across the 30-ft. opening in the pier, four latticed steel girders are built into the concrete masonry, as shown by the plans. These girders are 43 ft. long by 4 ft. deep, the plans showing the details of their construction. They weigh 11,000 lbs. each and are spaced 18 in. on centers in the pier. Reinforcing rods are placed in the concrete above and below the girders as shown, the lower rods being surrounded by wire netting. The abutments are plain concrete, the details of their design being shown. The track girders are 67 ft. long and the structure is



Plan of Grade Crossing Separation at Newell, Wabash Railroad.

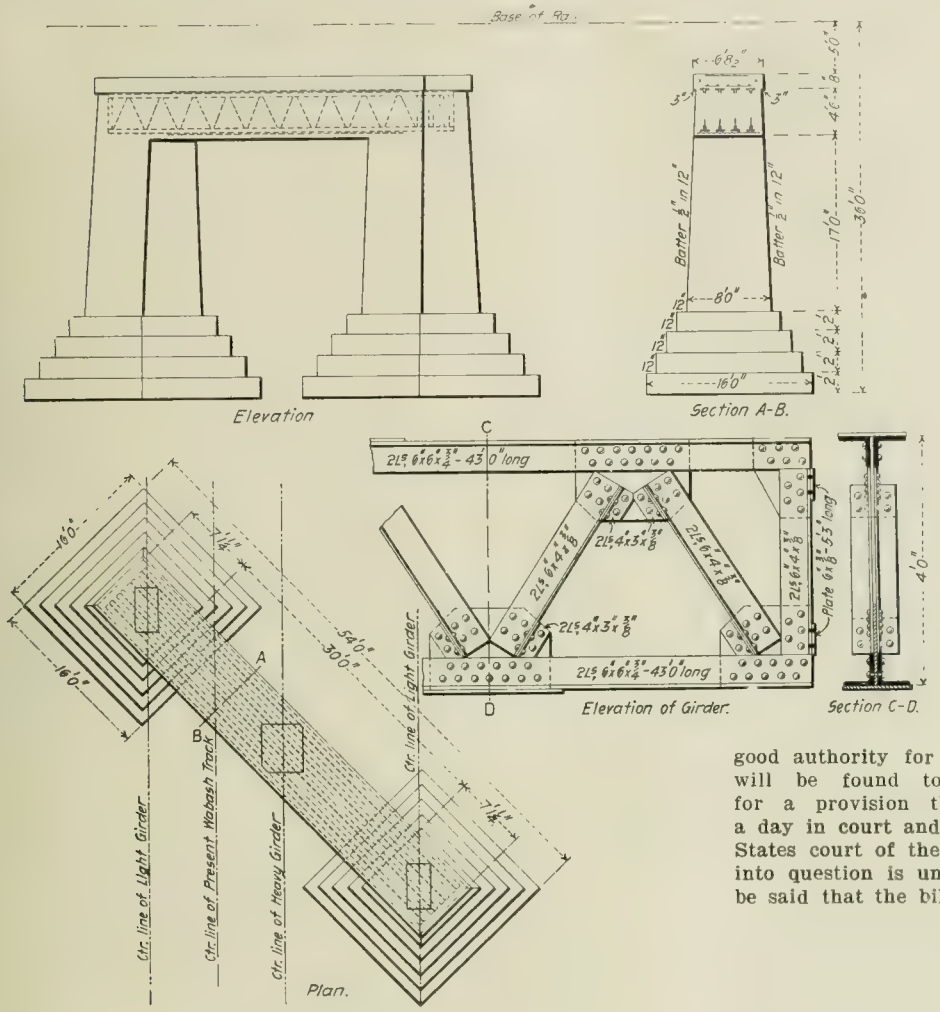


Details of Concrete Abutments for Newell Grade Crossing.

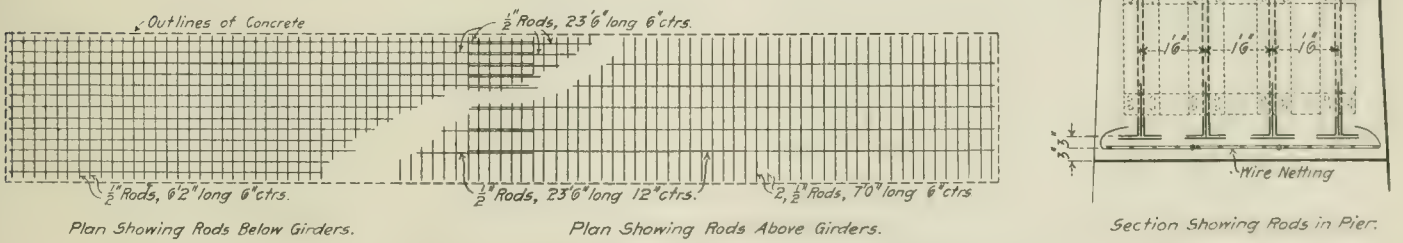
designed for double track to provide for a future second track for the Wabash.

While the head-room of the Chicago Southern is 22 ft., the actual raise in grade of the Wabash is only 10 ft., as it was on a 12-ft. fill at this point, crossing the creek and highway on a trestle. The raise of 10 ft. greatly improves the gradient of the Wabash, which was one of the considerations prompting the change. The raise was accomplished with the assistance of a pile trestle, by filling in the ends gradually and blocking up on the trestle.

We are indebted to Mr. A. O. Cunningham, Chief Engineer of the Wabash, for the plans.



Details of Center Pier and Cross Girder.



Details of Reinforcement in Center Piers and Cross Girder.

Washington Correspondence.

WASHINGTON, Jan. 2.—Representative Hepburn, of Iowa, Chairman of the House Committee on Interstate and Foreign Commerce, is putting the finishing touches on the railroad rate bill that he proposes to introduce. It is understood that this bill will follow very closely the lines of the Dolliver bill already introduced in the Senate. It will form the basis of the measure that will be reported from the House Committee and passed by the House. The House Committee is to take up the consideration of the many railroad bills that have been introduced, on January 9. It is not at present intended to have any hearings and an early report is expected. The bill reported to the House will be the Hepburn bill with few amendments of importance. Longer debate is to be permitted in the House than was the case last year when the Esch-Townsend bill was jammed through. It has not yet been decided whether the bill will be opened to amendments in the House, but, whether it is or not, it will probably be passed substantially as reported from the committee.

It is safe to predict that this House bill will not receive the approval of the Senate Committee. A majority of the Republican members of that committee take the ground that such a measure would give the Interstate Commerce Commission autocratic authority over railroad rates, and that it would be impossible for either a railroad or a shipper to obtain a judicial review of the real question at issue, that of the reasonableness or lawfulness of the challenged rate or rates. The Senate Committee will not approve the Foraker bill as it was introduced, but it is probable that any measure agreed upon by the Republican members will contain some of the features of the Foraker bill and will provide clearly that the courts shall, at some stage of the proceeding, pass squarely on the judicial question as to the reasonableness of the challenged rate.

Senator Elkins, Chairman of the Senate Committee, is working on his bill which he will bring forward as a compromise measure and which he hopes will be satisfactory to the President and the less extreme advocates of empowering the Commission to make rates as well as to the Senators and Representatives who have been unwilling to support any of the other measures thus far presented. It is understood that since Senator Elkins gave out his statement outlining what he thought ought to be the general form of a provision for changing a rate found to be unreasonable or otherwise unlawful, he has changed this feature of his bill somewhat. Just what the character of this change is he is not yet ready to announce, but there is good authority for the statement that his bill, when introduced, will be found to meet the contention of railroad officials for a provision that will insure to a carrier the right to a day in court and will provide for a determination by a United States court of the question whether a rate that has been called into question is unreasonable or otherwise unlawful. It can also be said that the bill proposes in some form to give the Interstate Commerce Commission authority to prescribe a reasonable rate to take the place of one found to be unreasonable. Senator Elkins will not say whether the judicial review of the question of whether the rate complained of was unreasonable or unlawful is to be prior to the new rate going into effect or subsequent thereto, but the action of the court is to be provided for in such way that the review will not be limited to the single question of whether the new rate is one that could lawfully be prescribed, but will cover the question of whether the old rate was unreasonable and should have been set aside.

J. O. W.

Underground Electric of London, Limited.

To succeed Charles T. Yerkes, Mr. Edgar Speyer has been elected Chairman of the Underground Electric Company of London, and Sir George Gibb, Deputy Chairman. The Underground Electric Company controls the Metropolitan, the Metropolitan District, the Great Northern, Piccadilly & Brompton and the Baker Street & Waterloo, and the Charing Cross, Euston & Hampstead subway lines, and also the London United Tramways. Sir George Gibb is well known to readers of the *Railroad Gazette* as General Manager of the North Eastern Railway

How to Avoid Accidents.*

Next come the accidents in which patrons are injured and their property damaged. It is generally understood, and has been the custom on all railroads, that before going onto a track on which cars are placed to be loaded or unloaded by patrons or employees it is the duty of the person in charge of the crew to go along the track to ascertain if there is anyone in the cars, loading or unloading them, or wagons close enough to the cars to be injured or damaged by their movement, and, if so, to give ample warning in order that such persons, wagons, and gang planks may be moved to a safe place. In the mining district especial care should be exercised in handling cars being loaded or unloaded by the mining companies' employees, many of whom do not understand our language or the danger of the business, in order that ample opportunity be given them to get off the car before it is moved. How often that rule and custom is violated is shown by the following cases:

Ludwig Hoffmeister, injured at Montmorency, July 12. some cars were switched down against the car from which he was unloading apples, without notice to him, and he was thrown down and injured.

H. Schurmann, laborer, injured April 2 at Hennessy. He was in car 16,495 at the Winston Tile Works, piling tile in the car, when the car was struck by a car of coal dropped in on that track by 12, engine 607, knocking the tile down on Schurmann.

Claim presented by Foster & Roberts Co., for value of building at Lewiston, May 3, 1904. Engineman Henry Brinker and his fireman left engine No. 526 and went into factory to get a drink; the engine with car U. Q. & Z., 4391, ran away and knocked this building down.

A., B. & C. car 38,952, loaded with salt, was being kicked down main line by engine No. 171 at Hawkins, October 12, brakes broken, car ran in on side track and struck another car, knocking it against side of building belonging to Blumenthal & Co., breaking in the walls and damaging cooking machinery. No bumping posts.

June 8, switching crew at Kempshall backed a box car against the ammonia pipe which carries ammonia from the brewery to the bottling works of the Kempshall Brewing Company, knocking down the pipe, which was only twelve feet high, allowing the ammonia to escape.

No one will pretend that these accidents and consequent injuries and losses could not have been avoided by the exercise of a little forethought and care. Why not do it and stop them in the future and save the money they cost?

The increasing frequency of accidents to travelers crossing the tracks at highways, one-third of which the country over are fatal, is caused by the increase in number and speed of trains, increase in the population of the territory through which the road runs, by the failure to always give the required signal of the approach of the train, frequently by freight trains passing through stations at a speed prohibited by Rule No. 431, by failure to have gates or flagmen at crossings where they are needed, by failure of gatemen and flagmen, when provided, to properly perform their duties on account of ignorance or carelessness, generally the former—in the investigation of a recent accident we learned that five out of seven flagmen on that section of track could neither speak nor understand English—but chiefly is the increase caused by failure on the part of the persons crossing the track to exercise any care whatever. Gates and flagmen are generally disregarded by adults and, as a natural consequence, by children, and the result is death and injury. This class of accidents, which in some states are nearly as hard to defend as the case of an injury to a passenger, will also explain in a measure the increase in the personal injury account. I think that as a matter of dollars and cents it would be profitable to the company to increase the number and quality of flagmen and have greater supervision given to this class of the service, as it seems to me a self-evident proposition that the lower the grade of labor the more supervision there is needed.

Among the many cases of this kind, I have selected some which will illustrate the matter. I want you to remember that the cases to which I refer in this talk are only a part of those occurring, and are selected for the purpose of calling the attention of the employees to accidents which might be avoided by the exercise of care on their part, and do not include the many cases caused by such negligence on the part of the person injured as should bar a recovery.

Herbert Janson, wife, daughter, son and George Griffith killed; Morris Peck and Henry Blume injured, December 18, at 9:00 p. m., while driving across the tracks at Haskell; caused by sleigh being struck by engine No. 245, hauling train No. 50. Engineman L. Kendrick, Fireman G. M. Lane, running forty miles an hour. Headlight not burning as required by Rule 94. No flagman at this crossing at night. No whistling post for crossing.

H. S. Sorner, who was riding in an automobile across the tracks at Grand Ave., Morton, April 14, was struck by engine No. 320, hauling train No. 25; automobile was demolished but occupants not seriously injured. No gates or flagman at this crossing.

Jacob Reich and Lobert Harris struck and killed while driving on 13th St., Montgomery, May 29, at 5:30 p. m., by engine No. 462, hauling train No. 6. Gates up. The piano wagon on which these men were riding was demolished as well as the piano, and the horse killed. The gateman at this crossing is an Italian and very excitable.

K. L. Manson, injured, rural mail carrier, struck by switch engine No. 869, at Woodmont Ave., Custer, June 12. There are gates at this crossing, but they had not been operated for a year on account of being out of repair.

Gertrude Schiff, aged sixteen years, and Gustave Schiff, aged twenty years, were injured while driving across the tracks at first crossing east of Granton, August 9, at 6:35 p. m., by being struck by engine No. 563, hauling passenger train No. 71, G. B. Jones, engineman, Sam Silverton, fireman. No whistle was blown for the station and bell not rung. The station employes, whose duty it was to be on the crossing to flag same when trains were passing, had left there only an instant before the accident in order to go to the station house to assist in loading and unloading baggage for train No. 71.

H. L. Connors, driving across the tracks near Lowell, November 18, was struck by engine No. 382, hauling train No. 4. No whistle sounded or bell rung for the crossing. The whistling post is not in the right place.

M. A. Graves, while crossing the tracks at 9th Avenue and Wilbert street, Ontario, May 8, was struck by switch engine No. 105, Engineman G. Allwood, Fireman A. M. Branton. No one on the engine knew that the accident had occurred.

Edward Langdon struck and killed by engine 619, hauling extra freight, at 7:21 p. m., August 6, at Water and Orchard streets, Berlin; James Olds, engineman. No one on the engine knew that an accident had occurred; train traveling twenty to twenty-five miles an hour. Ordinance provides speed limit of twelve miles an hour; gates at this crossing, but not in operation. If Rule 338 had been complied with this accident would not have occurred.

Wagon belonging to the Empire Novelty Company struck at Calkins at 9:37 a. m., October 29, by train No. 13, engine No. 932, Engineman Henry Robbins; wagon and contents badly damaged. Flagman at this crossing claims to have been sick at the time of the accident, and was in his shanty sitting down. He could not speak or understand English. Michael Powell, driver, injured.

Many of these crossing accidents occur and no one on the engine knows that they happen. Whether it is because the men on the engine are not keeping a proper lookout or by reason of the recent manner of construction of the large engines, making it impossible for the men in charge to always see a man on the track, I do not know, but I notice that some of the Class G-9 engines have the air cylinder and pump on top of the running board. While riding on a train the other day I asked one of our old runners whether they obstructed the view. His answer was an object lesson. He took his hat and placed it in front of the window opposite which I was riding and asked me if that obstructed my view. The cylinder could, I think, be put on the tank and the pump below the running board, which is now made wide enough to hold a political meeting on. Formerly they were narrow, just wide enough for a man to walk on, the old theory of construction being, as I understand it, that there should be nothing protruding from the sides of the boiler which would prevent the man in the cab seeing the bunting beam. If it were practicable to so construct the running boards and place air cylinders, pumps, etc., so that this could now be done, the engineman would certainly have a much better chance to see, and possibly some of these accidents be avoided.

And while our patrons and the public insist upon our running trains at a high rate of speed and guarding the crossings with gates, flagmen, or warning bells, they, at the same time, for some inexplicable as well as unconscionable reason, attempt to hold us liable for all deaths and injuries, no matter how great the care and foresight we have exercised, or how gross the neglect of the injured party. It therefore behooves us to do everything possible to prevent such accidents, not only that we may thereby save life, but also money.

If gatemen and flagmen were uniformed and given authority to arrest persons crossing the track when gates are down, or trains approaching, the number of cases of this kind would be largely reduced.

When there is a penalty provided and enforced against people attempting to cross a railroad track when the gates are down or they are warned by a flagman, accidents at crossing will be greatly reduced. As it is now, the public compels the erection of the gates and then almost universally disregards their warning.

Before leaving this subject of accidents at highway crossings I want to call attention to Rule 47, which says that when cars are being pushed by an engine (except when shifting or making up trains in yards) a flagman must be on the leading car, and Rule 47A requires that when cars are being switched over highway or street railway crossings a man must be stationed on the ground to act as flagman. Too much importance cannot be placed upon the observance of these rules, not occasionally, but always. If you will comply with them in the future fewer people will be injured. Try it and see.

In municipalities, run as slowly and carefully as you can and see that the bell is always ringing. Rule 406. Freight trains in going through stations should reduce their speed and do so under control as per Rule 338. The fireman, as well as the engineman, should be on his seat at that time keeping a lookout, and not engaged in waving a signal to some one on another train or elsewhere, or putting in a fire, and you enginemen should see that he does this. On the double track when you are going to meet another train at a crossing, try to get your engine over the highway before the tail end of the other train gets by it. If you can't do that, slow up a little, so as to give the people who may be waiting a chance to see you, and, if you think there is danger, open your whistle to let them know that you are coming; that is what the whistle is for.

* From a paper prepared by the Claim Department of the A., B. & C. Railroad, part of which appeared in the *Railroad Gazette* of December 15, under the heading "Injuries to Passengers."

In the country be sure to sound the whistle; not once, but four times as required by Rules 99 and 100, and see that the bell is kept ringing until the crossing is passed, at dangerous and obscure crossings where you can neither see the travelers approaching nor they you; if you are running at a nigh rate of speed, sound the whistle before you get to the post, as well as at it. The law requiring the giving of this warning eighty rods from the highway was enacted when few trains exceeded twenty-five miles an hour. Now, when few trains make less than forty ,and many over seventy, in the open country, so little time elapses between the sounding of the whistle and the reaching of the highway that when possible more timely notice should be given.

And I want to say here that one of the difficulties we meet with in this class of cases is the fact that sometimes you do fail to blow the whistle and ring the bell, and as long as men are human I suppose such things will happen; but let us commence now and try to do it every time. The greater the storm of rain, snow, or wind, the denser the fog, or the darker the night, the more important it is to give the warning.

If there is any way to discover whether the engineman and trainmen are observing the signals, which are located along the track for the protection of the passengers, other employees, themselves, and the property in their care, other than by having inspectors observe their action on approaching signals, and ascertain if they give the required warning of their approach to highway crossings, etc., and you will advise the management what it is, I am sure they will be glad to adopt such a plan. It has always been customary to have auditors examine the accounts of officers and agents handling money to see that not only are their accounts correct, that the money collected is remitted, but also to ascertain if the business of the company is done in accordance with the rules and a correct record kept of the transactions. No one for an instant thinks that the fact that the officers' and agents' accounts are examined is any discredit to them; most of us are not only willing but anxious that it should be done, as it is a protection to us as well as to the company. And if it is necessary to check up the officers and agents who handle money, is it not much more necessary to check up men who handle human beings and property ot immense value, to see that they observe signals and rules before, instead of after, an accident?

And as it sometimes happens that an engineman will not notice that his headlight has gone out, especially when there is snow on the ground, any employee who sees an engine moving after dark without the headlight burning should stop it and tell the engineman; if you can't do it yourself call up the train despatcher, so he can do it at the next station.

Occasionally we have an accident in which trespassers are killed or injured while walking or playing on the tracks, which might be avoided by greater care and watchfulness to discover their danger, by warning them of your approach, either by continuous sounding of the whistle, by slowing up, or by stopping when you have reason to think they do not know a train is coming, especially on the double track when trains are moving on both tracks. The most heartrending of them all are injuries to children, and, sometimes, to women.

Let me cite you several of just such cases:

Albert Jennings, ten years old, was sitting on the tracks north of Lampton, July 9, at 10:45 a. m., when he was struck by a work train of twenty-two empty flats backing north; engine No. 634, Conductor H. B. Welles. Air not coupled in as required by Rule 1036; no hand brakes on the cars. Welles was on the rear car and claims he was keeping a lookout, and although he had a clear view for over a quarter of a mile he says he did not see the boy until he was within three or four car lengths of him.

Charles West, aged eighteen months, struck and killed 1,000 feet south of Savannah Station, June 16, by train No. 31. Child came on track through a break in the right of way fence.

Margaret Kennedy, struck and killed on June 13, at 6:10 p. m., while walking on the tracks inside the city limits of Utopia, by engine No. 396, hauling passenger train No. 48, Engineman J. H. Simpson, Fireman Robert Cross, running about twenty five miles an hour; although the engineman saw her in time to have stopped, he did not realize that she did not see or hear the train coming, and failed to do so.

Mrs. Helen Boston, eighty four years old, struck and killed on a bridge near Lenox, September 1, at 4:35 p. m., by engine No. 684, hauling passenger train No. 15; Engineman I. W. Landis; Fireman B. M. Lent. Track is straight for about two miles and a half east of place of accident, and the woman wore a bright pink dress skirt. No one on the engine knew the accident had happened.

December 21, engine 746, Engineman Allen Woods, ran over G. P. Krauss, at 5:40 p. m., a quarter of a mile south of Slazenger. Engineman says he saw something lying on the track and thought it was a bough of evergreen. He did not know until he reached the station that anybody had been struck.

As the traffic and population increase, cases of this kind grow in number, and, for some unknown reason, the public think that, while they must keep off the property of private individuals, where there is no danger, they are privileged to go onto a railroad track where everyone knows there is great danger, and that after doing so a few times, the courts may say that they have a license to do so, and that we must look out for them and see that they don't get hurt. On the same theory I suppose the courts would say after a man burglarizes your house six or seven times that he has a license to try it again, and if he gets hurt doing it because too much force was used in throwing him out, that you must respond in damages. So when you discover that people, old or young, are making a custom of walking through the yards or on the track, report it to your superintendent before, not after, someone is killed or injured, and he will try to stop it. And if you find a child or a drunken man on the track, drive him off, because if you don't he is likely to get killed; and the company will not only back you up in doing so, but thank you for your thoughtfulness.

Rule 691 says that cars must be placed so as not to project over highway crossings, and yet any one riding over the system will see any number of them so left, and the result is that about once in so often a wagon strikes a car in an attempt to get across, a horse is frightened, and a runaway results, someone is hurt, and money paid to settle the claim.

The last serious case of this kind occurred at Warburton, July 9, in which Mrs. Jansen was fatally injured, caused by her horse being frightened by a freight car which was left standing fifteen feet in the highway, the end of the car being on the crossing plank. Horse ran away and she was thrown out.

When cars are left in such position they not only frighten horses and cause accidents similar to the one last mentioned, but also obstruct the view of approaching trains. Both the law and rules of the company prohibit this, and the practice should be stopped.

And right here I want to call attention to Rule 723, which prohibits engines standing within 100 ft. of a highway crossing, under a bridge, or near cars occupied by passengers, when it can be avoided, and yet the rule is so often disregarded that one wonders whether any one knows of its existence. Especially is this so with engines hauling passenger trains stopping at stations and occupying half of the highway, when they could just as conveniently be back some distance from it.

The stoppage of trains with the rear car standing in the highway should also be avoided so far as possible, particularly in the winter time, when there is always more or less steam leaking from the hose, as it is likely to frighten horses waiting to get by or in crossing the track.

Rule 571 says that trains must not block highway crossings more than five minutes. The failure to observe this rule is the cause of as much, if not more, criticism and profanity on the part of our patrons and the public than almost any other one thing that train and switchmen do. No one but the person who is waiting to get across the track, and sometimes it is a doctor answering an emergency call—we had such a case a few days ago—can realize how tantalizing and annoying it is, so for goodness' sake observe the rule in the future.

Turntables should be locked (that is what Rule 263 says), and yet I rarely, if ever, go over the line but what I see one unlocked. The result is that children are attracted to the place, and sooner or later one of the little ones gets hurt, as did the following, which are cited as examples:

Anthony Young, a ten year-old boy, had his foot caught at Grandison, March 30, while playing on turntable which was unlocked.

Phillip Chartres, eight years old, injured at Alvin, August 14, 2:30 p. m., while playing on turntable, which is about 1,400 feet north of roundhouse, used by Bridge Department to turn wrecker on. Turntable was not locked

Now, it wouldn't take but an instant to lock the turntable. Why not do it and prevent some child, perhaps your own, from going through life a cripple?

Be careful not to leave any torpedoes around that are not attached to the rail, as required by Rule 33, and never put them on a rail in a highway; if you do children may pick them up and in examining them get injured. We have had several such cases.

John Newton, aged nine years, injured June 30, about two miles north of Walker. This little boy with his sister and another boy were returning from school, walking along the track. They picked up a torpedo lying alongside the track, and after trying to open it with a knife young Newton placed the torpedo on the rail and struck it with a stone, the torpedo exploding and pieces of the tin striking him in the eyes and face, badly injuring him.

One of the great risks that every railroad that uses soft coal for fuel runs is the risk of fire to adjacent property started by sparks or ashes from engines. Any man running an engine ought to know from the sparks thrown out and fires started whether the engine is in good or bad order. Rule 946 says that the enginemen must report defects in netting and ash pans; this is required so that if the inspector overlooks the defect, or if one occurs between the regular inspections, it will be remedied before any damage is done, and if an engine is throwing more fire than she ought to, it is up to you to report it and get it fixed. It will take you less time than to make a report about the fire and condition of the engine, and, at the same time, save both the owner of the property and the company a loss. In lumber and sawmill country it is especially important that this be done, and where engines are working in or around sawmills, lumber yards, powder and tie plants, and other places where danger of fire is great the apparatus for preventing the escape of fire should be absolutely perfect, and it ought to be the personal business of the engineman to know that fact, he should be present when the inspection is made and see that it is

done thoroughly, the same as he would if he and not the company had to foot the bill if the engine started a fire.

On the outlying division, where traffic is light and trains are few, if your engine starts a fire, stop and put it out. If conditions are such that you can't do that with safety, drop a note off to the first section crew or agent, so that they can send men out to extinguish the fire. If you don't, the Lord only knows where it may run to (on the western prairies I have known it to go twenty-five miles) or how much damage it will do in lumber country.

If the precautions suggested here, which are neither new nor original, but can be found in the book of rules and on the bulletin boards, had been adopted, none of the following cases would have occurred

June 3, engine No. 2011 started a fire at Hansel & Woods Company's plant at Myron Valley, netting on this engine was in bad order; the hood provided by the company to be placed over the smokestacks of engines going into the plant of this company also in bad condition.

Claim presented by Gilbert Purcell for value of a house and contents burned April 29, one half mile south of Fort Andrew, started by engine No. 1759. This engine was inspected and reported to be in good condition, but upon examination by my assistant was found to be defective.

On August 17, engine No. 539, hauling train No. 81, Shirley division, set out three fires between Selkirk and Belmont. Fires were observed by train crew, but train was not stopped, and no effort was made by crew to extinguish the fires. Fires burned over 15,000 acres of ground, destroyed about 1,100 tons of hay in stack, one building, a large acreage of winter feed, fence posts, etc.

Experimental Locomotives for the Pennsylvania Railroad.

In following out its practice of keeping posted in regard to current development the Pennsylvania Railroad has ordered five locomotives for experimental and observation purposes to follow the work done upon the testing plant which formed a part of the company's exhibit at St. Louis. The order consists of two each of four types of American locomotives and two of a foreign build. The American engines include a four-cylinder balanced compound of the Atlantic type built by the Baldwin Locomotive Works, from its own designs; a four-cylinder balanced compound of the same type built by the American Locomotive Co. from its own designs; a consolidation locomotive built by the American Locomotive Co. from its own designs; a prairie type locomotive built by the same company from its own designs, and a four-cylinder balanced De Glehn compound, built by the Société Alsacienne de Construction Mecanique, of Belfort, France.

As stated, two of each of these engines have been ordered, one to be worked on the lines east of Pittsburg and one on the lines west. It is not claimed that they embody any distinctive novelties, for many of each type have been built for other roads and have been in service for some time. They were merely ordered that their performances might be observed and compared with those of engines of a similar class designed at Altoona.

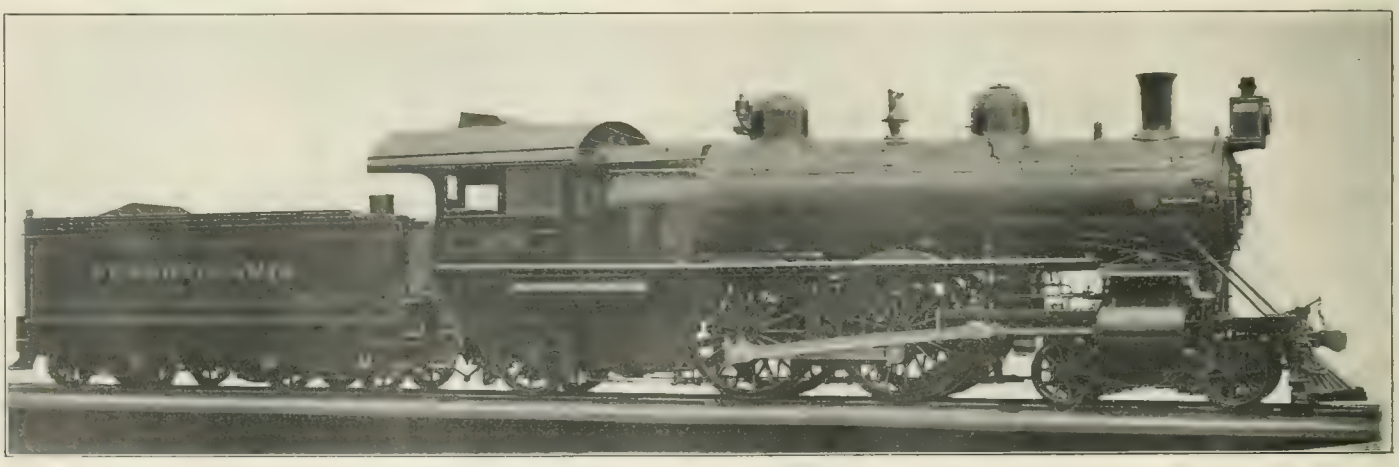
Of the five types of engines ordered three are of the four-cylinder compound class, and of these the two of the Atlantic type were designed by the Baldwin Locomotive Works and American Locomotive Co. respectively. The two engines are very similar to each other in general appearance, though with the differences incidental to the fact that they were independently planned. Each has the low-pressure cylinders upon the outside, driving the rear pair of wheels upon whose axle the eccentrics are placed, and moving the piston valves set above and between the two cylinders on either side. A single valve operates the high and low-pressure cylinders on each side. The most noticeable difference in the external appearance of the two is to be found in the arrangement of the equalization between the drivers and the trailing truck. In the engine from the Baldwin Locomotive Works there is a single bar with unequal arms spanning the distance between the springs of the rear driving wheel and the equalizer over the oil box. The American Locomotive Co. on the other hand uses a series of three short equalizers to cover this same distance. Both engines conform in general to the standard practice of the Pennsylvania in the use of certain parts, such as the Belpaire boiler, the Vogt protected single-bar guide and other features.

The principal dimensions of the two are as follows, and from these a detailed comparison can be made.

	American Locomotive Co.	Baldwin Locomotive Works.
Cylinder diameter, h. p.	16 in	16 in
Cylinder diameter, l. p.	27 "	27 "
Piston stroke	26 "	26 "
Wheel base, driving	7 ft. 5 in.	7 ft. 5 in.
" " total	31 " 11 "	33 " 8 "
" " engine and tender	61 " 4 "	63 " 1 1 16
Weight in working order	200,500 lbs.	195,000 lbs.
" on drivers	117,200 "	120,500 "
" front truck		42 400 "
" trailing truck		33,000 "
" engine and tender	325,800 "	328,000 "
Heating surface, tubes	2,680.17 sq. ft.	2,698.0 sq. ft.
" " firebox	181.10 "	166.0 "
" " total	2,861 57 "	2,864.0 "
Grate area	35 0 "	55.5 "
Axles, diameter, driving journal front	10½ in	10 in
" length, driving journal front	12 "	11 "
" diameter, driving journal back	10½ "	9½ "
" length, driving journal back	12 "	13 "
" diameter, truck, journals	6½ "	5½ "
" length, truck journals	12 "	10 "
" diameter, trailing journal	7 "	7 "
" length, trailing journal	11¾ "	11¾ "
" diameter, tender journals	5½ "	5½ "
" length, tender journal	10 "	10 "
Boiler, outside diameter, first ring	67 "	67 "
" working pressure	205 lbs.	205 lbs.
" fuel	Bituminous coal	Bituminous coal.
" thickness of sheets	11 16 in.	11 16 in.
Firebox, type	Belpaire.	Belpaire.
" length	111 in.	111 in.
" width	72 "	72 "
" depth front	73 13 16"	67 1-16"
" depth back	66 1 16"	64 1-16"
" thickness crown sheet	⅜ "	⅜ "
" thickness tube sheet	½ "	½ "
" thickness sides and back	5 16 "	5-16 "
" water space front and sides	4 "	4 "
" water space back	3½ "	3½ "
" crown staying	Radial.	.....
Tubes, number	315	261
" diameter	2 in.	2¼ in
" length	16 ft. 4 in.	17 ft. 8 in
Nozzles	Single.	.....
Piston rod diameter	3 in.	.....
Tank, type	Water bottom.	.....
" capacity, water	5,500 gals.	5,500 gals.
" capacity, coal	20,000 lbs.	25,000 lbs.
Valves, type	Piston.	Piston.
" travel	6 in.	.....
" lap	1 "	.....
" extra clearance, h. p.	5-16"	.....
" extra clearance, l. p.	⅜ "	.....
" lead	¼ "	.....
Wheels, driving, diameter	80 "	80 "
" truck, diameter	36 "	36 "
" trailing, diameter	50 "	50 "
" tender, diameter	36 "	36 "
Tractive power	23,300 lbs.	23,300 lbs.

Cast-steel is used for the axle boxes throughout and also for the driving wheel centers. The engines are equipped with the Westinghouse-American high-speed brake with shoes applied to all wheels. The high-speed brake is also used on the tender. A 9½-in. air pump is used. The exhaust nozzles are single and vary from 5⅝ in. to 5⅞ in. in diameter. The lead which is indicated for the engine of the American Locomotive Co. is set for ¼ in. opening when in the forward motion and cutting off at 11 in.

A comparison of the figures in the schedule show some difference of practice with two builders that are of interest. It is understood, of course, that the two engines were intended to be practically the same, and yet at the very outset there is a difference of 5,500 lbs. in the weight. Curious enough, it is the lighter engine

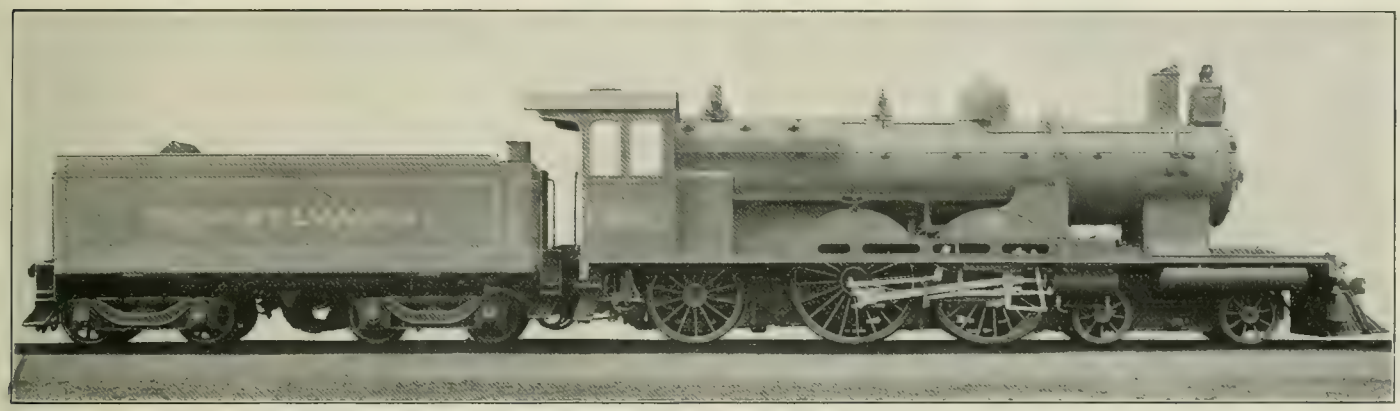


Four-Cylinder Balanced Compound Atlantic (4-4-2) Type Locomotive.

Built by The Baldwin Locomotive Works



Prairie (2-6-2) Type Simple Locomotive.
Built by The American Locomotive Co.



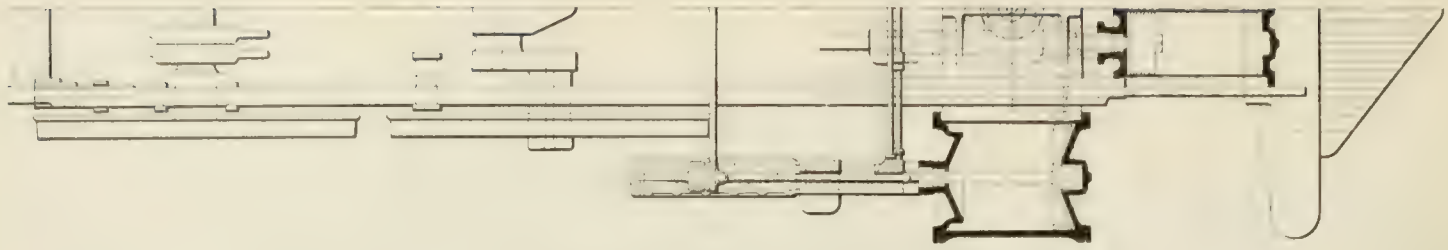
De Glehn Four-Cylinder Balanced Compound Atlantic (4-4-2) Type Locomotive.
Built by The Societe Alsacienne de Constructions Mecaniques, Belfort, France.



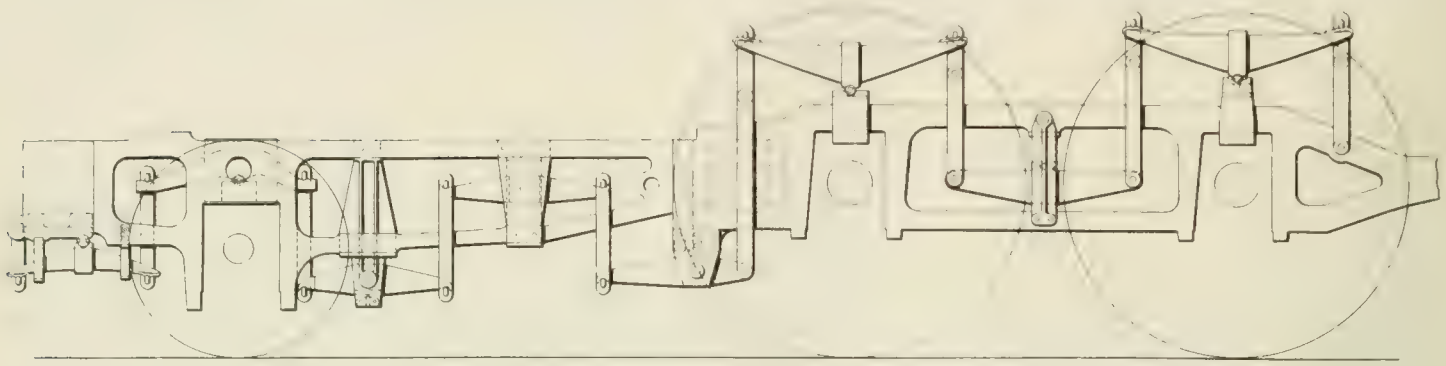
Consolidation Locomotive with Walschaert Valve Gear.
Built by The American Locomotive Co.



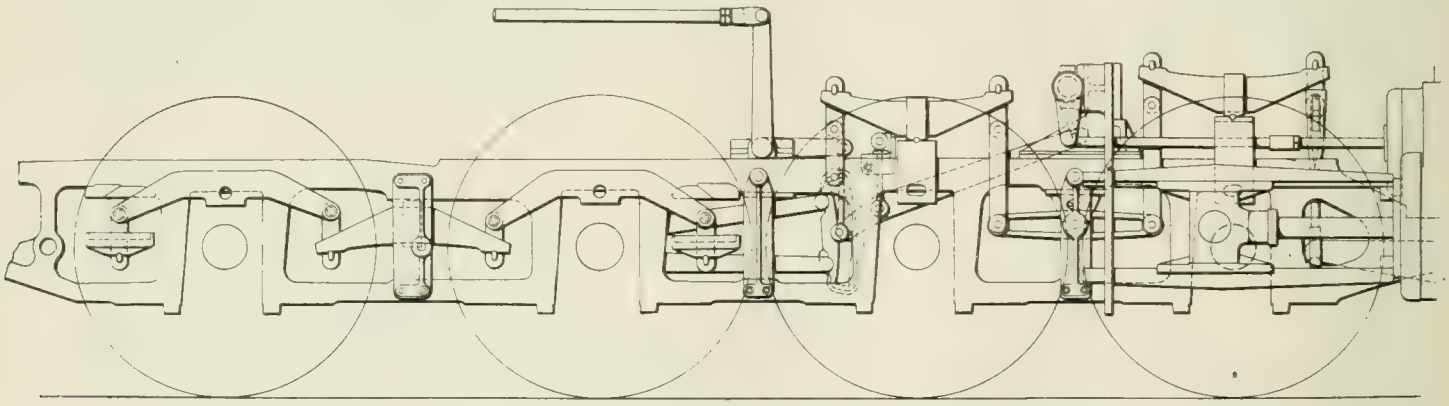
Four-Cylinder Balanced Compound Atlantic (4-4-2) Type Locomotive.
Built by The American Locomotive Co.



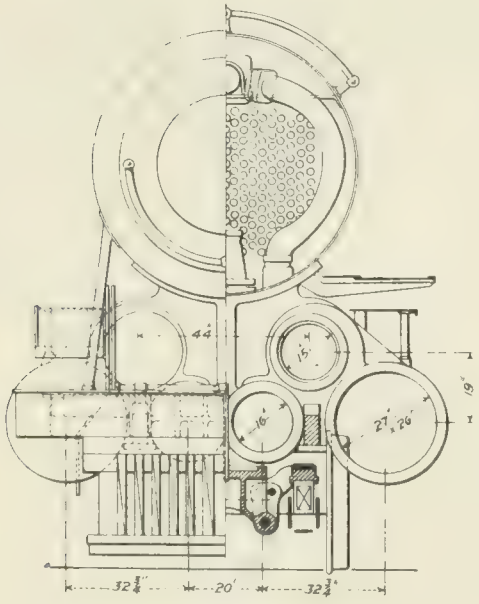
Half Plan of Cole Four-Cylinder Compound Atlantic (4-4-2) Type Locomotive.



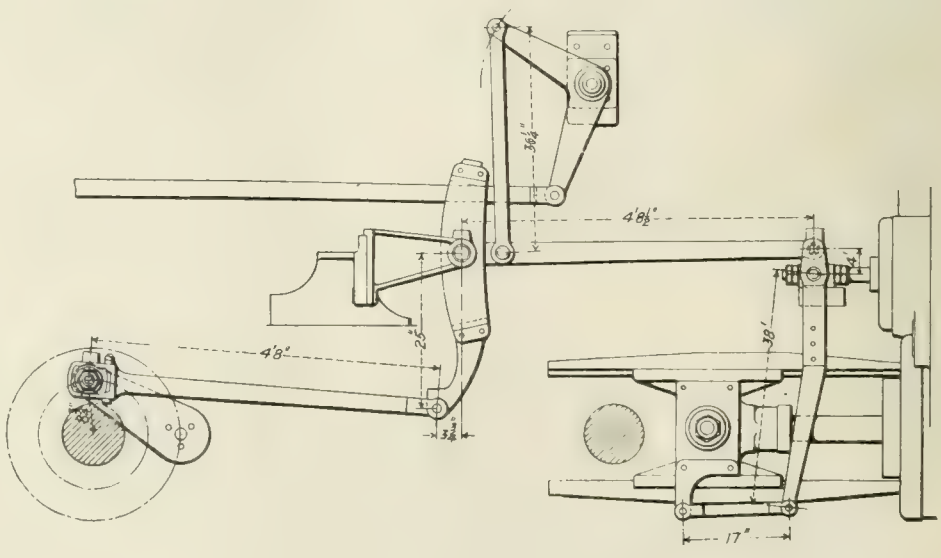
Spring Suspension of Cole Four-Cylinder Balanced Compound Atlantic Type Locomotive.



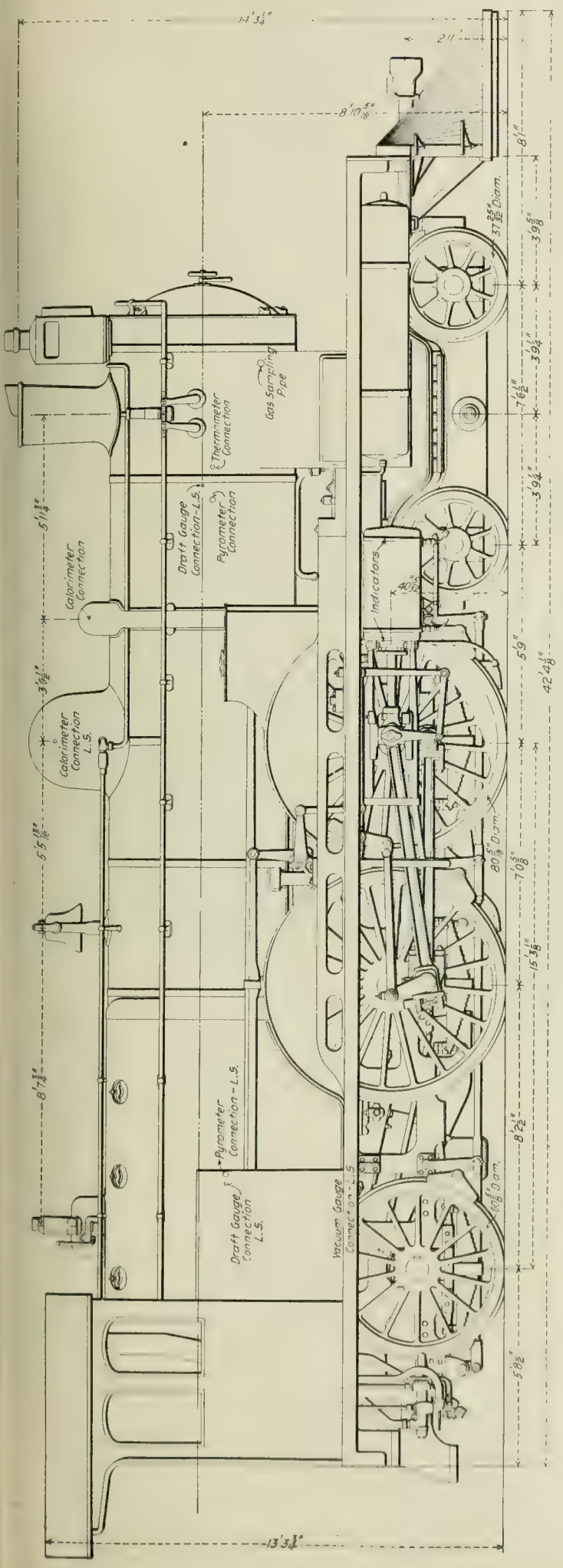
Spring Suspension and Valve Motion of Consolidation Locomotive.



Cross-Section of Baldwin Four-Cylinder Compound Atlantic Type Locomotive.



Walschaert Valve Gear for Prairie Type Locomotive.



Side Elevation of De Glehn Four-Cylinder Compound Locomotive for the Pennsylvania Railroad.

Built by The Société Alsacienne de Constructions Mecaniques, Belfort, France.

that has the greater weight on the driving wheels. Again, in the matter of heating surface, which is practically the same in the two, there is a marked difference in the way in which it is obtained. In one there are 315 2 in. tubes each 16 ft. 4 in. long. In the other the tubes are 2¼ in. in diameter, 17 ft. 8 in. long and only 261 in number. It will be interesting to note the relative fuel consumption on the two engines when they are placed in the testing plant and worked under identical conditions of drawbar pull and quality of fuel some inkling of the relative value of a long and large tube as compared with a small and short one should be obtained, though it cannot be expected to finally settle the question as to the relative merits of a large number of short tubes as compared with a smaller number of long ones of the same diameter. In other respects the engines are so nearly alike that the relative importance of the differences noted should be brought out in a striking manner, for it is not probable that the slight difference in the depth of the firebox at the front and back will make any appreciable difference in the fuel consumption or the work that the engines are capable of doing on the road.

The consolidation locomotive built by the American Locomotive Co. is a massive machine of over 220,000 lbs., of which 198,000 lbs. are upon the driving wheels, or 24,750 lbs. upon each wheel. The cylinders are 23 in. in diameter, with a piston stroke of 32 in. or the same, lacking 1 in. in diameter, as the engine built a number of years ago by the Pittsburg Locomotive Works for the Pittsburg, Bessemer & Lake Erie, which was heralded, at the time, as the largest locomotive in the world. The boiler has an outside diameter of shell of 83¼ in., using plates $^{13}/_{16}$ in. thick. It is of the straight-top radial stay type.

The equalization of the engine is arranged to take the two rear drivers and the two front ones with the pony truck. This will be recognized as a modification of the standard arrangement of a few years ago, when the equalization was between the three rear pair of wheels, and the front pair of drivers and the pony truck.

Piston valves are of course used, and a marked feature of the valve mechanism is the inclined connection between the link block and the rocker arm. This connection is carried, near its lower end, by a swinging link 14 in. long that hangs vertically when in its central position. The rocker arms are 10½ in. long, and the driven one stands at right angles to a line drawn from its swing center to the lower end of the link referred to. For an equal amount of motion on either side of its central position, this gives an unequal travel to the valve.

The slip of the link block is also in opposite directions, being down when ahead of the central position and up when back of the same. The result of this is that there is a greater travel to the block back of the center than forward, which tends to compensate for the inequality set up by the angularity of the connection bar, and thus equalize the valve travel and tend to keep the working of the engine square.

In the equalization of the two rear pair of driving wheels, bars are used over the top of the driving boxes, a single semi-elliptic spring between them and two helical springs beyond the boxes at the end of the equalization system. This method of spring suspension is not rare, but the comment to be made upon it is that the use of the helical spring tends to neutralize the sluggishness of the semi-elliptic spring, and to give the engine the motion that it would have if it were carried on the helical spring only. It has been found that when a helical and elliptic spring of about the same capacity are used in parallel to support a given weight, the trace of the motion of that weight is more rapid and prolonged than it would be if it rested on the elliptic alone, and yet not as rapid or as prolonged as if it were on the helical alone. In short it is a true resultant of the two. For this reason the use of an excess of helical spring support draws the resultant action towards that of the helical alone, which is an undesirable condition in the spring suspension of either a locomotive or a car.

The principal dimensions of this engine are as follows:

Cylinder, diameter	23 in.
Piston stroke	32 "
Tractive power	45,500 lbs.
Wheel base, driving	15 ft. 6 in.
" " total	26 " 5 "
" " engine and tender	60 " 1½ "
Weight in working order	220,000 lbs.
" on drivers	198,000
" engine and tender	360,500
Heating surface, tubes	3,496.1 sq. ft.
" " firebox	177.1 "
" " total	3,773.6 "
Grate area	50.4
Axles, diameter, main driving journal	10 in.
" length, main driving journal	12 "
" diameter, trailing, journal	9½ "
" length, trailing journal	12 "
" diameter truck journal	6 "
" length truck journal	10 "
" diameter, tender journal	5½ "
" length, tender journal	10 "
Boiler, type	Straight top
" diameter outside first ring	83¼ in.
" working pressure	200 lbs.
" fuel	Bituminous coal
Firebox, type	Wide
" length	106 1/16 in.
" width	72¼ "

Firebox, thickness crown, side and back sheets	⅜ in.
" thickness tube sheet	9/16 in
" water space	4½ "
" crown staying	Radial
Tubes number 446, diameter	2 in
Tubes, length	15 ft. 6 in
Piston rod, diameter	4 in.
Smokestack, diameter	20 "
Smokestack, above rail	14 ft. 9¾ "
Tank, style	Water bottom
" capacity water	7,000 gals.
" capacity coal	13 tons
Valves, type	Piston
" diameter	14 in.
" travel	6 "
" lap	⅞ "
" lead	0 "
Wheels, diameter, driving	63 "
" diameter, truck	33 "
" diameter tender	33 "

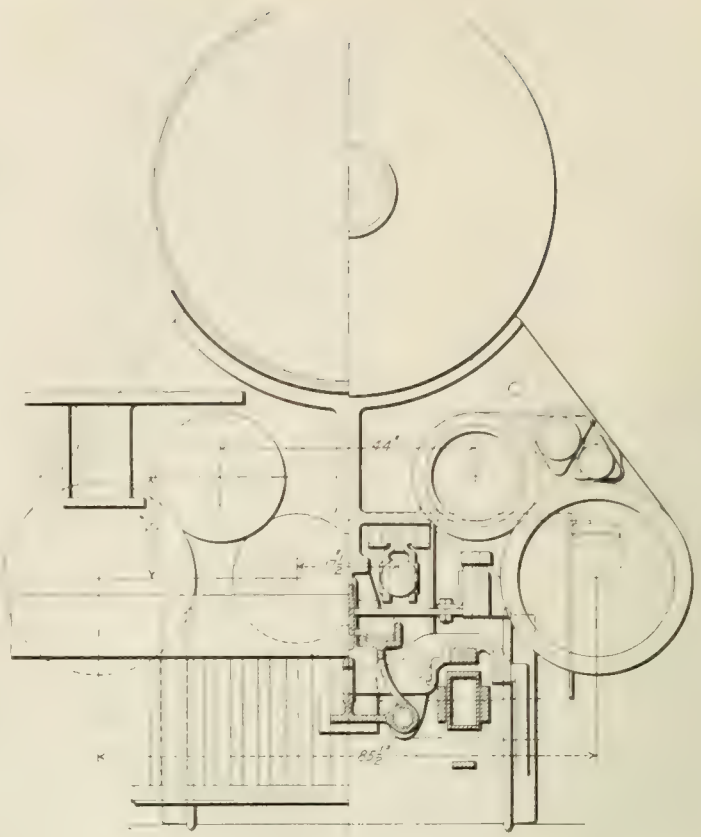
The engine is equipped with the Westinghouse-American air-brake, with a 9½ in. pump and two reservoirs of a total capacity of 83,865 cu. in.

The Prairie, or 2-6-2 type of engine, built by the American Locomotive Co., has the same form of straight top boiler as the consolidation with double fire-door and the crown held by radial stays. In this engine the most noticeable feature is the Walschaert valve gear, the details of the general arrangements or which are shown in the illustration. The equalization of this engine is divided between the rear drivers and trailing truck and the two front drivers with the front truck. Piston valves are also used on this engine. Its principal dimensions are:

Cylinder, diameter	21½ in
Piston stroke	28 "
Tractive power	27,520 lbs.
Wheel base, driving	14 ft
" " total	34 ft. 3 in.
" " engine and tender	64 " 6¾ "
Weight, in working order	234,500 lbs.
" on drivers	166,800 "
" engine and tender	373,800 "
Heating surface, tubes	3,678.9 sq. ft
" " firebox	202.7 "
" " total	3,881.6 "
Grate area	55.0 "
Axle diameter, driving journals	10 in
" length, driving journals	12 "
" diameter, truck journals	6½ "
" length, truck journals	12 "
" diameter, trailing journals	8 "
" length, trailing journals	14 "
Boiler, type	Straight top.
" outside diameter, first ring	74½ in.
" working pressure	200 lbs.
" fuel	Bituminous coal.
Firebox, type	Wide
" length	108⅛ in
" width	73¼ "
" thickness crown, side and back sheets	⅜ "
" thickness tube sheets	½ "
" water space front and sides	4½ "
" water space, back	4 "
" crown staying	Radial.
Tubes, diameter	2¼ in.
" length	19 ft. 6 in.
" number	322
Piston rod diameter	4 in.
Smokestack, diameter	18 in and 21¾ in.
Smokestack, above rail	14 ft. 10¾ "
Tank style	Water bottom.
" capacity, water	7,000 gals.
" capacity, fuel	10 tons.
Valves, type	Piston.
" diameter	12 in.
" travel	5½ "
" lap	1¼ "
" exhaust clearance	1/8 "
" lead	7/32 "
Wheels diameter, drivers	80 "
" diameter, front truck	42½ "
" diameter trailing	50 "
" diameter, tender	36 "

Like the other engines of this lot, the Westinghouse-American air-brake is used, with the usual attachments. In the packing of the pistons the Dunbar rings have been used instead of the cast-iron rings of the others. The exhaust nozzles are also made variable in this case, with a range of from 5½ to 5¾ in. in diameter. All of the tenders have steel underframing made up of 8 in. and 10 in. channels.

The De Glehn four-cylinder compound is the last on the list of these experimental engines and is in marked contrast, in general appearance, to those which have been built in the United States.



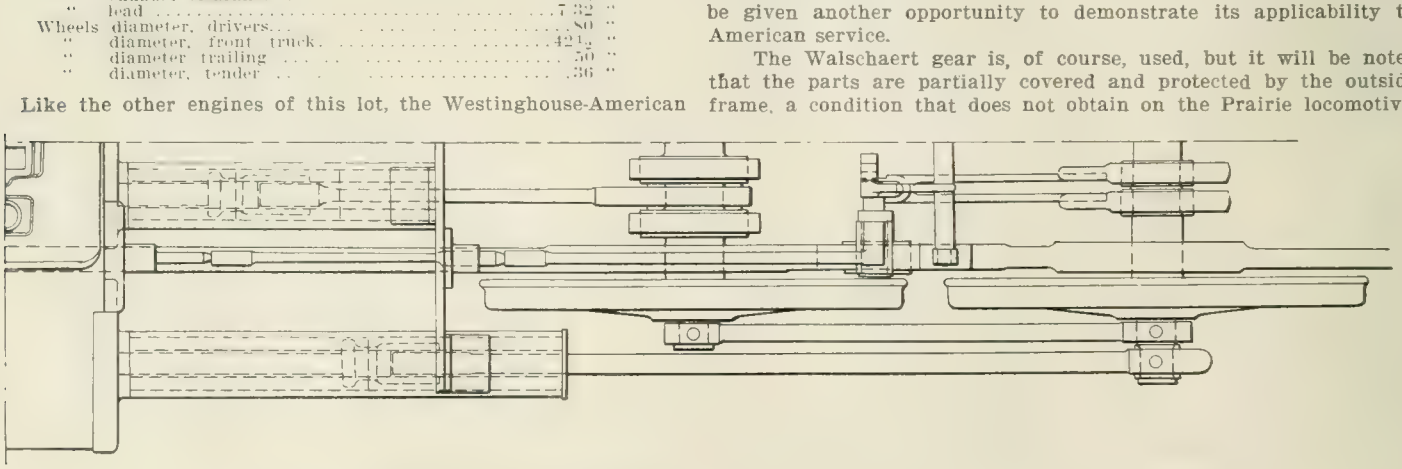
Cross Section of Cole Four-Cylinder Balanced Compound Atlantic (4-4-2) Type Locomotive.

The smoothness of the outline, the concealing and apparent inaccessibility of the working parts, the lack of equalization between the weights on the several wheels, the heavy plate frame of the truck, the smoke-stack deflector and the outside steam pipes all mark it as of non-American origin.

In the engraving, the points at which the various pieces of apparatus intended for use in the testing of the machine are to be applied are shown, and will be of interest as indicating not only how the work is to be done but the thoroughness with which it is to be prosecuted.

The engine is of the Atlantic type with a rather large trailing wheel. The arrangement of cylinders upon this engine is the reverse of that of the other two four-cylinder compounds of American build in that the high-pressure are upon the outside coupled to the rear pair of drivers, while the low-pressure are between the frames, are set ahead and drive to the front axle, which is cranked. The engine also differs in the use of the plate frame, which will thus be given another opportunity to demonstrate its applicability to American service.

The Walschaert gear is, of course, used, but it will be noted that the parts are partially covered and protected by the outside frame, a condition that does not obtain on the Prairie locomotive.



Plan of Rods on Baldwin Four-Cylinder Balanced Compound Atlantic (4-4-2) Type Locomotive.

Again, the wheel base of the leading truck is somewhat greater than we are accustomed to. It is 7 ft. 6½ in., while that of the American Atlantic type is but 6 ft. 4 in. The wheels are slightly larger, being 37¾ in. as against 36 in. on the American engine.

The principal dimensions are:

No. pairs of driving wheels, 2; diameter of same	80 3/16 in.
Size of driving axle journals	8½x9 1/16 "
Length of driving wheel base	7 ft. 0½ "
Total wheel base of engine	28 " 6½ "
Total wheel base of engine and tender	59 " 5 "
No. wheels in engine truck	4

Diameter of wheels in engine truck	37 13-16 in.
Size of engine truck axle journals	5 15-16 x 9⅞ "
Spread of cylinders	85⅝ "
Size of cylinders.	H.P., 14 3-16x25 3-16 in.; L.P., 23⅝x25 3 16 "
Steam ports:	H.P., 1⅞x14 3 16 in.; L.P., 1 11-16x20⅜ "
Exhaust ports:	H.P., 3⅛x14 3-16 in.; L.P., 3⅛x20⅝ "
Travel of valve	5½ "
Type of boiler	Belpaire narrow firebox.
Minimum internal diameter of boiler	58⅛ in.
Number of tubes	139
Outside diameter of tubes	2¾ in.
Length of tubes between tube sheets	173¼ "
Fire area through tubes	4.73 sq. ft.
Size of firebox inside	39⅝x119⅞ in.
Fire grate area	33.9 sq. ft.
External heating surface of tubes	2,435.7 "
Heating surface of firebox	181.1 "
Total heating surface of boiler	2,616.8 "
Steam pressure per sq. in.	227½ lbs.
No. wheels under tender	8; diameter of same 36 in.
Size of tender truck axle journals	5½x10 in.
Weight of engine, empty	147,400 lbs.
Weight on truck in working order	41,250 "
Weight on first pair of drivers	44,550 "
Weight on second pair of drivers	43,300 "
Weight on trailing wheels	34,900 "
Weight of engine in working order	164,000 "
Weight of tender loaded	132,500 "
Ratio of heating surface to grate surface	77.1
Ratio, external flue heating surface to firebox heating surf.	13.4
Tractive power with M. E. pressure equivalent to 4-5 boiler pressure	19,555 lbs.
Diameter of trailing wheels	60 11 16 in
Size of trailing wheel axle journals	7⅛x9⅞ "

Philippine Railroad Projects.

BY L. E. BENNETT.

In 1901 and 1902, when civil government was just being established in the Philippine Islands, the Civil Commission, headed by Governor Taft, advertised for bids for the construction of extensive harbor improvement works and a complete system of electric surface railways on the streets of Manila.



Foothills on the Island of Negros.



A Clearing in the Hill Country.

Up to this time practically no American capital had been invested in the Philippines and no public work of any consequence had ever been carried out with Filipino labor, except the Manila & Dagupan Railway, 120 miles long, which had taken several years in building.

In response to these advertisements the Government received only one bid for harbor works which could be favorably considered, that of the Atlantic, Gulf & Pacific Company, of New York and San Francisco; and only one complete bid for the electric street railway system, that of J. G. White & Co., Inc., of New York, associated with Mr. Charles N. Swift, of Detroit. It was a virgin field for capital investment.

The representatives of these firms studied the situation most carefully on the ground, organized the work to suit the conditions and peculiarities of the natives, even going to the point of providing school houses and teachers, churches, music, dance halls and cock fighting pits for the amusement of the laborers, also hospitals and medical attendance, a system of lunch money, giving each laborer 10 cents cash each noon for his lunch so that the improvident ones would not go hungry, and by prompt and honest payment of wages and scrupulous care in complying with every promise made to the laborers, they quickly gained the confidence of the people, and have been most successful in securing labor in abundance, which has demonstrated that it is entirely feasible to depend upon carrying out the proposed construction of about 1,000 miles of steam railroads with the common native labor available in the islands. Moreover, it has been amply demonstrated that the native Filipinos appreciate and understand the advantages of good transportation facilities, and that they will patronize and utilize such public utilities, as shown by the results which have been obtained on the 34 miles of Manila Electric Street Railways now in operation about nine months.

When J. G. White & Co. and Mr. Swift undertook to finance and build this trolley system, it was not known whether the natives would patronize the railway when built. They believed in the project, risked their money, and have won out, as shown by the tremendous traffic. The Manila Street Railways have proven that a good return may be expected from capital judiciously invested in public transportation utilities in the Philippine Islands, and we may confidently look forward to the same results from the building of 1,100 miles of steam railroads about to be undertaken in the Islands.

On December 15th, there were opened in Washington, in the presence of the Secretary of War, the Governor General of the Philippines, and others, tenders for the construction and operation of the new lines proposed by the government under limited government supervision and guarantee of interest on bonds.

The government proposed in an advertisement to grant perpetual franchises, the terms of which may be readjusted after 30 years, to such persons or corporations as may propose to construct the advertised lines and operate them on the most advantageous terms to the Philippine Government. As an additional inducement to capital, Congress authorized a guarantee by the Philippine government of not exceeding 4 per cent. interest on 95 per cent. of the bonds of these lines, up to $30,000,000. Unfortunately, Congress had not yet shown any intention to deal fairly and liberally with the Islands in the matter of free trade or reduced preferential tariff rates at the time the bids were opened, and probably on that account only two tenders worthy of consideration were received, offering to construct about 720 miles out of a total 1,100 miles advertised. The bidders were Speyer & Company, of New York, on behalf of the Manila & Dagupan Railway Company, already built, and J. G. White & Co., Inc., of New York, the builders and managers of the present Manila Street Railway Company, who offered to build on behalf of Mr. Cornelius Vanderbilt, Kean, Van Cortland & Co., the lines to be built by J. G. White & Co. The lines tendered for by Speyer & Co. are the following: A line from Dagupan, the present terminus of the Manila & Dagupan Railway to San Fernando, a good seaport about 30 miles north in the Province of Union. The line will pass through a densely populated district and should pay well. A line from Manila to Botangas via Calamba, a branch to Lucena, Tayabas, from Santo Tomas, and a branch from Calamba to Santa Cruz Laguna, altogether about 130 miles. A line from Pasacao to Nueva Caceres and Albay in the southern part of the Island of Luzon, which is probably the richest "Manila hemp" district in the Islands.

All of these projected roads are good ones. Speyer & Co. offered to build them without any government guarantee of interest whatever. These lines will serve a very thickly inhabited country with a rural population of as high as 250 per square mile. The products of the soil along these lines are chiefly rice, hemp, corn, tobacco, sugar cane, fruits and vegetables; also large quantities of coprax or dried cocoanuts for extracting cocoanut oil, which is shipped to France, Germany and Denmark, where it enters largely into the manufacture of butter, soap, candles and many other manufactured articles.

Generally speaking, the Philippine railroads are more important as passenger lines than as freight carriers, and about 66 per cent of the entire traffic is derived from passengers, while only about 33 per cent. is derived from freight traffic. The percentage of freight traffic is, however, increasing slowly.

Railroads are operated cheaply in Oriental countries on account of the cheap labor, operating expenses on the present existing lines

representing only about 15 per cent. of the charges. Natives make fairly good and very cheap section hands for maintenance of way, good foremen and engine drivers for locomotives, and possibly good telegraph operators and station agents.

The highest paid men are the machinists and locomotive engineers, who receive about $35 to $50 per month. Section hands earn about 30 cents per day, and foremen, station agents and telegraph operators from $15 to $20 per month. They are slow and in some respects unreliable, but generally more satisfactory than any other nationality for the work they have to do, and they are almost without exception sober, respectful and obedient to their superiors, all of which are important virtues not possessed by some foreigners in the Islands.

The fares for passengers are generally low, much lower than in the United States, and traffic is divided into three classes, first, second and third class. Fully 95 per cent. of the traffic is third class, and the present second class should really be abolished altogether. It is necessary to have first class, which will not be very profitable for some years, for the reason that there is a small percentage of foreigners and educated natives who object to riding with the poorer class of natives who form the bulk of the traffic.

Freight rates are high as compared with rates in this country, and range from $5 to $10 per ton for a 100-mile haul. Large freight cars do not pay, as an average car load is only about four tons, which accounts for the necessity of a high freight rate. It is almost impossible to get a full load for even a 10-ton car, as the natives ship in small quantities. Shipping is in the hands of many small dealers, and there are few merchants who ever ship a full car load of merchandise. The Chinese merchants are the largest shippers of merchandise, and by far the best business men in the islands outside of a very few prominent foreign houses who do almost exclusively an export and import business.



Native Bridge Over Mountain Stream.



Long Freight Train in the Mountains.

Railroads can only be made to pay on the larger islands and the cheap water transportation is always a serious factor of competition except from the interior of the larger islands down to the coast towns and vice versa. Along the coast, freight can be carried by native sail boats very cheaply.

The lines which are at present under consideration are narrow gage railroads, with a 3-ft. 6-in. track, and seem fairly well suited to the requirements of the island traffic. Trains make an average speed of about 16 miles an hour for passenger trains and 12 miles for freight. They follow the low lands wherever possible and have fairly easy grades and curvature. It is believed that in no case will the grades exceed 1½ per cent., and that only for inconsiderable portions of the line.

The greatest difficulty which has to be contended with is the extremely heavy rainfall which occurs within a few hours time, causing sudden and destructive floods and much damage to roadbed. This necessitates a very heavy expense for bridges and an abnormal provision for flood openings of all kinds. It is estimated that certain lines will require as much as 3 per cent. of the total mileage to be allowed for flood openings in the way of trestles, culverts and bridges over the whole line. The country is very much torn up and disturbed by seismic movements. In fact, the islands are still in the process of formation and the country has not yet found its equilibrium. It is almost impossible to find a good solid formation of rock, and road building in the mountains and hills is attended by huge land slides most disastrous and annoying to road building. There is scarcely any formation in the mountains which could not be worked out with a steam shovel. This has also played havoc with the mineral deposits of the islands, which are very extensive and widely distributed, but not concentrated enough to make mining successful as a general rule. The mountain tops are usually covered with dense vegetation and fine forests, but with the exception of tall, coarse grass and rank weeds, the valleys need no clearing or grubbing for railroad purposes.

The natives have no prejudices against railroad introduction and modern transportation facilities like the Chinese, and rarely ever disturb railroad property or obstruct the track and telegraph lines. In fact, they have shown great interest in the proposed roads and welcome the coming lines. Even extremely poor people gave the writer every assistance and accommodation within their limited means while inspecting the routes of the proposed lines in the interior country and evinced an unusual interest and enthusiasm over the prospect of railroad construction through their locality. They had some extraordinary ideas about what a railroad is like. Most of them had never seen one. One man in particular wanted to know if he could travel by rail as fast as a telegram, and others were quite surprised when it was explained that they would be able to travel as far in an hour as they could travel on foot at present in a day. They were much interested in knowing how much it would cost to ride on the railroad, and nearly all the young men expressed their desire to work for the road as soon as it started. Steel bridges several hundred feet long to carry a train were quite incomprehensible to them. And they said they had expected the trains would be ferried across all the large rivers in boats.

This ignorance of railroads, of course, refers to the southern islands. The people of Northern Luzon are more familiar with railroads which have been in existence in that section for 15 years. The people nearly all expressed their determination to ride on the trains when the road was built, and they will do so, as they are true sportsmen in that respect. They earn very little money but if they have a dollar in the world they will spend it like a king, bet it on a cock fight or ride on the train; and they are good losers. They accept a winning or a loss with equally good grace.

When the native rides in the train he likes best to take his few belongings with him in the car where he can see them. He has not much faith in baggage cars and checks, and we are inclined to think rightly so from personal experience on the present existing lines. Especially does the native insist on taking with him his fighting cock on the train, street car or boat, wherever he goes, taking better care of it than of his wife and children.

A story is told that one day a train was stopped by a native lying asleep with his head on the rail. Fortunately the engineer saw him in time and stopped the train. When he was awakened he was quite free to admit that he went to sleep deliberately with his head on the rail because he was an employee and was supposed to be at work, and believed that, by sleeping with his head on the rail he would more easily hear the approach of the train and be up and working when the train passed.

Transportation through the interior at present, where no navigable stream exists, must of necessity be very slow and expensive. Where roads exist at all, and they are few and extremely bad, transportation is carried on by bullock carts carrying about 600 lbs. of cargo. These water buffaloes are able to make at best only about 14 miles a day, and travel in the early morning or night, never in the heat of the day. Transportation by this method under the

most favorable circumstances costs about 35 cents per ton-mile, and from that up to $1.50 per ton-mile.

Another mode of transportation where there are no roads, but only trails, is by pack animals or on men's backs. Men carry from 50 to 100 lbs. in this way and animals about 125 lbs. each. Transportation by this method costs from one cent a pound per day upwards, according to the scarcity of animals and men. Packers are able to make 18 to 20 miles per day and frequently make trips of five days' duration, or 100 miles. It will be seen that transportation of this class costs from $20 to $100 per ton, and that only a very few high class products, such as hemp, fine tobacco and cocoa can be moved with such freight rates.

Transportation of timber and logging operations are difficult or almost impossible, even where an abundance of fine timber exists, and there is a fair depth of water which would ordinarily float logs in the United States, for the reason that the Philippine woods are so heavy they will not float, and have to be floated with the assistance of bamboos or other light wood which has no market value. This shows the sore need of railroad facilities to develop the great resources of the Islands.

The greatest population live in the Visayan group of islands, including Panay and Cebu. In Cebu there is a population of 350 per square mile along the route of the proposed railroad. This island grows corn, rice, hemp, fruit and vegetables, and also has extensive coal deposits quite close to one of the terminals of the new railroad project. There is also an abundance of material available near the proposed line suitable for the manufacture of good Portland cement.

It is quite within the range of possibility that coal can be successfully mined in Cebu and cement manufactured for building and operating the railroads instead of importing it. It has never been systematically demonstrated whether these coal deposits can be continuously followed and mined or not.



Manila Hemp Growing Wild.

The Island of Negros, it is believed, has the best ultimate prospect of successful development on a large scale of any island in the group. This island is entirely volcanic in formation and there are two principal craters, one active and the other extinct for several hundred years. The slope from the foot of the volcano to the sea is gradual and furnishes good drainage, sufficient to prevent the disastrous floods which occur on the flat valleys of some islands and about steep enough for irrigation purposes. The slopes are well watered with numerous streams which come down from volcanoes and irrigation ditches can be built cheaply. The formation is volcanic and thrown out by eruptions during thousands of years. This soil makes ideal sugar cane land and is similar and fully as good as the sugar land of Hawaii, but much better provided with water. At present only about 10 per cent. of the land is under cultivation, and that near the coast line, because there are no roads or transportation facilities in the interior, and the sugar, which is the principal product, is not worth the freight charges of an overland haul. Back from the coast are enormous areas of land better than that already cultivated, and entirely wild. At present about 80,000 tons of raw sugar a year is grown and exported from this island. This output is capable of expansion up to 400,000 tons a year with good transportation facilities, the introduction of modern methods of cultivation and sugar reduction and by utilizing the waste waters of the streams for irrigation purposes.

At present planting and cultivation are carried on by the crudest methods with a maximum of inefficiency and waste. There are a few Swiss and Spanish planters, but they are not much more progressive than the natives. Most of the plantations are operated by the natives. The natural market for Negros sugar is China and Japan. At present the Chinese are just beginning to use sugar, and with a market like China at her door, there is no real danger that Philippine sugar will swamp the United States and ruin the beet sugar industry. Negros can safely develop her full resources up to 400,000 tons of sugar per year, and sell it all in Asia.

Development will be slow, but eventually the Negros railroads about to be built should be excellent investments, and should pay operating expenses from the start. Already the natives and other planters are adopting new and improved methods of cultivation, and some of them have introduced, with considerable success, American plows, harrows, and other agricultural implements. One native stated that he was able to plow with an American disc plow five times as much per day as with an old-fashioned native plow, which merely scratched the surface.

The present land laws which prevent foreigners taking up more than 40 acres of land for an individual, and corporations more than 2,470 acres, has hurt the development of Negros. There is a prospect that Congress will modify this law at an early date.

Sugar can be cultivated only up to the foot of the slopes of the volcanoes, but, at higher elevations, other valuable products can be cultivated most successfully, and will be cultivated on an extensive scale when railroads are built. Some of these valuable products are rubber, gutta percha, cocoa beans, coffee, Manila hemp, and other products. Also, there are many valuable forest products, such as rattan and fine timbers.

In the northern part of the island there is, at the present time, an up-to-date American saw mill and logging outfit, owned by a New York firm. This is equipped with several miles of wire cable operated by winding engines for hauling logs down to the mill. The operations are considerably handicapped for want of transportation facilities, and the new railroads should be able to remedy this difficulty and develop a large and profitable lumber business.



Rafting Lumber with Bamboo Floats.

Near Escalante, the proposed terminal, a splendid harbor can be developed by improving the Danao river some 600 ft. wide and dredging out the bar at the mouth. When this is done there will be a uniform depth of 35 to 50 ft. of water, and accommodation for anchorage of eight or ten large ocean steamers. Coal is said to exist on the island about nine miles from the Escalante station on the private property of a Spanish planter, but it is not known if the quality of the coal is good, nor if the deposit is capable of being worked to advantage.

The Islands of Cebu, Negros and Panay are located side by side, and only about 30 miles apart, or less. It is quite possible, if found desirable or necessary, to construct car ferries, and interchange cars, empty or loaded, as the requirements of traffic may demand.

The Island of Panay has a rural population of about 167 per square mile, and the population, which will be served by the 100 miles of proposed railroad, will approximate 620,000 inhabitants. The location of the railroad is practically a continuous village for many miles, and a continuous succession of villages over all but some 27 miles of the line where it passes through the hills. Here again are large areas of uncultivated lands in the interior, because there is no means of transportation. Railroads will change these conditions.

The land produces a great variety of products, such as Manila hemp, almost pure white and of a silky lustre, pineapple fiber

of which grass cloth and "Jusi" cloth are made; also numerous other fibers for the manufacture of delicate and beautiful native cloth. Rice land is abundant and excellent. Coffee, cocoanuts, fruits, vegetables and poultry can be raised in abundance; also millions of sugar sacks are made for shipment to the sugar plantations of Negros. They are manufactured in nearly every household by the women and children, and are made from palm leaves. Nearly every house has one or more crude native looms for the weaving of grass cloth textiles referred to above, and they produce some delicate fabrics, which find a ready sale in the cities.

At Iloilo the government is building by contract extensive harbor improvement works, and dredging the river so that, ultimately, it is expected large ocean ships for Europe and the United States can load and discharge their cargoes inside the river at a wharf. At present, all cargo is handled by lighterage, which costs about $1.50 per ton. Also the harbor of Capiz, at the northern terminal of the island, is capable of development.

Labor is plentiful in all these three islands, except certain kinds of skilled labor. Common labor receives about 30 cents a day, and performs about one-quarter of a day's work as compared to our standard. Some skilled laborers, such as drillmen in rock excavation, receive 40 to 45 cents a day. Carpenters receive 50 cents, and machinists, boiler makers and riveters, blacksmiths, engineers, etc., from 60 cents to $2, according to their ability. This latter class of skilled mechanics is very scarce, and probably Japanese will have to be imported for the railroad construction to make up the deficit of skilled mechanics and riveters for bridge work.

When working in this country, or in isolated localities, it is advisable to spend considerable time, money and trouble in providing amusements for native laborers in order to make their surroundings more agreeable. With this object in view it is not unusual for engineers and contractors to provide dance halls, cock pits, and hire musicians for the principal camps, to make the men satisfied with their work; also to provide ample quarters for their families who accompany them on the work.

While considerable brigandage and lawlessness has been carried on in the interior of most all the islands in the past, the writer does not know of a single instance where the natives have molested engineers who were carrying out work where large numbers of native laborers were employed, and where considerable sums of money were being disbursed and scattered among the common people.

The 800 miles of railroad tendered for by Speyer & Co., and Messrs. J. G. White & Co., will cost, it is expected, in the neighborhood of $28,000,000, and if Congress treats the islands fairly and generously, as it should do, these railroads when built should mean to the islands the difference between poverty and prosperity, between lawlessness and business security.



Dao Village with Cocoanut Groves in Background.



Field of Sugar Cane in Lowlands.



Typical Native Plantation in Lowlands.

Foreign Railroad Notes.

The last fluid to make use of tank cars is milk. The practice grew up in Denmark, and for some months milk has been shipped long distances, and recently all the way to Berlin in such cars. The tanks, however, are not the boiler plate cylinders with which we are familiar, but consist of enormous wooden casks, each of 210 cu. ft. capacity, two of which are fastened to the floor of a covered freight car. For some time the German railroads charged freight only for the weight of the milk so shipped; but recently it has occurred to some one (probably to some milk producer who ships in cans) that while he was paying freight on his cans, the Danes were not paying any on their packages, which, though bolted fast to the car, nevertheless added to the weight to be carried. An end has been put to such discrimination.

In connection with the French Ministry of Public Works there is what is called an "advisory railroad committee." It was recently determined that all who have ever been at the head of this ministry shall be members of this committee. It now appears that this adds no less than 13 persons to the committee, which is a commentary on the short lives of French cabinets. A minister has hardly time to learn his way about his office before he must make way for a new man.

The Cologne *Gazette* affirms that it is virtually decided to work the Simplon Tunnel with electricity, and that from its first opening, which will be delayed until April or May. The Italian authorities are said to have urged this very strongly, and to have agreed to grant concessions of water power on their side and to loan some of the electric locomotives which for some years have supplied the motive power on the Valtellina Railroad. On the Swiss side, at Brieg, is already the plant which generated the electricity used during construction. Steam locomotives will be changed for electrical there; but the latter will haul the trains not only through the great tunnel but over the new line built to connect the tunnel at Iselle with the Italian railroad system at Domodossola, which has a number of tunnels, some of considerable length. The length of the line to be thus worked is 25 miles.

The island of Cyprus, which is more than twice as large as Long Island, had its first railroad opened Oct. 21 last, from the harbor of Famagusta to Nikosia, in the interior, 36 miles.

The German Dining Car Co. reports that at the end of its last fiscal year it possessed 50 dining cars, running on various routes. With these it earned net about $120,000, and paid 10 per cent. dividends, having paid tolls to the railroads which amounted to 6.4 per cent. on its stock. It has ordered four new cars, which will have six-wheeled trucks. The existing stock has four-wheeled trucks.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

CONTENTS

EDITORIAL:
The New Haven Convertible Debentures. 25
Rock Island Retrenchment 25
Free Pass Evils and Benefits..... 26
Car Building in 1905..... 26
Discipline of Enginemen..... 27
Summary of Annual Reports 28
Railroad Officers on the 1906 Outlook... 29
Illinois Central 31
Trade Catalogues 32

ILLUSTRATED:
Scranton Tunnel of the Lackawanna & Wyoming Valley 34
The Cost of Locomotive Operation 38
Winnipeg Shops of the Canadian Pacific.. 40
Lehigh Valley Hospital Car..... 42
Shapes of Switch Targets 43
Coal Pusher for Locomotive Tenders..... 45
The Acme Chain Hoist..... 48

CONTRIBUTIONS:
Walschaert Valve Gear in Service..... 32
An English Visitor 33

MISCELLANEOUS:
Electrolysis and Water Pipes in N. Y. City 36
Signal Arrangements for the New York Central Electrified Zone..... 36
December Railroad Law 38
Signaling of N. Y. C. Electrical Zone.... 40
Washington Correspondence 40
Westinghouse Single-Phase Equipment for the Sarnia Tunnel 42
The Past Year from an Interurban Standpoint 43
Annual Report of the Michigan Railroad Commissioner 44
The St. Paul's Pacific Extension..... 45
New Interurban Connecting Link..... 46
Railway Signal Association..... 46
The Manipulation of Tool Steel..... 47
Iron and Steel in 1905 48
Lake Flour Tonnage 48

GENERAL NEWS SECTION:
Notes 9
Meetings and Announcements 10
Elections and Appointments 10
Locomotive Building 11
Car Building 11
Bridge Building 12
Railroad Construction 13
Railroad Corporation News 14

VOL. XL., No. 2. FRIDAY, JANUARY 12, 1906.

The decision of the Directors of the New York, New Haven & Hartford to allow holders of $185,200 of non-converted 4 per cent. debentures of 1908 to convert them into stock par for par—the privilege having expired April 1, 1903—opens some exceedingly interesting questions in railroad economics, policy and ethics; nor are the questions of principle less striking because the amount involved is small. It should be explained that the $185,200 of debentures are the non-converted remnant outstanding of a former issue of $16,000,000, and that the reasons urged effectively upon the directors were that sickness, absence from the country and accidents unforeseen and unavoidable prevented the offer of many of the $185,200 bonds in time for conversion. As New Haven stock now sells at about $200 a share the holder of one of these bonds now receives about 100 per cent. dividend as a gratuity which the corporation is in no wise legally bound to pay. Hence arise such questions as these: (1) Does or does not, in such cases, the principle of *caveat emptor* morally apply—in other words, is the holder of a convertible bond supposed to provide against accidents and contingencies and not provide for them at his own risk? (2) How about certain of the remnant bonds which have passed by purchase to secondary holders who thus become by pure luck the fortunate beneficiaries of a 100 per cent. dividend? (3) Should or can—in practice—the corporation distinguish, in justice to its regular share owners, between the primary and secondary holders of the debentures? (4) What effect as a precedent will such a policy have on a speculative value of railroad bonds not converted in time?—a question, by the way, somewhat pat to the New Haven Company, which is to convert $30,000,000 3½ per cent. new debentures into $20,000,000 of stock five years hence. (5) By parity of reasoning ought not a bondholder besides his 100 per cent. dividend now be given also the extra 4 per cent. a year on stock which he has lost since April, 1903, and (6) Is or is not the unique action of the New Haven Company evidence of a corporative soul as against the proverbial philosophy of the economists? Here are six basic questions, each with its *addenda*, which we cheerfully relegate to the large and thoughtful body of economists, statists, moralists and financiers. Not often in the fiscal annals of our railroads have they had just such a problem for analysis and solution.

The definite passing, last week, of the 4 per cent. dividend on the preferred stock of the company in which is lodged final control of the Rock Island and Frisco Systems, marks a distinct change in the financial and operating policy of the Rock Island management. The last four years' history of this 14,000 mile group of railroads is familiar enough to the readers of the *Railroad Gazette*. In the issue of December 1st last, the make-up and inter-relations of the two systems controlled by the Rock Island Company of New Jersey, on whose stock it is that the dividend has just been passed was fully described in the review of the several annual reports. The year's results were also examined in some detail. The gist of the situation is that the Rock Island Company, being in no way an operating company, depends for its income entirely upon dividends from its controlled properties. Its investment in $28,881,900 common stock of the St. Louis & San Francisco as yet returns no dividends, the Frisco having all it can do to pay 4 per cent. each on its first and second preferred stock and meet its guarantees on the Chicago & Eastern Illinois and other controlled lines. The one source for the $1,950,210 annual dividends which the Rock Island Company has been paying on its preferred stock has been the Chicago, Rock Island & Pacific Railway, which has been paying, since the present owners took control, 8 per cent. dividends on its stock, until the last fiscal year, when 6¼ per cent. was paid. This reduction in the Railway company's payments during the year ending June 30, 1905, as was shown in the review of the reports, cut down the Rock Island Company's income after fixed charges to within $61,000 of the sum required to pay 4 per cent. on its preferred stock, a margin quite too narrow for comfort. At the same time, the Rock Island Company's profit and loss surplus was reduced from the nominal figure of $50,779 on June 30, 1904, to $28,111 a year later. It was at once evident on publication of these figures that the Rock Island Company was sailing pretty close to the wind in making payments on its preferred shares; but the large increase in earnings reported by the Railway company in the late summer and fall months made it seem likely that unless there came a change of policy on the part of the management this preferred dividend would be continued. This in spite of the fact that it was plainly evident from an examination of results on the controlled railroad properties that business was not being handled anywhere nearly as economically as must be done if the roads hoped to approach the standard of other large railroad systems. In particular, the conducting transportation figure on all the lines was high, this one fact accounting for much of the disappointing showing in net earnings. The decision to disregard the interests of holders of the preferred stock of the New Jersey holding company is an important change in the previous policy of the present management. The funds which would otherwise have been paid over in dividends by the Railway company to cover the Rock Island Company's preferred dividend payments are instead to be turned back directly upon the lines of the Rock Island System in an extensive campaign of improvements which will involve a total outlay (including expenditures for equipment) of about $15,000,000. This, surely, is a step in the right direction, the one thing, in fact, which can bring about the ultimate establishment of Rock Island securities on something like the firm basis of the old Chicago, Rock Island & Pacific Railway Company's stock. If the Rock Island companies, in the recent fiscal year, when most other railroads in similar territory were returning great increases in both gross and net revenue, could not produce any more favorable results than they did, it is surely time for definite reforms. Part of the great potential value of these roads lies, of course, in the development of southwestern territory, where so much of their mileage is situated, but the im-

provement of the lines so as to bring them all up to somewhere near a uniform standard of efficiency is the most immediately important need.

FREE PASS EVILS AND BENEFITS.

In October, 1899, when an effort was made by Western railroad officers to do away with passes, we made the comment that agreements not to give passes were as fragile as agreements not to cut rates; that the country must wait until it had the agreement and co-operation of the railroads plus the co-operation of an enlightened public opinion expressed in effective laws. The 1899 effort failed. Again, in November, 1901, the Trunk Line presidents met and agreed not to exchange passes. The agreement went into effect January 1, 1902—and lasted about three weeks. In view of these modern instances—to go back no further than 1899—it is of interest to see wherein the present ban on free transportation differs in its chances of success from previous efforts in the same direction, and also to look at some of the uses and abuses of the pass, viewed as an institution. Our previous requirements of respective co-operation by railroads and public opinion and of effective laws seem now closer to realization, it is safe to say, than they have been at any time in the last generation. Therefore, the decision made by the Trunk Line officers last December to shut off passes entirely on the ground that they constitute discrimination in the eyes of the law, is supported at once by the weight of authority and by a public opinion which is not only alert, but considerably excited, on issues of corporate favoritism.

Roughly speaking, a railroad has four reasons for issuing passes, and practically all of the free rides granted can be attributed pretty definitely to one of them. The first of these reasons, and the one which is unassailable, legally or morally, is the benefit which the company derives from having certain persons use its lines freely. Theoretically, a railroad could require its officers, traveling on company business, to pay their fares out of a fund provided for that purpose, receipts and expenditures balancing each other on the books. In practice, this is not done, nor, so far as we know, has it ever been suggested that it should be done. But it is sometimes hard to determine the limits of this practice, for, apart from regular officers and employees, there are a number of other persons who serve the roads in a capacity more or less temporary, but are nevertheless useful with a use perhaps directly proportioned to the amount of traveling they do. Under this head cattlemen could be classified, together with special messengers in charge of fruit cars. An exchange of passes to permit employees of connecting roads to attend meetings and conventions is also an indirect application of the first reason, which has sometimes been temporarily discontinued, but seems to have sound justification in its general benefits to railroad practice.

Apart from this primary use for passes, they are issued in great numbers to bring, or to hold, business; to disarm hostility, and as a reward or compliment, in exceptional cases. Little need be said about the last mentioned use; it does not make much difference whether a railroad rewards conspicuous service, as for example that of the bystander who prevents a wreck by thinking and acting quickly, by a gift of money or by a gift of free transportation.

As a compliment, certain high British railroad officers receive from companies with which they are not connected, a gold medal which is good as a perpetual pass over the line issuing it; whether this constitutes discrimination or not, need not be considered at present; the British law courts apparently do not consider the custom offensive to the principles of equitable dealing set forth in the Railway Act. But the evil, the injustice, and the flagrant discrimination of passes is found under the second and third reasons mentioned for issuing them: the desire to get new business or hold old business, and the effort to disarm the hostility of legislators and others who have it in their power to make trouble for the road or not to make trouble for it, just as they please. The idea that passes might be given liberally without cost to a railroad is doubtless founded on the general principle that forty passengers can be carried in a car as cheaply as thirty-nine can; transatlantic steamship companies, which are strictly limited in their accommodations, and must make a positive outlay for food per passenger carried, have never made a practice of getting or holding freight shippers in this way. But the principle has been so extended through competition between roads that passes have not only become extremely expensive as a medium through which passengers are prevented from paying their fares, but, especially in the West, they have come to require positive expenditure on the part of the roads for equipment, fuel and service.

Every year new uses are found for passes as a means of getting business. Not long ago one of the New York suburban roads gave season passes to prominent doctors, in large numbers, evidently on the theory that a doctor pleased with his summer residence was a first-class, high-grade advertising medium. But the difficulty with expedients of this sort—entirely apart from the guilt of their discrimination—is that they are promptly neutralized by similar action by competing roads, after which the new crop of deadheads must be carried without profit or advantage by all alike, for it is much easier and safer to give a pass than to discontinue one. This neutralization of the expected benefits derived from pass giving is so general that it is almost comic. The spectacle of transportation worth thousands of dollars given to legislators, not by a single road to gain friends, but by all roads, to disarm enemies, is one of the ridiculous features that the pass situation has developed. From the standpoint of what is accomplished, it doesn't make much difference whether the state law requires or prohibits giving passes to legislators; from the standpoint of gross earnings, it makes a good deal. The legislators themselves are quite willing to submit to this sort of bribery, and the blackmail is very thinly disguised when the railroads take a stand against it. The plausibility of their resources is illustrated by a bill submitted to the New York State Legislature in 1897, which proposed that the Secretary of State should issue certificates to certain state officers to the effect that they were traveling on official business, these certificates to be accepted in lieu of passage money—this in direct violation of the constitution, which says that no public officer shall make use of any free transportation or accept any discrimination in passenger rates.

As has been said, the chances now seem better than ever before that at least some of this useless, extravagant discriminatory transportation can be cut off. Just where the line can be drawn between the legitimate free transportation which is a part of the working of the railroad as a machine and the illegitimate transportation outside, is not yet clear, but it is certain that there is a chance for much good to be done.

CAR BUILDING IN 1905.

The record-breaking car building returns for 1905 which were published in condensed form in our issue of December 22, disclose some interesting facts aside from the magnitude of the industry and the extraordinary demand for rolling stock which prevailed during the last half of the year and which promises to continue well into the coming year. After the inactivity which prevailed in 1904 none of the car building companies were prepared for the sudden increase in orders which began early in the summer, and the capacity of most of the larger plants was taxed severely to deliver the cars ordered. The small plants profited by the inability of the big builders to promise deliveries, and as a result many of them turned out more cars in the last five months of the year than in any previous twelve months. While the total output for the year was only about 3,500 cars more than in 1903, the output of the last four months far exceeded that of any similar period in years past. As indicating the present conditions, the order of the Southern Railway for 10,029 cars, which is noted elsewhere in this issue, is of interest. The first deliveries from any of the builders are to begin in March, and deliveries of steel gondolas by the Standard Steel Car Company are not to begin until October, 1906. It is safe to say that the output for 1906 will be close to 200,000 cars, if it does not exceed those figures.

There are at the present time eight plants in the United States equipped for building steel cars and cars with steel underframes. These plants turned out nearly 75,000 cars in 1905, or about 45 per cent of the total output, and of these 75,000 cars more than 60 per cent. were built entirely of steel. Assuming the steel bodies alone to weigh 10 tons each, this would indicate a consumption of 450,000 tons of plates and structural shapes. The cars built with steel underframes would increase this total to more than 600,000 tons. The shortage in finished steel products has helped to delay deliveries of cars of this construction.

It is only seven years ago that the first all-steel cars were built. The total number of these cars now in service is close to 150,000, or about 12 per cent. of the entire freight car equipment in the country. Nearly all of the steel cars are of 100,000 lbs. capacity, some few of 80,000 lbs. capacity having been built. So far only two large systems have adopted the 100,000-lb. box car as standard. The Harriman Lines have a large number in service which have been built within the last two years, and the Pennsylvania Railroad and Pennsylvania Lines West use 100,000 lbs. as the standard capacity for equipment for every class of freight service. Most roads, however, are building 80,000-lb. box cars with the American Railway Association standard dimensions, 36 ft. long, 8 ft. high and 8 ft. 6 in. wide

inside. These dimensions permit of loading only a few commodities to the amount of 90,000 lbs. or over in one car, which the 40-ton car, with 10 per cent. overload will carry safely. Only a small part of the box cars ordered recently have steel underframes. The small builders, who are not equipped for making steel cars, have been able to promise deliveries on wooden cars and have received the orders in preference to waiting for long time deliveries from the steel car builders. With proper body trussing and side framing a wooden box car of 80,000 lbs. capacity can be built as light and in most respects as strong as a steel underframe car. The wooden car is cheaper to build and to repair, and in these times of urgent demand for rolling stock a car can easily earn in four or five months' service enough to pay most of the difference in ultimate cost represented by the assumed longer life of the steel underframe car.

The use of pressed steel shapes is becoming less each year. Most of the steel cars built last year had structural steel underframes or sills built up of plates and angles. For small parts, such as side stakes, stake pockets, brake beams and the like, pressed steel shapes are quite generally used, but the waste of material in forming larger members and the difficulty of making repairs to pressed shapes have caused the practical abandonment of this construction. There have been few changes in the construction of wooden cars. More substantial body framing has been the general rule, light steel sections having been used in many cases in place of wood.

The numbers of each type of cars built during the year were about in the usual proportions of previous years, as the demand for rolling stock came from all parts of the country. The western roads ordered large numbers of box and stock cars, and the coal carrying roads in the East ordered a preponderance of gondola and hopper cars. The two largest single orders recorded, those of the Pennsylvania for 36,160 cars and the New York Central lines for 20,000 cars, were divided as follows: Pennsylvania, 20,860 gondolas, 5,000 hoppers, 8,900 box cars, 1,100 stock cars and 300 flat cars, all of steel or steel underframes and 100,000 lbs. capacity; New York Central lines, 9,000 gondolas and 10,000 box cars, with 1,000 miscellaneous cars. The Southern Railway placed orders during the year for more than 17,000 cars, of which about 5,500 were gondolas and 11,500 were box cars.

The 5,300 cars built for export were shipped to all parts of the world. Nearly half of those built were included in two orders, one from the Japanese Government Railway for 1,900 cars, and one from the Argentine Government Railway for 750 cars. Both of these orders were for narrow gage cars with steel underframes.

DISCIPLINE OF ENGINEMEN.

It is against public policy—an injury to the people of the state—for a railroad superintendent to assign any other than the best man available to run the locomotive (or locomotives) of a fast express train; or to allow the officers of a labor union to bulldoze him into assigning members of the union to extra or irregular runs by some cast-iron rule which classifies all of the runners alike. (Classifying all alike always means lowering the best to the level of the poorest, for raising the poorest to the level of the best cannot be done by a stroke of the pen.) The foregoing is a pretty correct interpretation of the deliverance of the Grand Jury of Middlesex County, Massachusetts, in the matter of the disastrous collision of November 26. That paragraph, which looked almost like a secondary feature of the jury's report, was really of vital importance. As given in the *Railroad Gazette* of December 15, the paragraph referred to reads:

> If there is an agreement with the engineers whereby the first spare man on the list is to be assigned to the first vacant job, no matter what the character of the service required or the experience of the engineer, such an agreement is in violation of public policy and endangers the safety of the traveling public. The jurors find that no engineer should be permitted to work from 16 to 18 hours or more a day five days in succession.

And the last sentence, referring to long hours, is for practical purposes equally important. Neither statement condemns nor even criticises the practice of the road, and the public is left to guess how bad were the conditions discovered; but the admonition is weighty, as it is. Every superintendent knows the need of it—and knows how great is the firmness required to enforce the simple and reasonable regulations which are needed to prevent the abuses referred to. The newspapers say that the road in question has now ordered enginemen to be relieved after 11 hours and to be required to sleep at least six hours after 11 hours of service; an order which indicates that past practice has at least been unsatisfactory.

Both in maintaining the quality of his men and in regulating their hours of work the division superintendent has a task that is constantly difficult. It is impossible to assign the individuals of a list of, say, 20 extra runners, with a view solely to getting the best men for the most important trains or most difficult runs, without causing jealousies, if not acrimonious complaints. The selecting officer himself may exercise defective judgment, and the examiners who tell him how he must grade enginemen may do their work more or less imperfectly. For the first few years all enginemen are in some degree uncertain quantities; and on most roads this uncertainty is just now a constant factor by reason of the heavy traffic. Practically all of the extra men are pretty new; and it is with the extra men that most of the delicate questions of selection come up. In view of these difficulties it is a question whether there is any way to settle the problem except by maintaining a larger extra list, and, if possible, a better one. This, at any rate, is likely to be the only way for the perplexed general manager to look at it. If the division officer does not know how to secure good and satisfactory work with his present force, it is quite unlikely that his superiors can supply him with the knowledge.

The management of the hours of work is a simpler problem, if not an easier one. Hours must be made to conform to the same rigid rules, whether the force be large or small. Every time an officer consents to long hours because traffic is pressing and his force is too small, he is taking a definite risk, which is, indeed, "in violation of public policy." No road will ever be free from enginemen who are willing to work unreasonably long hours (catching naps while on duty, perhaps) for the sake of getting an unusually big check at the end of the month; and no manager will ever find it easy to repress trainmasters, despatchers and yardmasters who, when crowded with cars, will think that they can run risks of this kind without getting into trouble. This being the case, rigid rules are the only recourse. And it is futile to try to work all the time close to the limit. The Interstate Commerce Commission, in its accident regulations, inquires about men who work over 15 hours without 7 hours' rest; but that time-limit is a very liberal concession to the avaricious runner and the overzealous despatcher. Eleven hours' work, followed by six hours' rest, as in the rule mentioned above, is a much more reasonable limit. Even this last is, of course, far too hard a rule for regular service. We are not speaking now of what the human frame (and its firebox and boiler) can endure, but of what a general rule should prescribe. For regular service the thing needed is to adhere to the reasonable hours, similar to those for station and shopwork, which everybody is familiar with.

And this leads to a question which is really important, but which nobody seems to know how to grapple with, the irregularity of freight train men's hours. Could anything be more irrational than the universal practice of "running the rounds," under which no man ever knows three days in advance whether his sleep will come nights or days, whether the intervals will be long or short or alternately long and short? The utmost ingenuity could not devise a more perfect scheme for making work hours as bad and irregular as possible, than is now provided in the arrangements by which freight train men on most or all of the big railroads begin and end their trips. Whether it is the employers or the employees that are responsible for such a barbarous arrangement is of little moment; either party has the power to change it by united action. In war, or pestilence, or in emergencies at sea, it may be necessary for men to strain their bodies and their nerves to the limit of endurance, but what reason is there for it in the prosaic work of running freight trains? The fact that we ameliorate the strain as often as may seem requisite, does not relieve us from the responsibility for having imposed strains where there was no necessity for such an imposition.

A brotherhood cannot secure a change of the working-hour scheme to one which would be more conducive to health and normal mental conditions, without securing the co-operation of a large number of fellow-workmen. A railroad manager cannot make the change without either increasing his expenses or else forcing an unacceptable plan on a part of his employees. Neither party can be expected to do much, except as a result of a settled conviction that health of body and mind is an important element in a trainman's equipment. But none of these difficulties will serve as a full defense where a man kills passengers by sleeping at his post of duty. Neither is a superintendent excused for inaction because he cannot fully accomplish the object aimed at because men neglect to rest when their work hours are reasonable and regular. The public means to hold a railroad up to the theory of doing the best that it can.

We have said that the higher officers of a road cannot instruct

a division superintendent in the delicate work of finding and promoting efficient men, nor in the violation of the seniority rule which is necessary in carrying out that idea. Neither can the manager put good backbones into superintendents who have poor ones. But he can establish high standards for his subordinates to live up to, and can greatly aid the superintendents to improve their backbones themselves, by assuring them that their work is so well appreciated that they are to be given full power and authority to continue a wise policy long enough to insure its success.

Summary of Annual Reports.

There are certain operating characteristics which vary greatly from year to year, such as the amount of business transacted, as shown by gross earnings, and the economy with which traffic is moved, as shown broadly by net earnings; while as a further commentary on net earnings the expense account shows whether the general tendency has been to improve the properties out of income, or whether retrenchment has been necessary. For the past two years the *Railroad Gazette* has illustrated these tendencies with diagrams made up from the composite figures of a large number of roads, believing that in this way the abnormal effect of special circumstances as affecting any one road or any small group of roads would be neutralized, and a pretty accurate picture would be pre-

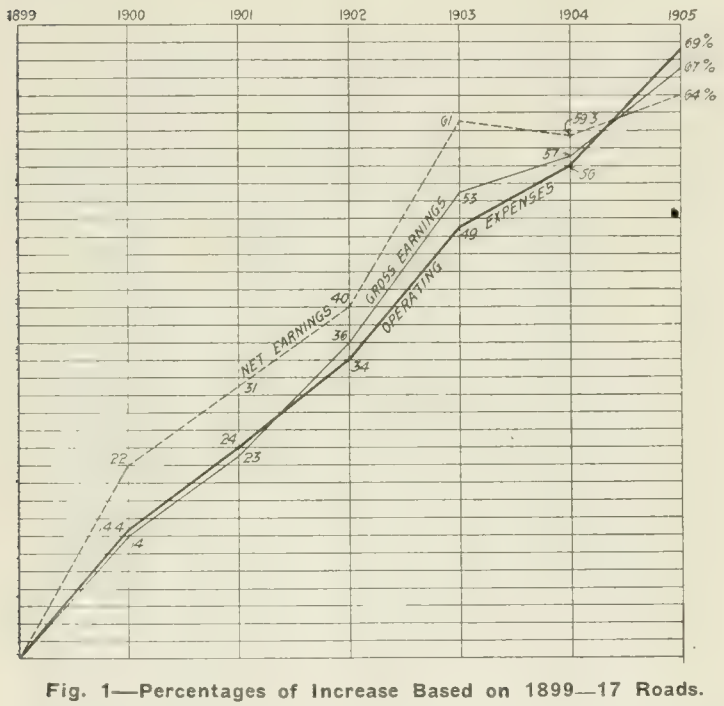


Fig. 1—Percentages of Increase Based on 1899—17 Roads.

sented of the railroad year in the country as a whole. The first diagram of this analysis is an enlargement of the one printed in our issue of January 13, 1905, and was made by taking the percentages of increase in gross earnings, operating expenses and net earnings of 17 large railroads, selected as being characteristic of conditions in all parts of the country. The increases are based on the year 1899 as a starting point, and the small figures under each ensuing year show the percentage of increase for each of the items, while the lines connecting these figures are intended to portray the same information in a graphic manner. The railroads which are included in this list are as follows: Atchison, Topeka & Santa Fé; Baltimore & Ohio; Chesapeake & Ohio; Chicago, Burlington & Quincy; Chicago & Northwestern; Chicago, Milwaukee & St. Paul; Cleveland, Cincinnati, Chicago & St. Louis; Erie; Great Northern; Illinois Central; Louisville & Nashville; New York, New Haven & Hartford; Norfolk & Western; Northern Pacific; Philadelphia & Reading; Southern, and Wabash.

The diagram needs no special explanation, and the curves show very clearly the steady increase in all three of the items from year to year, with the single exception of the year ending June 30, 1904, when net earnings decreased.

In making up the table this year it was necessary to approximate the figures for the Cleveland, Cincinnati, Chicago & St. Louis. All of the other roads were selected because they reported the fiscal year ending June 30, and in the previous comparison the same was true with the Big Four. This year, however, the time of its report has been changed to the fiscal year ending December 31. To get as close an approximation as possible in the figures used throughout this paper half of the year ending June 30, 1904, was taken together with the new figures for the half-year ending December 31, 1904, these being the last figures available. It is obvious, therefore, that the figures for this road are too small, and they would have been excluded except for the desire to retain the original group of roads in order that a continuous comparison might be made. It is fair to say that the difference between the assumed figures and the actual figures would not materially affect the curve after combination with the other 16 roads represented.

The most striking characteristic of the diagram printed last year was referred to as the struggle to reduce operating expenses, which increased at a more rapid ratio than gross earnings did. In 1905 this was also true, but the percentage of increase of gross earnings was so great that plenty of room was also left, in spite of the increase in operating expenses, for a substantial increase in net earnings not only over 1904 but over 1903, the previous high year. In 1903 net earnings were 61 per cent. greater than they had been in 1899; in 1904 they were 59.3 per cent. greater, and in 1905 64 per cent. greater. What these increases mean is well shown by a comparison with the actual figures for the 17 roads which make up the list, and which earned $457,272,272 gross in 1899, and $765,923,331 in 1905. They spent in 1899 $292,400,842 as operating expenses, and in 1905 $494,970,074; and they earned net $164,851,430 in 1899 and $270,953,258 in 1905. By way of making a uniform comparison, net earnings are given in the way they are most commonly reported; that is to say, without deducting taxes. Whether or not taxes are deducted does not affect the curve at all, so long as the practice adhered to is uniform.

It will be observed that in spite of the downward curve of net earnings last year, and in spite of the extremely satisfactory results in 1905, this year is the first one in which the curve of

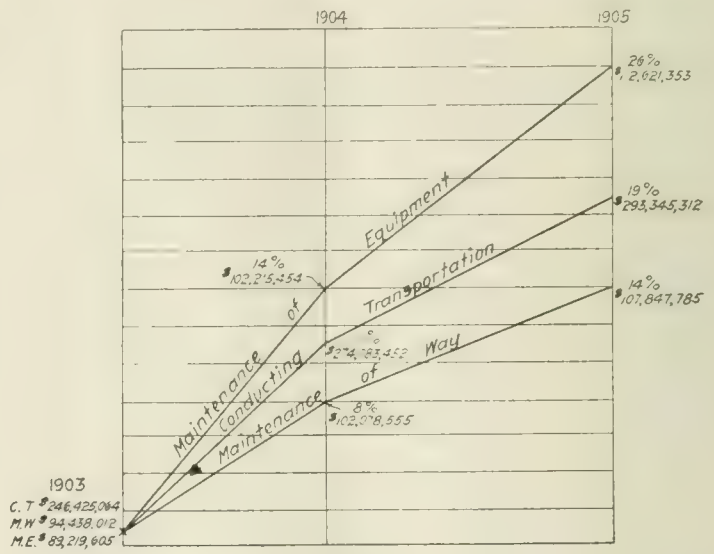


Fig. 2—Percentages of Increase in the Expense Account—19 Roads.

gross earnings and operating expenses crosses that of net earnings. The obvious reason for that is that with very great increases in gross the roads still had room to increase their operating expenses largely and leave sufficient net earnings for dividend and surplus purposes. The way these gross earnings were used is shown very clearly in the following table, based on the expense account of 19 railroads, substantially the same as the 17 used in compiling Figure 1, but including one or two others which were not available for a six-year comparison.*

This table shows some remarkable and very unusual results. It will be recollected that throughout 1904, particularly in the early months of the year, great efforts were made at retrenchment by all roads. The effects of this were not especially apparent last year, for when the average is based on a large number of roads it takes some time for tendencies to appear. In 1904 the cost of conducting transportation on these roads increased 11 per cent. over this item in 1903; but in 1905, in spite of the tremendous traffic increases, cost of transportation only increased 7 per cent. over 1904, or 19 per cent. over 1903. The diagram to illustrate these results (Fig. 2) shows clearly where savings can be made in the expense account, when economy is necessary, and where money is spent freely, when economy is not necessary. In the year ending June 30, 1904—the economy year—with all expenses cut as low as possible, the increase in the charge for maintenance of way and structures was only 8 per cent., and the companies were so slow in starting new work after the close of the retrenchment period that the charge under this head increased only 5 per cent. from 1904

*These roads are as follows: Atchison; B., R. & P.; B. & O.; C. & O.; C. & N. O.; C. & A.; C., C., C. & St. L.; C., M., & St. P.; C., B. & Q.; D. & R. G.; Great Northern; I. C.; M., K. & T.; New Haven; New York Central; N. & W.; Rock Island; Southern Pacific; Wabash.

to 1905, or 13 per cent. from 1903. Maintenance of equipment, however, is an item that cannot well be even temporarily reduced, except for certain special work that does not total up large. It will be seen that this charge increased 14 per cent. from 1903 to 1904, and 10 per cent. from 1904 to 1905, or a total of 26 per cent. over 1903, in the two years. With the increases in large locomotives, it is evident that this charge must continue to remain constantly high.

It is unfortunate that one of these curves—that for the conducting transportation charge—is not based on the proper fiscal

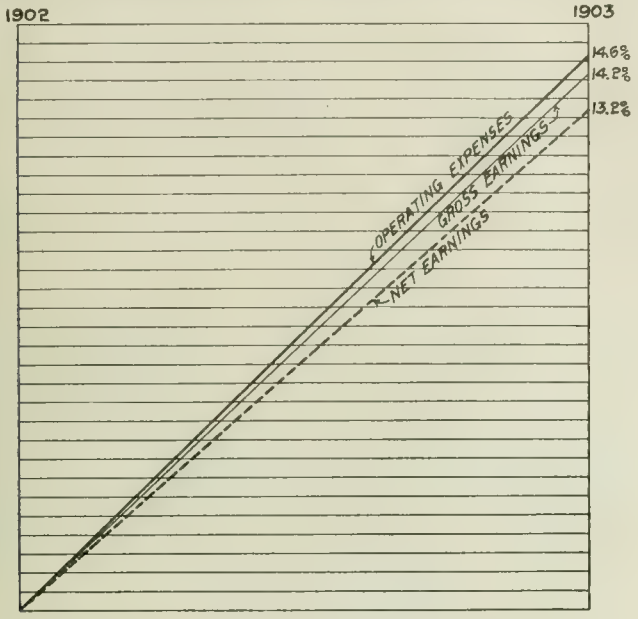


Fig. 3—Percentages of Increase. Years Ending Oct. 31, 1902 and 1903—101 Roads.

period to show the savings recently made. Continued care in operation, unprecedentedly large train loads and a lower fuel cost are now causing excellent economies, and these may be expected to show more plainly in the record a year from this time.

Figure 3 is a diagram which we have constructed from the totals of figures prepared by the *Commercial and Financial Chronicle*, as in previous years. The *Chronicle* bases its figures on current reports of earnings, and can use only those it receives from the

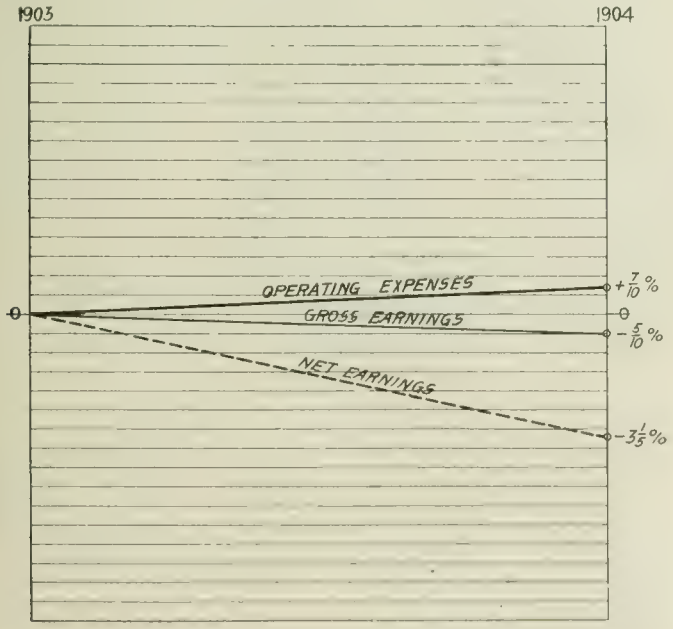


Fig. 4—Percentages of Change, Years Ending Oct. 31, 1903-04; —95 Roads.

roads prior to the publication of the annual reports. The number of roads making these reports varies. Last year 95 were reported; in 1903, 101, and in 1905 only 91. Therefore, no effort has been made to plot the curve for several years on the same diagram, since the properties from which the figures are made up are not constant; but in each case a comparison of precisely the same roads is made through the same ten months of two fiscal years. Thus the current diagram shows how gross earnings, operating expenses and net earnings for the ten months ending October 31, 1905, compared with the ten months ending October 31, 1904. Figures 4 and 5 make precisely the same comparison, only with a slightly different number of roads four years preceding. In each one of these three ten-month diagrams the increase in operating expenses has been the greatest of the three items presented. This year the three increases are all quite close together. Last year, as a result of radical efforts, the increase in operating expenses was cut down to .7 of 1 per cent., and yet both gross earnings and net earnings decreased.

The last table in the paper, comparing train loads through the last five years on 17 roads, which represent practically all parts of the country, is very striking. The figures exclude company's freight, except in one or two instances where no separation was made in the report, and where it is possible that the load is not strictly a revenue one. It was natural enough that in 1904, a retrenchment year, train loading could not be very materially improved; for, in spite of the economy of good loading, there are only a few roads, like the Great Northern, that can effect this by management alone without the aid of heavier equipment, and in 1904 the amount of new equipment was considerably smaller than it was this year. In 1905 five roads made the remarkable showing of an average revenue train load of over 500 tons. These were the Chesapeake & Onio, 557; the Great Northern, 523; the Union Pacific and the Buffalo, Rochester & Pittsburg, 507 each; and the Lehigh Valley, 501. The Pittsburg & Lake Erie, with its average loading of over 900 tons, is intentionally omitted from the table, as its traffic is so highly specialized that the figure affords no comparison with roads doing a general business. Last year only one road of the group, the Chesapeake & Ohio, had an average loading of over 500 tons.

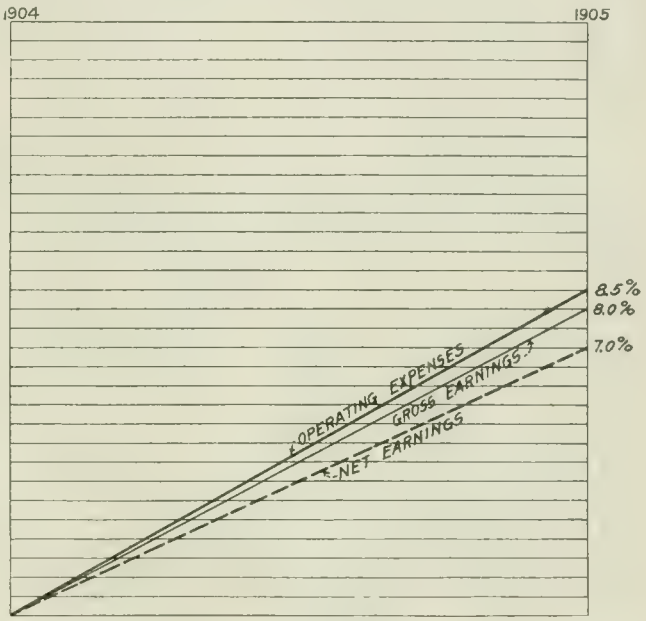


Fig. 5—Percentages of Increase, Years Ending Oct. 31, 1904-05; —93 Roads.

In 1903 this loading was not reached by any road reported in the group, although the Chesapeake & Ohio had respective loads of 508 and 511 tons in 1902 and 1901. The average loading of the 17 roads was 376 in 1905 as against 356 in 1904, the largest increase which has occurred in any of the five years reported.

Revenue Train Loads; Tons.

	1905.	1904	1903.	1902.	1901.
Atchison, Topeka & Santa Fe	282	269	279	247	242
Baltimore & Ohio	399	401	416	406	381
Buffalo, Rochester & Pittsburg	507	439	441	424	406
Chesapeake & Ohio	557	508	493	508	511
Chicago & Alton	347	336	356	316	288
Chicago, Burlington & Quincy	327	278	266	218	201
Chicago, Milwaukee & St. Paul	265	245	244	254	236
Erie	412	403	406	376	375
Great Northern	523	447	446	447	384
Illinois Central	319	278	288	275	235
Lehigh Valley	501	486	485	467	467
Minneapolis, St. Paul & S. Ste. Marie	359	301	305	315	314
Northern Pacific	367	339	344	346	324
St. Louis & San Francisco	200	198	195	187	200
St. Louis Southwestern	367	388	384	344	318
Union Pacific	507	441	403	418	365
Wabash	299	286	304	284	283
Average for 17 roads	376	356	356	341	325

Railroad Officers on the 1906 Outlook.

We have made it a custom for several years to send circular letters to the principal executive officers of the most important railroads in the country at this time asking them for an expression of opinion, as specific as possible, about the outlook for traffic in the year to come. We agree in writing these letters not to disclose the identity of those who answer, in order to secure as frank an expression of opinion as possible. The following quotations are

taken from answers received to these letters, classified by the sections of country from which they came.

CENTRAL ROADS.

"The present business conditions at points on our lines as indicated by traffic returns are somewhat higher than they were a year ago, and the outlook for the immediate future at least is favorable. The indications are that shipments of iron will be as large during the coming year as they have been during the past one. We think the grain movement will also be as heavy in 1906 as it was in 1905, and unless signs fail shipments of flour will be larger."

President.

"The business conditions in the territory through which this road passes are much more favorable for 1906 than during the two previous years. During 1903-1904 the crops along the line were poor, but this year they have been far above the average and the crops in the territory west of the Missouri river, especially the corn crop, are much larger than in the two previous years. The same is true of the territory west of St. Paul and Minneapolis. We are preparing to try the experiment of building freight cars. We shall start in slowly, calculating to build about 15 or 20 a month."

President.

"Our impressions are that the business conditions in the territory through which this road passes are considerably better than they were a year ago and decidedly better than in 1903. We will probably spend 10 millions or 15 millions for construction work, and we expect to order 100 locomotives."

General Manager.

"Business conditions as compared with last year and the year before are much better. Good crops and activity in all industrial lines are responsible for this result. We will order about 55 locomotives and 3,600 cars." *President.*

"The business conditions in the territory served by this company are excellent, and are as good if not better than in any previous year." *President.*

"The business conditions are favorable to an increased heavy tonnage occasioned by the great demand for iron, coal and coke. We will probably order 50 heavy freight locomotives and 4,300 freight cars during the year, and we expect to spend about $925,000 on new shops and shop equipment, about $825,000 on bridges, and about $2,000,000 on permanent road improvements."

President.

"My impression of the general business conditions of the territory traversed by this line is that they are better than they have ever been. The specific indications that will affect earnings are, first, the general business prosperity; second, the great demand for manufactured articles, and, third, a full crop of grain to be moved, coupled with the good foreign demand. During 1906 the company will receive 6,700 freight cars and has already placed orders for 100 locomotives." *President.*

"General business conditions in our territory seem to be much better than at the same time last year. Orders are on hand in greater number and the only drawback in sight is the restriction resulting from shortage of cars. We expect to receive something over 2,000 cars next year, which will practically double our equipment." *General Manager.*

EASTERN ROAD.

"Every kind of business throughout the section of the country served by this company is apparently more prosperous than at any corresponding period during the last five years, and we see nothing in the outlook, other than possible radical action by Congress at the present session, which seems likely to disturb these present conditions of prosperity. We have 36 first class locomotives under contract for delivery between now and the first of next May; also 2,000 freight cars under contract, with the prospect of 4,000 more, if we can get them built within the next 12 months."

President.

WESTERN ROADS.

"I consider the business outlook for 1906 to be the best that this country has ever had. We have raised a good crop and our territory is settling up fast, which necessarily makes business. We have contracted for 16 locomotives and will buy 1,500 box cars."

Vice-Pres. and Gen. Mgr.

"My impression of the business conditions in the territory through which this line passes is favorable. From all the indications before us, traffic next year should show an increase over the present year and the year preceding, so far as freight is concerned. Earnings the coming year will probably be affected by the lower rate brought about by competition between the Gulf lines and those reaching the Atlantic Seaboard. The only cloud on the horizon is the possibility of hostile legislation, both Federal and state, which would in itself have a very serious effect on the railroad interests in this section of the country. We have ordered 25 locomotives, 1,000 box cars and 300 stock cars, and will probably order 250 more box cars in the coming year. Our construction expenditures will probably amount to two and one-half or three million dollars." *President.*

SOUTHERN ROADS.

"My opinion of the business conditions of the territory through which our road passes as compared with those of last year and the year before is that, being a new line in territory hitherto untouched by railroads, we will show an extremely large increase. Our tonnage is largely forest products and at the present time the market for these is extremely good and likely to continue so. The probabilities are that we will make heavy expenditures for both motive power and equipment."

Vice-Pres. and Gen. Mgr.

"There is every indication of an increase in business, caused by the general prosperous condition of the country and the new acreage that has been set out on our line. Our traffic consists largely of fruit and vegetables, and while it is almost impossible to undertake to say just what returns will be, on account of the various uncertainties entering into farming operations, we feel that it is fairly safe to prophesy with the new acreage set out that there will be a considerable increase for the coming year."

President.

"At present we are inclined to believe that business will be generally better next year than in 1904, and expect some slight improvement over 1905, which has been our best year for tonnage handled. We can see no specific reasons at present which should affect our earnings next year. This, of course, could be affected by possible labor troubles, which are, however, not apparent at present."

President.

"The territory through which our road passes is showing steady growth. Each year there is a decided improvement in our business over the preceding year, and I consider the outlook in our territory for continued growth bright. I have no specific causes to give for this growth except the development of this whole section of the South in all lines." *President.*

"My impression is that business conditions in the territory served by our lines are certainly as good and probably better than they were a year ago. At present there is a shortage of cars which has restricted the amount of business handled to some extent. Our gross earnings for the fiscal year so far are a little in excess of those for last year, and I see no reason why they should not be equal to or better than they were last year from now until June 30th."

President.

"Business conditions throughout the South along our line were never in better shape than at present. The only specific item of traffic which would be apt to affect our earnings during the coming year is lumber. This is moving in greater volume than at this time last year and every indication points to a continuance of these conditions. The movement of general traffic of every character is good." *President.*

SOUTHWESTERN ROADS.

"It is pretty early to form a correct opinion as to the business conditions for 1906, but we look hopefully forward to a continuance of the present prosperity throughout all of our country."

President.

"The outlook for this year is very good. There are no specific indications likely to affect the earnings in this territory for 1906."

President.

"The business conditions of the territory through which our road passes are quite as favorable if not more so than at the same time last year and the year preceding. The future outlook is quite bright because of the increasing developments in the mining districts served, and particularly owing to the prospect of additional land which will be put under irrigation by the building of the United States Reclamation Service dams and irrigation systems."

Asst. to President.

"The business of this company has been much better this year. I cannot name any specific indications which are likely to affect our earnings in 1906, except perhaps an increase in cotton acreage."

Vice-Pres. and Gen. Mgr.

"I do not anticipate that there will be any material change in business conditions on this road during the year, except possibly a decrease in its earnings due to falling off in oil shipments from the Humble oil fields." *President.*

"Our impression of the business conditions of the territory through which this road passes as compared with those at the same time last year and the year before is that there is an improvement in every way. Specific indications that are likely to affect earnings in our territory during 1906 are found in the almost phenomenal settlement of the country through which the line passes, particularly at the west end."

Vice-Pres. and Gen. Mgr.

CANADIAN ROADS.

"The business conditions of the territory through which this road passes are quite as favorable as for the same period last year, while the larger grain crop of the season should insure even a better movement. It is too early to determine fully upon our budget for the ensuing year, but we intend not only to continue to fully maintain our properties but to keep up the same ratio of general improvements in all directions."

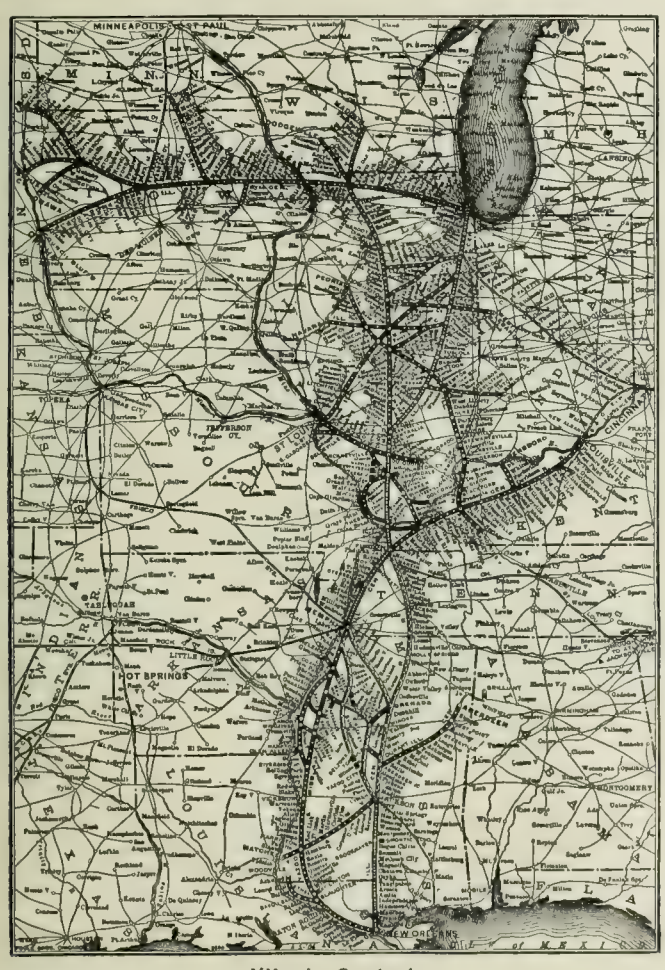
General Manager.

"The business conditions in our territory appear to be somewhat better than they were at this time last year and the year

before, and I have no knowledge of any specific conditions likely to affect earnings, except that I understand that the shippers generally are preparing for a somewhat increased output of pulp wood, lumber, etc." *Vice-Pres. and Gen. Mgr.*

Illinois Central.

For many years there was no more common axiom of railroad finance than that north and south lines were not profitable and that the only successful railroads were those running east and west. For many years also, the Illinois Central stood out as the exception which proved the rule. To-day, with the old axiom thoroughly disproved and a rapidly growing realization on the part of railroad managers all over the country of the coming importance of the gulf export trade, the Illinois Central with its water grade line down the Mississippi river and its dominant position at the most important gulf port, is one of the most immediately and potentially valuable railroad properties in the country. Besides having the most direct line between Chicago and New Orleans, most of it double track or with alternate routes, supplemented by extensive systems of branches and feeders, the Illinois Central has for the present another advantage over all the other north and south lines.



Illinois Central.

It is itself a granger line. From points on its own line extending west through Iowa as far as Albert Lea, Minn.; Sioux Falls, S. Dak.; Sioux City, Iowa, and Omaha, Neb., it can carry export grain all the way to the gulf over its own rails and secure the whole of the 1,200 to 1,300-mile haul. This, too, without having to bring the grain into the congested territory about Chicago.

Even on grain for export via the gulf coming over other lines, the Illinois Central gets by far the larger part of the haul. For example, on tonnage moving by the recently announced cut in grain rates from Omaha to New Orleans by the Chicago & North Western, the North-Western gets a 392-mile haul from Council Bluffs to Dixon, Ill., against the 914-mile haul of the Illinois Central from Dixon to New Orleans. This illustrates pretty clearly the advantage which accrues to the Illinois Central on the rapidly developing gulf export business.

The financial history of the property is a brilliant one. During the past year came the one hundredth semi-annual dividend on its stock, celebrated by the declaration of an extra dividend, which though still continued as an "extra," practically raises the rate to 7 per cent. At the last annual meeting President Fish addressed the stockholders on the growth of business since his first election in March, 1877, as a director of the company. At that time commercial and financial conditions were at a very low ebb, and especially was this true of railroads. The shares of the Illinois Central sold in April, 1877, at the lowest price ever known, $40.50 per $100 share. Their price was particularly affected by the failure in both Illinois and Iowa of the crops of the year before, 1876; by uncertainty in the minds of the investing public as to whether the company could recover the advances which it had made to the Mississippi Central and the New Orleans, Jackson & Great Northern Railroads, and by doubt as to whether, having through foreclosure reduced those properties to possession, they could be made to earn an adequate rate of interest, or indeed any interest, upon the capital invested; and by the enforced reduction in 1877 of the dividend rate from 8 per cent. to 4. At that time British and Dutch proprietors owned more than four-fifths of the entire capital.

Mr. Fish, after remarking that to-day more than four-fifths of the company's capital is held in the United States, presented a statement showing the changes which have taken place in the intervening 28½ years. This statement was prepared with the particular idea of selecting the items of the company's business bearing directly upon its relations to the public which it serves and to those in its employ: Namely, the gross receipts from traffic—that is, the money collected from the public, from other railroads, from the express companies and from the carriage of mail—and the use made thereof; the number of persons employed, the amounts paid them, the proportion which such payments bear to the gross receipts, and the average yearly wages of employees; together with a comparative statement showing for each of the years named not only the service rendered, but the service rendered per mile of railroad operated; that is, the density or intensity of the service. The statement follows:

Comparative Statement Showing for 1876 *and* 1905, *the Gross Receipts and the Use Made of Them.*

	Calendar year ended Dec. 31, 1876.	Fiscal year ended June 30, 1905
Gross receipts	$7,040,969	$49,508,650
Operating expenses and taxes: Amount	4,270,205	35,111,706
Per cent. of gross rec ipts	60.65%	70.92%
Earnings from operation:* Amount	2,770,764	14,396,944
Per cent. of gross receipts	39.35%	29.08%
Fixed charges, inc. int., rent & sinking fund	1,242,780	7,023,109
Av. rate, pr annum of int. on funded debt	5.44%	3.78%
Per cent. of gross receipts	17.65%	14.19%
Leaving applicable to dividends: Amount	1,527,984	7,373,835
Per cent. of gross receipts	21.70%	14.89%
Dividends actually paid: Amount	2,320,000	6,652,800
Rate per cent. per annum	8.0%	7.0%
Per cent. of gross receipts	32.95%	13.44%
Number of employees	4,573	31,223
Wages of employees: Amount	$2,548,047	$20,902,737
Per cent. of gross receipts	36.19%	42.22%
Av. yearly wages each person employed	$557.19	$669.47

*Being excess of gross receipts over operation expenses and taxes.

On Sept. 1, 1876, a scaled reduction in pay of all officers and employees went into effect, ranging from 5 per cent. to 25 per cent.

Since 1876 the capital stock has been increased from $29,000,000 to $95,040,000 by the payment into the treasury of the company of somewhat more than $66,040,000 in cash. Every dollar of this additional capital has been offered to all stockholders for subscription at the same price, in no case less than par, without the intervention of any syndicates or underwriters. In addition to which, $32,994,878 has in the meanwhile been taken from moneys properly applicable to dividends, for the betterment of the property and the creation of various funds, including one for pensions.

The annexed table shows for the two years in question the service rendered to the public:

Comparative Statement Showing for 1876 *and* 1905 *the Service Rendered the Public.*

	Calendar year ended Dec. 31, 1876.	Fiscal year ended June 30, 1905.	Increase in 1905 over 1876.	Per cent. of service rendered in 1905 to that in 1876.
Pass'gers carried 1 mile	51,238,031	583,481,895	532,243,864	1,138.77%
Tons freight car'd 1 mi	264,602,314	5,559,139,454	5,294,537,140	2,100.94%
Units of service.*	315,840,345	6,142,621,349	5,826,781,004	1,944.85%
Miles, railroad operated	1,107.66	4,373.91	3,266.25	394.88%
Units of service, pr mile	285,142	1,404,378	1,119,236	492.52%

*Being the sum of the passengers and tons of freight carried one mile.

Mr. Fish then said that in considering the increase of service rendered it must be remembered that at the end of 1876 the Illinois Central had been operating the whole of its lines in Illinois for 20 years, and the lines in Iowa for more than nine years, and that the railroads which have since been taken over and are now operated are of much later construction, besides having had, when taken over, a comparatively light traffic. That is to say, the increase in the density of service rendered on the old lines in operation in 1876 has been much greater than appears from the statement, which includes all lines now operated. Yet taking results as they stand, it is shown that during the last fiscal year the company rendered to the public with respect to each mile of railroad operated a service which is 492.52 per cent. as intense as was the service rendered in 1876, while the volume of service rendered has increased in respect to passengers carried one mile 1138.77 per cent.; in respect to tons of freight carried one mile 2100.94 per cent., and in respect to units of service performed more

than 1904 85 per cent. Mr Fish said that in view of the criticism of railroads for failing to perform their duty toward the public, he wished thus to demonstrate to the owners of the property that the Illinois Central has done and is increasingly doing its duty to the public; a fact which, he added, he believed is appreciated in the territory served by the company in which so many of the stockholders live.

This statement of the President's shows graphically the wonderful growth of the last quarter of a century. Results for the past fiscal year show a similarly favorable record. With an increase of only 34 miles in the average mileage operated, gross earnings increased $2,677,514; operating expenses only $291,060, and net earnings $2,386,507, or 17 per cent. over 1904. Taxes, which amounted to $2,027,448 (the Illinois Central owing to the provision in its charter by which it turns over 7 per cent. of its gross earnings in Illinois to the state, has an unusually heavy tax charge) and fixed charges brought down the $16,424,392 net earnings to $10,135 342, the net income for the year. This is equal to 10.66 per cent. on the stock. From this, $6,652,800 was paid as a 7 per cent. dividend on the stock; $1,255,396 was subtracted as discount on bonds sold; $500,000 was added to the insurance fund, and $1,683,886 was set apart for betterments, leaving in the surplus dividend fund at the close of the year, $1,269,027.

One disastrous event of the year was the fire of Feb. 26, 1905, which destroyed the Illinois Central elevators, warehouses and other facilities at the Stuyvesant Docks, New Orleans. As these were the property of the Yazoo & Mississippi Valley, which, with its 1,175 miles of line, makes returns as a separate corporation, the direct loss to the Illinois Central was principally in the destruction of 233 freight cars, a money loss of $87,250, which was charged to the insurance fund. The Yazoo & Mississippi Valley's losses were $1,095,729 on account of structures and $32,730 on account of freight cars; a total of $1,128,459. Of this, $935,682 was charged to the Yazoo & Mississippi Valley insurance fund, the remainder, representing depreciation, to be charged to repairs and renewals as the work of rebuilding progresses. To the insurance fund was credited $1,201,259 altogether, of which $655,643 represented the Yazoo & Mississippi Valley surplus for the year, and $545,616 was, instead of being paid to the owners of the second mortgage bonds of the Louisville, New Orleans & Texas, as ordered by the Board of Directors at the close of the fiscal year 1904, with the assent of the holders of all such bonds, transferred to the Y. & M. V. insurance fund.

During the year the Illinois Central took steps to acquire its own line into the city of Indianapolis. The Indianapolis Southern, a railroad which was being built from Indianapolis to Switz City, Ind., the terminus of the Illinois Central's Effingham branch, and was projected to run westward paralleling that branch into the coal fields of Sullivan County, Ind., was acquired, and track has now been laid on more than half of the line into Indianapolis, giving the Illinois Central shortly its own line into that city.

A similar reaching out to the eastward since the close of the fiscal year was the purchase of the Tennessee Central by the Illinois Central and the Southern Railway. On the partition of the Tennessee road, the Illinois Central obtained the western end, giving it its own line from Hopkinsville, Ky., the terminus of one of its branch lines, into Nashville, Tenn.

A policy long in vogue on the Illinois Central is that of steadily improving the standards of maintenance. During the past year the average weight of rail in main track increased from 72.78 lbs. to 73.50 lbs. Similarly, the average tractive capacity of locomotives on level track increased from 3,724 tons to 3,860 tons; and the average capacity of revenue freight cars from 33.77 tons to 34.21 tons. The steady application of this policy through a series of years is clearly shown in the high points which these different figures have already reached.

The operating statistics show an increase of $1,175,000, or 12.3 per cent. in passenger earnings, against an increase of $915,347, or 2.9 per cent. in freight earnings. The operating ratio, excluding taxes, decreased from 70 per cent. in 1904 to 66.8 per cent. in 1905. Maintenance of way increased $415,785; maintenance of equipment $481,467, and conducting transportation decreased $683,887; a fine record of operating efficiency. The largest increase in maintenance of way came in the three items, renewals of rails, renewals of ties and repairs and renewals of bridges and culverts. In maintenance of equipment the increase in repairs and renewals of freight cars was larger than the total increase in equipment maintenance. On the other hand, there was a reduction in freight train expenses of $777,740, larger than the total reduction in conducting transportation account. The reduction of 3.64 per cent. in conducting transportation expenses is particularly favorable in view of the 338,000,000 more ton-miles and 98,000,000 more passenger miles than in 1904.

Other figures show operating efficiency in other ways. The average number of freight cars in a train increased from 24.44 to 26.19; the average revenue train load from 278 tons to 319 tons—a notable increase in view of the large amount of high class and perishable freight, such as bananas and domestic small fruits, which the road carries. The train load, including company freight was 367 tons. The average number of passengers in a train increased from 43 to 50, or 16.7 per cent. Net receipts per mile of road clearly reflect this efficient handling of traffic. With an increase of $529 per mile in gross earnings, net earnings show an increase of $520 per mile, or only $9 out of $529 per mile used in increased operating expenses. Maintenance of way per mile increased from $1,308 in 1904 to $1,393 in 1905. Repairs and renewals cost $2 211 per locomotive in 1905 against $2,458 in 1904; $485 per passenger car in 1905 against $688 in 1904; and $68.50 per freight car in 1905 against $61 in 1904. These are all liberal maintenance expenditures for the road. A particularly valuable statement in estimating the value of the equipment is a comparative statement showing the number of locomotives and the years in which they were built, an exhibit which would be received with great interest from certain roads whose record is not so clear as is the Illinois Central's in this respect.

The results shown in the report make it clear that the directors took no extreme step in declaring the two successive extra dividends. Except for the unusual conservatism for which the Illinois Central management is noted, the showing of the road would fairly justify an out and out declaration of the flat 7 per cent. rate, a step which it is not unlikely will soon be taken.

The Yazoo & Mississippi Valley shows gross earnings of $8,670,245 against $7,868,335 in 1904, an increase of 10 per cent. Net earnings were $2,281,271, an increase of 8 per cent. The average revenue train load was 246 tons, which is almost the same as the 1904 figure. The gross earnings per mile of road increased $494 per mile, or 7 per cent.; but $400 per mile of this amount was absorbed by operating expenses, leaving net earnings per mile of road $1,895, an increase of $93 per mile of road over the preceding year.

The principal statistics of operation for the Illinois Central proper are tabulated below:

	1905.	1904.
Mileage worked	4,374	4 340
Freight earnings	$32,607,922	$31,692,575
Passenger earnings	10,729,825	9,554,743
Express earnings	1,002.154	854,246
Gross earnings	49.508,650	46,831,136
Maint. way and structures	6,095,096	5,679,311
Maint. of equipment	7,804,810	7,323,343
Conducting transportation	18,102,052	18,785,938
Operating expenses	33,084,258	32,793,251
Net earnings	16,424,392	14,037,885
Gross income	52,270,157	49,547,685
Net income	10,135,342	8,865,927

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Lock Joint Pipe.—An illustrated pamphlet setting forth the superiority of lock joint pipe for the protection of piles in wharves, warehouses, trestles and other structures is published by the Lock Joint Pipe Co., New York.

Fans and Blowers.—Fans, blowers and exhausters for heating and ventilating, mechanical draft and other purposes, are described in a booklet issued by the Green Fuel Economizer Co., Matteawan, N. Y.

CONTRIBUTIONS

Walschaert Valve Gear in Service.

Philadelphia, Pa., Dec. 27, 1905.

To the Editor of the Railroad Gazette:

Motive power men who are now waiting for the first reports on Walschaert valve gear service will be interested to receive some advance information as to the general satisfaction of this gear now in use on the Pennsylvania Railroad. This road has practically been the pioneer in its use in this country, and the average railroad man has been rather skeptical about the success of such a radical departure from the standard type of valve motion. Although it is realized that the Walschaert motion has proved successful, after many years of service on the other side of the water, yet foreign conditions of train tonnage and service are not those found in this country, so that the call has been for American results.

The first Pennsylvania locomotive equipped with the Wal-

schaert valve gear was received from the Baldwin Locomotive Works during the latter part of June, 1905, and has been in actual service since the first of July, hauling heavy freight trains over the Middle Division, from Harrisburg to Altoona. This engine, No. 2751, is of the Pennsylvania standard freight class H-6-B, and during its five months of service has covered 22,000 miles without a failure due to any part of its valve gear. It met with an accident, however, and is now in the Harrisburg round-house receiving a new set of side sheets, stay bolts and flues. A careless hostler fired her up, after a check valve had been reground, and neglected to find out if there was any water in the boiler.

A careful examination of the pins and bearings of the valve motion on this engine fails to disclose any decided wear or defect, and with the exception of the brasses on the eccentric rod end the work is just as it was received from the builders. The valves have been reset once in five months, and this setting was only necessary because the balance rod had worked loose and thrown the valve out to some extent. At this point it may be well to mention that this engine is the only one equipped with the stub end eccentric rod and split brasses. All that have since been received have the solid end with the customary brass bushing.

Five months of good service is scarcely enough upon which to base a claim of success, but a systematic inquiry among round-house machinists and engineers will soon disclose the future of any new departure. With 107 of the Walschaert gears in use on locomotives running between Harrisburg and Altoona, it was not hard to obtain a wide range of criticism. The general opinion, however, is expressed in the words of one old engineer who was so fond of his new engine that he said: "I hate to leave her at the round-house and go home to sleep. I'm afraid some one will steal her." The engines are not thrown into a "pool" on this division, as is often the custom, but one engineer is assigned to a locomotive, and is responsible for any failures that may occur. All of the 107 have shown good steaming qualities, and have pulled their trains as well as their sister engines, with the ordinary Stephenson link motion. Failures that have been reported were due to the exhaust nozzles, which were originally 5½ in. in diameter, and are now being bushed down to 5¼ in.

Much criticism having been heard with regard to the number of pins necessary in the Walschaert motion and the valve troubles caused by their wear and subsesquent lost motion, special inquiries were made, and it was discovered that while some of the pins did give trouble occasionally, it was more the result of heating than any lost motion. The pin that holds the link hanger to the end of the reverse shaft arm is one of the most frequent offenders; and the valve stem pin is also the cause of considerable trouble, due to faulty design in the oil cellar. The oil is compelled to travel three or four inches from the cup before it lubricates the pin, and in this distance the hole becomes clogged with dirt. It is necessary to exercise great care in the design and workmanship on this gear because with 12 pins and their bearings on each side of the locomotive something will sooner or later be likely to give trouble.

On the Southern Pacific Railroad a similar form of "grasshopper" valve gear, known as the Stevens, was placed in use many years ago and a number of the engines are still running on the divisions between Sacramento and Portland, but the experiment was not deemed successful, owing to the great wear on the pins, and other reasons best known to the superintendent of motive power of the road. This gear differs from the Walschaert in the construction of the valve and valve stem, there being a double valve with one stem working through the other which is hollow.

From the machinists in the Pennsylvania round-house there was a diversity of opinion, but the only general complaint was with regard to the work necessitated in reducing lost motion between the crosshead and guide bars, the latter being of the "wing" type. Under ordinary circumstances it is sufficient to line down the top guide bar to take up light wear, but in this case it is impossible to do so because the mechanism that supports the valve rod attachments is bolted to the upper guide bar and it would not do to move it from its original position. It is therefore necessary to disconnect the crosshead from both piston and main rod, and place liners under the crosshead shoe or else resort to loose liners. This is a heavy job for round-house men and some dissatisfaction may be expected when it is considered that they are working on the piece work system.

Added to the opinion expressed by both engineers and machinists, the general road foreman of engines dispelled all thoughts of non-success that might have lingered in the mind of a conservative inquirer. He was loud in his praises of the "grasshopper" motion, and remarked that the engines on his division were never doing better work with fewer failures than at the present time. He insisted that the machinists at either end of the division were disappointed because there was really so little work to be done when a run was complete.

The first engine equipped, and one already mentioned, No. 2751, has given the best service of any so far in use. This is accounted for from the fact that special pains were taken in its construction, as it was known to be a test locomotive. The others, however, are doing their share of the work and averaging about 4,400 miles a month. Two were repaired, owing to a wreck, shortly after they were received, but in no case have they fallen down through defective valve motion.

The argument has been raised at times that with this motion a small amount of lost motion at the driving box of the main drivers would amount to considerable when transmitted to the eccentric rod at the end of the crank pin. The work of these engines fails to reveal any fears from such a cause as that. It is a much better proposition for the engineer to have important parts outside where he can inspect them easier, when oiling up, and give them the attention that is practically impossible when leaning over the tops of driving wheels, or crawling underneath.

From the above discussion it is evident that with engineer and machinist satisfied, and the road foreman anxious to get more engines of the same type, but one conclusion can be reached, which is that the Walschaert valve motion has come to stay. The present design will no doubt be improved with great rapidity, especially the sliding cross-head that guides the valve rod. There is already a visible difference between No. 2751 and those that have come from the shop during the past month. As yet the engines equipped have only been used for freight service, but with such satisfactory results it is only a question of time when they will enter the passenger field.

Other roads will follow in the footsteps of the Pennsylvania, and although the progressive Rock Island has been building them for some time, and is at present receiving quite a few, we must credit the Pennsylvania with taking the lead in a step that marks an important milestone in American motive power development.

THOMAS F. CRAWFORD.

An English Visitor.*

30 Streatham High Road, London, S.W., Jan. 2 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

About a year ago I was traveling from New York to Chicago. I was in the smoking car, and sitting next to me was a genial American, who, guessing that I was an Englishman, pleasantly opened a conversation with me. After chatting about various subjects we came to talk of the comfort and convenience of modern travel, and as we were then in one of the most luxurious of modern trains I remarked upon the excellence of its appointments. My friend agreed with my observations, but said he could not understand why there were so many more fatalities on the American railroads than on those of England. "Oh, it's because their trains go so slow," replied a railroad official who was standing near to us. I was rather surprised to hear this, and told him that he was certainly mistaken. It was evident, however, that he persisted in his belief. I spent several months in the United States, traveling many thousands of miles, and so prevalent did I find this error that I determined to do what I could to correct it. My first intention was to make a list of all the regular daily trains in England which attain or exceed an average speed of 50 miles per hour. These, however, I found were so numerous that I was constrained to limit my list to trains which, besides fulfilling these conditions run for distances of not less than 100 miles. Even that I found would occupy much more time than I could devote to the subject, so I have contented myself with giving a list which, although very incomplete, will, I think, be sufficient to show that English trains do not "go so slow."

I would like to add a few further remarks concerning railroads in general and English railroads in particular. Most people will agree that it is far more desirable to have a frequent service of trains running between important points at rates averaging between 40 and 50 miles per hour than to have a relatively meagre service of slower trains, relieved by three or four, which attain much higher speeds. And in this respect surely the English railroad companies serve the public exceedingly well. As an illustration of this I give in my table 35 more or less important British towns and cities, distant 100 miles or more from London, and indicate the number of trains which run between them and the Capital daily (except Sundays). The speed of most of these averages more than 40 miles per hour, and several, as will be seen, attain or exceed 50 miles per hour.

Many of the cities named are connected with London by one or more railways which I have not mentioned because the route

*Our correspondent offers a defense where he [illegible] by well-read Americans, for his main point, that [illegible] large numbers of trains at very high speed is well understood. Nevertheless we print his letter because he presents a fresh study of the time tables and because he sets forth the facts in a form somewhat different from that with which the American reader is familiar. It will be observed that the fastest train in the list is one of the Great Central between Leeds and Doncaster, 103 miles, at 59.4 miles an hour. The Great Western runs three trains to Bristol at substantially the same speed (59.2), and these we believe make the stop at Bath. Other specially fine runs are those of the Great Central to Sheffield, 164½ miles, at 58.1 miles per hour; the Great Western to Exeter, 193¾ miles, at 56.7, and the London & North Western to Liverpool, 201 miles, at 56.1.—EDITOR.

is longer and takes little through traffic. Berwick, for instance, is reached by the Midland Railway.

As I wished to show the number of fast trains available for each of the places mentioned I have been obliged sometimes to give the same train more than once. Some of the trains going to Bath, for instance, go to Bristol and Exeter also. But of the 259

Fast Regular Trains in England and Scotland.[1]

I. Name of place	II. Railway.	III. Miles from London	IV. No. of daily regular trains.	V. No. of trains av'g 50 m.p.h., or higher.	VI. Speed of fastest train.
Bath	G. W.	106⅞	13	9	59.3[2]
	L. & S. W.	148	14	.	....
Berwick	G. N.	339	16	1	50.1
Birmingham	G. W.	129¼	21	5	54.4[3]
	L. & N. W.	113	30	8	56.5[4]
Bournemouth	L. & S. W.	108	24	1	51.4
Bradford	G. N.	196¼	20	1	50.5
	L. & N.-W.	219	22	..	....
	Mid.	208	29	..	....
	G. C.	203½	16	..	....
Bristol	G. W.	118⅜	33	10	59.2[5]
Carlisle	Mid	310½	22	1	50.3
	L. & N.-W.	299¼	25	..	....
Chester	L. & N. W.	179	28	2	50.4
	G. W.	214	14	..	....
Crewe	L. & N.-W	158	47	16	54.5
	G. W.	173	10	..	....
Darlington	G. N.	232	24	1	52.0
	Mid.	246	22	..	....
Doncaster	G. N.	156¼	38	7	55.5
	G. E.	180½	11	..	....
Durham	G. N.	256	15	1	52.0
	Mid.	400	18	..	....
Edinburgh	G. N.	395	22	3	50.9
	L. & N.-W.	..	14	1	50.0
	Mid.	404	13	..	....
	G. C.	..	10	..	....
Exeter	G. W.	193⅞	24	9	56.7[6]
	L. & S.-W.	171½	17	4	52.8
Glasgow	L. & N.-W	401½	14	1	....
	G. N.	444	14	..	....
	Mid.	..	14	..	....
	G. C.	..	9	..	....
Grantham	G. N.	105¼	51	18	54.0
Harrogate	G. N.	203	27	3	....
	G. C.	218	10	.	....
	Mid.	..	24	..	....
Holyhead	L. & N. W.	263½	18	1	50.2
	G. W.	298	11	..	....
Leamington.[7]	G. W.	106	23	6	57.8
	L. & N.-W.	97½	28	3	53.2
Leeds	G. N.	186¼	26	4	52.3
	Mid.	196¼	37	9	....
	L. & N.-W.	220½	22	..	....
	G. C.	201	12	..	....
Leicester.[8]	Mid.	99¼	48	20	56.7[9]
	G. C.	103	27	7	59.4[10]
	L. & N.-W.	115½	20	..	....
	G. N.	..	6	..	....
Liverpool	L. & N.-W.	201	24	7	56.1
	Mid.	218½	23	2	50.4
	G. W.	230	14	..	....
	G. C.	240½	19	..	....
	G. N.	..	17	..	....
Manchester	Mid.	185	27	5	52.6
	L. & N.-W.	183½	28	5	52.4
	G. C.	206	20	3	53.7
	G. N.	203½	17	1	50.9
	G. W.	219	11	..	....
Newark	G. N.	120	30	3	50.3
Newcastle	G. N.	272	28	6	52.6
	Mid.	297½	22	..	....
Newport (Mon.)	G. W.	133½	24	4	52.3
Nottingham	Mid.	125	36	11	56.8[11]
	G. C.	125½	26	5	57.5
	G. N.	128	29	2	54.8
	L. & N.-W.	..	10	..	....
Plymouth	G. W.	246	21	5	55.7
	L. & S.-W.	230¾	12	..	....
Sheffield	G. C.	164¾	22	4	58.1
	G. N.	162	20	4	57.2
	Mid.	158½	35	3	52.8
Shrewsbury	L. & N.-W.	162¼	19	1	50.6
	G. W.	171½	15	..	....
Stafford	L. & N.-W.	133½	38	12	56.4
Stockport	L. & N.-W.	177½	31	7	53.8
	Mid.	..	18	..	....
Wakefield	G. N.	175¾	26	5	55.8
	Mid.	184	25	..	....
Worcester	G. W.	120½	21	4	55.6
	Mid.	156	18	..	....
York	G. N.	188¼	34	8	52.7
	G. E.	212½	7	..	....
	Mid.	..	24	.	...
	G. C.	..	16	.	...

[1] G. W. Great Western; L. & S.-W.—London & South-Western; G. N.—Great Northern; Mid.—Midland; L. & N.-W.—London & North-Western; G. C. Great Central; G. E. Great Eastern.

[2] Bath, two of the 9 trains at 55.7, and two at 54.5.

[3] Birmingham, G. W.; four of the five faster than 54 miles per hour

[4] Birmingham, L. & N.-W.; seven of the eight at 56.5.

[5] Bristol; three of the 10 over 55.

[6] Exeter; four of the nine over 55.

[7] Leamington, G. W.; four of the six over 55.

[8] Leamington on the L. & N. W., and Leicester on the Midland are both just under 100 miles from London, but as they are over 100 miles distant by the other lines which serve them, they are included.

[9] Leicester, Midland; seven of the 20 over 55

[10] Leicester, G. C.; four of the seven over 55

[11] Nottingham, Midland; four of the 11 over 55

given in Column V. 155 are absolutely distinct and separate trains. Some English expresses lose a good deal in speed by the caution which they have to exercise while in the neighborhood of London or other large cities where there is much local traffic. For example, the Great Central Railway's Sheffield express, which leaves London at 3.25 p.m., when once clear of the Metropolitan lines at Quainton Road averages 60 miles an hour for the remaining 120 miles.

When one considers the rapidity with which trains follow one another on the English railroads, the high speeds at which they run, their punctuality and the extremely small number of fatalities which occur, it must be admitted that they are managed very efficiently. As regards the comfort of traveling on the English lines, one could hardly wish for more luxury for a five or eight hour journey than is provided in the splendid "Cornish Riviera Express" of the Great Western Railway, the equally fine Scotch Expresses of the Midland, the Great Northern, and the London & North Western, the "Grampian Corridor Express" of the Caledonian, or, indeed, of any of the main line trains of the principal companies. And for a journey of an hour or two, Englishmen, at any rate, find the compartment carriages very comfortable. When criticising railroads it is essential to take into account the conditions under which they are run, and the requirements of the public whom they serve, considerations too often neglected by those who make comparisons between the railroads of England and America.

FRANK FAIRER SMITH.

Scranton Tunnel of the Lackawanna & Wyoming Valley.

The Lackawanna & Wyoming Valley Railroad, or the Laurel Line, as it is generally known locally, is a standard-gage, double-track, rock-ballasted, third-rail electric road, controlled by the Westinghouse interests. It is laid with 90-lb. rail on private right-of-way throughout its length from Scranton to Wilkesbarre, Pa. The line was put in operation between these points in December, 1903. A full description of the road from an engineering standpoint was published in the *Railroad Gazette* of April 22, 1904, when also its traffic possibilities were discussed editorially. The road then entered the city of Scranton by a temporary location known as the Erie cut-off, with steep grades (4 per cent.) over a hill that was to be pierced by a tunnel.

This tunnel was, on October 19 last, opened for service. It connects with the line first built at a point about half a mile from the Scranton passenger terminal at its north end, and at a point over the hill beyond South Scranton at the south end. It has saved a considerable amount of distance, and, more important still, has reduced the ruling grade on this section from 4 per cent. to 1 per cent. The grade through the tunnel is 1 per cent. and 0.8 of one per cent. The accompanying photographs show in order passing through the tunnel from north to south the portals and typical sections in the tunnel.

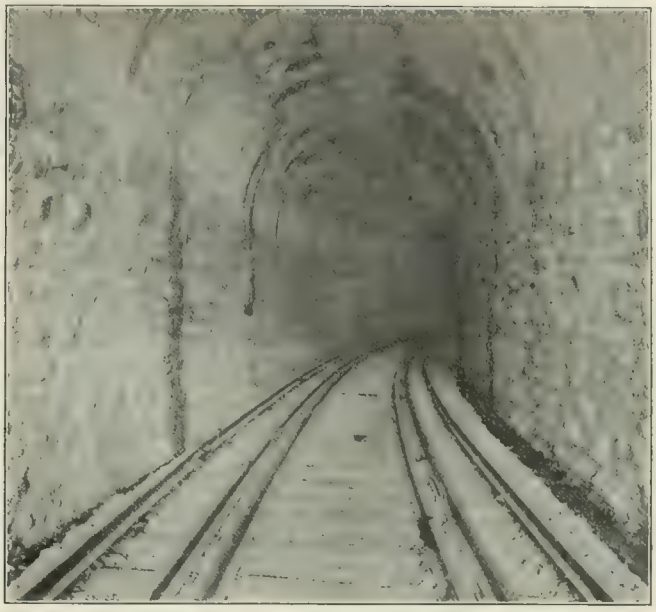
Work was begun on July 5, 1904, and was carried on from both ends and in both directions from two shafts, making six working headings. The first round of shots was fired at the north end on August 12, 1904, and at the south end on September 8 of the same year. The headings met between the two shafts on June 10, 1905, giving a continuous opening from portal to portal. The excavation was completed on July 19, 1905.

The tunnel is 4,747 ft. long. Of this distance 1,300 ft. is solid rock section, 750 ft. masonry lined, and 2,700 ft. timber lined. The masonry-lined section is 17 ft. wide by 22 ft. high, and the timber-lined section is 18 ft. wide by 23 ft. high. These dimensions give plenty of clearance to the largest type of Pullman car or freight car. The two tunnel shafts are each 10 ft. by 20 ft. No. 1, the southerly shaft, is 110 ft. deep, and No. 2, the northerly shaft, 180 ft. deep. The excavation for the shafts amounted to 2,700 cu. yds. The tunnel excavation was 88,000 cu. yds., of which 16,000 cu. yds. were taken out at the south end, 30,000 cu. yds. out of the south shaft, 20,000 cu. yds. out of the north shaft, and 22,000 cu. yds. were taken out at the north end. At the top of one of the shafts the company bought more than a city block of swamp land, where the excavated material was wasted and the lots made available for building purposes. The tunnel contains 3,500 cu. yds. of concrete lining and 1,150,000 ft., board measure, of timber lining in place. The excavation for the approaches amounted to 45,000 cu. yds., and there were 3,000 cu. yds. of concrete used in the approaches. The gauntlet track through the tunnel is operated by the Union Switch & Signal Company's electric train staff system, the installation providing for a possible consecutive movement of 20 trains in one direction. The photographs show in remarkable detail the characteristics of the rock, masonry and timber sections of the tunnel, and also the concrete portals at both ends of the tunnel.

The regular passenger schedule provides for 20 southbound and 17 northbound trains through the tunnel out of a total of 81 trains daily in each direction. There are 13 limited trains a day in each direction which make the 20-mile run between Scranton and Wilkesbarre in 30 minutes, including two stops and three minutes spent in running over the last mile into Wilkesbarre. These all use the tunnel. The company is building up a freight service both in package freight and in carload lots. Trains of two or three freight cars are hauled by 300-h.p. freight motors. The elimination by the tunnel line of the 4 per cent. grade of course greatly increases the load which a motor can handle. The maximum grade on the



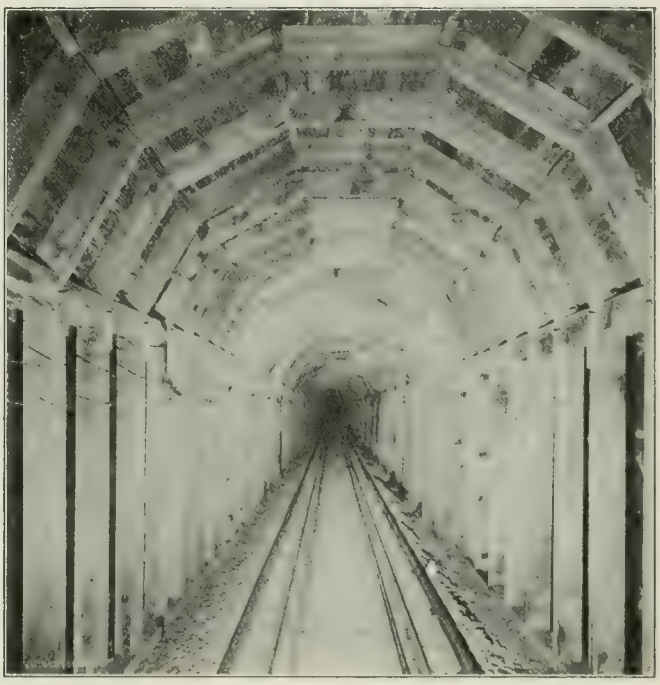
North Portal.



In From North Portal—Masonry and Concrete Section.



Rock Section.



Timber Section.



In From South Portal—Concrete Section.



South Portal.

Scranton Tunnel of the Lackawanna & Wyoming Valley.

whole line is 2 per cent. near Pittston, which is about half way between Scranton and Wilkesbarre.

The Scranton tunnel was built by the Lackawanna Tunnel Company, Westinghouse, Church, Kerr & Co. being the engineers for the railroad company, and Mr. P. B. Easterbrooks the Assistant Engineer in Charge. The Rinehart & Dennis Co. were the contractors. For the photographs and other information we are indebted to Mr. Charles F. Conn, Vice President of the Lackawanna & Wyoming Valley Railroad.

Electrolysis and Water Pipes in New York City.

The precautionary measures taken by the New York City Department of Water Supply in Manhattan and Bronx boroughs to prevent the destruction of pipes by electrolytic action resulting from stray return currents from the electric roads are interesting. They have been costly, but reasonably successful. Below 125th street all of the surface roads are operated with the conduit system, using the track rails as a return circuit as in the overhead trolley system. When the conduits were first put in the entire track structure was designed to be as substantial and permanent as possible. Extra heavy sections of rails were used and the joints were either cast or electrically welded, in addition to which copper bonds were applied at certain points. The Department of Water Supply insisted on the most effective means being taken to prevent leakage to the ground and adjacent parallel mains, and the street railway company in compliance with these demands designed the conduit structure with ducts in the walls of the underground chambers in which return copper cables were laid connected to the track rails every 500 ft. and extending from the end of each section of the road back to the ground connection at the power stations. At the same time, wherever it was necessary to do so, the water mains were removed from under the tracks and relocated at a minimum distance of 5 ft. to one side of the nearest track rail. These measures proved effective from the beginning in nearly every case. In some places where crossings of car tracks over-lie a network of water mains stray currents have done some damage to hydrant and service connections 40 or 50 ft. away from the crossing, requiring the renewal of the connections at infrequent intervals, although not causing the complete destruction of the pipes. Readings taken at these places with a voltmeter at the time the excavations were made showed a perceptible flow of current at varying potentials, proving the damage to have been caused by electrolytic action.

On the upper end of the Island and in the Bronx, where there are a number of surface roads using the single overhead trolley, the cases of damage and even total destruction of pipes underground have been more numerous. The track rails, often poorly bonded at the joints, are relied on to carry the return circuit without the use of a supplementary copper return cable. Wherever the tracks run parallel to the water mains the Department of Water Supply has required the company to pay the cost of the relocation of the pipes to one side of the tracks, but this has not entirely prevented electrolytic action. At crossings and other points of excessive leakage copper cables have been laid in the ground around the path which the current seeks to follow in the pipes, and these are bonded to the rails at each end to form a continuous metallic circuit. This is a makeshift expedient and not to be compared in efficiency with the parallel copper circuit used with the conduit system. Service and hydrant connections are the principal points of attack by stray currents, and these are renewed in some places at quite frequent intervals. The chief damage is done at the wiped joints in the lead service pipes, which are eaten away or so badly oxidized that they crumble when exposed. The railroad companies when called upon to settle claims for the cost of renewing damaged service connections usually pay up without protest. Near the power stations the usual copper returns are laid throughout the danger zone and are fairly effective.

When the Elevated Railroads were changed from steam to electricity the entire structure was carefully bonded with copper at every point in the longitudinal girders, and the track rails were likewise bonded. While some evidences of electrolysis are found at junction points and crossings where the path of the return current is not continuous, underground structures have not been affected to any appreciable extent.

The Subway has not been in operation long enough to determine whether or not stray currents from the rails are causing damage to the water pipes laid along side or above the tunnel. At places where the Subway lies under a network of pipes the voltmeter shows a flow of current up the columns and thence to the pipes. At other points no flow of current can be detected. It has been suggested that in case damage is found to result from these stray currents one or more of the ducts already provided for in the walls of the tunnel could be used for carrying a return copper cable connected to the track rails every 1,500 ft., as is done with the surface conduit roads. The Subway structure differs from the elevated roads in the distribution of the steel work. On the Elevated the girders are longitudinal and form a good metallic return independent of the track rails. In the Subway the cross girders in the roof are supported on separate columns without longitudinal girders except at a few stations and cross-overs, and there is thus no continuous metallic system. Any leakage of current finds its way up the columns to the pipe systems overhead.

Signal Arrangements for the New York Central Electrified Zone.*

The block system to be installed within the Electrification Zone territory of the New York Central in the vicinity of New York is to be arranged with an overlap of the full length of the block. An engineman will then be given two warnings and two chances to stop before it will be possible for a train to overtake another on the same track.

The signaling will be the most complete, and, it is felt, the most perfect of any installation that has ever been made. It certainly will be the largest and most expensive, and the cost would be considered prohibitive if the signals were not necessary for the safe operation of trains. No expense is to be spared to provide every feature that will add to the safety of operation, as where safety is concerned it will not do to be "penny wise and pound foolish."

The block system to be installed is the automatic electric. An alternating current will be required for the track circuit, and a relay that is acted on only by an alternating current and not by direct current will have to be used. Alternating current is principally employed in street and house lighting, and, owing to the ease with which the voltage may be raised or lowered by means of a transformer, its field of usefulness is very large. An alternating current, as will be understood from its name, is one where the current is alternately made to flow in one and then in the opposite direction. The frequency of the alternations or number of current impulses occurring in a given time are termed cycles; and these ordinarily vary from 25 for power currents to 60 and even 133 cycles for lighting circuits. The alternating current to be used in the track to operate the track relay will be of 25 cycles, and distributed on two main wires strung on the transmission line poles, some of which may be seen now in place at Spuyten Duyvil. Owing to the large current required and the long distance it will have to be transmitted from the power stations, the current in the main signal lines will be of 3,000 volts potential; and at each location where signals are to be placed a transformer will be connected to the line to step the current down from 3,000 volts to 50 volts.

A current of 50 volts potential is a convenient one to use for the various circuits forming part of the signal system. It is to be employed to light the lamps in the signals, work the signal motors, the switch indicators, the relays and all circuits of the system except that of track where, owing to the low insulation between the rails, a low voltage current must be used. For the track circuits the voltage is to be reduced by a second transformer from 50 to 6 or even 2 volts, according to the length of the track circuit section. An alternating current, owing to the change from zero to full voltage, sets up an opposing magnetic resistance in the rails; and, as the resistance varies according to the length of rail through which the current passes, the voltage used must be proportioned to the length of the track circuit.

The relay required differs materially from the ordinary form of relay used for track circuit purposes. A relay of the ordinary type is acted on by any small direct current; and as there will be large quantities of direct current flowing through the track and wires that are connected to the same, a relay that is worked by the alternating current only is a necessity. The alternating current relay is, in fact, nothing more than a motor, the armature of which is allowed to turn about ¼ of a circle in place of making a complete revolution. There are two forms of these relays in use; one, a single-phase relay taking its current only from the track, and requiring a comparatively large current, as sufficient has to be received at the relay to magnetize the fields and turn the armature. The other type is really a two-phase induction motor with two field windings. One of the windings takes current from the 50-volt power line, the other the low voltage from the track. The ample power of the 50-volt current is used to furnish the major portion of the energy required to actuate the relay, and only a small current is required from the track to give the necessary rotation of the armature. The current in the two windings must differ in phase or time of maximum intensity by about 90 degrees, or one-quarter of a cycle period, in order to produce the necessary pull, and the direction of rotation depends on the relative phase of the two currents. If the relation of the phase of the currents is reversed, the armature will turn in the opposite direction to the normal and thereby cause the signal to indicate stop. Protection is thus secured against a breaking down of the rail-insulating joint, as the current coming through from the transformer of the adjoining track section

*Extracts from a paper by W. H. Elliott, Signal Engineer of the New York Central, in *Railroad Men* for January.

will be of a different phase and rotate the armature in the direction to cause a separation of the contact points opening the signal circuit and causing the signal to indicate stop.

A most important part of the track circuit equipment is the reactance bond. This bond is designed to allow the direct current returning to the power house to pass from one section of the track to the other, while it must stop the alternating current from passing to the next sections in sufficient quantity to interfere with the working of the relay of those sections. Accurate calculations have had to be made and much ingenuity displayed in the design of these bonds, for they must be so proportioned as to pass 3,000 amperes of direct current continuously while stopping the alternating current and limiting it to the track section where it is to be used. These bonds are formed of a copper bar 1 in. square and about 30 ft. long, bent in the form of a coil and placed in an iron box and surrounded by oil to carry away the heat generated by the current passing through the bond. A bond is required for each end of a track circuit. There are about 1,000 track circuits in the electrification zone, and as the bonds cost about $150 apiece it will be seen that apparatus of this kind is quite expensive. Each bond allows approximately 60 watts of current to pass, in order to render the bond effective to any larger current; and as about 30 watts of current is lost in the track section, a total of 150 watts is required to operate each track circuit. One hundred and fifty watts is approximately one-fifth of a horse-power, or a total of 200 horse-power is required for the 1,000 sections on the 54 miles of four-track railroad to be signaled. As illustrating the great expense there will be in operating the new system, it should be remembered that for 1,000 track circuits worked by direct current obtained from gravity batteries but 1¼ horse-power would be required.

In operation the new system should be an ideal one, for there will be no batteries of any kind to need cleaning and inspecting and no lamps will have to be lighted. All power will be supplied from the sub-stations, and unless some of the connections break or are burnt out by lighting there is little to go wrong. The alternating current relays and magnets are quick in releasing, and there is small danger of the signal being improperly held in the clear position from residual magnetism, as sometimes happens with the battery-operated systems. Ample power is available to work the signals quickly, while they may be loaded heavily enough to overcome a lot of ice on the blade or increased friction in the parts which might keep the signal from changing to the stop position.

In almost every way the system is an ideal one, and while it will be expensive in first cost and the cost of operation will be high, the increased efficiency and greater safety in working will more than compensate for the large outlay of money.

The interlockings to be installed will be of the latest type of power apparatus, and the safeguards which practice has shown to be necessary will be provided. Electric locking of the switch levers will be used to prevent the switch being thrown under a train, as with the modern rail and a power-operated movement it is difficult to so locate the detector bar that it will be stopped by the wheel and prevent the movement from opening the switch when there is a train over the points.

In the Grand Central yard, where, in time, all of the tracks will be covered by buildings or streets, the tower floor on which the interlocking machine will be placed will be almost level with the car floor, and a car standing or passing in front of the tower will completely shut off the view. As the largest interlocking machine will have 172 working levers controlling about the same number of switches and signals as the machine now in use, it will be realized that the conditions under which the signalman will have to work will be extremely difficult. It is expected that the operation of the plants will be carried on almost entirely by information furnished by a track indicator which has been designed to show when each section of a track is occupied by a train. The sections will be limited to one or two switches and comparatively short pieces of track. Each section will be provided with a track circuit, and in the Grand Central terminal there will be 426. These track sections will control a relay in the tower which will close a circuit to a lamp giving a white light when the track is not occupied and another lamp giving a red light when a train is on the section. A red and a white lamp will be provided for each section, and the sections will be represented on a large piece of ground glass placed in a frame and hung on the wall of the tower in front of the signalman. Small partitions on the back of the glass will keep the light from one section showing through to that of the next, and those sections which are showing red will be understood as being occupied by a train.

The large number of high-speed trains which are now being run to meet the demands of the public has made it necessary to convey to the engineman by means of a signal certain information which it has not heretofore been attempted to give. The introduction of the long cross-overs through which trains may run at speeds of from 40 to 50 miles an hour has made necessary the use of an additional signal arm to indicate when the route is set for a train to take such cross-over. Instead of limiting the number of arms on any pole to two for almost all situations, as has been the practice for a number of years, three arms now have to be used, of which the top arm will govern movements to be made to the unlimited route, the second arm will govern movements over the limited speed route, and the lower arm govern movements to be made to all other routes. Such use of the signal is what is termed speed signaling, and for roads that have four or more tracks and long cross-overs such a system is necessary if the benefits to be derived from the use of these cross-overs is to be secured.

The conditions of modern practice require that a distant indication shall be given for each home signal where a movement is made from one main track to another in a direction with the current of traffic. To give this indication requires the use of at least five arms. The upper arm, the home signal for the unlimited speed route; the second, the distant signal for the home signal in advance on the same route; the third, the home signal governing through cross-over to main track running in the same direction; the fourth, the distant signal for the next home signal in advance on this other main track, and the fifth, the home arm governing movements to the other main or side tracks. With a spacing of 6 ft. between each arm and the pole located on a signal bridge, the top arm will be 58 ft. above the track. At such a height it is difficult to see the light when near to the signal, and even in the daytime the position of the arm cannot be told with desirable certainty. When standing under the signal the light may be seen between the spectacles and the lamp, and mistakes have been made in assuming the signal was clear when it was not. It is therefore practically out of the question to put so many signals on a pole placed on a signal bridge.

The situation may be materially improved by the user of the three-position signal, by which means the stop indication, the distant indication for the next signal in advance and the proceed indication may be given by one signal and the number of signals on a mast reduced from five to three. The proceed indication is given by the arm when in a vertical position, the cautionary indication when the arm is in the 45-degree position, and stop is indicated when the arm is horizontal. Such use of the signal requires that the sweep of the arm be 90 degrees instead of the 60 degrees which the signals on the New York Central now move through when being cleared. The giving of the distant or cautionary indication by the arm when in the 45-degree position is a new feature which should aid materially in the safe operation of trains. At the present time the distant signal is distinguished by the arm havng a forked end, and when indicating caution it stands in a horizontal position the same as the home signal. As the forked end cannot be distinguished until the engineman is quite near, it is possible and has sometmes happened that a home signal will be mistaken for a distant signal and the mistake not noticed until too late for the train to be stopped at the home signal. With the cautionary indication given by the position of the arm, a mistake of the kind indicated cannot occur, for the character of the indication is denoted by the position of the arm and not by its form. With the 3-position system of signaling, an arm in a horizontal position means stop, no matter where the signal is located, and an arm in the 45-degree position will mean caution, whether or not the end of the blade is squared or notched. The proposed change is a very decided one from the standpoint of present practice, for, according to the rules now in force, an arm in the 45 or greater degree position means proceed.

An arm in the vertical position will stand parallel with the side of the pole and not be as easy to see or as distinctive as when in the 60-degree position. To make the blade more distinguishable and also to have the weight of any ice or snow that may collect on the blade assist in carrying the arm to the stop position, many signal engineers recommend that the arm be made to move upwardly from the horizontal position when giving the proceed indication, instead of downwardly as is the present practice. If adopted, this practice will be a very decided change, although the moving of the arm upwardly to give the cautionary indication is used by the Santa Fé and the Erie. In Germany the signals are made to move upwardly to give the proceed indication, so there is nothing new in the practice.

With the vertically-raised arm the greater part of the blade will be made to extend above the top of the pole, and with a proper offset from same can be easily recognized as a signal arm and not as an extension of the pole. It is true this greater distinction of the upwardly raised arm over the one that is downwardly inclined will not be had for any except the top arm, but the top arm is the most important signal governing trains moving on the unlimited speed track; and a change which will make this signal more distinct is undoubtedly warranted, although the appearance of the other signals on the pole will not be improved. It has been suggested that the change to the upwardly moving arm be made with the signals to be installed within the electrification zone, while it has definitely been decided to change from a white to green light for the proceed night signal indication, yellow being used for the cautionary indication, and red, as now, to indicate stop.

December Railroad Law.

The following abstracts cover the principal decisions on railroad cases handed down during December by the United States Supreme Court and the Federal Courts:

Liability of railroad company for assault on passenger by another passenger. The Circuit Court of Appeals for the eighth circuit has affirmed a decision favorable to the Rock Island Railroad Company in a case where an unoffending passenger was struck by a missile thrown by an intoxicated person expelled from the train for profanity and disorderly conduct. The missile was intended for the conductor and was thrown without warning. The court, after an exhaustive examination of the authorities, announced as a principle applicable to cases where a passenger is injured by another that the liability of the carrier must depend upon the presence or absence of evidence tending to show that the employees either knew or by the exercise of due care should have known from the circumstances of the particular case, that injury to the passenger was threatened or impending, which injury, by the exercise of that high degree of care which the law requires of a carrier of passengers for the safety and protection of the passenger, might not only have been foreseen but guessed against, thus averting the injury. Brown vs. Chicago, Rock Island & Pacific Railway, 139 Federal Rep. 972.

State taxation of rolling stock used without the state.—The rolling stock of a state corporation permanently located without such state and there employed in the prosecution of its business, is not subject to taxation by the state. The imposition of such a tax is a plain violation of the constitutional prohibition against depriving one of his property without due process of law, and of the well recognized rule of law governing levies for revenue purposes, that tangible property can be taxed only when within the territorial jurisdiction of the taxing power. Union Refrigerator Transit Co. vs. Commonwealth of Kentucky (U. S. Sup.), 26 Supreme Ct. Report 36.

Use of bridges in common.—The Supreme Court has held untenable the ground on which the Union Pacific Railroad Company sought to deny the use of its Omaha bridge to a new railroad recently built into Council Bluffs. The Act of 1871, under which authority for the construction of the bridge was conferred, provided that the Union Pacific Company should be governed and limited by the provisions of an earlier act of Congress authorizing the construction of nine bridges over the Mississippi river at different points. Eight of the bridges were authorized on the express condition that other railroads should be allowed the privilege of crossing for a reasonable compensation. The provision for the ninth bridge (at St. Louis) did not provide for its use by other terminating railroads. The Union Pacific in this case contended that the act of 1871 made applicable to the Omaha bridge only such provisions of the earlier act as were common to all of the bridges mentioned therein, and that the provision for use by other roads was not common to all the bridges. The matter was decided adversely to the Union Pacific by reference to the general policy of the government in authorizing the construction of bridges over navigable streams. Incidentally it was also decided that the purchasers of the Union Pacific Railroad at foreclosure took the property subject to the act providing for a joint use of the bridge, though the mortgage foreclosed was executed prior to the act authorizing the construction of the bridge. Union Pacific Railroad Co. vs. Mason City & Fort Dodge Railroad Co. (U. S. Sup.), 26 Supreme Ct. Report 19.

Land grants to unpatented lands.—Judge Swayne in the Circuit Court for the Northern District of Florida holds that a grant of swamp and overflowed lands to a railroad by the state is not invalid by reason of the fact that a patent to the lands had not been issued to the state by the Secretary of the Interior at the time of the grant. Under this decision the rights of the railroad by virtue of its grant attached at the time of the issuance of the government patent, which right was enforceable against the trustees of the Internal Improvement Fund of Florida by a proceeding for specific performance. Kittel vs. Trustees of Internal Improvement Fund, 139 Federal Report 941.

The Cost of Locomotive Operation.

XX.

BY GEORGE R. HENDERSON.

(*Continued from page 12.*)

UPGRADE WORK CONTINUED.

In the *American Engineer* of April, 1904, Mr. G. J. Bury, General Superintendent of the Canadian Pacific, is quoted as saying: "If freight trains average 15 miles an hour, train and enginemen can make 5,000 miles a month, while if the average be reduced to eight miles an hour, the men cannot stand more than 3,000 miles a month. Sixty crews at 15 miles an hour will make 300,000 train miles per month, while at an average of eight miles an hour it will take 40 more crews, or 200 extra men, to handle that business.

"Looking at the matter from a financial standpoint, a consolidation engine hauls a train weighing 1,100 tons (tare and contents) over 118 miles in a district where there are several grades of 1 per cent.; taking into consideration the time for meeting trains, and letting faster trains pass, slowing up over grades, etc., it averages eight miles an hour, the cost being as below:

Wages, engineman and fireman	$6.90
Overtime for engineman and fireman	1.75
Wages, conductor and brakemen	7.73
Overtime, conductor and brakemen	2.88
Oil and waste for locomotive	.30
Fuel 17 tons at $3.20	22.40
Total	$41.96

or 32.3 cents per 1,000 ton-miles

"The same train, if loaded with 1,000 tons, averages 15 miles an hour over the same district, and the cost is as follows:

Wages, engineman and fireman	$6.90
Wages, conductor and brakemen	7.73
Oil and waste for locomotive	.30
Fuel 10 tons at $3.20	19.20
Total	$34.13

or 28.8 cents per 1,000 ton-miles

"In a general way locomotives should be so loaded when traffic is dense that they will make an average speed of 15 miles an hour, providing there are no unusual delays."

As indicated by table A (see *Railroad Gazette*, Jan. 5, page 11) if we run above 15 miles per hour, we also reduce our earning capacity and increase our cost per ton-mile. In order to observe the effect of higher priced coal, we have calculated the cost at $2 per ton, the other figures remaining as before. We now obtain as follows:

Table B.

Running speed	5	10	15	20	25	30
Cost per 1,000 ton miles	0.96	1.06	1.02	1.11	1.32	1.56

Here the speed of five miles an hour shows the lowest cost; but 15 miles gives the next highest rate, and when we consider that the movement and consequently the earning power of the engine per month is nearly doubled, there is little doubt as to the 15-mile policy even under these new conditions.

Tables A and B give the cost per 1,000 ton-miles and the number of million ton-miles per engine per month on a 1 per cent. grade 150 miles in length, when the maximum possible loads are taken at the speeds selected. But if these loads can be hauled we can obviously take lighter ones at these speeds, and we should know how this will affect the cost and quantity of transportation. Let us determine which values composing the cost will be modified by reducing the train load. It is evident that the quantity of coal and water used will be less, and also that the repair account will be diminished, so that items 10, 11 and 14 will be reduced. As less cars will be in the train, item 21—car repairs—will also diminish. Items 12, 13, 15, 16, 17, 18, 20 and 22 will remain constant for each speed, regardless of the train load, in accordance with our assumption, as they are based upon engine miles, trips or hours required for the run. Table C shows how the values are computed for five miles an hour.

Line 3 evidently follows from 2 and the distance—150 miles—being the product as before. Line 7 is found by Figs. 2 and 8, as before, but it was necessary to draw upon Fig. 8 additional lines representing the resistance of trains under 1,000 tons weight, and line 8 simply multiplied these figures by 150. The water (line 9) allowed three-quarters of a gallon for each pound of coal, as previously. Line 10 was based on line 8 at $1 per ton, and line 11 on line 9 at 10 cents per 1,000 gallons. Lines 12 and 13 are the same as previously shown in Table A. Line 14 was based on tractive forces of 19, 17, 14.5, 12, 9.5 and 7 tons respectively.

As determined from Fig. 8 and the additional lines for loads less than 1,000 tons.

Reduced Loads.] *Table C* [5 Miles per Hour

2. Weight of train.*	1,400	1,200	1,000	800	600	400
3. Ton-miles per trip.*	210,000	180,000	150,000	120,000	90,000	60,000
7. Coal burned per mile, lbs.	450	340	270	210	170	120
8. Coal burned per trip, lbs.	67,500	51,000	40,500	31,500	25,500	18,000
9. Water used per trip, galls.	50,700	38,300	30,400	23,600	19,100	13,500
10. Cost of coal, per trip	$33.75	$25.50	$20.25	$15.75	$12.75	$9.00
11. " water, per trip	5.07	3.83	3.04	2.36	1.91	1.35
12. " lubrication pr trip	.50	.50	.50	.50	.50	.50
13. " supplies, per trip.	.20	.20	.20	.20	.20	.20
14. " repairs, per trip	30.00	27.00	23.28	19.50	15.75	12.00
15. Allow. renewals, per trip.	1.50	1.50	1.50	1.50	1.50	1.50
16. Pay of enginemen per trip	25.20	25.20	25.20	25.20	25.20	25.20
17. Cost of handling, "	2.00	2.00	2.00	2.00	2.00	2.00
18. Int. allowance, "	4.10	4.10	4.10	4.10	4.10	4.10
20. Cost of train sup. "	2.25	2.25	2.25	2.25	2.25	2.25
21. Cost, car repairs "	31.50	27.00	22.50	18.00	13.50	9.00
22. Pay of trainmen, "	28.98	28.98	28.98	28.98	28.98	28.98
23. Cost of movement "	165.05	148.06	133.80	120.34	108.64	96.08
24. Cost, 1,000 ton-miles, net.	.79	.82	.89	1.00	1.21	1.60
25. Million ton-miles per engine month	3.69	3.16	2.63	2.11	1.58	1.05

*Tons back of tender.

Lines 15, 16, 17, 18 and 20 are simply reproduced from table A. Line 21 was figured at 15 cents per 1,000 ton-miles; thus, 210 × .15 = 31.50, and line 22 was taken directly from table A.

As before, line 23 is the sum of lines 10 to 22 (as in table C), and the costs in line 24 are the quotients of 24 and 3, thus $\frac{165.05}{210} = .79$. Line 25 has been computed as in table A, and is proportional to the values in line 3.

This process is repeated for speeds of 10, 15, 20, 25 and 30 miles an hour, and we are then able to produce tab.e D, in which the upper figures indicate the cost in dollars per 1,000 ton-miles, back of tender, and the lower figures the millions of ton-miles hauled per engine per month for the corresponding loads and speeds found upon the left-hand column and the top line.

Table D.

Cost per 1,000 ton-miles in Dollars and Million Ton-Miles per Engine Month.

	Miles per hour.					
	5.	10.	15.	20.	25.	30.
400 tons back of tender....	1.60 / 1.05	1.11 / 1.87	1.05 / 2.54	1.10 / 3.08	1.15 / 3.54	1.25 / 3.92
600 tons back of tender....	1.21 / 1.58	.90 / 2.81	.85 / 3.81	.91 / 4.63		
800 tons back of tender....	1.00 / 2.11	.78 / 3.76	.79 / 5.08	.86 / 6.18		
1,000 tons back of tender....	.89 / 2.63	.72 / 4.70	.76 / 6.35			
1,200 tons back of tender....	.82 / 3.16	.70 / 5.63				
1,400 tons back of tender....	.79 / 3.69	.75 / 6.57				

These costs are based on coal at $1 per ton, but any other price would be handled in the same way.

In order to show the effect of speed and weight of train upon cost and haulage capacity graphically Fig. 11 is presented, which,

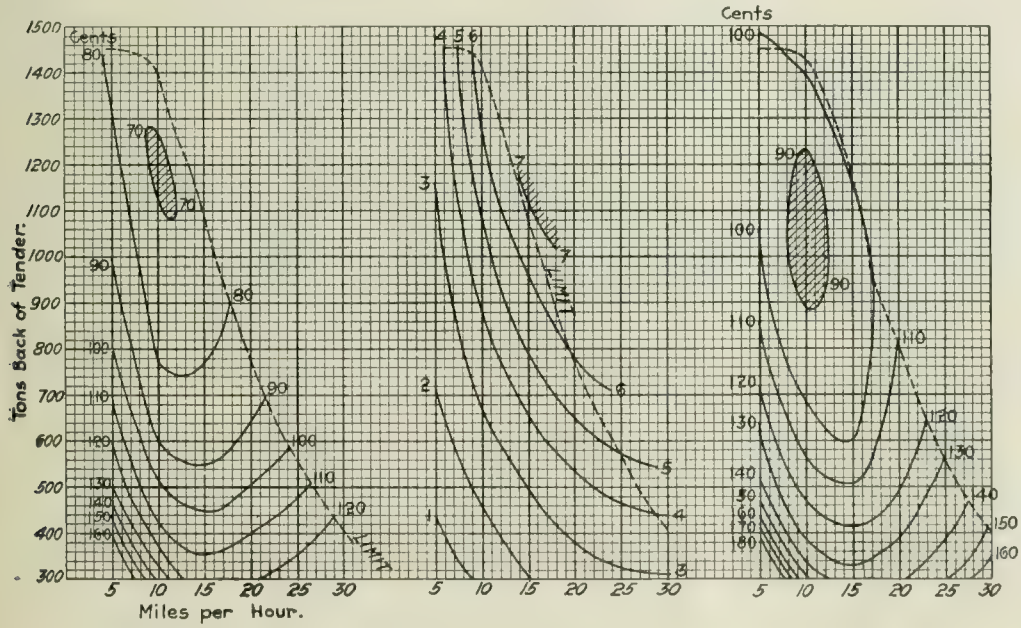


Fig. 11—Diagram Showing the Effect of Speed and Weight of Train Upon Cost and Hauling Capacity.

it is believed, gives the clearest possible illustration of this very important problem. The left-hand diagram gives the cost in cents per 1,000 ton-miles (back of tender), with coal at $1 per ton, and, of course, for the engine and grade selected. The right-hand diagram shows the same when coal is $2 per ton. The center diagram gives the hauling capacity in millions of ton-miles per month for a locomotive. In all these, the speed is shown by the abscissæ (as indicated at the bottom), and the train load by the ordinates, as seen at the left side of sheet. The cost in cents (in the side diagrams) is indicated by the contour lines, that marked 70 corresponding to 70 cents per 1,000 ton-miles, etc. The lowest point or "valley" is cross hatched. Thus if we wish the cost (under the conditions which have been assumed) to haul a train of 800 tons at five miles an hour, we find that the intersection of the five-mile vertical line and the 800-ton horizontal line is crossed by the contour line marked "100" cents, which means that the transportation covered by the accounts mentioned in table A will cost $1 per 1,000 ton-miles, thus agreeing with table D. For a train of 400 tons at 20 miles an hour we find a cost of $1.10 (110 cents), also agreeing with table D. The broken line marked "limit" indicates the maximum speed at which any given load can be hauled. For the conditions covered by the left-hand diagram it is evident that the greatest economy for any definite speed requires that the train be as heavy as the engine can haul "at that speed," except in the portions above the shaded "valley of minimum cost."

We found in table D that the minimum cost was obtained with 1,200 tons at 10 miles an hour, and this point in Fig. 11 is in the center of the "valley." As might be expected, there is little change effected by a variation of 100 tons either way, but a very marked difference is caused by a change in speed of three or four miles per hour. For instance, with 1,200 tons, if the running speed be reduced to six miles an hour, the cost will be 80 cents per 1,000 ton-miles. A higher speed will also increase the cost of transportation.

In table A, which gave maximum loads only, it was seen that 15 miles an hour with 1,100 tons was the most economical combination. However, table D indicated that the greatest economy was not at a maximum or full load, and Fig. 11 explains this. We also notice that the most economical speed for any possible train load lies between 10 and 15 miles an hour, the lighter the train the higher being the point of economical speed. If we pass away from this speed, the cost rises rapidly, either for slower or faster runs.

Again, if for dead freight we haul 1,200 tons at 10 miles an hour, the cost will be 70 cents per 1,000 ton-miles; if, however, the nature of the merchandise calls for a speed of 25 miles an hour, we must cut our rating to 560 tons, and the cost will be about $1.03, which is the lowest possible for that speed, as any further reduction in load would increase the cost. If the speed for this load were only eight miles an hour, the cost would be the same, but at 15 miles an hour it would be about 90 cents.

The value of this diagram is at once apparent, as a superintendent can decide from it what load and speed to adopt, if both are left to his discretion, or if a definite running speed be demanded, the most economical load is at once found. If for special reasons, a reduced load must be given engines (as in order to get them over the road) then the best schedule to make for them is also immediately obtained. Of course, such a diagram must be constructed for the particular locomotives and the physical characteristics of the division, but this can be readily done by following the processes above described.

The right-hand diagram (for coal at $2 a ton) shows similar characteristics, but the lowest cost is now about 90 cents per 1,000 ton-miles; it is still at 10 miles per hour and extends from 900 to 1,200 tons bank of tender. As the train load decreases, the minimum cost requires a speed of 15 miles an hour. The effect of the price of coal is also shown at high speeds; for instance, at $1 per ton, a speed of 20 miles and a load of 500 tons will cost $1, and with $2 coal, $1.20 per 1,000 ton-miles. In general the cost is from 15 to 20 cents greater.

The central diagram shows contours of million ton-miles per month. Without exception, the maximum ton-mileage for any train load is at the highest speed, and at any speed is with the greatest load, as it obviously should be. The especial point of interest is, however, that at which the maximum results can be obtained. This is especially important in times of congested traffic. It is seen that for the conditions which we have been assuming, a load of 1,150 tons and a speed of 14 miles an hour will result in the greatest freight movement that can be brought about. It is probable that ordinarily an engine of the size selected would be given a train load of 1,430 tons. The total monthly movement per engine would be about 6,500,000 ton-miles; if the load and speed were set as above indicated, 7,000,000 ton-miles could be made.

Perhaps the most interesting feature of Fig. 11 is the close correspondence of the points of minimum cost and maximum capacity. In the case of dollar coal, the best arrangement for cost is 1,200 tons at 10 miles an hour; in the center diagram the greatest hauling capacity is found with 1,200 tons at 13 miles an hour. We also see that for the same cost, viz., 70 cents per 1,000 ton-miles, we can move either 5,000,000 ton miles per month by hauling 1,280 tons at nine miles an hour, or 6,000,000 per month by taking 1,100 tons at 12 miles an hour. In other words, by properly selecting the train load and scheduling the run, we can operate at the minimum cost and very near the maximum engine capacity, considering the total monthly movement. When the full import of

this diagram is understood, we believe that every division superintendent in the country would find it to the advantage of his company to have such a chart prepared, and that by following its suggestions, he could considerably reduce his cost of operation.

(To be continued.)

Signaling of N. Y. C. Electrical Zone.

It seems to be definitely settled, although not yet officially announced, that the contract for the interlocking and block signal work necessary to equip the Grand Central Station yard and the adjacent electrified lines of the New York Central is to be given to the General Railway Signal Company, of Buffalo. The lines which it is expected to put into operation this year aggregate about 14 miles; Grand Central Station to Mott Haven, 5 miles; Mott Haven to Wakefield, on the Harlem division, 7 miles; and Mott Haven to High Bridge, on the Hudson division, something less than two miles. The contract includes the block signals for all these lines, all four track, and the interlocking throughout, though a few of the smaller present interlocking machines may be kept in service temporarily. There are to be 62 interlocking plants, in all. The principal ones outside of the terminal yard are at Mott Haven Junction, at the Wakefield and High Bridge terminals, at the junction with the Port Morris branch at Melrose, at the junction with the New Haven road at Woodlawn, at the drawbridge over the Harlem river, and at the three or four points where there are cross-overs. All-electric interlocking will be used, and the block signaling will be the General Railway Signal Company's system. The track circuits will be worked with alternating currents. Detector bars will not be used, the locking of levers being done by track circuits.

Some details of the signaling plans for these electrified lines are given in an address recently given by Mr. Elliott, Signal Engineer of the New York Central, extracts from which will be found in another column of this issue.

Washington Correspondence.

Washington, Jan. 9.—Senator Elkins, Chairman of the Committee on Interstate Commerce, has not yet introduced his bill in the Senate, and it is not his present intention to do so. He proposes to hold it back to serve as the basis of the final compromise in the Committee. The present outlook is favorable to an agreement of a majority of the Committee on some measure along the general lines of that prepared by Senator Elkins. It is in a way a combination of the proposition to have rates made by the Interstate Commerce Commission, and the proposition of Senator Foraker to have the courts enjoin all charges in excess of what may be found to be reasonable. It can, therefore, be supported by Senator Foraker as well as by the less radical of the advocates of giving the Commission power to make rates.

The first part of the Elkins bill follows very closely the text of the Foraker bill. It proposes to provide for court injunctions against the continuance of excessive charges or discriminatory practices, but there the principle of the Foraker bill is abandoned. The new rate or practice is not to be determined by requiring the court to specifically enjoin any rate above a certain amount or requiring it to specifically indicate what shall be the practice substituted. It is proposed that the road itself shall substitute a rate or practice subject to the approval of the Interstate Commerce Commission. If the rate or practice proposed by the road is not satisfactory to the Commission the Commission is then to prescribe the rate or practice that is to become operative. In addition to the fact that a case might be carried to the supreme court of the United States in the first instance, the bill is so drawn as to permit a judicial review of an order issued by the Commission after the carrier has failed to substitute a satisfactory rate or practice. This, it is believed, will be entirely satisfactory to those who have insisted that all orders of the Commission should be subject to judicial review. The present draft of the Elkins bill, it is claimed by its advocates, ought to be satisfactory to the advocates of Commission-made rates for the reason that every rate made under it must either be satisfactory to the Commission or made by the Commission itself. It is contended, however, that the Commission would very rarely exercise the rate-making power for the reason that the carrier would generally substitute a rate that would be entirely reasonable in the light of the decision of the court condemning the rate complained of.

Three important rate bills have been introduced during the past week. In the House Representative Hepburn has presented his bill, which is almost identical in its important features with the Dolliver bill. One important point of difference is that the Hepburn bill proposes to require the Commission to make rates that will be "fairly remunerative." The purpose of this is to broaden the scope of judicial review and leave no question as to whether the court could consider whether or not the rate made by the Commission was one that would yield reasonable compensation for the service performed. The Hepburn bill will be made the basis of whatever bill is reported from the House Committee on Interstate and Foreign Commerce, and it is expected that it will be reported substantially as introduced.

Bills have been introduced in the Senate by Senator Morgan, of Alabama, and Senator Culberson, of Texas. The Morgan bill is important as showing that one of the leading authorities on constitutional law on the Democratic side is in harmony with Senator Foraker in believing that the rate-making power cannot be exercised by an administrative commission. Mr. Morgan proposes to afford no remedy for any transportation abuse except a suit for damages to be brought either by an individual or by the governor of a State on complaint from an individual that a carrier is charging excessive rates or is discriminating between individuals or places. It provides no method of fixing or enforcing a new rate for the future, the idea of Senator Morgan being that a carrier would not trifle with the courts, but, when an award for damages in excess of a certain rate had been made, would reduce its rate to the level found by the court to be just. The Culberson bill proposes to have rates made by the Commission, such rates to remain in effect for one year. It provides that a reviewing court, in considering whether a rate made by the Commission is confiscatory or is not such as would yield fair compensation, shall not consider the value of the stock of the road involved, but the actual value of the property of the carrier.

J. C. W.

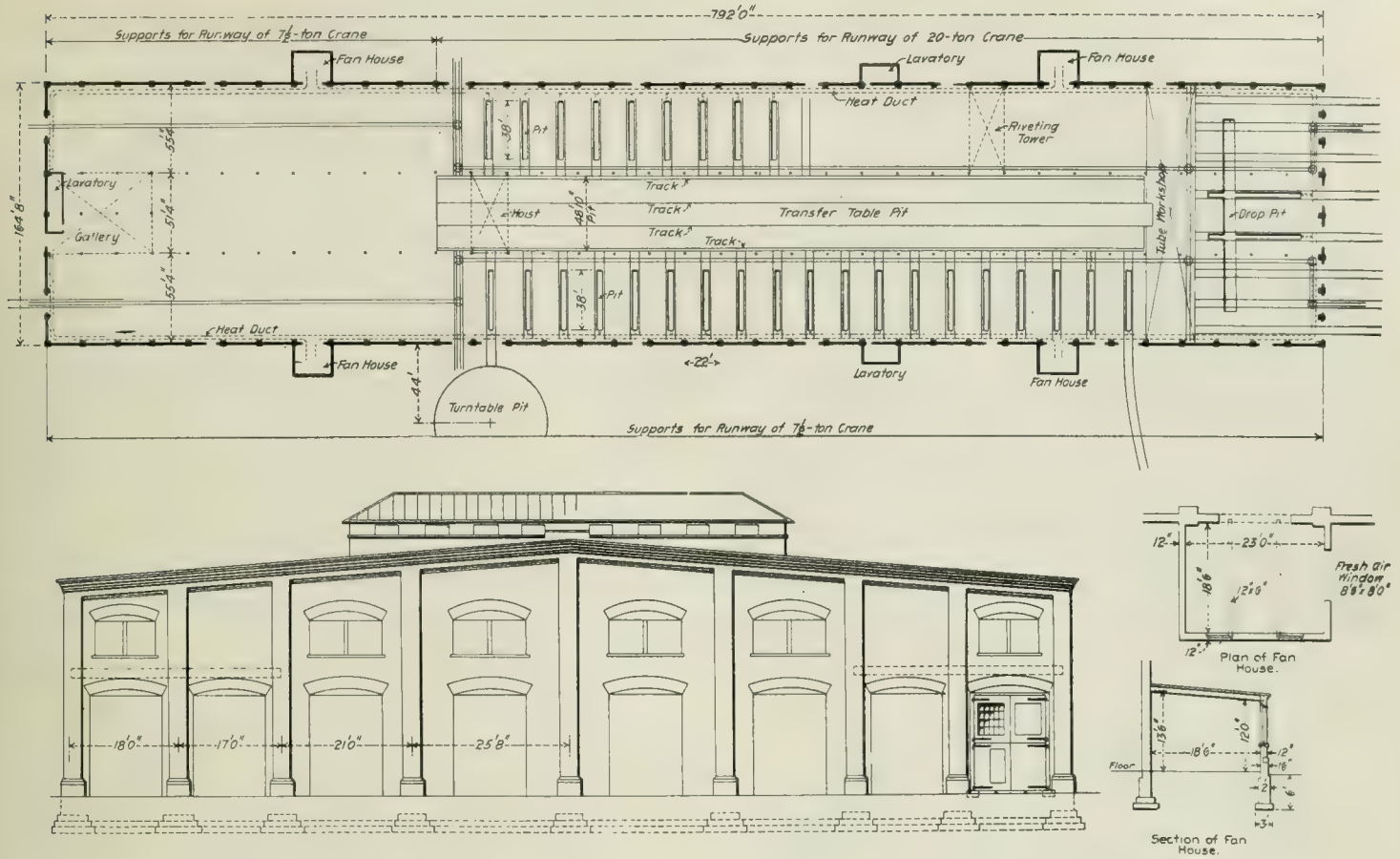
Winnipeg Shops of the Canadian Pacific.

In our issue of Dec. 29, 1905, page 612, was a brief description of the new Winnipeg shops of the Canadian Pacific. Mr. Henry Goldmark, M. Inst. C. E., who was engineer in charge of the construction of these shops, sends the following comments on the design of the locomotive, machine and erecting shop:

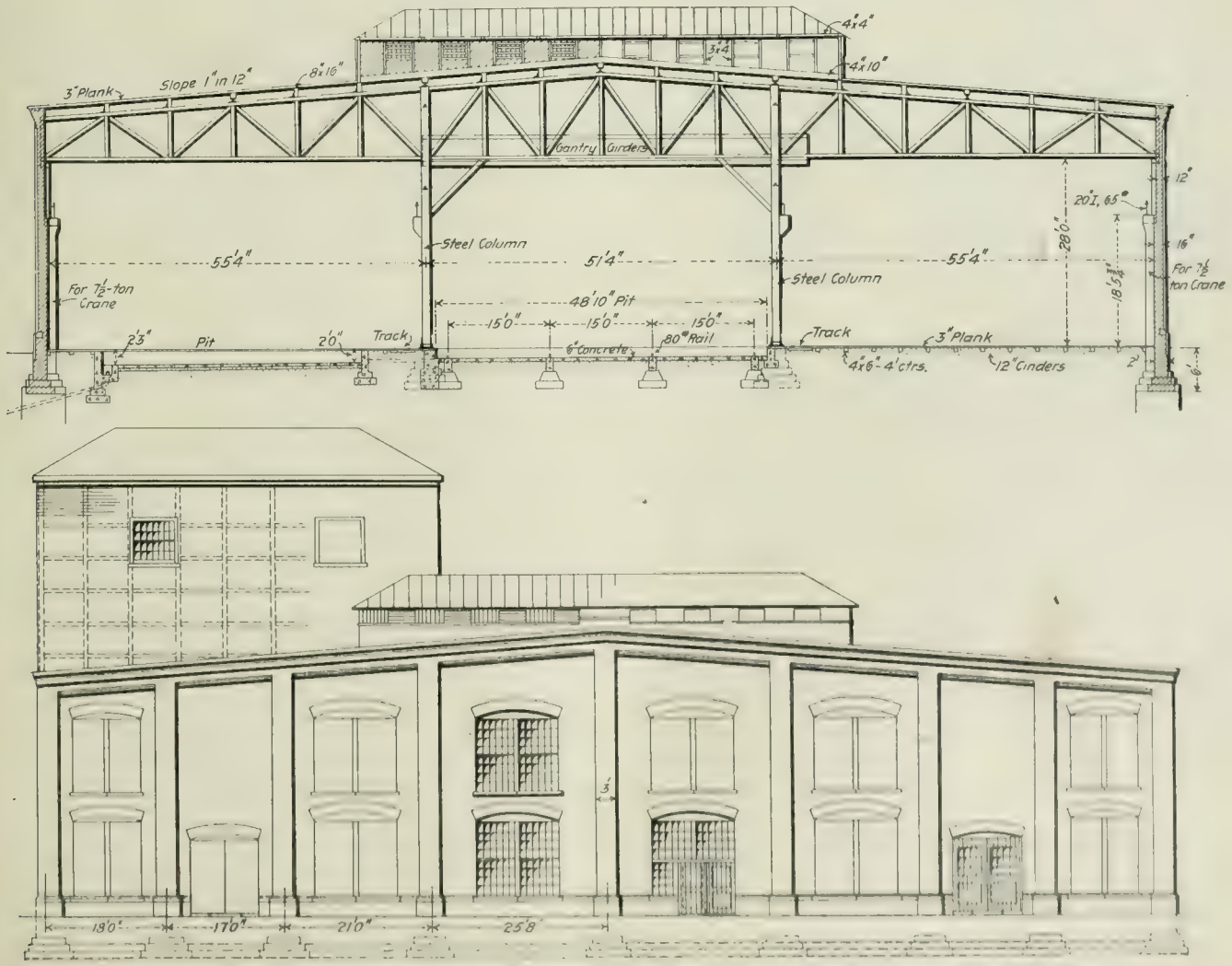
It may be of interest to point out certain features of the locomotive, machine and erecting shop at Winnipeg, in which it differs from other large shops recently built. As pointed out in the article this shop is intended solely for repair work and not for new construction, all of which is done at the new Montreal shop. The latter is of the usual longitudinal type, 1,160 ft. long, with one 80-ft. erecting bay and two machine shop bays 55 and 25 ft. wide respectively, the latter having also a gallery. The engines are handeld by two 60-ton traveling cranes of the usual pattern.

In designing the Winnipeg shops the writer believed that for the work to be done there a more economical type of shop could be built which would serve the purpose equally well. The plan proposed, which was adopted by the railroad company, is believed to meet these conditions and to be working satisfactorily in practice. The clear width of the building is the same as at Montreal, viz., 160 ft. It is, however, divided into three bays of nearly equal width, the central bay being 50 ft. and the side bays 56 ft. wide. The east end of the building, for a length of 440 ft. forms the erecting shop, while the west end for the entire width of the building is given up to the machine tools.

Owing to the very severe climate the electric transfer table is placed in the central bay between the transverse erecting pits which occupy the side bays. The transfer table is of the usual electric type, its pit being only 15 in. deep, with a finished concrete floor to facilitate passage across it. The construction of the roof is uniform for the entire length of the building so that the transfer table pit can be lengthened or shortened in the future if desired. All heavy traveling cranes are omitted, the heaviest moving crane being of 20 tons capacity; this is confined to the north bay of the erecting shop where boiler work is done. In all other parts of the side bays both in the erecting and machine shops the runways are designed to carry 10-ton cranes only. These light cranes run the whole length of the building carrying material direct from the machine shop to the pits. The wheeling and unwheeling of engines is done by a special hoist. This is placed over the central bay, that is, over the transfer table at a point opposite the track by which the engines enter the shop. Two heavy girders, 8 ft. between centers, are permanently fixed, forming a part of the structural frame of the building. On these fixed girders are two crane trolleys each of 50 tons capacity moving on heavy rails. These trolleys are in every way similar to the usual type of crane trolley, but their movement is controlled from the main floor. They are each fitted with one 30-h.p. and one 5-h.p., 3-phase electric motors for lifting and traversing respectively. The position of this hoist over the transfer table is in practice extremely convenient, as the engines remain suspended while the wheels are taken away on the transfer table and shop trucks are similarly brought to take their place. The economy in this style of shop is considerable. The roof construction becomes light and can be built either of timber or steel while where the weight and shock of heavy traveling cranes have to be supported very heavy structural work is required throughout the building. In many shops lately built the structural steel alone has cost over $1 per sq. ft. of floor area, or about half



East End Elevation and General Plan of Locomotive Shop—Winnipeg Shops, Canadian Pacific.



West End Elevation and Cross-Section of Locomotive Shop—Winnipeg Shops, Canadian Pacific.

the total cost of the building. In addition, the moving cranes are much more expensive than the hoist with fixed girders, as above described.

At Winnipeg, even after allowing for the space occupied by the transfer table under the shop roof, the saving was very appreciable. The plan and cross section herewith shown will make the general arrangement clear.

Lehigh Valley Hospital Car.

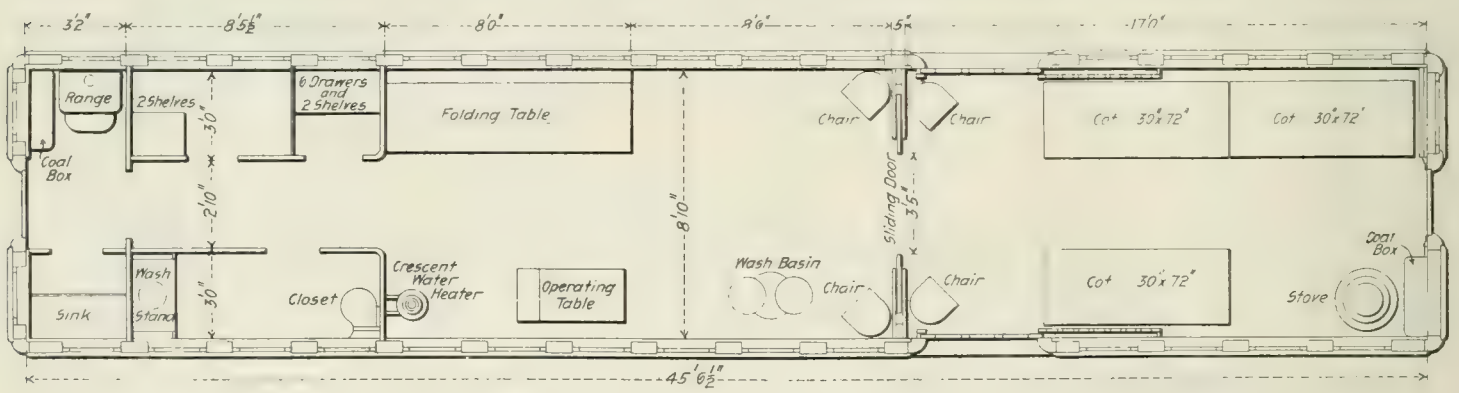
At Packerton, Lehighton and vicinity several thousand men are employed by the Lehigh Valley Railroad in the shops and yards, and as the nearest hospitals are at Allentown and Bethlehem, the railroad company has provided a hospital car for the prompt treatment of injured employees, which is located at Lehighton, where physicians can be had promptly and where the wreck train is also held. Ordinarily this car is used for the treatment of injuries to employees of the Packerton yards and vicinity, which are of such a nature that while they need surgical attention, they do not require the movement of the patient to a hospital. In case of serious injury, requiring movement to a hospital, a preparatory treatment is given before sending the patient. If the injury is serious after the preparatory treatment is given, the patient is removed from the hospital car and taken to the hospital by passenger train. If, however, the injury is sustained at a time when no passenger trains are due, and the injury is of such a nature that it is advisable to move the patient to a hospital at once, an engine is attached to the hospital car and the patient moved in that manner. In cases of accident on the road requiring the service of the hospital car, it is moved in connection with the wreck train.

The car has the following dimensions:

Length over sills	46 ft. 7 in.
Width over sills	9 " 5 "
Distance, center of bolster to end of sill	5 " 0 "
Width over all at eaves	10 " 0 "
Height, top of rail to under side of sills	3 " 9 "
Extreme length over platforms	52 " 7 "
Height, top of rail to top of platforms	4 " 2 "
Type of trucks	4 wheel
Wheel base of trucks	7 ft.
Body bolsters	Wood.
Heated	By stoves; except in train, then heated by steam.
Lighted	With oil lamps.
Type of platforms	Miller
Weight of car complete	51,600 lbs

The inside finish of the car is of maple and walnut with canvas head lining. It is divided into two compartments, one of which contains a stove, two chairs, three cots, springs, mattresses, sheets, pillows and blankets complete. This is used as a reception room for the injured before and after receiving medical attention. The second compartment is used as an operating room and contains a large drop table, a stand with basins, two chairs, one enameled iron operating table, a Crescent water heater, a large, round, shallow, galvanized iron receptacle on the floor for soiled clothing, dressings and refuse.

At one end of this compartment are closets, one of which contains a sink, buckets, basins and tin utensils. Another is a toilet and dressing room with lavatory and urinal. Another large closet contains extra tables, bedding, clothing, underwear, towels, splints and crutches. Two other closets contain surgical dressings, etc. Another closet is provided for the more delicate instruments and appliances. This is fitted with drawers which contain tin boxes in which are surgical dressings for immediate use. The surgical appliances carried in the car are very complete, consisting of crutches, splints, buckets, basins, stretchers, a sterilizer for instruments, hot water bottles of various kinds, bed pans, urinals, rubber blankets, pus basins, hypodermic syringes, tournequets and a full large operating case. Surgical dressings, cotton, ordinary gauze of all kinds, bandages, muslin gauze, plaster of parts, pins, ligatures, toweling, medicines, ether, chloroform, soda bicarbonate, salt, bichloride tablets, hypodermic tablets, emollients for burns, aromatic spirits of ammonia, carbolic acid, dusting powders, green soap, etc., are carried on the car. The car has been in service about five years.



Floor Plan of Lehigh Valley Hospital Car.

Westinghouse Single-Phase Equipment for the Sarnia Tunnel.

The St. Clair Tunnel Company has awarded the contract to the Westinghouse Electric & Manufacturing Company for the complete electrical equipment of the single-phase alternating current system to operate all freight and passenger trains through the tunnel under the St. Clair river above Detroit, which connects the American and Canadian Divisions of the Grand Trunk Railway. The terminals of the tunnel are at Port Huron, Mich., and Sarnia, Ont., and the tunnel proper is 6,032 ft. long. It is single tracked but double-track approaches lead up to within 300 ft. of the portals at each end. The total distance to be electrically equipped from terminal to terminal is 19,348 ft.

At the present time passenger and freight trains arriving from either direction are hauled through the tunnel by steam locomotives. Nearly all freight trains are divided into two or more sections before entering the tunnel as they are too heavy for one locomotive to handle up the 2 per cent. grades at each end. It is expected that the use of electric locomotives will greatly relieve the congestion existing at the terminals as their greater hauling capacity and flexibility will reduce the division of trains to a minimum. The danger from suffocation from gases in the tunnel will also be done away with entirely. It will be remembered that a little over a year ago six trainmen were suffocated in the tunnel as a result of a train of 17 loaded coal cars breaking in two on the heavy grade and stalling.

The plans and specifications for the electrification project were prepared by Mr. Bion J. Arnold, Consulting Engineer of Chicago, who has been one of the pioneers in single-phase electric traction in the United States, and who is a member of the New York Central Electric Commission. The installation of the apparatus will be done under Mr. Arnold's supervision.

The equipment includes a complete power station containing boilers, stokers, coal and ash handling machinery, feed pumps, feed water heaters, condensers, water supply, fire protection and heating systems, piping, electric crane, steam turbine generating units, engine-driven exciting unit, motor-driven exciting unit, switchboard, feeder and distributing system, bridge and pole lines for catenary trolley construction, overhead work, bonding, transformers for power and light, light and power distributing systems, lightning protective apparatus, arc and incandescent lamps, roundhouse motors, motor driven pumps, drainage and sewer systems for buildings and yards, and electric locomotives.

Six locomotive units will be furnished equipped with Westinghouse series-wound, single-phase motors. Each unit will exert a drawbar pull of 25,000 lbs. on a 2 per cent. grade at a speed of 10 miles an hour. The locomotive units may be operated from either end and two or more may be coupled together and controlled in multiple from the cab of any unit so that the mechanical strength of the couplings between cars is the only limit to the size of train which may be taken through the tunnel.

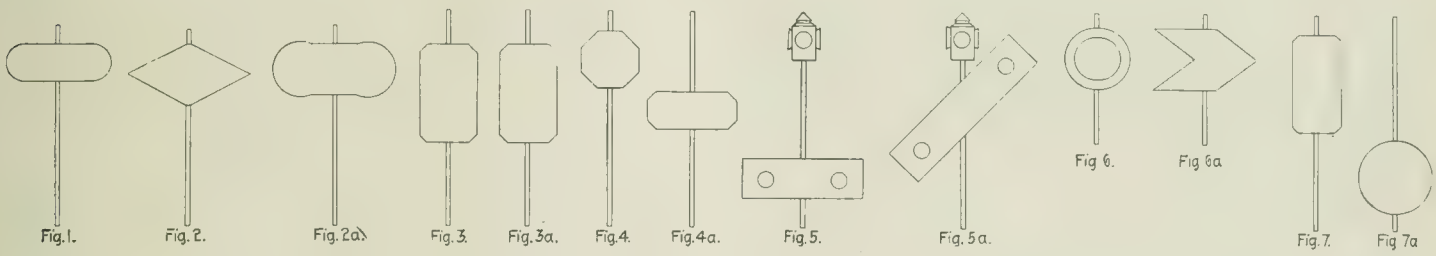
The locomotives are of the rigid frame type, with driving axle boxes and draft gear mounted on the same frame. Each unit will have three pairs of 62-in. driving wheels with a motor on each axle connected with a gear reduction of 18 to 95. It will weigh approximately 62 tons, all of which is on the driving wheels. Equalizer beams similar to those used in standard steam locomotive practice will distribute the weight on the six drivers. The frames will be made of cast-steel and will be placed outside the wheels. The locomotives will be equipped with the Westinghouse friction draft gear. The power equipment of each unit consists of three

250-h.p., single-phase, series-wound motors of the same general type as those recently adopted by the New York, New Haven & Hartford for its terminal operations in New York. Pneumatically operated trolleys of the pantagraph type will collect the current from the overhead trolley line outside the tunnel.

Alternating current at 3,000 volts, 25 cycles, will be delivered to the locomotives. Outside the tunnel the current will be fed through a No. 0000 grooved trolley wire and pantagraph trolley to the locomotive equipment. The trolley wire will be hung by a catenary suspension from steel towers which span the track or from bracket arms mounted on lattice-work steel poles.

Shapes of Switch Targets.*

Replies to a circular sent to 60 different roads in 1904 have elicited information on the practice of 50 of these roads in 10 different particulars as indicated below.† After summarizing the information received, the Central of New Jersey adopted a switch target of the shape shown in Fig. 1, the stand being of the Ramapo pattern. This is the target as it appears when the switch is set for the side track. When it is set for the main line no target appears. This standard is the same as that which has been in use on the Philadelphia & Reading for some years.



Standard Switch Targets of Central of New Jersey and Six Other Roads.

Question No. 1. On double track are targets and lamps used on both facing and trailing point switches? Nearly all of the roads which have much double track answer yes. The Delaware & Hudson says no, except important trailing switches; on the Pennsylvania Lines West of Pittsburg they are used for facing switches only. The Atchison and the Southern Pacific are among those answering no.

Question 2. Do you use both safety and danger blades on the target? Nearly all roads answer yes; those answering no are the Chicago & N.-W.; Chicago Great Western; Chicago, M. & St. P.; D. & H.; Great Northern; Grand Trunk; Michigan Central; Northern Pacific; Phila. & Reading; Southern Pacific.

Question 3. Are the safety and the danger blades alike? Nearly all of the roads answer no.

Question 4. The answers to this question indicate that on nearly all of the roads the position of the switch is indicated by the shape as well as by the color of the target blade.

Question 5. The replies show that eight roads use switch targets in the form of a semaphore blade. These are the Chicago & Alton; Chicago & E. I.; C., M. & St. P.; Cincinnati, N. O. & T. P.; D. & H.; Lake Shore & M. S.; Lehigh Valley (on some facing switches); Missouri, Kansas & Texas (experimentally); Pennsylvania [west of Pittsburg]; Seaboard Air Line.

Question 6. Do you use a distant signal interlocked with switch-stand of facing point switch? Thirty-one roads use this arrangement, but do not say to what extent.

Question 7. Replies indicate that high tripod stands are used on the Baltimore & Ohio; Buffalo, Rochester & P.; Canadian Pacific; Central of Georgia; Chesapeake & Ohio; Chicago & Alton; C. & N.-W.; C. G. W.; C., M. & St. P.; C., R. I. & Pacific; Cincinnati, H. & D.; C., N. O. & T. P.; C., C. C. & St. L.; D. & H.; Illinois Central (in some places); Louisville & Nashville (in special cases); Michigan Central (where necessary); M., K. & T.; Missouri Pacific (in special cases); New York Central ("but not generally"); Pennsylvania Lines (replacing with semaphores); Southern Railway.

Questions 8 and 9. All of the roads replying use a lamp to indicate safety at night; 28 use white and 21 green.

Question 10. Do you consider the use of a white light as a fixed signal to indicate safety advisable? Eleven roads answer in the affirmative, four are non-committal, and one has the subject under consideration;‡ but 34 believe that the use of white is not advisable. These are the B. & O.; B. & L. E.; B., R. & P.; Burlington & M. R.; Canadian Pacific; Central of Ga.; Ches. & O.; C. & A.; C. & E. I.; C. & N.-W.; C., B. & Q.; C. G. W.; C., R. I. & P.; C., H. & D.; C., N. O. & T. P.; C., C., C. & St. L.; D. & H.; D., L. & W.; G., C. & S. F.; G., H. & S. A.; G. N.; I. C.; L. V.; M., K. & T.; M. P.; N. Y., N. H. & H.; N. P.; O. S. L.; P. M.; P. & R.; S. P.; S. L. & S. F.; U. P.; Wabash.

A number of roads with their replies sent drawings of their standard switch targets, and some of these we copy.

Fig. 1 is the standard adopted by the Central of New Jersey. The top of the target is 6 ft. 8½ in. from the surface of the ties. The target is 9 in. wide; extreme length 24 in.

Fig. 2 (white) and 2*a* (red) show the standard of the Bessemer & Lake Erie; height of top of blade 7 ft.; length of blade, 30 in.

Fig. 3 (white) and 3*a* (red) show the Delaware, Lackawanna & Western standard for facing points; height of top of spindle 6 ft. 11 in.; target 14 in. x 24 in.

Fig. 4 (white) and 4*a* (red) illustrate the target for trailing switches on the D., L. & W.; height of top of spindles 8 ft. 1½ in.

Fig. 5 is the red target of the C., C., C. & St. L., 10 in. x 2 ft. 6 in.; the white target (5a) is 10 in. x 3 ft. 6 in. The top of the red target is 16 ft. 6 in. high.

The C., N. O. & T. P. standard is similar to these, except that the white target has a black border and heavy black rings, while the red target has a white border and heavy white rings.

Fig. 6 (N. Y., N. H. & H.) shows for safety a green center with a white border. The red target (6*a*) measures 15 in. vertically. The height from the base of rail is not given; but it is about 7 ft.

Fig. 7, the Union Pacific white target is 12 in. x 24 in., and the top of the spindle is 7 ft. 5 in. high. Fig. 7*a* is the U. P. red target.

*Abstract of a paper on "Target and Lamp Signals Applied to Switches," by J. O. Osgood, Chief Engineer of the Central of New Jersey; printed in the November Bulletin of the American Railway Engineering & Maintenance of Way Association.

†Prominent roads which do not appear in the list are the Atlantic Coast Line, the Boston & Maine, the Erie, and the Pennsylvania.

‡The road which had the subject under consideration was the New York Central; but it has recently been announced that that company is to adopt green for all clear. EDITOR.

The Past Year from an Interurban Standpoint.

The following review of the year 1905 from the interurban railway standpoint is taken from the *Interurban Railway Journal* of December 30 last:

During the year just closing there has been a marked improvement in methods of financing and construction of electric lines. With some of the early promoters it was more a matter of how cheaply a road could be constructed and how largely it could be bonded, than of providing for future development. Some lines were built along highways, using jointly county bridges cheaply constructed. The result was that an increase of traffic demanded heavier and better equipment and some roads were unable to operate because of light track, inadequate strength of bridges, and lack of funds to extend power stations. The interest on excessive bond and stock issues absorbed the revenues to such an extent that nothing was left to provide for increased facilities. The roads recently built have avoided these difficulties by more conservative financing and by being equipped at the outset for the heavy traffic that every well located electric line develops. Many electric lines that were built a few years ago, costing from $15,000 to $20,000 per mile, have a bond issue of from $30,000 to $38,000 per mile, in addition to stock allotments. At the present time there is a tendency to reduce the bonding of electric roads to three-fourths of their cost, requiring the promoters to furnish the right of way, franchises, preliminary expenses, and 25 per cent. of the cost of the road from the sale of stock securities, thus reducing the bond issue to the basis of real estate loans having a 25 per cent margin. This will increase the value of interurban securities and tend to repress the promotion of "wild cat" lines.

The greatest amount of electric railway building during 1905 has been in the central western states of Ohio, Indiana, Michigan and Illinois, where numerous towns and the favorable topography of the country invite such enterprises. There has also been marked activity in some other states. In California, which is a land of magnificent distances, some very long lines have been projected with more reference to terminals than to intervening towns. The same is true generally of the new and less populous states of the north

west. Readers of this journal must have been struck by the wide field covered by announcements of new interurban lines that are being built or surveyed. The last issue of this paper contained notices of such enterprises in Ohio, Michigan, Indiana, Illinois, Texas, California, Wisconsin, Tennessee, Pennsylvania, Kentucky, Delaware, South Carolina, Oregon, New York, Iowa, South Dakota, Maine, Massachusetts, Colorado, Nebraska, Georgia, Washington and Alabama, and the territories of New Mexico and Oklahoma. In every one of these states and territories from two or three to 12 or 15 new electric enterprises were reported, and this in only one issue.

The year 1905 has witnessed some notable improvements in the facilities of interurban lines. The rapid growth of the system in the central west has brought about new conditions of long distance travel, interchangeable mileage, sleeping cars, dining cars, and in the handling of local freight. Sleepers for interurbans are one of the latest innovations and are destined to become very popular in the future. In some cases where the run is not yet long enough to justify sleepers, parlor cars have been put on temporarily until long distance connections can be made.

Another progressive step of the present year has been the formation of plans for through interurban traffic, not only by interchangeable mileage on interurbans, but also in co-operation with steam roads. Some interurban lines have made traffic arrangements with certain steam roads whereby tickets may be sold at stations on the interurbans acceptable on steam lines to cities reached by the steam roads. This arrangement has worked satisfactorily to both parties and is likely to spread. It is one of the progressive steps of 1905. On the whole, the year has been one of great activity in electric interurban business, and the prospect is that 1906 will show still further development.

The new lines constructed and extensions made during 1905 make it possible to travel by trolley from western New York and Pennsylvania to the Mississippi river and beyond, and the closing of a gap in central New York will enable one to make a continuous trolley trip from Maine to Missouri. There are far-sighted electric railway men who believe the day is not distant when there will be continuous trolley connection between Portland, Maine, and Portland, Oregon, perhaps not by a direct route, but continuous.

There is a continuous trolley connection from Akron, Ohio, to Kalamazoo, Mich., 305 miles, and the connections are such that the distance can be covered by electric railway in less time than by steam, and at about one-third less cost. A trip from Indianapolis, Ind., to Zanesville, Ohio, 250 miles, can be made in one hour less time by electricity than by steam. All these long line connections have been made during the past year.

There is reason to believe that interurban interests have been injured and retarded by the attempted promotion of "fake" schemes. This has been the fate of other new business enterprises. Scores of steam railroad companies were organized that never built a mile of road, and it could hardly be expected that the electric interurban business would escape the same experience. It is a case in which the innocent must suffer for the faults of the guilty—that is, meritorious and legitimate enterprises for "wild cat" and illegitimate schemes. This cannot be altogether avoided, but at the present time there is an obvious tendency toward a more solid and settled order of things.

Among the distinctive features of 1905 must be mentioned the increasing popularity of interurban securities for investment. The general prosperity of the country causes a steady accumulation of wealth and of investment capital. This, in turn, causes a demand for safe securities based on properties of present and prospective value. Capital is proverbially conservative and sagacious and knows a good thing when it sees it. Reports from all the money centers of the country show an increasing demand for interurban securities for investment. On all the stock boards, where they are listed, the quotations indicate that the men who have money and who know how to invest it, regard this class of securities as among the best offered. There is no mistaking the meaning of the steady trend of capital in this direction. It means that capitalists recognize the solid basis and future growth of the interurban business.

A recent development in the business is the building of electric railway lines by steam companies. We do not refer to the electrification of former steam lines, but to the construction by steam companies of new electric roads between cities and towns which are reached by the steam lines, thus paralleling themselves with electric interurban lines. Several lines of this kind have been constructed or are proposed by prominent steam railroad companies of the east. This means, first, that they recognize the practical value of electricity as a motive power, and, second, that they propose to anticipate the construction of electric interurban lines by others by building them themselves. The construction of these parallel electric lines will undoubtedly draw off considerable local passenger traffic from the main lines, but as the electric lines will be owned by the parent company, this will not matter. Steam railroads depend mainly on freight traffic. The interurban trolley can live and thrive with only its passenger service as a source of profit, while to many steam railroads the passenger service is a source of actual loss. For a sum that it will cost a steam road to run a train every hour, the electric line can send out a car, if need be, every five minutes. Moreover, the trolley line has its terminals wherever a passenger wishes to alight, whereas many of the trains on the leading steam roads run through and the local trains stop only at regular stations, usually several miles apart. It is an open question whether the loss of local traffic is not a benefit to steam roads by affording them greater opportunity for the handling of freight and through traffic. We are of the opinion that steam railroad companies traversing populous sections of the country, show business shrewdness in paralleling portions of their route with electric lines, and they also virtually admit the superiority of electric lines for local and interurban traffic. The fact that they have entered on this policy should cause private capitalists, who contemplate building such lines, to lose no time, lest they be anticipated and shut out. If there is money for steam railroad companies in building such lines, there is money for those who would build them as independent lines.

Annual Report of the Michigan Railroad Commissioner.

The year just closed has been a prosperous one for the railroad companies doing business in the State of Michigan, the volume of business done being the greatest in their history. Although there has at times been some difficulty in furnishing a sufficient number of cars to carry the traffic offered, the business generally has been handled to the apparent satisfaction of shippers and the public, and but few complaints have been received. All complaints have been carefully investigated, and it has generally been found that the railroad companies were putting forth every effort to satisfy their patrons, and to handle as expeditiously as possible all traffic presented. Two companies have gone into the hands of receivers—the Pontiac, Oxford & Northern, running from Pontiac to Caseville, aboue 100 miles, whose troubles appear to have been caused by disagreement among its stockholders, and the Pere Marquette, serving a large portion of the state. This action has not, in either case, interfered materially with the business of the companies. The service rendered is and has been quite satisfactory, and material and important improvements have been and are being made by both companies.

The people of the State are much interested in the probable ultimate outcome of the receivership of the Pere Marquette, and it is sincerely to be hoped that when the receivership shall have been terminated the ownership may pass to those who will be interested in its development and improvement, and that such ownership may be of a permanent, lasting character, and that the road may not thereafter be hawked and peddled about for speculative purposes as has been done during the past four years.

There is some sentiment that the issuance of all railroad stocks and bonds should be subject to the scrutiny and approval of state authority. It might be well to consider the advisability of making restrictions upon new companies organized under our laws by requiring them to do a certain amount of work upon their proposed lines within a specified time, in order to hold the rights and privileges granted them by their articles of incorporation. The necessity for this has been suggested by a case recently decided in the Monroe circuit, where it was claimed that a railroad company was organized and incorporated with a merely nominal amount of capital stock for the express purpose of preventing the condemnation of certain property by another company that is honestly striving, in good faith, to construct a railroad line.

Notwithstanding the great amount of business done, but few accidents have been reported involving loss of life or injury to persons.

Some of the recommendations contained in the last annual report of this department were enacted into law by the Legislature, a bill having been passed fixing penalties for the construction of a crossing of two railroad lines without the approval of the Board of Railroad Crossings, and another providing similar penalties for the building of a crossing of an electric and steam road before its approval by the Commissioner of Railroads.

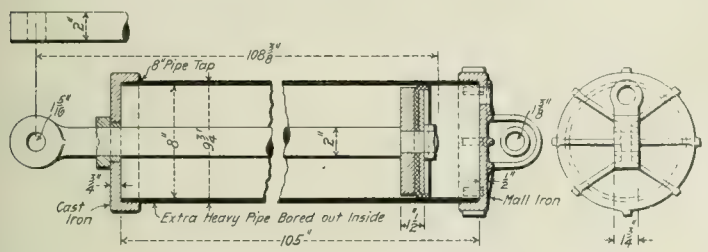
An amendment was also made to the law providing for the exercise of police power over electric railways, authorizing the Commissioner of Railroads to order fencing along the line of such roads whenever in his judgment it should be considered necessary, and also to order the necessary farm crossings over electric railway tracks.

While there has been much discussion throughout the country during the past year upon the subject of freight rates, there has been but little, if any, agitation apparent in this state, and but few complaints regarding the rates charged.

It is unfortunate that there is no law requiring electric railway companies to make official reports to this department, in order that definite information may be available regarding them. A number of new lines are in course of construction, a great many of the existing roads have built extensions during the year, nearly if not quite all have made important improvements, and all seem to be doing a successful and prosperous business.

Coal Pusher for Locomotive Tenders.

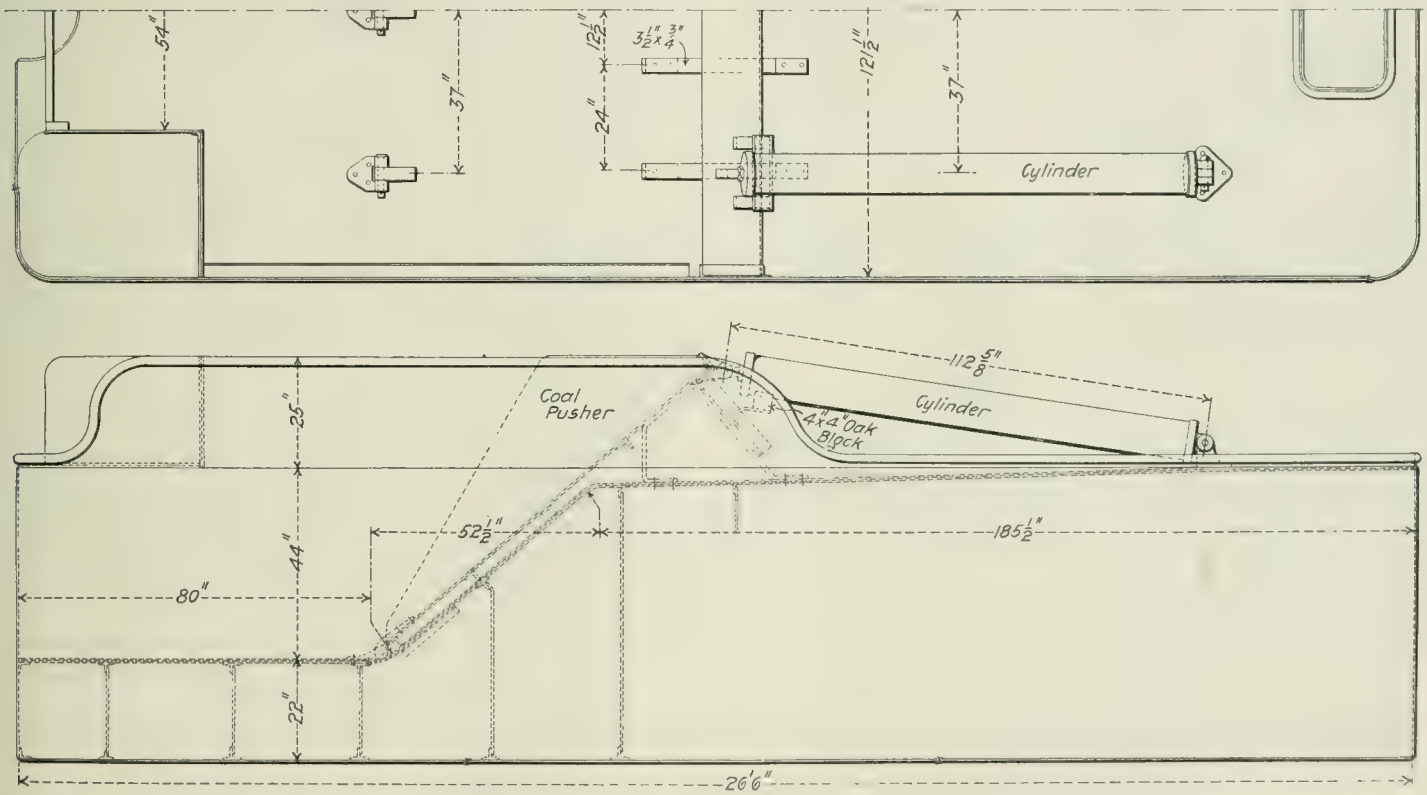
The accompanying illustrations show a recent labor saving device applied to the tenders of large locomotives. It is what is known as a coal pusher and is located at the rear end of the tank coal space, for the purpose of pushing the coal toward the front end as often as the fireman needs a fresh supply. The device was first applied to the tank of engine No. 924 on the Atchison, Topeka & Santa Fe in August, 1904. Since that time 27 locomotives built by the company at its own shops have been equipped, and on a recent order completed at the Baldwin Locomotive Works 20 more were put on. These locomotives haul freight over the long western divisions where it is necessary to carry a large supply of coal, and the pusher has proved to be of considerable assistance to the fireman.



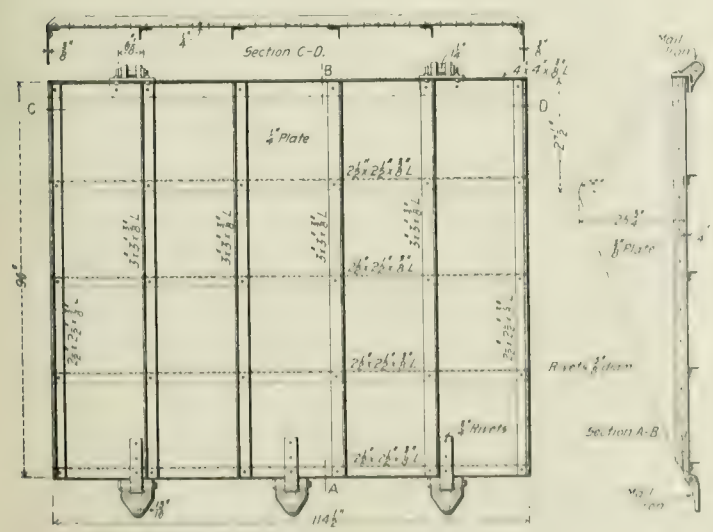
Air Cylinder for Raising Apron.

The apparatus consists of an apron made of ¼-in. steel plate, which in its regular position forms the back end of the coal space being inclined at an angle of 45 deg. with the floor. The lower part of the apron is attached to the floor by three pins which permit it to swing about them as a center. Fastened to the top of the plate and to the rear are two cast-iron lugs, which are in turn attached to the piston rods of two long 8-in. cylinders. These cylinders are anchored at the back end in such a way as to permit a slight turning motion as the plate is swung ahead.

When the fireman needs coal pushed to the front, instead of climbing to the top of the pile and shoveling it down, he turns a small valve and admits air enough to push the apron and coal the required distance forward. The tank shown has a water capacity of 8,500 gallons, and a coal capacity of 10 tons.



General Arrangement of Device for Pushing Coal Forward in Locomotive Tender.



Details of Movable Apron.

The St. Paul's Pacific Extension.

The *Wall Street Journal* quotes Capt. W. E. Pedrick, of New York City, President of the Western Anthracite Coal & Coke Company, as follows in regard to the route of the Chicago, Milwaukee & St. Paul's new line to the Pacific:

The route from Evarts, South Dakota, northwesterly into Custer County, Montana, will have no difficult grades, but a worthless, non-producing country to enter. Unless the line parallels the Northern Pacific up the north bank of the Yellowstone and Gallatin rivers there will be more expensive construction and a poorer country to traverse for local traffic except for the spring and fall shipments of live stock, until Deer Lodge valley, the prettiest valley in the state, is reached and the Butte region with its mineral tonnage. From there on, heavier grades and construction work are necessary across the Bitter Root range, where St. Paul engineers and Northern Pacific engineers are now battling with each other up to their necks in snow for precedence over Lolo Pass. From the Pass the St. Paul surveys run down a fork of the Clearwater river and to the western line of Idaho in the neighborhood of Lewiston, whence a spur north to Spokane is probable. Approximating the foregoing route, articles of incorporation of the Chicago, Milwaukee & St. Paul Railway Co. in Montana, were placed on record last week in Silver Bow County defining the route through Custer County on the east, and thence through Rosebud, Carbon, Yellowstone, Fergus, Broadwater, Jefferson, Madison, Silver Bow, Deer Lodge, Powell, Granite and Ravalli, the border counties of Montana, on the west. The location of the west end in Montana will doubtless be on the Snake river near Lewiston, Idaho, thence from a point near Lewiston, Idaho, west to Wallula, thence northwest to North Yakima, thence to Seattle, a total distance from Evarts of 1,558 miles. This estimate of distance over government land based on government township scale plus 25 per cent for development, is nearly correct, as is proven by both the Northern Pacific from St. Paul to Seattle, and the Union Pacific from Council Bluffs to the old 1,000-mile tree near Ogden. There are no wheat fields

as in the eastern Dakotas, and the former immense yields to the acre which gave such impetus to the building of the Northern Pacific, have now dwindled to that of Ohio, or perhaps less. From Spokane west, a rolling prairie country has the appearance of the semi-arid lands of the states west of the 100th meridian, for instance, near Pierre, S. Dak.; North Platte, Neb.; Garden City, Kan., and Washburn, Texas. But in the state of Washington this semi-arid land yields fine crops of wheat and furnishes a million bushels for shipment at one station, though mixed farming would fare as badly for lack of rainfall as in the Dakotas west of Evarts. It is the same south of this parallel from Dakota to the Rio Grande border in Mexico. Therefore there is not much to expect from local traffic until new precious metal mines are discovered, which is not unlikely in western Montana, as has happened recently in Nevada. Before Pasco is reached the opportunities presented through plenty of water for irrigation for a rich agricultural region are unsurpassed. The entire Yakima Valley has special possibilities. The altitude is but a thousand feet, more arid than Colorado, rainfall often but six inches, a delightful climate with energetic farmers pouring in every year, buying untouched soil at high prices, and paying for it from two years' crops. It is only 40 miles from this arid climate west to the peaks of the Cascade Range where there is rainfall in abundance and the vapors from the Pacific ocean hug but do not cross the mountain passes. Great veins of anthracite coal appear south of Mt. Ranier after crossing Cowlitz Pass. The St. Paul can, as the Northern Pacific does, continue to Seattle from Tacoma, or reach Seattle by branching off on the Natches river around the east side of Mount Ranier. It is well enough to note what has been done this year as to terminals for possible transcontinental lines: First, there is the Pacific Railway, which filed corporation papers in December. Its route is from Seattle southeasterly through North Yakima and Yakima Valley to Wallula, Washington, on the Columbia and touching the Oregon Short Line. This would serve for the northern route of the Chicago, Milwaukee & St. Paul. Next, we have the Spokane & Columbia River Railway & Navigation Company, its route from Spokane through Spokane, Whitman, Adams and Franklin Counties to Wallula. This would also answer the St. Paul for its Spokane connection. Then there is the North Coast Railway, starting from the Yakima river on the north side of the Columbia near Kiona, Wash., on the Northern Pacific, thence up the Yakima through North Yakima and up the Natches to the foothills of the Cascade Range, over Cowlitz Pass through the coal fields and down the Carleton and Cowlitz rivers on the west slope. Three surveying parties have performed diligent work there this season. They have halted at the anthracite coal fields, where they can look westerly and see the smoke of the locomotives at Ashford, the terminal of the Tacoma Eastern, and its paying lumber and coal business. The purchase three months ago of $700,000 wharfage and tidewater flatlands at Tacoma, in addition to the transfer of 640 acres more last week, for the former of which the St. Paul gets the credit by rumor, and for the latter Mr. Harriman, and the 20 miles of completed grading of what is known locally as the "Donald" road from North Yakima up the Natches, is the record of work done this season.

Capt. Pedrick's estimate of 1,558 miles as the length of the new St. Paul line from Evarts to Seattle, added to the 796 miles from Chicago to Evarts over existing St. Paul lines via Milwaukee and La Crosse, Wis., and Hastings, Minn., would make the distance from Chicago to Seattle 2,354 miles as against 2,260 miles from Chicago to Seattle by the Burlington and Great Northern, and 2,344 miles by the Burlington and Northern Pacific.

New Interurban Connecting Link.

The two most important groups of electric interurban lines in the country—the one group composed of the roads along the southern shore of Lake Erie and in eastern Michigan, connecting the cities of Erie, Pa.; Cleveland and Toledo, Ohio, and Detroit, Bay City and Kalamazoo, Mich., and the other of the lines about Columbus, Dayton and Cincinnati, Ohio, and Indianapolis and Fort Wayne, Ind., although not far distant from each other at several points, have until recently had no actual physical connection. On December 30 last, a 30-mile connecting link from Findlay, Ohio, on the north, to Lima on the south was completed and put in operation. This brings into connection 70 electric interurban roads with a mileage of over 3,700 miles, which figure is exclusive of more than 1,000 miles of city lines. Of these 78 roads, 48, with a mileage of 2,261 miles, are in Ohio; 11, with a mileage of 888 miles, in Indiana; eight, with 482 miles of line, in Michigan, and three, with 75 miles, in Pennsylvania. By using the new connection, it is now possible to travel by electric railroad between the extreme points of Titusville, Pa., southeast of Erie, to Crawfordsville or Columbus, Ind., respectively northwest and south of Indianapolis, a run of something over 600 miles. A journey from Bay City, Mich., south to Cincinnati, nearly 400 miles, also becomes possible, this by even more direct line. Further extensions and rounding out of the present territory of interurban lines in the central west is going on rapidly.

Railway Signal Association.

The January meeting of this Association was held at the Grand Union Hotel, New York City, on Tuesday, the 9th, President C. H. Morrison (Erie) in the chair. Some 60 members were present. About 30 new members were elected. The change in the constitution, proposed at the last meeting, was adopted, and the Association now has two Vice-Presidents, Mr. A. H. Rudd (P. R. R.) being elected at this meeting. The meeting also adopted the proposed change in the by-laws, Article 6, under which associate members henceforth will have only those privileges which are accorded to honorary members. Mr. G. M. Basford, now with the American Locomotive Company, and who was the originator of the Railway Signaling Club (which in 1903 became the Railway Signal Association) was elected an honorary member of the Association.

The Executive Committee reported that the digest of the proceedings for the years 1895-1905, inclusive, would be published in two volumes, aggregating some 1,400 pages. These will be issued in about three months.

The first paper on the programme was the report of Committee No. 4, I. S. Raymer, Chairman, on storage batteries. Mr. Raymer reviewed what had been done by committees on this subject during the past four years, and, continuing, said:

"Leaving out at the present time the question of cost, on account of the difficulty in arriving at a fair basis of calculation, the committee is of the opinion that, from the standpoint of service rendered, storage batteries are preferable for block signal work, on account of their uniform and continuous supply of current as compared to the weakening or failing of caustic soda batteries, due to the approach of their exhaustion, and to the interruption in signal operation while renewals are being made. On the P. C. C. & St. L. the 'primary storage' method of charging is in use. Six cells of storage battery are used at a signal location, a set of eighteen gravity cells are connected in series; positive of gravity is connected to positive of storage, and negative of gravity to negative of storage. The e. m. f. of the gravity is great enough to overcome the counter e. m. f. of the storage. While the signals are going toward the proceed position the motors receive current from the storage cells, but when signals are standing in either proceed or stop current is being supplied from gravity to storage. Experience of three or four years has shown this method to be practical and economical. The storage cells are apparently in a better condition than those of the same age on the power line. Storage batteries for track circuits have been in service long enough to show that they are well adapted for the work." * * *

The discussion of this report was participated in by Messrs. C. C. Anthony (P. R. R.), M. E. Smith (D., L. & W.), C. C. Rosenberg (L. V.), A H. Rudd, and D. M. Case (C., N. O. & T. P.); also by Messrs. Bezer, Reynolds and Leslie. There was considerable testimony to the effect that a storage battery charged for several years at only a moderate rate deteriorates, the positive plates tending to buckle Experience has shown that to counteract this every battery ought occasionally to be charged at the normal rate. If necessary, there should be an extra gasolene generator to insure being able to charge at a sufficiently high rate. Surprise was expressed at the success on the P., C., C. & St. L., mentioned in the report; but Mr. Raymer said that the same arrangement was in use on his road, the Pittsburg & Lake Erie. The storage batteries which have been in use on 40 or 50 miles of the D., L. & W. for 10 months past have thus far given uniformly satisfactory results. The power wire on this line is No. 10, B. & S., hard drawn copper. To some of the signals the power has to be transmitted 10 miles, and the current is from 2 to 2.5 amperes. Mr. Smith in future installations proposes to use a 6-h.p. gasolene engine and a 3-k.w. generator instead of 4 h.p. and 2.5 k.w. The Pennsylvania uses for its power transmission a No. 6 wire; distance, 12 to 15 miles.

Mr. Case uses portable storage batteries, and therefore always charges them at the normal rate. He has 75 signals thus operated. Each maintainer keeps two extra sets, for use while regular sets are being re-charged. These are taken out, sent to the charging station, charged in one night, and immediately put back in service at the same place. A number of members appeared to be still in doubt as to the conditions governing the use of portable batteries; on what kind of a line are they desirable and economical? On the Southern Pacific the batteries are carried to and fro on independent motor cars, but the use of such cars is objected to in some cases where the line of road is very crooked. Sending batteries by freight train is objectionable because they get broken, and in baggage cars the space occupied by them is grudged. No one had definite data on this question of transportation. The Michigan Central has recently ordered a number of sets of portable storage batteries for signals. These are to be used in very light service, where it is expected one charge will last a month or more.

Mr. Ames, for the committee on rubber-covered wire, reported that he had been negotiating with the officers of an inspection bureau maintained by insurance companies for testing insulated wire. The committee hopes to be able to recommend some convenient and economical means of inspecting wire so that the large

railroads will not have to keep their own inspectors at the wire factories, and so that smaller roads can have independent inspection at reasonable cost.

The next business was a short paper by Mr. G. K. Rogers, of India, a member of the Association, describing the Mackenzie & Holland improved Sykes block signal apparatus used on the East Bengal State Railways. This was read by the Secretary, and a vote was passed thanking Mr. Rogers for the paper.

Next Mr. H. W. Lewis (L. V.) read a paper on the care of storage batteries. Mr. Lewis said in substance:

"It is important that the initial charge should be full and complete, and for that reason it should be continued until both the specific gravity and voltage cease to rise; then discontinue the charge and immediately adjust the electrolyte to the proper density as recommended by the manufacturers and mark the height of the electrolyte on the cells (a file mark is preferable, as it is permanent). Then discharge the battery about half and follow this discharge by a regular eight-hour charge, keeping the electrolyte at the proper height during this charge by the addition of distilled or other known chemically pure water to compensate for the water thrown off by evaporation; and if at the end of the charge the specific gravity has risen to the fixed density and remained there for at least half an hour, it will insure beyond a doubt that the battery is fully charged.

"The only reliable indication of charge and discharge is the specific gravity of the electrolyte. While no fixed figure can be laid down, it can readily be ascertained in each individual battery by observing the lowest specific gravity at which the device can be operated at the minimum voltage on closed circuit. This once attained and a reasonable margin allowed, a fixed minimum specific gravity is established. I have found that, charging on this basis and everything going smoothly, we are able to designate regular days for charging.

"As the density of the electrolyte varies materially with the temperature, it is therefore necessary to note that a battery having a specific gravity of 1.200 when fully charged at 60 deg. F. would need to be of nearly 1.2096 specific gravity at a temperature of 30 deg. F. and nearly 1.1872 at a temperature of 100 deg. F., and so on. In general no attention is paid to housing batteries with a view to a uniform temperature, and therefore it is an all-important feature that the temperature be watched as well as the specific gravity during charge and discharge, and that the electrolyte be maintained at the predetermined height and adjusted at a temperature of 60 deg. F.

"The irregular discharge rate at which batteries are subjected to in this line of work has a great deal to do with amount of current required to re-charge them, the discharge varying from hours to days, weeks and months. I might cite a battery whose discharge covers a period of six and one-half days, and as a rule it requires twelve hours at the normal rate to charge it; another whose discharge continues for 39 days requires 29 hours at normal rate, while a battery discharged in two or three days can readily be charged in eight or nine hours at normal rate; the efficiency of such batteries is greatly reduced.

"It is important that batteries in this class of work be not discharged too low. In this condition they sulphate more rapidly, and there is grave danger of buckling the positive plates on charge. The only cure in sight for this bothersome sulphate is incessant charging. This, of course, does the battery no good; as the sulphate, falling, carries quite a lot of active material with it."

The discussion on this paper was participated in by Messrs. Ames (L. S. & M. S.), Waldron (Interborough), Smith (D., L. & W.), Yocum (P. & R.), Arlington, Willis, Corey, and others. In setting up new batteries they are charged all the way from 100 per cent. to 200 per cent. of their normal capacity; some immediately discharge the battery and then re-charge, while others put the batteries at once in service on the first charge. On the Interborough batteries are charged to 200 per cent. at half the usual charging rate. The results have been remarkably good. Mr. Yocum has been charging at 200 per cent. for eight years or more, and the batteries are still in good condition. On the Lake Shore & Michigan Southern certain batteries which have very light duty are occasionally discharged into a rheostat so as to keep them in good condition. Commenting on this, Mr. Corey remarked that by the use of a rectifier, such as is used in charging automobiles from a. c. lines, it would be unnecessary to thus waste half the current; nearly all of it could be used. In this process a mercury vapor tube is used, which allows current to flow one way but not the other. Replying to a question, it was said that the mercury vapor tube is not excessively costly. A tube which, with its panel, is about 5½ ft. high and weighs about 150 lbs., is good for 1,000 hours.

At the afternoon session Mr. F. F. Fowle, of the American Telephone & Telegraph Company, read, by invitation, a paper on Specifications for Line Wire. Mr. Fowle went thoroughly into the details of his subject, most of his experience having been, however, with telephone lines. The discussion which ensued had to do principally with weather-proof insulation for line wires. It would seem that a number of roads have within the last few years bought considerable quantities of double-braid weather-proof insulated wire on which the insulation proved to be of poor quality, and there was considerable sentiment in favor of using bare wire because of the impossibility of securing good braid; but one of the wire manufacturers cleared the atmosphere by stating that not only his company but, he felt sure, a number of others were ready to furnish a good quality of weather-proof wire whenever the railroads should present the proper specifications. Not only this, if the railroads will agree upon standard uniform specifications the manufacturers will make the principal sizes of wire, with double and triple braid, and keep sufficient quantities in stock to promptly supply all demands.

Mr. Ames is satisfied that with No. 12 wire, double braid, it is necessary to have at least 60 poles to the mile. A number of members felt sure that No. 10, double braid, is the smallest size that should be used. No. 12 wire, triple braid, supported by 80 poles to the mile, has been found to last a satisfactory length of time.

A number of members were satisfied that weather-proof insulation could be depended upon only for currents of low voltage. Where these wires have fallen across telegraph wires carrying stronger currents the insulation did not prevent a cross.

Mr. Anthony had heard of instances of very faulty wire recently found in service. In one lot there were connections so poor as to almost destroy the conductivity, the insulation at the same time being so clumsily done that the faulty splices were quickly discovered. In another case the maker had made scarfed joints. These joints were soldered and the insulation carried over them so nicely as to conceal the faulty work. A lot of this wire broke in service. Two roads which have used insulated line wire for many years and extensively are the Lehigh Valley and the Philadelphia & Reading. The officers of these roads are settled in the opinion that bare wire must not be used; but as to just what size of wire and quality of insulation is most desirable their opinions are not so definite. A No. 10 copper power line, with triple braid, put up about one year ago on the D., L. & W., with 35 poles to the mile, broke in five places the first winter. This is the record for 142 miles of wire.

Mr. Anthony: This has been a most profitable discussion, and it shows clearly the need of united action looking toward standard specifications and adequate inspection. Very few roads buy enough wire to warrant independent efforts in this line, hence the necessity of associate action.

The Manipulation of Tool Steel.*

When any number of tools are to be made I have found it a good practice to forge tools first, and let them get quite cold before tempering them. I work the steel at as low a heat as possible and as quickly as possible but not with a heavy blow as is sometimes given by careless workmen under a steam hammer, as this destroys the grain by crushing it. Consequently when the steel is tempered, it will develop what are called tempering cracks. It is better to forge the tools with a sledge or a belt hammer, such as a medium sized Bradley hammer, as with these the tool can be shaped without injuring the texture of the steel. To temper the tool I heat it just hot enough to give it sufficient hardness, plunging it in a cooling mixture, gradually down to the upper end of the red, then pulling it out gradually. This will give a tapering from a low red at the upper end to a cold point, leaving the tool without any or with but very little contracting strain. Then I ease off the temper to the desired color, and generally speaking, if the steel is of an ordinary good quality the tool will be good. This is our practice for lathe, planer, slotter, twist drill, reamers, rose bits and such like tools made out of high carbon steel. Miller cutters and such tools we forge the same way, but in tempering we use a small charcoal furnace, and lay our tools in the furnace on a good bed of fresh red coals; then we put more coal on top of them and close the door of the furnace, letting the cutter get hot as the coal burns up, while the tool dresser is at work on other tools. When the cutter becomes hot we plunge it into a tempering liquid slightly heated. To draw the temper we place a piece of ordinary plate iron on the bed of charcoal which is left in the furnace. The cutter is then placed on this plate until it is slowly heated throughout. It is surprising how nicely this method will draw the color.

For high-speed tool making we have five different makes of steel, and they all have their own little peculiar differences of texture, consequently a little different way of working is necessary. These little points of difference have to be picked up by the tool maker. In forging a tool we generally follow the directions given us by the manufacturers of the steel, but in hardening the tool is where the difficulty lies, for I have found that this kind of steel deteriorates rapidly by tempering, that is, it gets soft

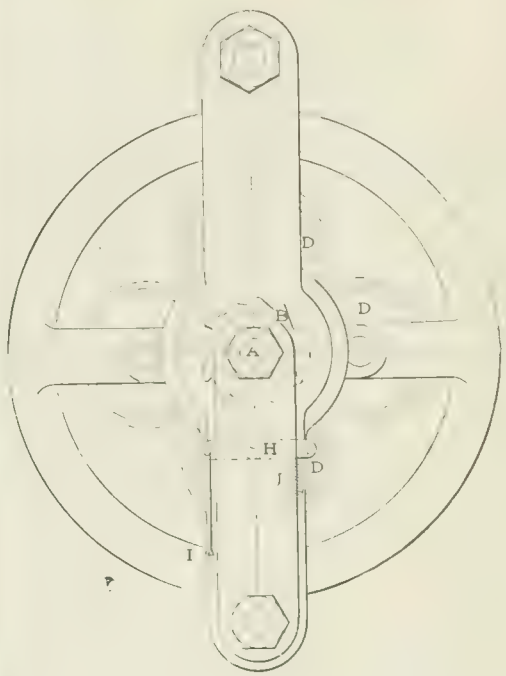
*From a paper by Arthur Stockall, Master Smith, I. C. R. Works, Moncton, N. B., read before the National Railroad Master Blacksmiths' Association.

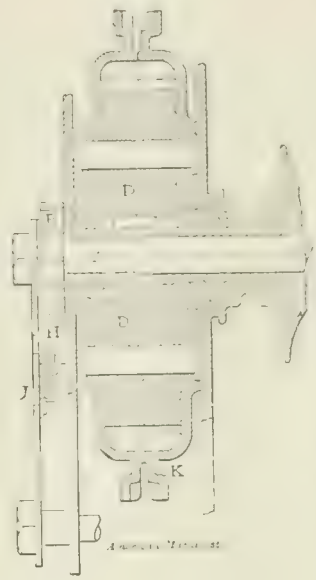
in its texture as though some of its chemical parts have lost their cohesion, after two or three times tempering; this is due, I think, to the high heat necessary for hardening by air blast. The point for us to discover is, how to harden this steel at a low heat, and thus preserve its quality. I have tried the ordinary tempering mixture and also warm water. The steel will crack easily. With oil it is better, but not hard enough for hard tires and ends like the air blast in a softer tool.

I am now experimenting with a liquid that certainly makes the tool hard enough at a greatly reduced heat, but whether it will keep its cutting power I am not prepared to say at present, but our practice is for lathe, planer and such machines, and where speed is high and material hard to harden in an air blast at white sweating heat. For wheel boring cutters I have an air blast made of copper pipe which straddles the tool. This is softened so that it will bend easily, so that it can be readily adjusted to suit any length of tool. I also have a pair of tongs with broad jaws with which I grip the tool in the middle and put it in the fire and heat only both ends. I then place the cutters between the ends of the blast pipe and gradually turn on the air, and in this way cool off both ends at once, leaving the center at its usual temper, and I must say that the tools made in this way work splendidly. For taps, reamers, twist drills, miller cutters and such like tools that have to be finished to a cutting edge before tempering I have used the lead bath for heating and cooling in air where convenient and in oil when necessary, but when air is used great care must be taken or the fine edge will be blown off, but the lead bath, where only one or two pieces are to be tempered, is very slow and inconvenient. I have found the following plan very good in this kind of work: I mix some fire clay very thin, almost to a liquid, then I heat the tools just warm, not red, and dip them in the fire clay, then I pull them out and let them dry which only takes a short time. Repeat this until you have a layer of clay on the tool sufficient to protect them from the heat of the fire or blast, $^1/_{16}$ in. or $^1/_8$ in. thick is plenty. Then place them in the fire and heat them to the desired point and cool them by a blast or in an oil bath.



The Acme Chain Hoist.





Details of the Acme Hoist.

Iron and Steel in 1905.

The year 1905 was not only the most productive and the most prosperous year in the history of the American iron trade but it was the most uniformly prosperous year. From January to December the demand for all leading forms of iron and steel and for the raw materials of their manufacture was continuous and insistent. There was no "dull season," no overloading of the markets, no slump in prices. Upon the other hand there was no great scarcity of iron and steel at any time, the markets in the main were well supplied, and consequently there were no "famine" prices. Few orders were sent abroad and our export trade was not neglected. Production was abnormally and phenomenally great, but best of all prices were wisely kept within reasonable bounds. We have heard of no complaints that prices were too high. We estimate the year's production in round figures at about 43,000,000 tons of iron ore, 23,000,000 tons of pig iron, and over 3,000,000 tons of steel rails. Even these extraordinary figures may be exceeded in 1906. The present outlook certainly justifies this opinion. The country is increasing its capacity to meet any possible demand that may exist in the near future for either pig iron or manufactured iron and steel. There were no strikes or lockouts in the iron trade in 1905 that are worthy of mention.—*Bulletin of the American Iron and Steel Association.*

The Acme Chain Hoist.

The accompanying illustrations show the Acme chain hoist made by the Franklin Moore Company, Winsted, Conn. The hoist, as shown in the line drawing, is equipped with differential gearing by means of which it is possible to lift a weight equal to the full capacity of the blocks. The gearing is arranged so that by throwing a pawl out of engagement with the ratchet the lower block can be raised or lowered at increased speeds, as in taking up slack or adjusting slings, etc. The arrangement of the differential gearing is clearly shown in the line drawing.

Through the center of the hand chain wheel is a shaft, *A*, upon which two sleeves are mounted. The gear *C* is mounted upon the same sleeve as the ratchet wheel *B*, and the gear *F* is mounted upon the same sleeve as the chain-wheel *G*. These gears are of the same diameter, but *F* has fewer teeth than *C*. In operation the pawl *H* locks the ratchet and gear *C*. When the hand-chain is pulled it causes the differential gears *D*—which mesh with both the gears *C* and *F*—to revolve around *C* and also to rotate on their axes. As the gear *C* has more teeth than the gear *F* it is obvious that by the time the chain-wheel has made one complete revolution around *C*, *F* will have advanced the amount of their difference and have turned *G* with it. When the pawl is released from the ratchet, the differential gears are free to revolve independent of the hand chain-wheel, thus permitting the unloaded hook to be raised or lowered instantly.

Lake Flour Tonnage.

The *Northwestern Miller* prints the following tables to show the quantity of package freight, chiefly consisting of flour, shipped eastward via the different lake ports from the opening of navigation to Dec. 16, 1905, in tons:

Companies.	Ports on Lake Michigan.	Ports on Lake Superior.	Total Tons.	Total Per cent.
Lake Season of 1905.				
Western Transit	213,425	226,395	439,820	27.8
Union Steamboat	162,690	.....	162,690	10.3
Erie & Western	291,000	105,765	396,765	25.0
Mutual Transit	.....	184,595	184,590	11.7
Lackawanna	51,050	.....	51,050	3.2
Lehigh Valley	239,680	.....	239,685	15.1
Soo Steamship	109,520	.....	109,520	6.9
L. & Green Bay	.....	.....	.....	....
Total in tons	1,067,365	516,755	1,584,120	100.0
Lake Season of 1904.				
Western Transit	119,211	172,907	292,118	29.1
Union Steamboat	86,957	.....	86,957	8.7
Erie & Western	174,616	51,499	226,115	22.5
Mutual Transit	.....	159,023	159,023	15.8
Lackawanna	33,727	.....	33,727	3.4
Lehigh Valley	136,626	.....	136,626	13.6
Soo Steamship	65,331	.....	65,331	6.5
L. & Green Bay	3,813	.....	3,813	0.4
Total in tons	620,281	383,429	1,003,710	100.0
Lake Season of 1903.				
Western Transit	208,437	244,066	452,503	26.6
Union Steamboat	118,050	.....	118,050	6.9
Erie & Western	259,605	121,514	381,119	22.4
Mutual Transit	.....	180,059	180,059	10.6
Lackawanna	76,338	.....	76,338	4.5
Lehigh Valley	258,950	.....	258,960	15.2
Union Transit Co.	.....	83,111	83,111	4.9
Soo Steamship	145,463	.....	145,463	8.6
L. & Green Bay	5,855	.....	5,855	0.3
Total in tons	1,072,708	628,750	1,701,458	100.0

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Block System Recommended in Massachusetts. 49
- Cause of the Baker Bridge Collision..... 49
- The Kansas City, Mexico & Orient 49
- Railroad Routes to the Gulf 50
- Railroad Gross Earnings for October.... 52
- Use of Telephones on Small Railroads... 52
- New Publications 52
- Trade Catalogues 53

ILLUSTRATED:
- Heavy Eight-Wheeled Passenger Locomotive for the Central R. R. of N. J..... 56
- Steel-Frame 80,000 lb. Box Cars for the Chicago & Eastern Illinois 60
- The Care of Boilers 62
- Railroad Statistics 65
- St. Clair Tunnel Electrification 68
- Western Pacific Terminals 70

CONTRIBUTIONS:
- The Origin of Four-Cylinder Balanced Compound Locomotives. 53

MISCELLANEOUS:
- Massachusetts Railroad Commission's Report 54, 59
- Working of Harriman Lines' Equipment Clearing House 58
- Washington Correspondence 60
- The Armour Car Lines..... 64
- Transatlantic Passenger Business..... 65
- Steel Rail Outlook. 70
- Shipping Subsidies 71
- American Association of General Freight Agents (G. N. S.) 17

GENERAL NEWS SECTION:
- Notes 15
- Meetings and Announcements 17
- Obituary 17
- Elections and Appointments 18
- Locomotive Building 19
- Car Building 19
- Bridge Building 20
- Railroad Construction 21
- Railroad Corporation News 22

VOL. XL., No. 3. FRIDAY, JANUARY 19, 1906.

The Massachusetts State Railroad Commissioners recommend a law compelling the use of the block system on the railroads of that State, thus putting themselves in line with the Interstate Commerce Commission and with Congressman Esch. The Massachusetts report (which we give on another page) does not present much of an argument in support of the recommendation; but it states one fact which ought to make argument for the use of the block system unnecessary, the fact that in the minds of all competent judges the question is already settled; "the day for discussion is passed." Whatever may be said about legislation on the subject, it is clear that the main reason for the continuance of the time interval system of running trains is the fact that the railroads have not yet found it convenient to make the necessary outlay of money. On the subject of train rules the Commissioners also utter a sound opinion, but offer no argument. They say that the rules—referring particularly to those of the Boston & Maine—need to be made plainer. The Massachusetts board has, however, dealt with this subject before, and in clear terms. But a sound opinion does not accomplish anything. In spite of the declarations of this and other commissions, and in spite of the work of the American Railway Association, train rules everywhere are faulty, and only the introduction of the block system on the busiest lines has prevented this defective condition from resulting in disaster. It is time to confess that this work has suffered from superficiality, if not from neglect. Such success as has been attained in the running of trains on those American roads where the block system is not used, is due to something else than perfect rules. To carry out the spirit of this Massachusetts recommendation it will be necessary to delve into the subject after the manner of Mr. Forman; and, like him, to keep in very close touch with the trainmen while doing it. Committee recommendations which anybody may modify as he pleases, or ignore entirely, must always be subject to the defect of inadaptability, because the work has to be done at arm's length; because a national committee is necessarily so small as compared with the number and variety of minds to be satisfied.

The commissioners' views on the Baker Bridge collision are so closely in accord with those which we have ourselves expressed that we do not take the space to quote them in full. The implied criticisms in the Grand Jury's presentment, concerning hours of work and the relations of employer and employee, already published in the *Railroad Gazette*, again appear as implied—not direct—criticisms in the present report. One thing which the commissioners appear to have passed over with slight attention is the question of the fitness of the fireman of the leading engine of the express train. This man was instantly killed. Theoretically, the fireman is an assistant lookout man—as much of a lookout man as he can be and properly attend to his fire. If this function is ever of value it must be particularly so on a fast train, which is following closely behind a slower one and which is run by an inexperienced engineman. We hear that the fireman of this engine on this trip was inexperienced, so much so that the engineman assisted him in firing—which, incidentally, affords another illustration of a thing often seen in the higher ranks of the railroad service, the propensity of a man who is promoted to continue giving his thought and much of his energies to that department of the work which he has just relinquished. If this engineman got down and shoveled coal into the firebox no further evidence is needed to show the parallelism between this and the Westfield (New Jersey) case. The engineman's published assertion that he saw the lanterns and fusees at Lincoln and beyond there, but could not explain why he disobeyed them, excited universal incredulity; and his subsequent statement (as now given by the railroad commissioners) that he applied the brakes, which statement appears to be wholly demolished by the testimony of the runner of the second engine, only increases the suspicion that the facts were not fully divulged. Collisions would afford very much less ground for grave discussions about the mysteries of the personal equation if only the public could always have the true facts about bald and knowing disregard of the very simplest rules.

THE KANSAS CITY, MEXICO & ORIENT.

We have several times taken occasion to point out that the distinguishing characteristic of 1905, from a railroad construction standpoint, was the extraordinary recurrence of building to the Pacific Coast. After the previous years of maximum opening of new territory, like 1882 and 1887, there was a long time when railroad development was either of a local character, such as the opening of Texas, Oklahoma and Indian Territory, or in more recent years, was devoted primarily to rebuilding existing lines, making cut-offs where old locations were unfavorable, reducing grade and curvature

and equipping the crude pioneer routes to handle a tremendously increased business under modern economical conditions. But following this, and following the Northern Securities decision, we now have the Grand Trunk Pacific building to the coast in Canada, with the Canadian Northern looking on as an interested observer, apparently ready to step in and do likewise within a few years. South of the border, the Chicago, Milwaukee & St. Paul has announced its plans of building to the coast in Great Northern and Northern Pacific territory; the Western Pacific has been financed, and work has been begun on this Gould connection from the Rio Grande system through to Oakland; the San Pedro, Los Angeles & Salt Lake has been built and sold to the Harriman lines, while the Denver, Northwestern & Pacific offers an important connection between Denver and Salt Lake, with easier grades than those of existing lines. It is safe and fair to say that all of these projects are genuine ones, built to meet a real need and in the hope of great future business, rather than to aid any promoter or series of promoters in an access to sudden wealth." Further south, another Pacific line is now building, and it is unfortunate that the same assurances cannot in this case be given.

The Kansas City, Mexico & Orient commenced construction work in May, 1900, simultaneously in the United States and in Mexico, on a proposed line to be built from Kansas City to Topolobampo, far down on the Gulf of California. Since that time work has been pushed vigorously on this road at a number of separate points. Approximately 100 miles of line in Oklahoma were opened in 1903, and in 1904 about the same amount of track was being operated in Mexico. Meantime provision was made for an entrance into Kansas City; and during 1905, 75 miles of line was completed in Texas, 50 miles in Oklahoma, and 100 miles more in Mexico, a considerable mileage in Kansas having been opened the year previous. Trains are now running on four portions of the route: From Wichita, Kan., through to Oakwood, Okla. T., 157 miles; from Sagerton to Sweet Water, Tex., 52 miles; and in Mexico, eastward from the Gulf terminus to Hornillos, 73 miles; and from Chihuahua to San Sostenes, 73 miles additional.

The promoters base their claims for the prosperity of the line on two main points: The fact that they have the shortest route from the great producing and consuming part of the West to the Pacific Coast, and the additional fact that they pass through a territory which they consider to have great agricultural possibilities, and which is as yet practicaly unworked. The project is a novel one, and it is worth while to consider carefully these points, viewed in the light of such information as is now at hand. With regard to the specific distance: The Kansas City, Mexico & Orient route comprises, roughly, 271 miles in Kansas, 200 miles in Oklahoma, 560 miles in Texas, and 475 miles in Mexico; a total, as originally announced, of 1,506 miles from Kansas City to Topolobampo, although it is to be presumed that this will pan out a little longer by the time the work has been done. The road which affords the closest comparison is perhaps the Atchison, with a mileage of 2,120 miles from Kansas City to San Francisco. Of the other American transcontinental lines, so-called, the Harriman route from Omaha to San Francisco is 1,848 miles long; the Great Northern route from St. Paul to Seattle, 1,829, and the Northern Pacific route from St. Paul to Seattle, 1,913 miles. The Kansas City, Mexico & Orient announces that the Hamburg-American Packet Company has entered into a contract to furnish an Oriental service from Topolobampo as soon as the railroad is completed; therefore, it is perhaps well to consider first the possibilities of the road with regard to this traffic, which has been so carefully studied in the north by Mr. Hill. The reason for the short land distance of this route is, of course, accounted for by the eastward slope of the coast, which furnishes tidewater at Topolobampo some 16 degrees east of tidewater at Seattle and some 13½ degrees east of San Francisco. Of course, the great circle ocean route from Mexico is much longer than the route for transpacific steamers further north, so much longer, in fact, that the rail distance is vastly more than neutralized thereby, not only in actual miles, but also taking into consideration the greater economy of water as compared with rail haul. It requires a globe rather than a flat map to demonstrate to the casual reader that the nearest route from Mexico to Japan lies by way of the San Francisco coast and the Aleutian Islands, but this is indeed the case. It will be seen, therefore, that the Kansas City, Mexico & Orient will have no advantage in distance or economy, so far as Oriental trade is concerned, by its shorter rail route. Moreover, we have not yet considered the grades. Just what the new line can do with its route over the Sierre Madre mountains we are not prepared to say at present, but if it gets off with a three per cent. grade it will surprise most observers of this territory. The existing transcontinental lines now have their grades well in hand, and, without going into this part of the discussion in detail, it is fair to say that the new line has yet to demonstrate that it can do anywhere nearly as well in this respect as the lines which now reach the coast.

But the present coast lines are not dependent on their Oriental traffic for existence. They have also a rich and constantly increasing local and branch line traffic to support them. We have called attention to the recent and very notable branch line extension work of the Union Pacific, and surely nothing more than an allusion need be made to the great grain crops handled by the northern lines and to the traffic in citrus fruits, etc., which is handled by the Southern Pacific. The Kansas City, Mexico & Orient strikes a section of country which seems of much less promise than that traversed by the other routes. It is less well built up, its grain is not so good, and it has fewer natural advantages. This is true from Kansas City almost as far as Chihuahua. What the traffic possibilities of this part of Mexico are it is hard to say, but they have not sufficed to attract much railroad building as yet.

With these facts in mind, it must frankly be said that the prospects of the line appear more interesting than inspiring. In the face of this may be made the confident prediction that it will be built ,and built rapidly to completion. Mexico has given handsome subsidies; aid has been granted by numerous towns on the route, and the subscriptions to the construction capital seem to have been liberal. Whether the road can make a living when built, and, if so, how it is going to make it, are interesting questions for the next few years to determine. In the meantime, the project stands as an example of a kind of construction that has not been much attempted in the United States within the last generation.

RAILROAD ROUTES TO THE GULF.

The two most persistent rumors of impending changes in railroad control each relate to the purchase by a northwestern line of an outlet to the Gulf of Mexico. The Hill roads, through the Burlington, are widely credited with the purpose of securing a gulf connection by taking over the Missouri, Kansas & Texas; and the Chicago, Milwaukee & St. Paul is known to have at least been considering the desirability of getting control of the Kansas City Southern. Ownership of the Missouri, Kansas & Texas would give the Burlington a fairly direct north and south line from Kansas City to Galveston, and would also connect with Burlington lines at St. Louis, which it now enters over Burlington rails, and Hannibal, Missouri. The Kansas City Southern would join the St. Paul's Kansas City line to Port Arthur, a good harbor on the gulf, some 75 miles east of Galveston.

The foundation basis for reports such as these lies in the rapidly increasing importance which has within the last few years come to be assumed by the gulf ports as exporters of grain. Grain is the most spectacular commodity which the railroads carry—the one over which rate wars are most frequent and about which rate adjustments are most sensitive. Within the last two or three years, New Orleans, in particular, and Galveston as well, have been taking away from the Atlantic ports a large share of the grain export business—this in spite of all the influence of long established custom in the grain export trade to the contrary. The map of the United States shows pretty clearly the natural reasons for such a change. Grain from almost any point in the principal grain producing states of the country is going out of its way, so far as distance is concerned, in reaching the Atlantic seaboard for export. It is from 200 to 300 miles shorter from Iowa and the Dakotas to Galveston or New Orleans than to New York, Boston, Philadelphia or Baltimore. From the grain raising states further south, the advantage of the gulf ports in distance is, of course, greatly increased. Then, too, the north and south routes to the gulf follow, in general, water grade lines; that is, they run parallel to the general trend of the streams in that territory. On the other hand, by every route, with the exception of the New York Central, between Chicago or St. Louis and United States ports on the Atlantic, freight has to cross the summit of the Allegheny mountains.

There are, however, certain advantages which the Atlantic ports possess over their new competitors. The machinery of export has long been centered on the Atlantic seaboard, and it is never an easy matter to change the current of an established way of doing things. More than this, in the case of the larger eastern ports, particularly

New York, the size of the cities and the commercial development of the country back of them tend to center the export trade at their docks, because vessels can always find a cargo to bring when they come in to get grain. In the case of the gulf ports—though with the growth of the South and Southwest this is decreasingly true—vessels have in many cases to arrive in ballast, owing to the small demand in that territory for general imports. This means, of course, that in such case the export grain rates have to be large enough to cover the expenses of both the inbound and outbound trip. As has also frequently been pointed out in the *Railroad Gazette*, New York in particular has a further very great natural advantage in export grain rates. Not only can steamers always find lading to bring to New York but grain export rates are also lower on account of the large amount of other exports from that port. The rates at which export grain is carried are of two sorts: cargo rates, where a whole, or substantially a whole, ship is chartered, and berth rates, where a ship carrying a general cargo has extra room available. Grain very conveniently fills up such extra spaces at a late moment before sailing, since it requires no handling or stevedoring in the berths to which it is assigned, and as a consequence berth rates are low. Therefore, aside from other considerations, through the competition of berth-rate business, grain can in general be exported more cheaply from a port where there are a large number of steamers engaged in miscellaneous traffic.

In expense of terminal facilities, on the other hand, the gulf ports have a great advantage. Available locations for terminals on New York harbor are very many times as expensive as similar and equally available locations near New Orleans. Comparison between the less important Atlantic and gulf ports would show much greater difference in this expense. Certain gulf ports which possess as good harbors as some of the most important Atlantic ports are not large cities but places where land is comparatively cheap. In addition to the much greater cost of land, various terminal charges have grown up at some of the eastern ports, particularly at New York, which, though perhaps they would be equally justifiable at some of the gulf ports, are, in order to attract business, not applied there. In short, the competition boils down to this—that the Atlantic ports have the extensive advantages which result from undisputed possession for many years of the export trade and from their much greater commercial importance, while the gulf ports have the advantages of cheap terminal facilities and in particular of their natural geographical location.

The interest in the subject at the present moment, aroused particularly by the Missouri, Kansas & Texas and Kansas City Southern rumors, makes it interesting to take stock of the routes which are at present open to grain export via the gulf. From Chicago, the Illinois Central, with its low-grade line 914 miles long from Chicago to New Orleans, holds a commanding position. Over the Chicago & Eastern Illinois from Chicago to Terre Haute, the Evansville & Terre Haute from Terre Haute to Evansville, and the Louisville & Nashville from Evansville to New Orleans, the distance is 1,068 miles. Through the acquisition on January 1st of last year, by the St. Louis & San Francisco, of trackage rights for freight trains over the Mobile & Ohio and New Orleans & Northeastern, between Tupelo, Miss., and New Orleans, a new route was formed over the Chicago & Eastern Illinois and St. Louis & San Francisco via Thebes Bridge and Tupelo, 993 miles between Chicago and New Orleans. From St. Louis there are 11 routes, the shortest, to New Orleans, over the Mobile & Ohio and the New Orleans & Northeastern, 705 miles. The Illinois Central line between the same points is 711 miles long; the Frisco via Memphis and Tupelo, 748 miles, and the Missouri Pacific and Texas & Pacific, via Texarkana, Tex., 891 miles. The Louisville & Nashville has the longest route, with 945 miles between St. Louis and New Orleans. From St. Louis to Galveston the shortest route is 860 miles, by the Missouri Pacific, Texas & Pacific and International & Great Northern. The same haul over the St. Louis & San Francisco and Houston & Texas Central, via Sherman, is 1,031 miles long. There are also three routes to ports east of New Orleans: By the Mobile & Ohio, from St. Louis to Mobile, 644 miles; the Louisville & Nashville, from St. Louis to Mobile, 805 miles, and by the Louisville & Nashville from St. Louis to Pensacola, 787 miles.

Last of all come the routes between Kansas City and the gulf, which are particularly important because Kansas City is the point through which most of the export grain via the gulf is hauled. The Kansas City Southern from Kansas City to Port Arthur has the shortest line from Kansas City to any point on the gulf, 786 miles. Between Kansas City and Galveston the Missouri, Kansas & Texas is 884 miles long. By Santa Fe lines the distance between these same points is 916 miles, and by the Missouri Pacific and International & Great Northern, including 268 miles over the Missouri, Kansas & Texas, 890 miles. The Frisco system has the shortest Kansas City-Galveston line, 873 miles long, including 385 miles over the Houston & Texas Central; also the shortest line between Kansas City and New Orleans, 879 miles long, including 395 miles between Memphis and New Orleans over the Illinois Central. By making use of its trackage over the Mobile & Ohio and New Orleans & Northeastern, the Frisco has its own line, 927 miles long, to New Orleans. The Missouri Pacific and Texas & Pacific together form a line 1,067 miles long between these same points.

These include practically all of the existing gulf routes. In addition, several other companies are reaching south toward the gulf. The Colorado & Southern has announced plans for an extension from Fort Worth to Galveston, and thence eastward to New Orleans. The Rock Island not long ago bought the Arkansas Southern, a line extending 100 miles south from the Arkansas line into Louisiana, has work now under way to connect this with the rest of its system, and has recently acquired a new charter empowering it to build on south to Alexandria and beyond to New Orleans. The Missouri Pacific, through the Iron Mountain, is building a low-grade line along the west bank of the Mississippi river which, in connection with the Texas & Pacific at the southern end, will give the Gould companies a favorable line between St. Louis and New Orleans. Two new cut-offs in Arkansas, one building, the other already built, will also shorten considerably the Missouri Pacific's line from the territory about Kansas City to New Orleans. It is notable that all the southwestern lines which have heretofore stopped short of the gulf are reaching out for a share in the gulf traffic.

Of the existing gulf routes, with two exceptions, every one is either itself part of, or controlled by, one of the large railroad corporations. The Illinois Central is itself one of the strongest railroads in the country. The Chicago & Eastern Illinois, Evansville & Terre Haute, and St. Louis & San Francisco are all controlled by Rock Island ownership. The Mobile & Ohio and New Orleans & Northeastern are properties of the Southern Railway; the Louisville & Nashville is held by the Atlantic Coast Line, and the Missouri Pacific, Texas Pacific and International & Great Northern are parts of the Gould system. The Houston & Texas Central is a Southern Pacific line. Nor is the Atchison, Topeka & Santa Fe likely to be bought up as some other road's gulf connection. These cover all the gulf routes, except the Kansas City Southern and the Missouri, Kansas & Texas, the first of which connects Kansas City and the second both Kansas City and St. Louis with the gulf over its own rails. The situation, then, is that if any of the northwestern railroads wish to acquire a gulf outlet, these two roads form the only available material which can be acquired in the open market at anything like reasonable expense. Kansas City Southern stock is selling at 62 for the preferred and 32 for the common, and there is $21,000,000 preferred and $30,000,000 common outstanding. This makes the value of the road at present prices $22,620,000. Missouri, Kansas & Texas sells for about 71 for the preferred and 39 for the common, which makes the value of the $13,000,000 preferred and $63,300,300 common stock about $34,000,000. Actual control could, of course, in either case be bought for about half these amounts. Whether either of these roads, taking into account their physical condition, their situation in highly competitive territory, and their individual finances, would be worth that amount to one of the northwestern lines is a question which can only be decided upon by the managements of those roads. Judging from the recent tendency of the grain export business, it seems as though they might be. Acquisition of the Kansas City Southern by the St. Paul would require some building of additional connections in order to avoid hauling grain east as far as the Mississippi river before starting for Kansas City; but this would not be a difficult matter. All that is at present public property in regard to a Kansas City Southern purchase is President Earling's statement that, "I am not quite sure whether the St. Paul wants that road." A decision that it does want the Kansas City Southern would no doubt be greatly influenced by the fact that the St. Paul will within a few years reach the Pacific coast at Tacoma and Seattle, when a gulf connection would have a greatly added value. The Missouri, Kansas & Texas would similarly be useful not only to the Burlington as an outlet to the south for its large grain traffic, but to the Hill transcontinental lines as an originator of the cotton traffic to the Orient which Mr. Hill has so consistently tried to build up. According to statements credited to Burlington officials, the Missouri, Kansas & Texas now originates

a large amount of cotton tonnage which goes west for export over the Burlington and Northern Pacific or Great Northern to the Pacific coast. If trade to the Orient keeps on increasing at anything like the rate it has recently grown, the value to the Hill roads of a line south from Kansas City to the gulf should correspondingly increase. With the Missouri, Kansas & Texas in possession the whole haul from the gulf or the intermediate states would be over Hill system rails.

In any case, whatever becomes of these two properties, every new adjustment of rates shows that the most important controversy still to be settled is the proper relation between gulf and Atlantic ports. The most interesting phase of the conflict of interests at the moment is as to whether any of the northwestern or transcontinental lines will, or perchance already have, come to the conclusion that instead of turning over export grain to other roads at Chicago or the Missouri river it is worth their while to pay the price necessary to make it possible for them to carry it over their own rails for the whole haul from the grain fields to tidewater on the gulf.

Railroad Gross Earnings in October.

The gross earnings during October, while continuing to show large increases, would have made a much better showing if the roads had been able to handle all the traffic offered. An exceptionally severe car shortage existed during this month in all sections of the country, except possibly on the Pacific coast. Equipment was being worked to its fullest extent, as is shown by the reports of 37 car service associations, which handled during this month 3,222,911 cars, as against 2,845,951 cars during the same month of 1904. The fact that the earnings this month compared with a month last year, when the Louisiana Purchase Exposition at St. Louis was still giving many roads an enormous passenger traffic, accounts for decreases this year in the earnings of the Chicago & Alton, the Big Four, the St. Louis & San Francisco, the Wabash, the Missouri, Kansas & Texas, and also some of the southern roads, which suffered in addition from the condition of traffic in the south referred to below. Of the trunk line group, six roads report gross earnings of $30,909,132, an increase of $3,030,055, 11 per cent. As affecting these roads, it is interesting to note that the eastbound grain movement from Chicago and Chicago centers was 9,746,000 bushels, an increase of over 4,000,000 bushels over October, 1904. The gross earnings of ten of the coal roads amounted to $22,501,689, an increase of $2,028,899, 10 per cent. Anthracite shipments show only a small increase and bituminous traffic, especially, was hampered by lack of cars. The iron and steel trade, however, which was booming, helped the roads of this group, although in most cases the increases were probably due to the detouring of freight over other lines by larger systems which could not take on their main lines all the traffic offered. The Pennsylvania, which controls several coal roads, has been doing this a great deal for several months. The Norfolk & Western undoubtedly owes some of its increase to the activity of construction work on the Tidewater Railroad, the N. & W. having a monopoly on hauling the supplies for this new road and also the material for new industries which are locating on its route. In the southern group, nine roads report gross earnings of $18,885,189, a decrease of $30,255, one-sixth of 1 per cent. Only one road of this group shows a substantial increase, and this is very evidently due to the diversity of its traffic, which enabled it to make up for the decreased traffic in cotton, the net overland movement of which amounted to only 82,397 bales, as compared with 114,079 bales in 1904. Of the granger roads, seven show gross earnings of $21,152,340, an increase of $2,154,809, 11 per cent. The harvest in Minnesota and Dakota was finished in October and was greater per acre than in any season for ten years. The wheat crop in these states amounted to 187,482,020 bushels, an increase of 33,689,020 bushels, and other crops show similar results. The receipts of grain at 12 interior markets were 93,823,139 bushels, an increase of over 18,000,000 bushels. Of the southwestern group, five roads report gross earnings of $15,579,806, an increase of $1,253,925, 9 per cent. In 1904, the labor troubles in Colorado decreased the earnings of some of these roads, so the figures this year are large in comparison. The cotton and corn crops in this section were large, and the live-stock movement also increased, the receipts at six interior sections increasing nearly 14 per cent. Of the transcontinental roads, five show gross earnings of $33,762,772, an increase of $3,959,416, 13 per cent. Officials of the Great Northern were reported as saying that twice as many carloads of freight were shipped east from the state of Washington in October as ever before. The amount of lumber carried increased slightly. It is noticeable in regard to the traffic of the northern roads of this group that grain shipments by sea from San Francisco were about 670,000 bushels (50 per cent.) less than in 1904, and the figures for shipments from Tacoma show an increase of nearly as many bushels, making evident one respect in which the northern roads are profiting at the expense of those further south.

The accompanying table shows the gross earnings of 46 roads for October, 1905, and the increase over the figures for October, 1904.

	Month of October	
	1905.	Increase over 1904
Atchison, Topeka & Santa Fe	$6,797,290	$1,243,910
Atlantic Coast Line	1,986,461	69,778
Baltimore & Ohio	6,853,792	672,719
Buffalo, Rochester & Pittsburg	818,836	72,437
Canadian Pacific	5,722,767	978,805
Central of Georgia	1,080,492	*27,212
Central of New Jersey	2,158,112	250,510
Chesapeake & Ohio	2,039,665	92,198
Chicago & Alton	1,097,778	*203,005
Chicago & North Western	6,148,512	775,942
Chicago Great Western	871,126	106,262
Chicago, Milwaukee & St. Paul	5,598,603	582,984
Chicago, Rock Island & Pacific	4,842,716	523,903
Chic., St. P., Minneapolis & Omaha	1,367,179	80,694
Cin., New Orleans & Texas Pacific	710,656	54,068
Cleve., Cin., Chicago & St. Louis	2,067,682	*134,888
Colorado & Southern	1,060,988	169,515
Denver & Rio Grande	1,849,135	157,757
Erie	4,412,629	474,565
Great Northern	5,708,211	800,893
Hocking Valley	599,509	29,626
Illinois Central	4,481,706	*96,034
Interoceanic of Mexico	247,327	3,355
Lehigh Valley	3,031,261	25,796
Louisville & Nashville	3,579,772	25,011
Mexican Central	1,218,156	89,042
Mexican International	278,260	*14,907
Minn., St. Paul & Sault Ste. Marie	1,226,126	288,029
Missouri, Kansas & Texas	2,165,467	*195,461
Nashville, Chatt. & St. Louis	910,658	16,134
National R. R. of Mexico	553,734	78,789
New York Central & Hudson River	8,138,377	961,558
New York, Ontario & Western	662,412	69,834
New York, Susquehanna & Western	255,728	34,867
Norfolk & Western	2,393,037	351,310
Northern Pacific	6,230,972	853,137
Pennsylvania Railroad Company	11,692,978	1,843,400
Philadelphia & Reading	3,689,337	289,602
Pitts., Cin., Chic. & St. Louis	2,447,245	278,362
St. Louis & San Francisco	3,719,928	*122,686
St. Louis Southwestern	844,051	*65,645
Southern	4,666,160	231,857
Southern Pacific	9,392,428	453,960
Union Pacific	6,708,394	782,621
Wabash	2,150,221	*392,942
Yazoo & Mississippi Valley	616,239	*238,212
Total	$145,088,466	$12,552,206

*Decrease.

That railroads in the United States aggregating over 4,000 miles in length are operated without the use of the telegraph is a surprising fact; yet a mileage considerably larger than that may be figured out from the information given in the *Official Guide*. The explanation is that these railroads, all of them of minor importance, have telephone lines. The fact is still surprising, from one point of view, because of the assertion so many times made, that the telephone is not a safe instrumentality for sending train-orders. Evidently these roads—there are one hundred and thirty-seven of them—use it for such orders as they have to send. Many of them are very short, and some have no regular business but freight; some of them, moreover, have only one locomotive—the greatest safeguard against collisions of trains that was ever invented—but taking all these lines together, there must be a good many train orders and therefore many chances for collisions, if mistakes in orders are to be considered a cause of collisions; so that on the whole this extensive use of the telephone must be considered good evidence of its availability. Besides the roads in the class here alluded to, the telephone, as everybody knows, is used to some extent for train orders on the Pennsylvania, the Illinois Central and other large roads. Besides the 137 roads referred to, a number of roads are entered in the *Official Guide* as having both telegraph and telephone lines.

NEW PUBLICATIONS.

Car Distributor. By O. O. Carr, Freeport, Ill. $4\frac{1}{2} \times 5\frac{3}{4}$ in., 61 pages. Price, $1.00

The full title of this book is "Car Distributor and Clerk to Chief Train Despatcher and Division Operator," and it is "devoted principally to economical methods of handling railroad freight equipment." Mr. Carr, who is car-distributor for the Illinois Central road at Freeport, has worked a number of years in the positions indicated by the title and has made good use of his experience; that is to say, he has done his work and surveyed his conditions with a studious mind and a philosophical spirit, so that what he knows he knows well enough to have the knowledge available when occasion arises for its use. He has filled his fifty small pages with solid matter which will be of interest to all doing this kind of work. He tells the train despatcher a great many things which the despatcher already knows, but it is useful, all the same, to have the matter put in print in compact form. It is to be regretted that the book has not been more carefully edited, for many passages are lacking in clearness. A characteristic sample of the matter and style of the book may be found in the following extract from "Miscellaneous Ideas on Handling Cars":

"Leaky roof, no door or other similar equipment fit only for rough freight loading should be worked to the stations or division

having a demand for such cars for rough freight loading. Watch agents loading cars with light weight freight off your line and insist on orders being placed for foreign cars, also watch agents loading merchandise cars and keep the loading consolidated much as possible. Keep in close touch with the traveling freight agent and acquaint yourself with the business he desires taken care of. Watch newspapers where car works contract to build new cars and if, when they are being turned out, you are extremely short of that class equipment, suggest that some of them be sent you for a round trip loading or a trip over your division. When you have difficulty in finding a proper foreign car for a shipment and such route will not deliver one of their cars, and you can take care of shipment with another foreign car by asking the agent to change the route to correspond with the available car, do so and save the business to your line. When a firm or connecting road is receiving more freight for a firm than can be consumed or received promptly and it ties up your equipment, take the matter up with your proper officer and recommend that a temporary embargo be placed against the further loading of such freight, ascertaining the actual daily consumption of such freight and lift the embargo in time to get the freight started again without allowing them to close down. When cars are being held with less car load lot shipments, have the agent unload and store in freight house, section men assisting, if necessary, in order to get the car released and in service. Local freight conductors should have copies of all circulars of instructions to agents about handling of cars, as a well posted local conductor is a valuable employee to a company and an unposted, careless one can tear down more car instructions in a month than you can build up in a year."

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾ in.	by	6⅛ in.
Pamphlets and trade catalogues	3½ "	by	6 "
	6 "	by	9 "
	9 "	by	12 "
Specifications and letter paper	8¼ "	by	10¾ "

Water Wheels.—A neatly gotten up catalogue entitled "Doble Tangential Water Wheels" has just been published by the Abner Doble Company, San Francisco, Cal. The first portion contains general matter descriptive of the essential features and parts entering into the construction of Doble tangential water wheels, special attention being paid to the Doble needle regulating nozzles, ellipsoidal buckets, ring-oiling bearings, nickel-steel shafts, etc. Illustrations of several of different types of water wheels are followed by descriptions of some of the typical hydro-electric power plants in which the Abner Doble Company's water wheels are operating. These include some hydro-electric units of unusually large capacities which have recently been built in accordance with designs shown in the catalogue. Among them are two 8,000-h.p. wheels which were constructed for the de Sabla and Electra power houses, and a 9,000-h.p. wheel now building. An illustration is also given of the plant at Cornell University. This plant is of interest for the high efficiency, 84.5 per cent. obtained on the Doble wheels.

The latter portion of the book contains the Doble water wheel tables, covering all conditions of water power up to a head of 2,550 ft., and in capacities up to 5,000 h.p. Other tables relate to the loss of head in pipe by friction, riveted steel pipe, etc., and four pages contain useful hydraulic information. The last seven pages are devoted to a series of ready conversion factors, most of which have been compiled from a recent work by Carl Hering.

Personally Conducted California Tour.—The Chicago & North-Western sends a folder announcing a personally conducted tour to California of 41 days, leaving Chicago February 7. A special train will be used and the cost of the entire trip, including all necessary expenses, will be $350. The folder gives the itinerary, enumerates briefly the interesting points and things to be seen, and gives other particulars.

Corliss Engines.—The Allis-Chalmers Company, Milwaukee, Wis., sends a 20-page booklet descriptive of its "Reliance" Corliss engines. A full detailed description of the engine is given as well as a number of detailed illustrations of its parts. These engines are made in 20 sizes and a table showing the principal dimensions of each size is given.

Bridge Building, Conveying and Hoisting Machinery, Cranes, Etc.—A handsomely illustrated 6-in. x 9 in. catalogue containing upwards of 75 pages illustrates and describes the works and products of the Interstate Engineering Company, Cleveland, Ohio. Full page illustrations and brief descriptions of the following products made by the company are given: Locomotive cranes, wrecking cranes, gantry, cantilever, pillar and jib cranes; derricks and dredges, hoisting and conveying plants, clam shell buckets, transfer and turntables, locomotive coaling stations, railroad pile drivers, concrete mixers, elevating and conveying machinery, mine surface equipment and structural steel work.

Machine Tools.—A catalogue bearing the title "Twentieth Century Machine Tools," is being distributed by the B. F. Barnes Company, Rockford, Ill. Brief descriptive illustrations and specifications of the various machine tools made by this company, including upright drills, horizontal drilling and tapping machines, gang drills, small screw cutting lathes, key seating punches and water tool grinders are given.

Seamless Cold-Drawn Steel.—A neatly illustrated pamphlet issued by Janney, Steinmetz & Co., Philadelphia, Pa., contains illustrations and descriptions of various applications of seamless cold-drawn steel, including high-pressure reservoirs, boiler shells, domes, tanks, tubes, cylinders and special shapes.

Electric Hoists.—"Electric Hoisting Machinery" is the title of the latest bulletin issude by the Crocker-Wheeler Company, Ampere, N. J. Illustrations and descriptions of various types of electric hoists, winches, capstans, etc., are shown, and their weights, dimensions and capacities are given.

Direct Current Motors.—Detailed descriptions and illustrations of the Sprague Electric Company's Type D d. c. motors are given in its Bulletin No. 224. A brief description of these motors was printed in the RAILROAD GAZETTE of December 29, 1905.

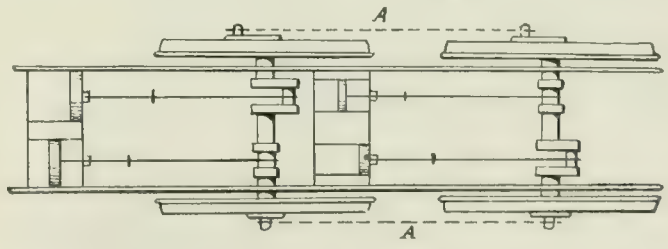
CONTRIBUTIONS

The Origin of Four-Cylinder Balanced Compound Locomotives.

Bristol, England, Jan. 3, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In my contribution under the above heading in your issue of December 8 last I described the first applications of two different systems of four-cylinder compound locomotives—the one with the motor stresses balanced on one driving axle and the other with the motor stresses balanced between two pairs of driving axles through the intermediary of side-rods. Therein it was shown that the French P. L. M. lines, under M. Henry, were the first to make the application of the latter system—that is, the one necessitating side rods for the free balancing or synchronizing of the efforts upon two pairs of wheels. It was also mentioned that Dawes,



Plan of Locomotive with Two Separate Driving Axles.

First proposed by Dawes in 1872. A. Mallet was the first to suggest the use of the rods U in 1877.

in his patent of 1872, proposed for the first time, and for one of his locomotive arrangements, a locomotive with two, *unconnected*, driving axles. This disuse of side rods, in one form of locomotive mentioned, met the want for an engine in which this wheel-connection, and its several notable inconveniences, were suppressed. An engine in which there are four cranks to one pair of wheels, and divided at 90 deg., is as well balanced in its efforts as modern practice can effect, and is applicable to one driving or any number of connected axles without the side rods playing any essential part in the balancing, whether they are applied or not applied, and this, it may be presumed, satisfied Dawes that he covered, in his three proposed types, all possible desiderata in locomotive design. But he did not (and expressly so) "couple" the wheels in that case where these were driven from two distinct sets of engines. The first engineer to publish the proposal for connecting up the wheels of such engines (having two motor axles) was Mr. A. Mallet—which important fact I failed to note in the article in question and which (as engines of this type have been built largely, especially in France) merits notice as an addition or erratum thereto. It is contained on page 958 of the proceedings of the Societe des Ingé-

nieurs Civils, Paris, 1877, as follows: "Four cylinders, of which two high pressure and two low pressure, each cylinder with its own driving rods. These four cylinders may be connected to the same axle, and in this case by keying the cranks of each group" (that is on the same side of the machine) "at 180 deg., a very satisfactory balancing of the driving axle may be realized as already effected by Randolph & Elder in marine engines. Or, each group of cylinders may be connected to a separate axle, these axles being coupled or not coupled; in the latter case this would be a Meyer or Fairlie engine, but working compound; and the complication of the arrangement would be justified both by the principle and by the system of the machines that is, flexibility, and by the superior working, as a steam engine properly so-called."

The subjoined sketch represents the idea emitted by Mr. Mallet for "coupling" rods applied to a compound engine of any arrangement suggested up to that period (1877). Mr. Von Borries referred to this proposed arrangement for coupling the wheels in his paper read at the Chicago (1903) Engineering Congress, and published on page 1,183 in Vol. 11 of the transactions of the American Society of Civil Engineers as follows: "The arrangement of working one set of drivers by a pair of h.p. cylinders and another by a pair of l.p. cylinders, the two sets of drivers being coupled or not, placed in the same rigid frames, or in two articulated frames was first mentioned in Mr. Mallet's paper of 1877, page 958; and therefore these engines should be classed under the head of Mr. Mallet's system."

CHARLES B. KING.

Massachusetts' Railroad Commissioners' Report.*†

Changes in law.—A number of changes in the law governing steam railroad and street railway companies, which would ordinarily have been suggested in this report, have been called to the attention of the joint recess committee of the Legislature, which has been reviewing these statutes. A discussion of these changes at this time, therefore, is rendered unnecessary.

Boston Elevated Railway. The commendable features in the management of the Boston Elevated railway would undoubtedly receive favorable criticism that is now withheld, were it not for the crowding of stations and of cars at certain hours in the morning and evening. While the company during the year has brought into use more cars and trains, added to its force of employees, made changes at stations and introduced the change to side doors at the ends of cars, the public must await the completion of the Washington street subway, now being constructed in a manner that challenges the admiration of those interested in such work; the building of the extension to Forest Hills, with accompanying changes in stations; and the abolition of the Dudley street railroad crossing, for which the Board has recently approved plans, before the running of longer trains and a greater freedom in distribution of traffic will effectually relieve the still present evil of over-crowding.

Financial outlook for street railway companies.—In our last report attention was called to the unsatisfactory showing by street railway companies in their annual returns. The returns of the year that has just closed exhibit some improvement, but the fact remains that unwise promotion, increase in cost of operation and the sins of past managements in paying dividends with earnings that ought to have been used in renewal of properties, make the task of placing many of these railways upon a prosperous footing a difficult and tedious one.

There have been here and there increases in fares. Some of these, when reviewed by the Board, upon complaint of communities affected, have been approved, some approved in part, others disapproved. As predicted, increase in cost of travel has resulted not infrequently in such decrease of patronage as to make the change unprofitable as well as unpopular. Upon the whole, however, there seems to be promise that companies under wise management will in time realize a reasonable return upon investment. The present heavy burden of reconstruction will doubtless afford the foundation for future profitable operation, and tend to create a permanent dividend paying basis. A management that recognizes this should be supported by stockholders for selfish reasons.

South terminal.—During the severe weather of last winter the running of trains through the South terminal yard was on several occasions interrupted. When, however, the number of trains is taken into account, the record seems to entitle the management to congratulation upon its success rather than censure for its failure. Comparison with results obtained at other large terminals makes the showing under the circumstances an exceptional one; but review and criticism of methods is profitable.

Among the devices suggested for the prevention of delays occasioned by storms and severe weather were the roofing over of the yard, the installation of oil or electric heating plants, or the construction of a system of snow pits beneath the tracks. Any one of these plans would introduce a remedy worse than the disease. We are satisfied that the present practice is altogether the best as well as the simplest one, that of employing men to keep tracks and switches free from snow and ice. When occasion demands, a larger force of men should be employed, and greater pains taken to notify the public as promptly and as fully as possible of the causes and the probable length of delays, even though the statement must be an indefinite one. Nothing provokes complaint more than apparent indifference to patrons who are left not only without expected accommodations, but without knowledge as to whether such accommodation is likely to be available, or whether they must look elsewhere for a way to reach home. More effort should be made to give what information is at hand to people who are waiting to take trains that are delayed, and this information should be given in a manner that does not imply that questions ought not to be asked.

Lighting of cars. Complaint has been made that suburban trains are not properly lighted. There is enough of reason for complaint to lead us to make the recommendation that the management of every company take steps to have cars used in this service so lighted that passengers who desire to read may have the opportunity.

Vestibules of street cars. The practice of locking from the outside the door leading from the body into the front vestibule of street cars was recently criticized in an order of the Board. This practice had been adopted by companies in the effort to prevent passengers from occupying the front vestibule. To meet the objection to the present method of locking doors, it is proposed to adopt some device which will enable the conductor as well as the motorman to open them. In our opinion legislation, which would make the violation of a proper rule for the protection of motormen a criminal offence, would be desirable in the interest of safety.

Accidents.—. . . The first of a group of recent accidents occurred upon the Worcester & Southbridge street railway. An attempt, as the result of an understanding between the despatcher and the motorman, to make connection between a special car sent out late at night and a regular car upon another railway, was the underlying cause of reckless speed in approaching a sharp curve. In approaching sharp curves at the foot of heavy grades, street cars should always come to an absolute stop, at a point indicated by the maintenance of a stop sign.

The second accident of the group was the explosion of a locomotive boiler upon the New York, New Haven & Hartford Railroad. Fortunately no one was injured. An examination of the boiler after the explosion showed a giving way under steam pressure at a point where the boiler was weakest. This was one of four engines of the same type purchased of a reputable manufacturer in 1889. One of these, on the Plymouth division, adjusted to a pressure of 150 lbs., exploded. The safety valve was adjusted at the time to the pressure of 149 lbs. Nothing was found which pointed to any leak, crack or defect that could have given warning of the danger in any ordinary inspection. In the opinion of the Board the strain upon boilers with such a history ought to have been lessened unless some special test had justified it. When a difference of opinion between experts involves the taking of a possible risk, there ought to be some one with absolute authority to insist upon safety at the expense of every other consideration.

A third accident of most unusual character took place upon the Boston Elevated Railway. [A derailment was caused by a loose switch, loosened by the breakage of a pinion in a motor.] One prominent factor in keeping the train upon the structure and preventing loss of life is found, we believe, in the type of construction. If there had been here the solid floor often advocated in the interest of quieter operation, it is altogether likely that in rounding the curve the cars would have been thrown into the street. Tied together as it was, the existing structure offered a resistance which a railway with solid flooring would not have given.

In approving a construction similar to this for the extension of the elevated railway to Forest Hills, against the objection of those who urged a solid floor, the action of the Board was based upon the belief that in our climate this form of structure is safest. Its strength as proved in this test adds another to the reasons which seem to justify the selection. The fourth, and most important of this group of accidents, is that which occurred within a few weeks at Baker Bridge. [*Railroad Gazette*, Dec. 1, 8, 15, 22.]

The engineer upon the pilot engine of the express train states that he saw the green lights at Lincoln crossing and at Lincoln station, the red fusee just west of Lincoln station and that east of Baker Bridge, and that he knew the meaning of these lights and the rules governing them. He claims that upon seeing the red fusee near Lincoln station he shut off steam. With reference to the use of brakes, his statement is vague, involving at most a claim that he made a slight use of the brake and reduced speed a little. The engineer of the second engine of the express states that in his judgment the brakes were not used, and that the speed was not slackened. That the train proceeded from Lincoln to within a few hundred feet of the place of accident at high speed, with little or no appreciable slowing down, is proved by abundant testi-

*From thirty-seventh annual report of the Railroad Commissioners of Massachusetts—Jas. F. Jackson, Geo. W. Bishop and Clinton White.

†See also page 59.

mony as well as indicated by the impact of the blow in collision. The engineer of the pilot engine of the express further states that he took the train out voluntarily after notice, at 11 o'clock in the forenoon, that he was next on the list to go on duty and a further notice at 4 o'clock in the afternoon that he was assigned to this train; that he felt competent to take the train and was in good condition notwithstanding a headache of which he spoke to nobody; that the night was clear and his view of the track, which runs here in a straight line, seemed unobstructed; that the engine was working well and nothing happened to divert his attention; that it was not until he was within 100 yards that he saw the rear-end lights of the train in front of him and at once applied the emergency brake. As the fireman was immediately killed there is no one to give any other version of what took place in the cab.

. . . However disposed one may be to treat generously a man of previous good record, and one of a body of men to whose splendid fidelity and courage the public owe so much, it would be unjust to those whose lives were in the care of this engineer to overlook his failure in the performance of duty.

It was the practice upon the Boston & Maine to assign trainmen to extra or special duty in accordance with the understanding that the first man to report after the performance of a tour of duty shall be first on the list for the next tour. The engineer assigned to the Montreal express upon the night in question was the man to whom the assignment fell by this understanding. Much of the criticism founded upon the fact that so many of the crew of the express train were spare men rests upon a misapprehension of what that phrase means. A spare man is one who is qualified for, but not yet assigned to, regular service. As there are fewer trains upon Sunday than upon other days, and so many men prefer Sunday as the day to be off duty, the train service of that day is one to which spare men are very generally assigned. It by no means follows that they are not men of experience and ability. Every spare engineer has served his term as fireman and has passed written and oral examinations and ought to be equipped with all knowledge that can be acquired previous to actual practice. Although opinions differ as to the kind of work which had best be first given to a new man, it would seem fairer to him and better for all concerned that he have preliminary experience at a less responsible post before he is assigned to the most important trains. Where expert skill in the grasp of a situation, cool judgment in action and sure control of engine are especially needed, a man new to the work is ordinarily not the one to best meet requirements.

The mere fact that the engineer assigned to the Montreal express was a spare man in no way prejudices him or the company. As to his experience, it seems that he was familiar with the road and had served a long term as fireman upon the engine of an express train, where it was a part of his duty to look out for signals and where he would become more or less familiar with the handling of engine and train. His actual practice as engineer was limited, being confined to a little more than a month in charge of a night switcher in the yard, five days in charge of a freight train upon the road and one day in charge of a passenger train.

Hours of labor on railroads ought to be regulated, but in our opinion this should be done through agreement between employer and employees, and not by statute. Such an agreement is better suited to railroad service, where emergencies, in case of storms, washouts, accidents, and other temporarily unusual conditions demand a reasonable amount of extra work and an elasticity in the regulation of labor incompatible with a statute rule.

There was an agreement of this kind between the Boston & Maine and its employees, but the record shows that the agreement was not always enforced, apparently through a mutual understanding that it might be at times disregarded. In this case the engineer assigned to the express had worked beyond ordinary limits during the week, but a night of sleep and a day of rest had intervened between his employment of Saturday and that of Sunday night, and nothing that he said and nothing that he did gave intimation that his condition was physically or mentally in any degree impaired.

Whether or not the work of the preceding week had any remote connection with what happened on this Sunday night, such instances as these show the advantage of a rigid enforcement of some general rule limiting hours of labor, and permitting exceptions only in such cases as are named in the rule and involve no risk of life. The human factor plays so large a part in all questions of safety in travel, even upon railroads equipped with the most modern devices, that it is of great importance that the assignment of men should be carefully safeguarded. A man cannot be vigorous and alert and watchful without proper hours of rest. We are convinced that railroad employees do not desire legislation to fix hours of labor upon railroads, and we believe that such legislation under present conditions would be unwise. It will be warranted only when the desire of employees to work overtime and the inclination of employers to profit by such work practically destroys any limitation upon the hours of labor under an agreement of parties. [The Board holds that a fusee should be red and be a stop signal.]. . . Nor is there any likelihood that serious interruptions of service would follow if engineers were required to stop their trains on approaching red fusees. With other safeguards, such a rule should work well. Red fusees can be used too freely, and so lose their significance and value. They had better be used less and mean more.

Rule 99 reads: "When a train stops or is delayed under circumstances in which it may be overtaken by a following train, the flagman must go back," etc. The superintendent stated that under this rule no flagman would be sent back unless something out of the usual course, such as a breakdown or extraordinary delay, had occurred, and this was evidently the way in which the rule was interpreted by those in charge of the accommodation train and by employees generally, if the statement of one of many engineers be excepted. But a delay that has held a train back almost to or quite upon the time of a following train would be within the literal wording of the rule.

Rule 703 reads: "Enginemen must never run past a red signal displayed on the track." . . . In practice this rule does not apply to red fusees, and that it is not intended to apply to them is apparent from a reading of the whole code. But why should a red fusee be classified as any other than a danger signal?

Railroad rules are too often uncertain and inconsistent. Changes are needed to make them more effective, and to bring about harmony in understanding and practice. Colors should uniformly mean the same thing, and we believe that red should invariably mean danger and that trains stop before proceeding further. Results of experience in the use of colors lead us to suggest that green indicate safety, and yellow, if used, caution.

Recent accidents within and without the state emphasize the paramount importance of the enforcement of discipline. One undivided authority to be obeyed without questioning is indispensable to safety, and any agreement or understanding which transfers this authority from employer to employee in matters affecting the safe operation of a railroad is vicious. Though a man be ready to work beyond his physical strength, tempted by the opportunity to earn extra wages, or ambitious to undertake a service for the safe performance of which greater experience or different qualities are requisite, the responsibility for permitting this must rest with the management, and the right to prevent it surely belongs with the responsibility.

Block signals.—The public has the right to expect that a management will adopt every measure of precaution which ought to commend itself to men of expert ability in the operation of rail roads. Not that it should heed every suggestion from theorists or men commercially or otherwise interested in promoting patents, but that it should study questions of safety in the light of all available information and without reference to questions of economy. No company has the right to be content with methods and instrumentalities of the past or present, and not keep a look-out for improvements in mechanical and electrical devices that serve to aid and strengthen human agencies.

The experience of many years upon the Boston & Maine undoubtedly led the management to believe that the rules governing fusees and green signals furnished adequate protection against such collisions as that at Baker Bridge. In defence of that belief it must be admitted that if these rules had been followed there would have been no accident at that place. But the rules left too much discretion and responsibility with the train hands.

Although the company has favored the use of block signals under certain conditions, it had not generally replaced the time system of signals with the block system. In our opinion the latter is so far the better system that whatever the policy of the past may have been, that of the future ought to be one which shall vigorously push forward the installation of block systems of the most approved types.

The day for discussion as to whether signals founded upon a division of railroads into blocks are a desirable safeguard is past, experiment having conclusively proved their value. Obviously, no arrangement of mechanical devices yet invented can insure against accident. It is unnecessary to enumerate the many instances in different sections of the country where block signals have failed to prevent accident. And yet beyond question companies ought to have their important lines equipped with them. Block signals give an engineer more definite knowledge of conditions immediately ahead of him, and, in limiting the field of his responsibility, decrease the chances of accident. While failure to observe these signals is always possible, the likelihood of collisions is undoubtedly lessened by their use. The block signal has been introduced to a varying but insufficient extent upon our railroads. We believe it should be generally installed where trains follow each other in quick succession or meet each other at frequent intervals. This suggestion applies as well to street railways where cars are run at high speed.

We recommend legislation requiring railroad companies and such street railway companies as run cars under similar conditions, to equip, within a reasonable time, lines of the character above named with a block signal of such type and installed in such manner as the Board may approve.

Heavy Eight-Wheeled Passenger Locomotive for the Central R. R. of New Jersey.

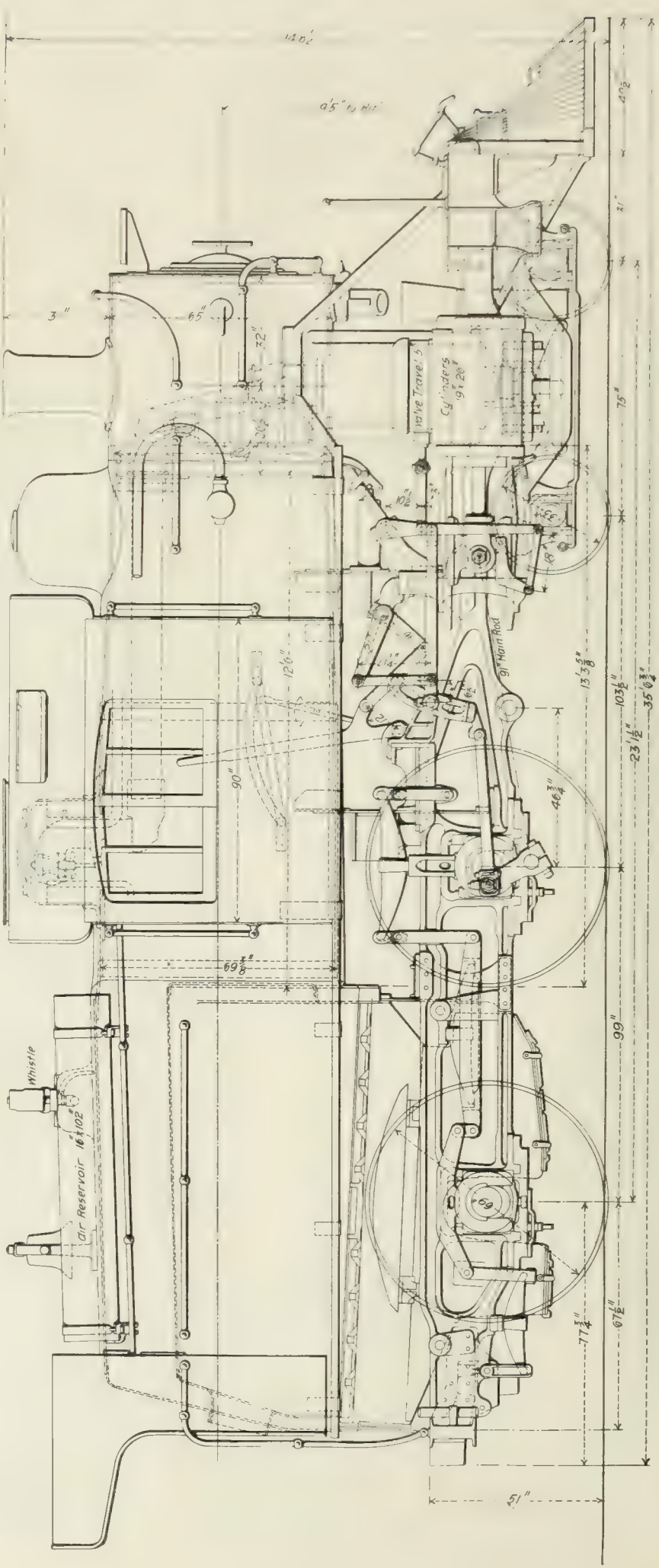
The American Locomotive Co. has recently delivered to the Central Railroad of New Jersey, from its Brooks Works at Dunkirk, New York, three exceedingly heavy locomotives for passenger service. They are of the eight-wheeled American, or 4-4-0 type, and are interesting in part from the fact that comparatively few large engines of this character are now being built for the railroads of the United States. They were designed for hauling a comparatively light train over a very crooked division where the grades are heavy and where the work had previously been done by engines of the ten wheeled (4-6-0) class. The eight-wheeled engine has been adopted for this work because of the excessive repair charges incurred by the ten-wheeled type on account of the sharp curves.

The work that they are intended to perform is the hauling of passenger trains consisting of one combination car, one coach and one Pullman car, having a total weight of 134 tons without passengers or baggage, between Bethlehem and Scranton, a distance of 105 miles. This is a difficult division because of the grades and frequent stops. In it the track rises 1,394 ft. in 67 miles of continuous up grade, the steepest portions of which range from 37 ft. to 62 ft. per mile. On the other side of the same hill going down into Wilkes-Barre the heaviest grade is 95 ft. per mile. The locomotives are expected to run the 105 miles at an average speed of about 30 miles per hour, with allowances on the time card for a maximum number of 36 stops, many of which are flag stops. Out of the 36 about 15 flag stops and seven regular stops are made every day. These figures apply to train No. 23, which is the most severe of the four trains which the engines are to haul.

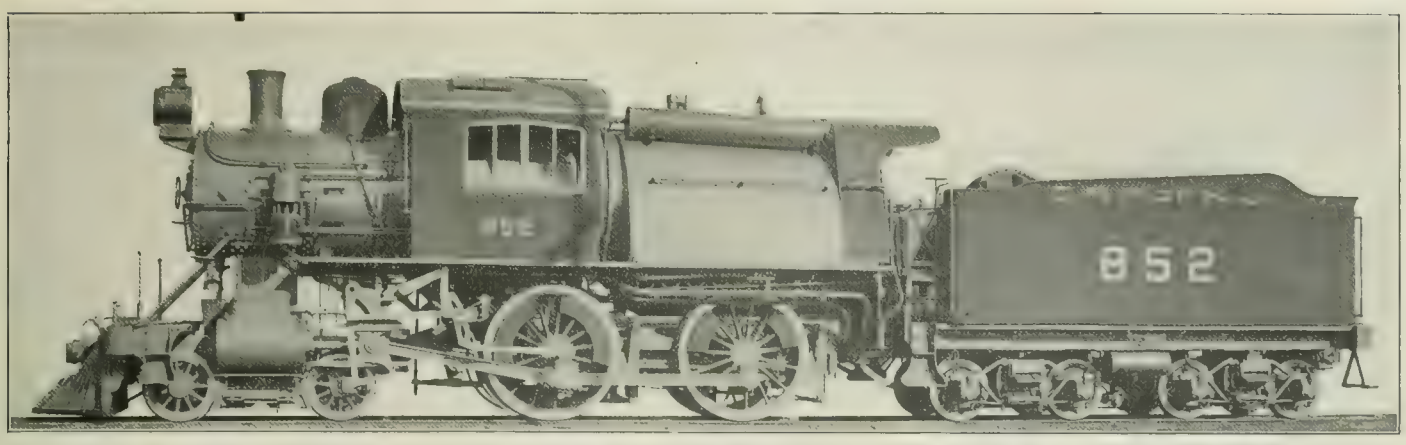
These locomotives were designed under the direction of William McIntosh, Superintendent of Motive Power, and B. P. Flory, Mechanical Engineer of the Central Railroad of New Jersey. They are fitted with the Walschaert mechanism, the arrangement of which is in accord with the regular practice, but it is interesting to note how the details have been worked out to adjust it to working with the cab set forward as in the case of these engines with Wooten boilers. The radius arm and combination lever are attached to an outer rocker arm that hangs down and through which, with a similar arm, the motion is carried to the valve stem. The lifting arm is turned back and the reach rod is a short inclined connection extending from a projection on the reverse lever to the lifting shaft lever, and is but 24 in. long.

The frame of this engine is of cast-steel made in one piece, and is of I section back of the union of the single front rail with the double rail construction just in front of the front driving wheel pedestal. At the cylinders the frame has a width of 5 in. and a depth of 6½ in., by which it is expected that ample strength will be furnished for the stresses that will be imposed. The cylinders are bolted to the frames by seven 1⅜-in. horizontal bolts that are staggered and two vertical bolts near the ends. The guides are carried by a cast-steel yoke of substantial proportions and have an overhang of about 5 in. to the rear.

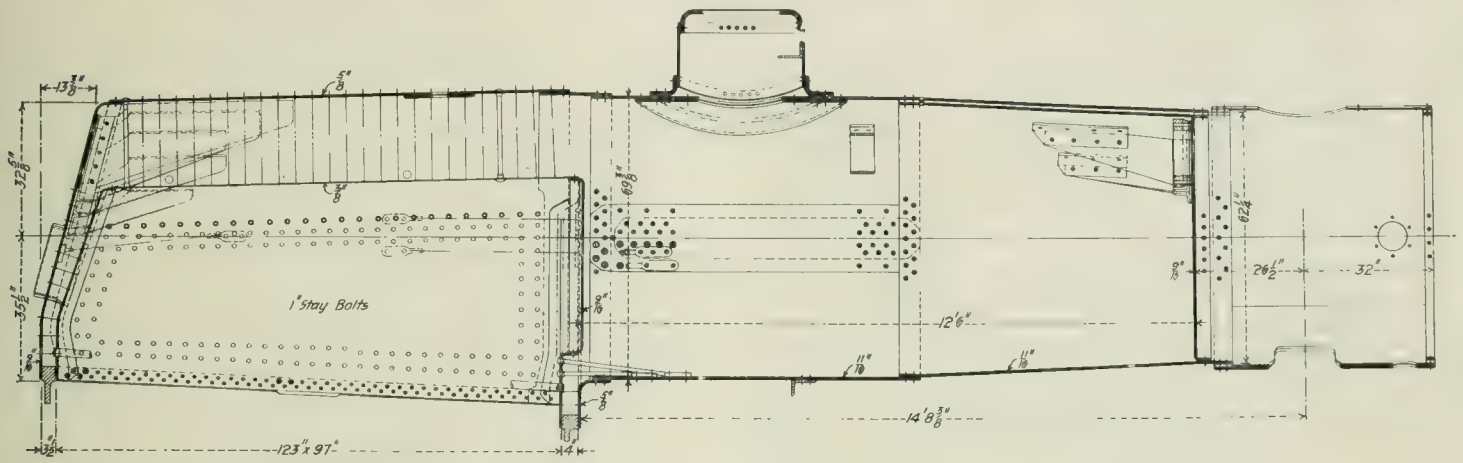
In the paper read before the Western Ry. Club by Mr. Wells, an abstract of which appears on another page of this issue, it was maintained that it would be bad practice to place the injector check less than 24 in. from the front tube-sheet on account of the tendency to cause tube leakages at the front if it were made less. Here, however, we find



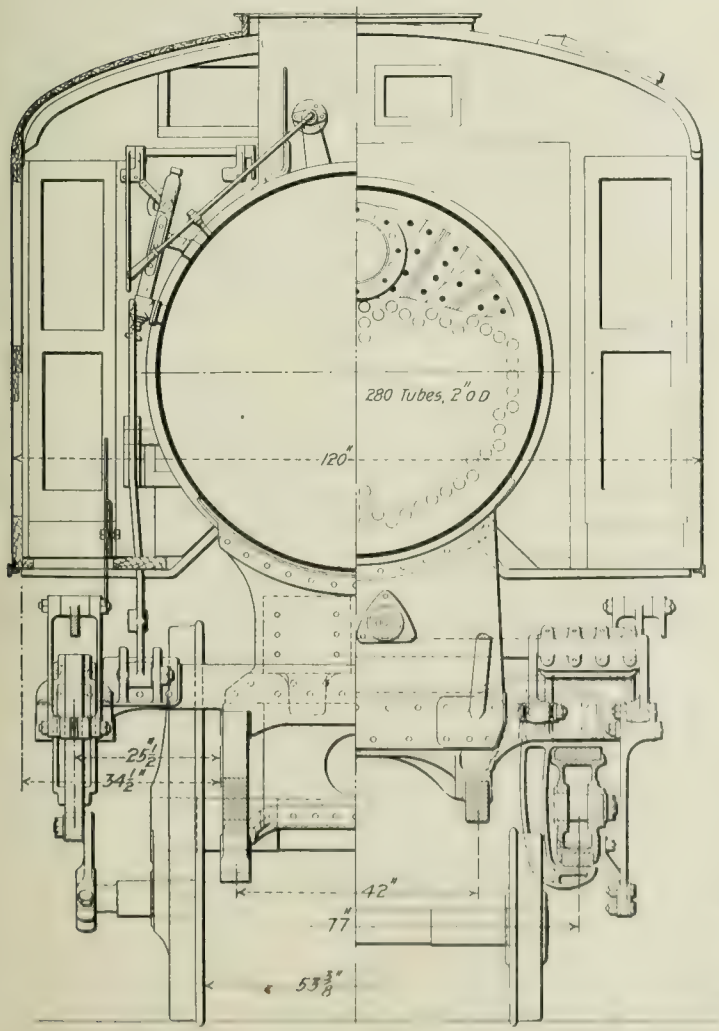
Side Elevation of American (4-4-0) Type Locomotive with Walschaert Valve Gear—Central Railroad of New Jersey.



American (4-4-0) Type Locomotive with Walschaert Valve Gear—Central Railroad of New Jersey.



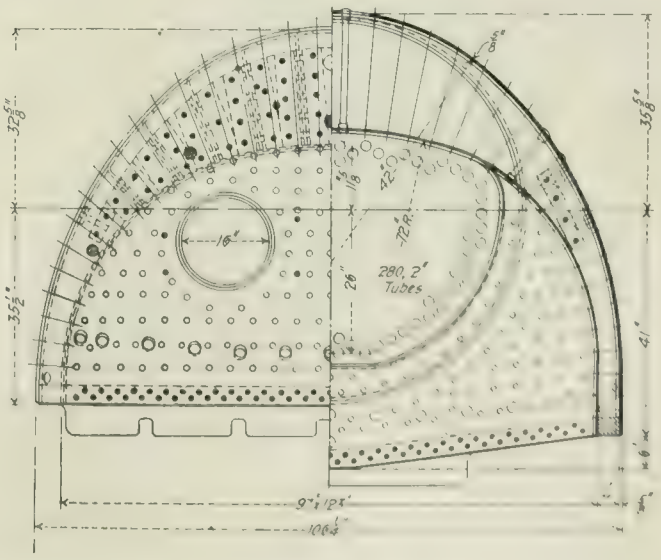
Longitudinal Section Through Boiler of American (4-4-0) Type Locomotive—C. R. R. of N. J.



Half Cross-Sections Through Boiler.

this check located but 8¼ in. back of the tube-sheet, and that where the run is heavy. It will be interesting to note whether front leakages will develop as the result of this or not.

The boiler is of the Wooten type, with a shallow combustion chamber and a long firebox. The back head is sloping with an increase in the width of the water leg from 3½ in. at the bottom to 6 in. at the top. Water grates are used spaced 8¼ in. apart from center to center. These are screwed into the front sheet and



Cross Section of Boiler.

secured with a copper ferrule and beading at the back. The boiler is carried by four buckle plates of the usual character back of the cylinders, two of them being located at the front and back of the firebox respectively. The front course of the shell is conical so that the latter increases from a diameter of 63 in. at the smoke box to 69¾ in. at the dome.

The general dimensions of these engines will show that they are

among the heaviest of this type that have been built. They are as follows:

Cylinder diameter	19 in.
Piston stroke	26 "
Tractive power	23,120 lbs.
Wheel base driving	8 ft. 3 in.
" total	23 ft. 1½ "
" engine and tender	49 ft. 7 "
Weight in working order	168,000 lbs.
" on drivers	108,000 "
" engine and tender	283,500 "
Heating surface, tubes	1,858 sq. ft.
" " firebox	194.6 "
" " total	2,065.4 "
Grate area	81.6 "
Axle diameter, driving journals	9 in.
" length driving journals	13 "
" diameter, truck journals	6 "
" length truck journals	12 "
Boiler, type	Wagon, Top
" outside diameter, first ring	62 in.
" working pressure	200 lbs.
" fuel	Pocahontas coal.
Firebox, type	Wide
" length	123⅛ in.
" width	96½ "
" thickness, crown	½ "
" " side and back sheets	½ "
" thickness, tube sheets	16 in.
" water space, front and sides	4 "
" " " back	3½ "
" crown, staying	Radial stays
Tubes, diameter	2 "
" length	12 ft. 6 "
" number	350
Piston rod diameter	3½ in.
Smokestacks, diameter	15 in. & 16½ "
Smokestack, above rail	14 ft. 8½ "
Tank, style	Water bottom
" capacity, water	5,000 gals.
" capacity, fuel	12 tons
Valves, type	Slide
" travel	6 in.
" lap	1 "
" exhaust clearance	1/16 "
" lead	¼ "
Wheels, diameter, drivers	69 "
" " front truck	33 "
" " tender	33 "

The engine is equipped with the Westinghouse American driver and truck brakes, and the firebox is fitted with water grates in accordance with the practice on anthracite coal burning engines, and as shown in the illustration of the boiler. In comparing this engine with the corresponding engine used on the Delaware, Lackawanna & Western, illustrated in the *Railroad Gazette* Oct. 13, 1905, it will be seen that while the latter has the larger cylinders (20 in.) this Central engine is the heavier. The Lackawanna locomotive weighs 153,100 lbs. when fitted with a superheater, of which 101,000 lbs. are on the driving wheels. The heating surface is less by 1.3 sq. ft. on the Central engine than the Lackawanna without the superheater, and 178 sq. ft. more than the same locomotive with the superheater. In brief, the two engines are very much alike with the natural variations of weights and design that invariably occur when two independent designs are set up to accomplish similar or comparative results.

Working of Harriman Lines' Equipment Clearing House.

An equipment clearing house was on June 1, 1904, established by the Union Pacific System and the Southern Pacific Company (Pacific System), including the Union Pacific, Oregon Short Line, Oregon Railroad & Navigation Company and all Southern Pacific lines in the United States west of El Paso, Tex. Under this arrangement cars of all the lines associated in interest are used without distinction by each. Its effect is to largely reduce the movement of empty cars consequent upon the former practice of returning cars to the owning road, to do away with expenses at junction points, and to add considerably to the available equipment in any of the territory where the demand for cars may become excessive. For comparison with the rules under which the New York Central Lines' freight car repair pool, described in the *Railroad Gazette* of June 16, 1905, page 705, is operated, the most important sections of circular No. 5 issued on May 1st last, by the accounting department of the Harriman Lines involved, are given herewith.

1. By authority of Mr. J. Kruttschnitt, Director of Maintenance and Operation, for reasons of economy and convenience, an Equipment Clearing House in connection with the operation of rolling stock equipment was established by the lines named above, effective June 1, 1904.

2. Locomotives and cars of clearing house lines will be assigned to the lines on which they can at the time be used to the best advantage.

3. Repairs required by locomotives or cars of clearing house lines to put or keep them in serviceable condition may be made by any shop on any of these lines.

4. Inspection to determine responsibility for repairs will not be required of locomotives or cars passing from one clearing house line to another, except only in the case of passenger cars belonging to foreign roads—that is, to roads other than the clearing house lines.

5. Per diem charges for the use of equipment have been discontinued between clearing house lines, and rental charges based on mileage will be paid by the line using to the line owning equipment, as follows:

	Cents per mile. Freight service.	Passenger service.
Locomotives		
Consolidation, 12 wheel, Pacific type	17	11
Mogul, 10 wheel, Atlantic type	15	10
All other locomotives	13	9
Passenger cars		
Coaches, composite cars and dining cars		3
Baggage, mail and express cars		2
Freight cars	0.6	

The rates for locomotives in freight service will apply also to switching, work and construction service; the mileage to be calculated on the usual basis, viz.: actual mileage under running orders, and an allowance of six miles per hour for time employed at a certain point or within certain working limits.

6. Separate reports will be made of locomotive mileage and car mileage.

7. Settlement for locomotive and car mileage will be made by draft.

8. The cost of repairs to locomotives and passenger cars of clearing house lines or of foreign roads occasioned by accident, will be borne by the line on which the accident occurs. It is assumed that accident damages to passenger cars, if of any magnitude, will be repaired by the line responsible therefor. If, however, a passenger car belonging to a clearing house line is damaged by accident on a clearing house line and is accepted by another clearing house line, or by a foreign line as safe to run, repairs made after such acceptance will be classed as ordinary, not as accident, and will be charged (or recharged) to the owner, in accordance with Section 10 hereof.

9. All repairs (except accident repairs) to locomotives of the clearing house lines will be charged to the owning line, on the basis of actual cost. By "actual cost" is meant store department prices for material plus the usual percentage for store department expense and the actual cost of labor employed, plus the usual percentage for "dead labor." An addition of 10 per cent. will be made to cover superintendence and "shop expense," which amount will be credited to Account No. 17, repairs and renewals of locomotives. The total cost of labor and of material (separately) should be given for each locomotive.

10. All repairs (except accident repairs) to passenger cars of the clearing house lines will be charged to the owning line, on the basis of M. C. B. prices. If the repairs are made by a foreign road and charged to a clearing house line not the owner of the car, they will be recharged by such line to the owner. This arrangement does not, however, abrogate any existing agreement in respect to repairs to passenger cars in through service over any of the clearing house lines in connection with others of these lines or with foreign roads.

11. Settlements for repairs to locomotives and passenger cars will be made by bill and voucher.

12. The cost of repairs to freight cars of clearing house lines or of foreign roads, when occasioned by accident, fire or wind, and amounting to $75 or more per car, will be borne by the line on which the accident occurred. Repairs to freight cars amounting to less than $75 per car, will not in any case be classed as accident repairs, and will be reported to the clearing house as provided in Section 13.

13. The amount of all expenditures made by each of the clearing house lines, which, according to the classification of operating expenses are chargeable to Account No. 20, repairs and renewals of freight cars, will be charged to the equipment clearing house and reported for apportionment as hereinafter provided, except the following:

a. The cost of repairs due to accident, fire or wind, when amounting to $75 or more for any one car.

b. The cost of temporary coal doors and grain doors, which, being incurred in connection with particular shipments, does not benefit all clearing house lines.

c. Charges for cars sold, worn out or destroyed.

d. Amounts billed against foreign roads for repairs to their cars. That portion of the cost of such repairs which cannot be thus billed out will be included in reports to the clearing house.

e. The cost of repairs to narrow gage freight cars.

14. To cover superintendence and shop expense, each line will charge to the equipment clearing house, and report for apportionment, an amount equal to 10 per cent. of the charges specified in Section 13, which amount will be credited to Account No. 20, repairs and renewals of freight cars.

16. Amounts paid to foreign roads for repairs to freight cars made by them, except accident repairs amounting to $75 or more per car, will be included in the amounts reported to the clearing house for apportionment.

17. Record need not be kept by individual cars or by classes of cars, of repairs made to freight cars owned by clearing house lines, except in the case of steel cars, steel frame cars and certain classes of wooden cars of similar age and capacity, the last mentioned to be designated by the superintendents of motive power; for which each clearing house line will report to the owner, month-

ly, the cost of repairs made to each class. The expense of repairs to these cars will be treated in the accounts in precisely the same way as repairs to other freight cars, that is, as directed in Sections 12 and 13 hereof, these reports being for statistical purposes only, and not for accounting. Each clearing house line will furnish to the general auditor and to the director of maintenance and operation, a monthly statement showing for each of the selected classes of its cars the total actual cost of repairs, the number of cars owned, and the cost per car. Miscellaneous expenses which cannot be located to individual classes of cars, such as wages of inspectors, cost of tools, etc., will not be included.

18. The motive power department of each line will render to the other lines monthly statements of their wheels replaced by it, that reclamation may be made on the wheel manufacturers for amounts due under guarantees of certain performance.

19. Settlements for cars destroyed will be made (by bill and voucher) between clearing house lines in accordance with M. C. B. rules. No portion of destroyed cars belonging to clearing house lines will be returned to the owner, but proper allowance will be made for the value of the entire car. Trucks in serviceable condition, when of common standard, will be used by the retaining line in the construction or reconstruction of its own cars, or reconstruction of cars of any of the clearing house lines; trucks of light capacity will be used for its work-car equipment by the retaining line.

20. The total amount of charges for repairs to freight cars reported to the clearing house as provided in Sections 13 and 14, will be apportioned to the various clearing house lines on the basis of mileage made on such lines by all cars in freight service, including those owned by clearing house lines and those owned by foreign roads. The mileage of roadway cars in freight service should be included, as the repairs due to such mileage are charged to Account No. 20, repairs and renewals of freight cars. The mileage of freight cars in roadway service should be excluded, as the repairs due to such mileage are charged to Account No. 21, repairs and renewals of work cars. The freight car mileage allowed for engines hauled dead in freight trains—also for new passenger cars hauled for other companies in freight trains—should be excluded, as no charges to Account No. 20 accrue from such service. No mileage, actual or constructive, made by cars of clearing house lines on foreign roads will be considered in the apportionment, and such mileage should not be reported to the clearing house.

21. As soon as possible after the close of each month, the net charge to the clearing house, as specified in Sections 13 and 14, and the freight car mileage, as specified in Section 20, for the month, should be telegraphed to this office, where the amount of the expense which should be borne by each line will be determined and announced by wire. Authority will be given at the same time for lines which have paid out more than their proportion of the total repairs to make sight draft on Union Pacific Railroad for the amounts of such excess, and Union Pacific Railroad will make similar drafts for the amounts of deficiency upon the lines which have paid out less than their proportion. Detailed statements of the apportionment will be furnished by mail.

22. The proportions for the various lines of the total freight car repairs as determined by the clearing house apportionment will be disposed of in Account No. 20, repairs and renewals of freight cars.

23. This arrangement applies only to equipment lettered as follows:

a. "Union Pacific R. R."

b. "Oregon Short Line R. R."

c. "Oregon Railroad & Navigation Co." "Oregon Railway & Navigation Co." "O. R. & N. Co." or "O. R. & N." Some of this equipment bears "S. R. V. R. R. Co." in addition to the foregoing.

d. "Southern Pacific Co.—C. P. Ry." "Southern Pacific Co.—S. P. R. R.," or "Southern Pacific Co.—O. & C. R. R."

It does not apply to equipment owned by or assigned to the Sonora Railway, or lines in Louisiana and Texas known as the "Sunset" and "Central" lines. The assigned equipment all bears the name of the road to which it is assigned, though some of it is also lettered "Southern Pacific" in medallion form.

Results from the operation of the clearing house, according to information furnished us by Mr. J. Kruttschnitt, Director of Maintenance and Operation, have been exceedingly satisfactory. The following statement was made in the annual report of the Union Pacific for the last fiscal year: "The clearing house put into effect this year by the companies for the common use of their rolling stock was an important factor in the excellent results attained by the transportation department. By this clearing house system of distributing cars there was effected an increase of 1.60 cars in the average number of loaded cars per train and also a gain of 1.55 per cent. in the percentage of loaded freight car mileage to total freight car mileage, representing a saving of about 5,726,992 empty car miles." Mr. Kruttschnitt supplements these figures by the following table, which shows for the last fiscal year results on the Union Pacific System and Southern Pacific Company (Pacific System) separately and for the associated systems together. The statement shows the loaded and empty freight car mileage on the two systems for the year ended June 30th last, during which the clearing house was in effect, as compared with similar figures for the previous year. The statement appears below:

Year ending June 30th	1905.	1904.	Increase or decrease	
	Loaded Freight Car Miles.			
Union Pacific system	269,763,446	240,405,820	Inc. 29,357,626	12.2
Southern Pacific Co.	344,926,922	338,783,730	Inc. 6,143,192	2
Total	614,690,368	579,189,550	Inc. 35,500,818	6
	Empty Freight Car Miles.			
Union Pacific system	99,719,947	96,008,791	Inc. 3,711,156	4
Southern Pacific Co.	140,793,852	158,982,665	Dec. 18,188,813	11%
Total	240,513,799	254,991,456	Dec. 14,477,657	6
Grand total	855,204,167	834,181,006	Inc. 21,023,161	3
	Ratio Empty Car Mileage.			
Union Pacific system	26.99	28.54	Dec. 1.55	
Southern Pacific Co.	28.99	31.94	Dec. 2.95	
Total	28.12	30.57	Dec. 2.45	

Had the 1904 ratio of empty mileage prevailed in 1905, empty car mileage would have been 261,435,000, or 20,921,000 in excess of actual figures. This is roughly equivalent to nearly 500,000 train miles.

This illustrates in a striking way the great saving which has been made in movement of empty cars, which means, of course, a consequent increased availability of equipment for securing loads. Had the 1904 ratio of empty mileage prevailed in 1905, the empty car mileage would have amounted to 261,435,000 miles, or nearly 21,000,000 freight car miles in excess of the actual figure. This saving is roughly equivalent to 500,000 freight train miles; that is, the 1904 ratio would, with an average of 42 cars to a train, have required the running of 500,000 more freight train miles. Since the close of the fiscal year covered by the table, there has been especial opportunity for efficiency in handling equipment to be shown because of the unusually severe car shortage and the consequent heavy demands on the equipment. In the four months ended Oct. 31, 1905, the ratio of empty car haul was still further reduced 1.15 per cent. on the Union Pacific and 1.19 per cent. on the Southern Pacific; an addition of nearly one-half to the saving in the fiscal year 1904-1905. Results as favorable as these speak for themselves for the success of the equipment clearing house as a means of operating efficiency.

Massachusetts Railroad Commission's Report.*

The report of this body was sent to the Legislature on January 15. The length of railroad in the state is 2,105 miles. This figure has remained practically unchanged for several years. The usual statistics of operation are given, which, however, include the business on 2,857 miles outside of the state. The ratio of expenses to earnings was 72.19, a fraction less than in the preceding year. Six passengers, 80 employees and 178 other persons were killed on the railroads in the state of Massachusetts during the year, and 19 passengers, 438 employees and 182 other persons were injured. A table is given, showing the casualties since 1895, in which travelers on the highway at grade crossings are separated from trespassers. From this table, it appears that in 10 years the number of trespassers killed (1,305) was 241 larger than the passengers, employees and travelers at crossings combined.

The report of the Bridge Engineer gives the usual statistics. Forty-nine bridges have been built or replaced during the year: 28 wooden spans by 18 wood and 11 metal; 21 metal spans by 21 metal and one stone. The New London Northern (Central Vermont) has replaced with pin connected steel trusses and plate girders the wooden bridge across the Connecticut river at Northfield, which had been in service 56 years, though it had been strengthened several times by the addition of arches.

The length of line now owned by the street railway companies of Massachusetts is 2,220 miles; length of track, 2,777 miles. Only 19 miles of the street railway is outside of the state. The principal statistics of the street railway lines are as follows:

	1905	1904
Assets	$[illegible]	$[illegible]
Capital stock	[illegible]	[illegible]
Funded debt	[illegible]	[illegible]
Other liabilities	[illegible]	[illegible]
Total liabilities and sinking fund	[illegible]	[illegible]
Surplus	[illegible]	[illegible]
Dividends	[illegible]	[illegible]
Cost per mile of main track	[illegible]	[illegible]
Gross receipts	[illegible]	[illegible]
Expenses, incl. taxes, and all charges	[illegible]	[illegible]
Expenses, including dividends	[illegible]	[illegible]
Surplus for the year	[illegible]	[illegible]
Passengers carried	[illegible]	[illegible]

*Deficit.

The dividends declared averaged 1.51 per cent. on the total capital stock, as against 1.69 per cent. the year before.

Eighteen passengers, 13 employees and 54 other persons were killed on the street railways during the year, and 3,950 passengers, 204 employees and 1,518 other persons were injured. The street railways report 18 additional spans of bridges over last year, and

*See also page 54.

two spans rebuilt. Hereafter the board is not to take account, in its inspection records, of highway bridges over which street railways pass.

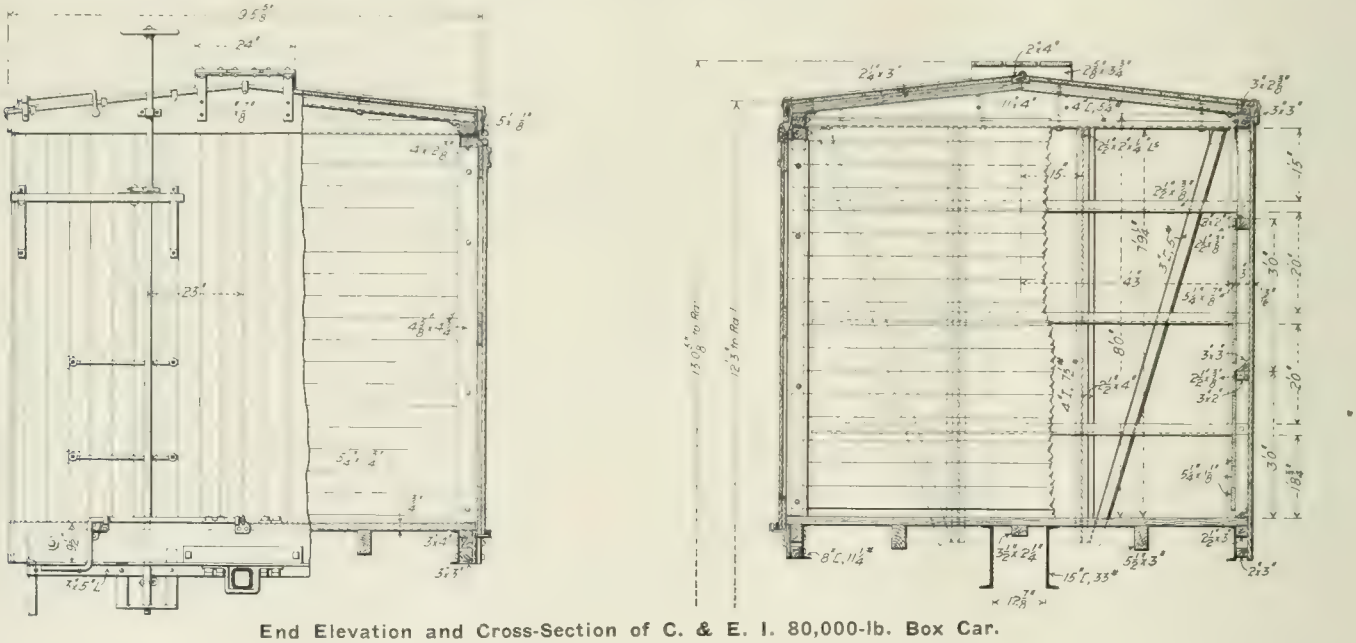
Washington Correspondence.

WASHINGTON, Jan. 16. Railroad rate legislation has not made any progress at either end of the capitol during the past week. It had been expected that the Hepburn bill would be favorably reported from the House Committee on last Friday. The Republican members of the Committee were unanimously agreed upon it, but opposition came from the Democrats, who asked for more time for its consideration. This was granted by the Republican majority and action was postponed for one week. It is not certain that a report will be ordered this week, as Representative Adamson, of Georgia, suggested at the last meeting that some of his constituents would like to be heard on the subject of private freight cars. The fruit growers of Georgia are very much interested in the refrigerator car service with which their fruits and vegetables are hauled to northern markets, and they are practically unanimous in opposing any legislation that might interfere with the present service. They contend that they have better service and that their products reach distant markets in much better condition since the railroads of the south entered into exclusive contracts with the Armour Car Line Company. Whether this hearing is granted or not, the Hepburn bill will sooner or later be reported to the House just as it has been agreed upon by the Republican members of the Committee.

The Senate Committee is not making great progress with the preparation of a compromise bill, but there are frequent informa. However this may be, it has developed within the past few days that there has been considerable discussion among the members of the House Committee on Postoffices of the advisability of making a material reduction in the pay for carrying the mails on the railroads of the country. It will be recalled that this subject was gone into very thoroughly some years since by a joint commission of Senators and Representatives, and the conclusion was reached that, taking into consideration all of the exactions of the government and the heavy penalties imposed for failure to carry the mails on time, the compensation received by the roads was none too great. This report was signed by every member of the joint commission except Representative Fleming, of Georgia. Now, however, members of the House Committee are talking of cuts of from 5 to 20 per cent., and some of the representatives of railroad interests here were told to-day that the Committee would probably take the matter up seriously and hear representatives of the Postoffice Department and of the railroads as to the rates of compensation that should be allowed for the railroad mail service. J. C. W.

Steel-Frame 80,000-lb. Box Cars for the C. & E. I.

The St. Louis plant of the American Car & Foundry Company is building for the Chicago & Eastern Illinois 750 80,000-lb. box cars with steel underframing and body framing, conforming to American Railway Association standard dimensions. They are quite similar to a design in use by the Norfolk & Western. The underframing consists of two 15-in., 33-lb. channel center sills spaced 12⅞ in. back to back, and 8-in. 11¼-lb. channel side sills. The transverse members between center and side sills are 4-in., 5¼-lb. channels,

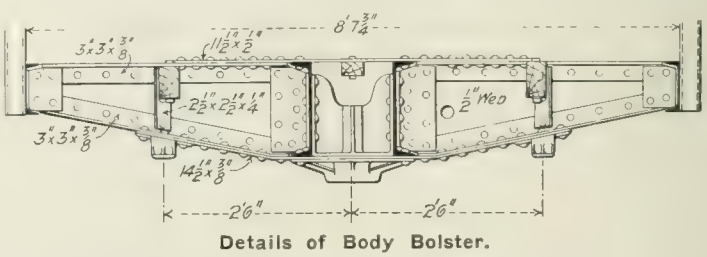


End Elevation and Cross-Section of C. & E. I. 80,000-lb. Box Car.

conferences among the leading Republican Senators with a view to an agreement on a bill that can receive the support of practically all of the Republican Senators. The idea that the question of the reasonableness of a rate or of the legality of a regulation or practice must be passed upon by a regularly constituted court in the first instance is apparently gaining ground in the Senate. Senator Fulton, of Oregon, made a speech to-day in which he indicated that he favored substantially the plan of legislation suggested by Judge Walter C. Noyes, of Connecticut, in his book on "American Railroad Rates," under which the question of the reasonableness of a rate would be passed upon by a court, and then, if the court should find the rate unreasonable, the Commission would proceed to make a rate for the future in harmony with the decision of the court. It will be noted that this is along the line of the compromise plan that Senator Elkins now has in mind, except that Senator Elkins would let the carrier have a try at fixing a substitute rate before having the Commission step in and exercise its final rate-making power. At present the prospects seem to be good of uniting enough of the Republicans on this compromise measure to put it through the Senate even if it should not be possible to obtain for it the support of all the Republican Senators.

When Representative Grosvenor, of Ohio, suggested that Congress might retaliate upon the railroads for cutting off free transportation by reducing the compensation paid for the transportation of the mails it was not generally believed that he could have been in earnest or that any self-respecting member of Congress would take a stand that could only be construed either as an attempt to blackmail the roads into restoring the pass system or as an acknowledgment that Congress has in the past allowed excessive compensation for the railroad mail service in return for free transportation.

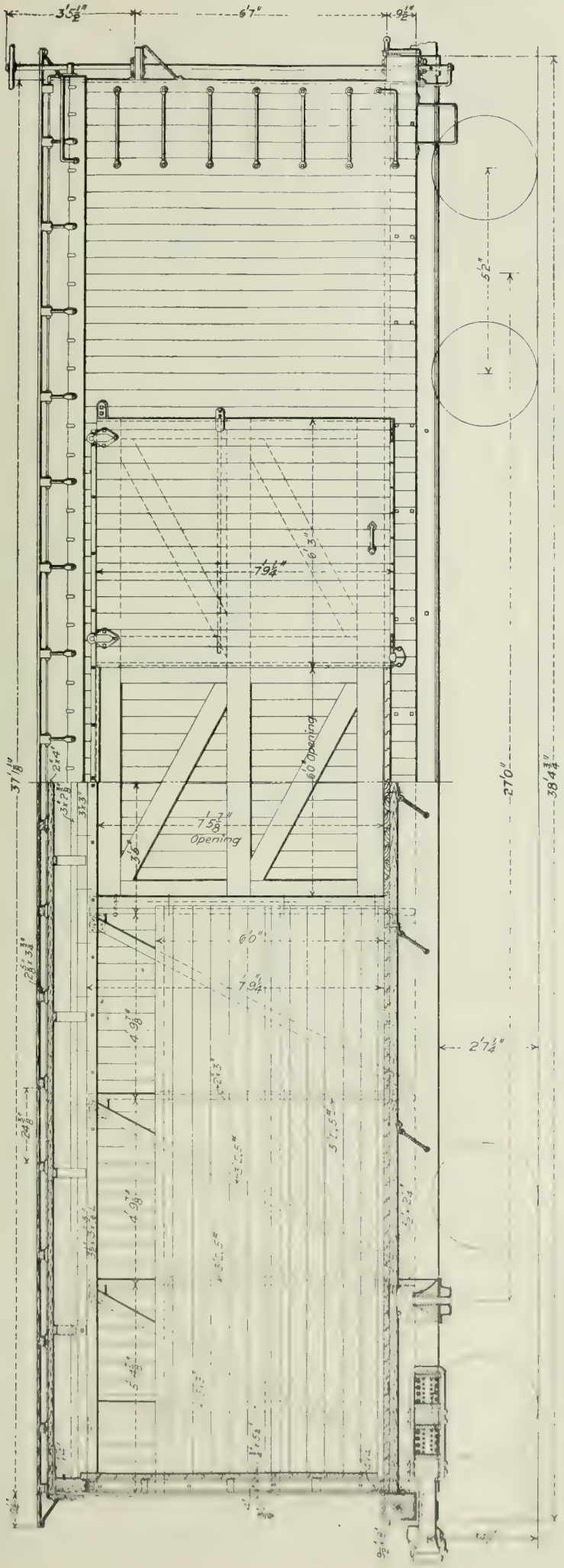
of which there are five on each side between body bolsters. The latter are built up of plates and angles with a steel center casting, as shown by the details. Braces of 6-in. x 3½-in. x ⅜-in. angles extend from near the ends of the center sills to the outer ends of the bolsters. A plate 12½ in. wide, ⅝ in. thick and 8 ft. 7¾ in. long is riveted across the ends of the longitudinal sills and a 5-in. x 3-in. x ½-in. angle at its lower side supports the 8-in. x 9½-in. wooden end sill. A wooden longitudinal nailing sill, 3 in. x 5½ in.,

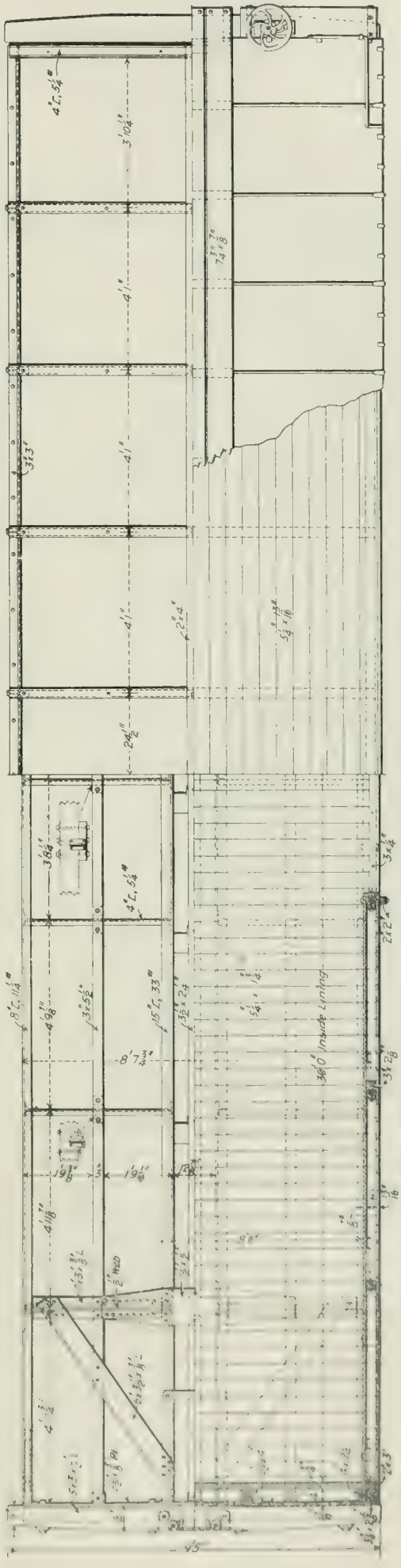


Details of Body Bolster.

is placed between center and side sills on each side and is dapped over the 4-in. transverse channels and secured to them as shown by the details. There is a nailing strip between center sills supported by and bolted to special supports secured to the center sill webs by two transverse ¾-in. bolts each, passing through the webs. To each side sill is bolted an upper and lower wooden nailing strip as shown, those under the doors being of larger dimensions than the others.

The upper framing is composed of channels, angles and I-beams. The end posts are 4-in., 7½-lb. I-beams, the corner posts 4-in. x





80,000-lb Box Car with Steel Underframe and Body Framing—Chicago & Eastern Illinois.

3 in. x ⅝ in. angles, and the side and door posts, the braces and purlins 3 in., 5 lb. channels. The top members are 3½ in. x 3 in. x ⅜ in. angles on the sides and rim, 5½ lb. channels on the ends. The belt rails are 2½ in. x ⅜ in. flat iron. Additional details are well shown by the drawings, for which we are indebted to Mr. W. A. Nettleton, General Superintendent of Motive Power of the Frisco System.

The Care of Boilers.

At the November meeting of the Western Railway Club, Mr. M. E. Wells, the traveling master mechanic of the Wabash, read an interesting paper on the care of boilers. He had begun his investigation with the idea that the majority of tube leaks were caused by nozzles in the roundhouse and clinker pit; and, after having formulated certain rules for the care and washing out of engines in these places, was surprised to find that tubes still continued to leak. A further investigation showed that injected feed water had a good deal to do with it. Comparatively cold feed water sinks to the bottom of the boiler, so that the temperature of the water at that point is sometimes 90 degrees lower than it is at the top, as indicated by thermometers placed at various points from above the crownsheet to the foundation ring of the firebox. With an ordinary check and an ordinary boiler, it is impossible to work the injector for half a minute without cooling the bottom of the boiler, no matter how hot the fire may be; though the hotter the fire the less will be the cooling at the bottom.

When the water is going into the boiler at a temperature of about 150 deg., and that is about the average feed-water temperature in the winter, it enters water in the boiler that has a temperature of 388 deg.—238 deg. colder than the water in the boiler—and not one drop of it ever goes above the boiler check. It sinks, at once, down between the flues and the outer shell, and towards the firebox. Tube leaks will be found, in ninety-nine cases out of a hundred, to be below the check, and, although there are some exceptions to the rule, it is the lower tubes that make trouble. This is one of the reasons why it is so objectionable to put on the injector and fill up the boiler while standing at a water tank. The steam gage does not show what is going on. The cold water drops down to the bottom, the hot water remains at the top and maintains the pressure, but, when the throttle is opened and the water is put in circulation, the pressure drops. The engineman who does this will use all the water put in while standing, and sometimes more, before he gets the steam pressure up again and can put the injector on. He would be as well off if he had not used the injector, but had waited until the engine was well started, when it could be put on almost at once.

An examination of the behavior of a boiler in firing up shows the same wide variation of temperatures at the top and the bottom. A diagram has been made from the indications of the thermometers to show this. The results of the first of three tests is shown by the two solid lines. The upper one shows the temperature above the crownsheet and the lower one that at the mudring. They were six degrees apart at the start, but when the fire was lighted the upper one began to rise at once, while it was nearly an hour before the lower one showed any appreciable change of temperature. Even then the pressure was raised with a temperature of 125 deg. between the two points. The second firing, the results of which are shown by the dotted lines, gave about the same indications. In the third case, shown by the broken lines, there was a difference of 135 deg. in temperature at the start, and at the end of an hour and ten minutes this had increased to 140 deg., so that while the top had a temperature equivalent to about 68 lbs. of steam pressure, the bottom stood at about 140 deg.

One of the interesting things shown by the diagram is the effect of putting the blower on. The house blower had been working up to an hour and ten minutes where the diagram is marked "See Note." At this point the house blower was taken off and the engine blower put on, which immediately started the circulation with a consequent simultaneous rise in the bottom temperature. This same effect is shown by the dotted lines of the second test. At the end of two hours and a half there was still a difference of 60 deg. The engine was then moved about 600 ft., which produced circulation enough to bring the temperatures together.

The second diagram shows the effect of cooling after raising steam. Each time the boiler was cooled in a different manner, the best results being obtained by that corresponding to the broken lines. In this there is but 12 deg. difference of temperature. In this particular case, the engine was equipped with a Talmage surface blow-off cock, and all of the cold water was spread uniformly over the top. In the ordinary method, the water goes through the boiler check and a large part of it through the injector throttle. The results so obtained are fair, though not quite as good.

It has been found that in firing up and cooling, the temperature is the same on any horizontal line through the boiler. Around the mudring, for instance, the thermometers would always read the same at any point, and the thermometers at the crown sheet in firing up and cooling down would always read the same. Hundreds of readings were taken, and they were always the same. The variations of boiler temperatures are vertical. The problem to be solved is finding the best method to be adopted to decrease the variations of vertical temperatures.

In firing up it was noted that there was less variation in temperature when the house blower was on than when the boiler was merely allowed to stand. The boiler was warmed more uniformly, which shows that the blower has a good and not a bad effect, as commonly supposed. On the other hand, where the engine blower is used the lines come closer together, showing the benefit of increasing the circulation. The variations decrease from the standing method without a blower, to the house blower and then to the case where the engine blower is used.

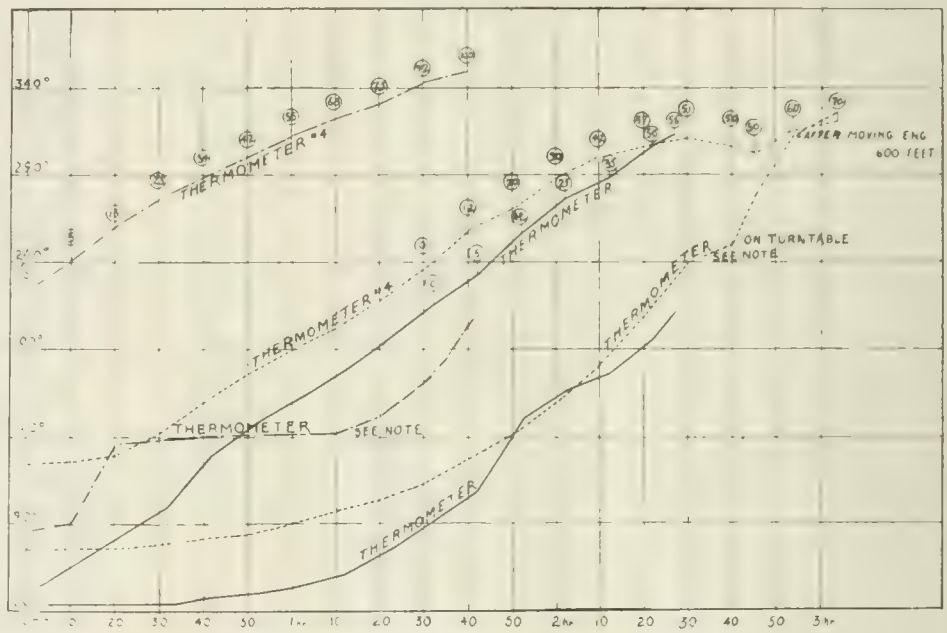


DIAGRAM OF TEMPERATURES TAKEN IN FIRING-UP TESTS.

———— Test No. 4.—Getting Engine Hot. Fire built by spreading 4 inches Coal over grates and building wood fire uniformly on top of Coal, but not as good a fire in front as in back of box.

- - - - - - - - Test No. 5.—Wood fire built on top of a layer of Coal, and close to side and flue sheets. Did not burn good in front.

———— Test No. 6.—Getting Engine Hot. Fire built in back of fire box. No fire in front. Wood in before Coal.

Note.—House blower used in all tests. It is necessary with the fine netting with Sheridan Coal.
Change 1 from house blower to Engine blower, at the 1 hour and 10 minutes reading, in test No. 6.
Engine taken out of house in test No. 5.

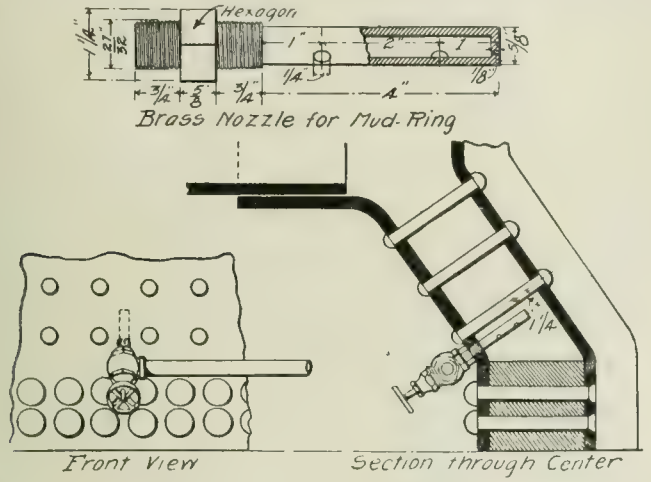
In order to overcome these inequalities, compressed air was introduced at the mudring in order to induce circulation, and with considerable success. In these tests, as shown by the diagrams, the lines of the top and bottom thermometers are quite close together. In fact, the temperatures were practically the same; and this was accomplished by merely introducing a jet of air or steam at the lowest point, by which the boiler was warmed uniformly from the bottom to the top. The illustration shows the arrangement designed by Mr. Wickhorst to introduce either steam or air. Of the two, it is better to use steam, because the air passes through the water and produces a circulation only, whereas the steam not only induces a circulation but heats the water at the same time.

In the first tests that were made, the thermometers were put in on the left side and the left injector was worked. It was afterwards found that the drop was almost twice as great on the side upon which the injector was located as upon the other.

If a boiler goes out of the shop with the tubes uniformly tight, the leakages will appear on the side where the injector is located. Then, if these are tightened, the next leakage may appear on the other side, because the tubes are not uniformly tight. A case occurred on a division where, of two engines in identical services, one gave no trouble and the other a great deal of trouble from leaky tubes in the bottom row. An examination showed that the latter engine was fitted with a deflecting plate just inside the check. This was put in so that the water would not strike the tubes, with

the result that it was turned downward and went directly to the bottom of the boiler, where it affected the lower rows of tubes and caused the leakage.

Another instance of the bad effect produced by filling the boiler when standing was that of a passenger engine that came in from a run of 238 miles with the tubes dry. Thirty minutes afterwards, while standing on the clinker pit, the tubes were leaking badly. The hostler had simply filled the boiler with water so that "she would hold," with the result that, as there was an arch in the firebox, the engine had to be taken to the house and have the arch torn out and all the tubes worked over. This is a good illustration.

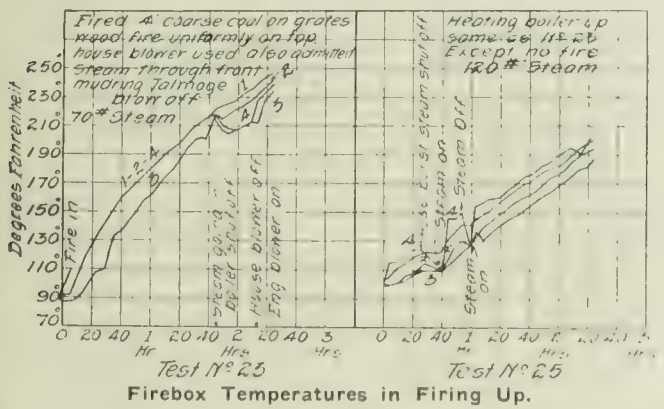


Device for Injecting Air or Steam into Water Leg to Produce Circulation.

The reason why tubes leak at the back and not at the front is explained by the tests made in France by which the evaporative efficiency of the various portions of a boiler was shown. It was shown there that 35 lbs. of water were evaporated per sq. ft. of heating surface per hour at the firebox; that the first quarter of the length of the tubes evaporated 9½ lbs.; that the second quarter evaporated 4½ lbs.; the third quarter 3 lbs., and the last quarter only 2 lbs. This is interesting as indicating where the largest amount of water is evaporated in a boiler, and shows conclusively that all injected water goes to the bottom and towards the firebox. The greater amount of steam being generated in the back end of the boiler compels circulation toward the back end of the tubes and firebox, and this is why the back ends are affected and the front ends are dry.

Forty years ago the boiler check was located near the firebox, but this was found to be so hard on the sheets that it was moved farther and farther forward until it was too close to the front tube-sheet and caused leaks there. It was then moved back a little and so located where it is to-day, so that it should not be nearer the front than 2 ft., although 18 in. may be safe.

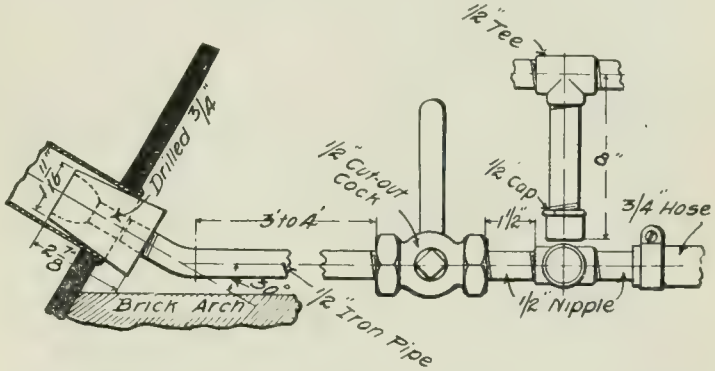
One of the most important things in caring for a boiler is to



Firebox Temperatures in Firing Up.

keep the fires clean and have the heat down close to the mudring, just as close to the grate as possible. In cases where the fire is very dirty and the grates are covered with a thick layer of ashes, all of the water that is put into the boiler goes directly down to the mud ring and stays there. It is impossible to heat water below the fire line, except by circulation, and this does not exist when the engine is standing. In this connection, attention is called to the fact that there are more leaky tubes in the winter than in the summer. The feed water goes into the boiler, as a rule, colder in winter time than in summer time. In the summer water goes into the boiler at 200 deg. and over. In the winter it goes into the boiler at 150 deg. and under. This is about the difference between summer and winter conditions. In zero weather it is even worse. The colder the water is when it goes into the boiler the colder it is when it reaches the bottom, and no matter how cold it goes in, it always reaches the bottom first. It is a good practice to heat the feed water a little while it is in the tank. To keep the engine from popping, the steam can be blown back into the tank, but care must be exercised not to get it too warm. It is a good preventive of leaky tubes.

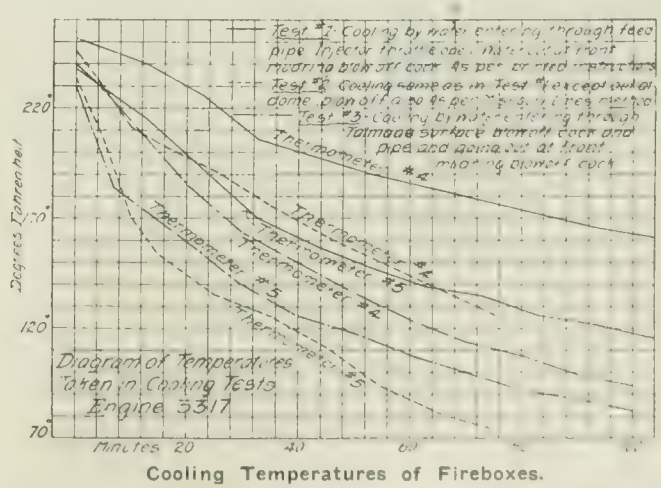
The injection of cold water into the boiler is not only a prolific cause of leaky tubes but also of corrugated and cracked firebox sheets; and this is especially true when the fire is dirty. It is a common opinion that this injury to the sheets in done in the round-house, but it is frequently done on the road. To be sure, the boiler washer can do a great deal of injury in this way, if he is not watched, especially if it is possible to couple the cold water hose to the mudring blow-off cock. When an engine comes in to be washed out, is standing hot in the house, and the boiler washer



Device for Blowing Out Tubes.

couples the hose to the mudring blow-off cock and puts in cold water at about 60 deg., the cold water slides in under the hot water and raises the heated water up as if it were oil. After this has been done, there is a positive line through the boiler, below which the temperature is practically 60 deg., while above it it is 212 deg. The line of separation will not be more than 3 in. wide, and such treatment will be pretty sure to corrugate the side sheets.

In the matter of feeding, there were some advantages attendant with the use of the old-fashioned pump attached to the crosshead, with which, when the engine was standing, it was impossible to put water into the boiler. The old-time enginemen got in such a habit of putting water in, in that way with pumps, that quite a number of them never got out of the habit when they began using injectors, and they were doing exactly what is being asked of the engineman to-day. It is impossible to put water in a boiler for so short a time as 15 seconds, with the ordinary check arrangement, without cooling the bottom tubes a little, according to the amount put in and the condition of the fire, and also according to whether



Cooling Temperatures of Fireboxes.

the bottom tubes are open. All these things govern and affect it. If the tubes are all open, more can be put in at stations, as the water will be warmed more as it enters. Water goes into a boiler about 238 deg. colder than the water already there, and unless this 238 deg. is added at once the cold feed water will slide down to the bottom and create this bad condition.

Many engineers fool themselves with the idea of filling up with the throttle shut off, thinking that they are saving fuel. But it is impossible to get something for nothing, and if the water is not heated as it goes in, it will have to be done afterwards. It is an interesting thing to note on an engine, where the injector is shut off with the throttle, how the steam stays up and does not drop back when it is again admitted to the cylinders. That is

about what the pump used to do, and is what the enginemen are asked to do with the injectors; that is, put the water in as it was done with the pump, and it can be demonstrated to any engine crew that it will save them leaky tubes. Take a boiler in any ordinarily fair condition, all the tubes open and a reasonable good coal and water; keep a clean fire, and there is no reason why it should not go over any average division without leaky tubes if this simple rule for using the injectors is followed; and it is not as difficult as might be supposed.

In filling a boiler, whenever the hose is attached to the feed pipe the injector throttle should be left open. In this way the waste will go in at the dome by way of the dry pipe. If the injector throttle is not open, the water will go in by way of the boiler check, and it will then drop straight to the bottom as though it had been put in at the mudring.

The introduction of the feed water should be done as high up in the boiler and spread out as much as possible. If the boiler is to be cooled let all of the water be cooled so that the steam gage will indicate what is going on.

Some tests were made on the Chicago & Alton to prove that the water boiled away from the firebox sheets and that the sheets were overheated and burned. These were tests with metal buttons and have already been detailed in the Proceedings of the Master Mechanics' Association. The men who made these tests were disappointed because they expected the buttons to melt. They were, however, a success, in that they demonstrated that the sheets do not overheat when there is any water in the boiler. Crown sheets do not burn out or corrugate or crack so long as there is any water on them.

In the Santa Fe tests, for example, with the gage-cocks extending close in to the fire sheets, they got steam because steam was being formed very rapidly on the side sheet. In order to burn the sheet it would require a constant, unchanging layer of steam there, but as long as there is a changing layer of steam, steam is being made all of the time and heat is being taken very rapidly from the side sheet.

Hot washouts, dirty fires, bad pumping, laying on sidetracks and herding engines with dirty fires, all these things ruin the side sheets. They do not burn out. This statement is corroborated by the results obtained with the fusible plugs used by the government. They melt at about 450 deg., yet they are placed directly over the hottest part of the firebox where the temperature ranges from 2,500 deg. to 3,000 deg. Fahr. They do not burn out, for a sheet will stand 60 deg. or 70 deg. higher temperature than the water and not burn. This is about as high as it ever rises, and that only when the engine is working the hardest. The instant the throttle is closed the fire loses in temperature and the sheet drops down to that of the water, or very close to it. When the throttle is shut off the temperature of the sheet is only slightly above that of the water.

In regard to the effect of cold air on the flue sheets it does not seem that this can be very serious so long as they are backed up by hot water on the other side. So long as the water is hot in the boiler it would be impossible to cool the sheets by blowing cold air upon them.

This matter of inequality of boiler temperatures has an important bearing on the quality of steel that should be used.

In 1894 the American Railway Master Mechanics' Association adopted a tensile strength of 55,000 to 65,000 lbs. for both fireboxes and external shells. At that time there was a minority report asking that the tensile strength of firebox steel be put from 50,000 to 58,000 lbs. Some engines that were built with the milder steel ran five and a half and six years, and those fireboxes were good when the engines were changed to wide fireboxes. They corrugated like a washboard, but there was not a crack in them. The 1854 specification steel was too hard; 55,000 to 65,000 tensile strength is too hard for fireboxes. It will not stand the strains, as the milder steel will. This very hard steel can be used, and by the introduction of some feed water scheme these inequalities may be partially overcome, and it will run much better but not as well as mild steel.

Tubesheet braces should not be made flat. Make them round, and thus avoid damming the water, and locate them so that they will not interfere with the boiler washing. Do not put in a brace too close to the tubes, but leave a good 4 in. space, and not try to tie too tight.

In putting in crown sheets put sling stays in front and rivet over three or four rows. Always slope the crown sheet so that, in case of low water those three or four rows will overheat and let go, and save trouble.

It is of the utmost importance that tubes should be kept clean. A very handy device for this purpose is shown in one of the drawings. It is merely a washout plug with a piece of pipe and a stopcock. First run a rod through the tubes to loosen the matter and then blow them out. After they have once been opened it will not be necessary to put a rod or auger into the firebox. The tubes should be opened every trip and kept open. The failure to do this is responsible for many leaky tubes.

It is well not to use the roller in making running repairs. It is quite true that the average boilermaker will say that a good man can use the tool and not do any harm, but the fact remains that more tubes are worn out with the roller in making running repairs than there are in pulling cars. An object lesson tending to sustain this position is in the office of a certain master mechanic. It consists of two strings of tube ends labeled "These made 40,000 miles. Cared for them with the roller;" and "These made 80,000 miles. Cared for them with the expander. The former are thin, and the latter almost as thick as when the tubes were new.

The Armour Car Lines.

Mr. J. Ogden Armour has published in the *Saturday Evening Post* of Philadelphia a long article telling of some of the facts and methods connected with the business of the Armour refrigerator cars and answering some of the accusations which have been made against the company. The first satisfactory refrigerator car was made in 1871 by Mr. Hammond, of Detroit. Several wrecks occurred because the sides of meat when hung in the cars, were set swinging by the speed of the trains in going around curves. This defect was cured; but not until the circulation of air was provided for, with the ice all put into a box at one end, were completely satisfactory results accomplished. Mr. Armour's father, seeing how the use of refrigerator cars would extend the territory of his meat business, tried to get the railroads to build the necessary cars, but they refused in the most positive manner; and so he had to build the cars himself, which was a decided hardship, for he needed the money in the regular channels of his business. Seeing the success of his cars in the meat business he concluded to go into the fruit carrying trade, and, with Mr. George B. Robbins, now President of the Armour Car Lines, designed and built a thousand fruit cars. Mr. Robbins distrusted their ability to get business enough for the cars, but men were sent around among the fruit growers to awaken them to the advantages which could be gained with the cars, and soon they so aroused the farmers that a second thousand cars were built. Soon the hard times came on, and 2,000 more fruit cars were built, simply to keep the Wells & French Car Works from shutting down. The elder Armour continued to have a lively interest in the fruit industry, aside from the refrigerator business and its profits. The number of fruit refrigerator cars in the Armour lines now is 12,000 (no mention is made of the number used in the meat business). The managers of the Car Lines, with their enterprise and facilities, are the men who have really built up the present great fruit business of North Carolina, Georgia, and other states.

Mr. Armour says that the present agitation against the Armour Car Lines started, not with the growers, but with the commission men, who have been driven out of business by the bringing of the growers and the local dealers into intimate relations with each other by means of the car lines, thus making the middlemen unnecessary. A prominent fruit grower of Georgia says that he is not afraid of the refrigerator car "octopus," but rather is afraid that the "pounding of the refrigerator service by the commission men will cause the octopus to jump the fence and leave us, as in former times, with no octopus but with all our peaches!" There is not one large fruit grower in the country who does not recognize that the private car line is necessary to efficient operation. In former years when fruit growers depended on the railroads and on unreliable supplies of cars, they were at the mercy of the commission merchants, and often when markets were unfavorable had to give away a car of fruit for nothing and pay money in addition to make up the freight charges and the middlemen's commission. The car lines have done away with the evil of glutted markets, as cars are allowed to be diverted while in transit, so that the fruit can always be sent to a good market and in good condition. The Armour private car is not used as a device to secure rebates or discriminations. "It was determined when the prohibitive law against rebates went into effect it was to be obeyed and not evaded; that a policy of indirection and evasion was a poor policy from any standpoint and would not be countenanced by the Armour interests." Mr. Armour then goes on to explain that self interest has impelled the Armour Lines to keep refrigeration rates down to a point that will foster the fruit industry. He quotes figures showing how rates for refrigeration from Georgia have been reduced from the basis which was in effect when five different car lines were competing for the peach business. The rates for refrigeration from California have in 10 years been reduced 27 per cent. to 55 per cent., according to kind, loading point and destination. The fruit growers say, "we want lower rates if we can get them, but above all do not deprive us of the efficient private car line service."

Mr. Armour cites certain serious losses which the business has had to bear. To the strawberry shippers of North Carolina, last summer, $75,000 had to be paid because, owing to extreme congestion on a certain railroad, the refrigerator cars were not on hand at the critical moment. It is necessary to do an extensive business in order to command the necessary capital. At Las Vegas, Nev., the Armour Lines have just put up an ice plant costing $125,-

000. In Georgia, in 1898, great quantities of ice brought from Maine were stored at two places, and the whole of it was lost by melting because there were no peaches that year and no ice needed, the peaches having been killed by a frost. On the other hand, when the crop is more abundant than has been expected the ice supply is sometimes insufficient and large quantities have to be brought from remote places at great cost.

Transatlantic Passenger Business.

The Bureau of Statistics at Ellis Island has published the following statistics of the New York transatlantic passenger business for 1905 and several years previous:

	1905	1904	1903	1902.	1901
Trips		967	956	922	838
First cabin	104,965	68,704	67,719		
Second cabin	107,088	93,685	93,557		
Total cabin	212,053	162,389	161,276	139,848	137,852
Steerage	780,012	572,798	642,959	574,276	403,491

Of the cabin passengers in 1905, 107,375 were U. S. citizens and 104,678 were aliens; of the steerage passengers, 25,666 were U. S. citizens and 754,346 were aliens. The White Star Liverpool service and the Hamburg-American Hamburg service each reported 87 sailings during the year, but the North German Lloyd Bremen service heads the list with 89. The following table shows the total trips and passenger traffic of the largest carriers, including all their New York services.

Line.	1905, Trips.	Total cabin.	Steerage.
North German Lloyd	125	12,817	135,099
Hamburg-American	112	23,109	117,486
White Star	101	27,946	63,516
Cunard	86	21,034	77,493
French	72	11,879	55,927
Anchor	71	11,482	45,751
Red Star	53	11,576	59,132
American	50	12,356	27,106
Holland-America	47	9,923	42,134
Atlantic Transport	47	3,603	29
Fabre	37	181	30,741
Nav. Gen. Italiana	24	1,594	35,686
La Veloce	29	768	32,179

Railroad Statistics.*

BY A. A. GOODCHILD,

Auditor of Stores and Mechanical Accounts of the Canadian Pacific, formerly Auditor of Statistics.

Statistics have been defined as "the disciplining of a property." They may be said generally to group themselves into two classes. In the first class are those which show results of operation, such as the more general statements found in annual reports; in the second class, such statistics as are devised for the purpose of checking details of operation with a view to improving results. It would be impossible in this paper to discuss all phases of railroad statistics. The field is too large. We must pass over such incidentals to a large railroad as the newsboys, sleeping and dining cars, telegraphs, hotels, dining rooms and steamships, which must all be scrutinized and analyzed in order to satisfy the management that these various branches of the service are being operated satisfactorily. Every station on the line must have its records laid bare and every phase of revenue must be looked after. Do receipts per passenger or per ton of freight keep up? What are the causes for the upward or downward tendency in the ton-mile or passenger-mile rate? What is the average journey per passenger or average haul of merchandise? Are too many cars or trains being run for the amount of business being done? Are the freight cars properly loaded? Is there cross-hauling of empty cars? What is the percentage of empty to loaded cars? These and many other similar questions are the stuff of which statisticians' dreams, and some railroad officials' nightmares, are made; questions which require an answer, not only for the entire road, or for a superintendent's division, but for a superintendent's district or an operating section of that district.

From 60 to 70 per cent. of the entire operating expenses of a railroad are made up from pay rolls, and the importance of closely watching the returns pertaining to these pay rolls, whether the outlay is incurred in the direct production of revenue, or for the purpose of keeping rolling stock and roadbed in proper condition, can not be overestimated. The large items of pay roll expense are, of course, trainmen, enginemen and station agents. Trainmen and enginemen are well taken care of by comparison with train or engine mileage, and station agents by comparison with the amount of business done at the individual station. The staff necessary for the upkeep of roadbed, buildings and bridges is largely fixed by the management, and the necessary authority or appropriation granted for any work of a special nature as distinct from the general working expense. Roundhouse expenses can conveniently be set off against the number of engines despatched and boilers washed, while the wages paid for maintenance of equipment may for general purposes be compared with the mileage made by cars or locomotives. This latter expense, however, should be considered for a series of months, rather than for any particular month, because cars and locomotives are, as far as possible, repaired when least required for business on the road. Provided a railroad keeps a separate record of its running repairs as distinct from its heavy or shop repairs—a practice in every way desirable—the running repairs can safely be criticized each month, by comparing the outlay with the work performed. In this connection, it would be well if the Master Mechanics at their next annual convention should place on record their views as to what properly constitutes a charge for running repairs for both locomotives and cars. The various roads would then have a fair figure with which to compare themselves with each other, providing, of course, that the basis for arriving at the work performed was uniform. With locomotives it should not be a difficult matter to arrive at a standard basis. If a running repair was understood to include all repairs costing $100 or less for labor, and the 100 per cent. capacity mileage, hereafter referred to, was recognized as the standard unit, a good basis of comparison would at once exist, namely, cost of running, and by deduction, other repairs per 100 per cent. capacity mile. With cars, the problem differs somewhat, but there does not appear to be any insuperable difficulty in handling them on a similar basis, by defining a running repair, and also fixing upon a unit of capacity similar to the 100 per cent. locomotive capacity. Of course, the large number of cars in use complicates matters somewhat, and the suggestion is put forward with a view of getting this question discussed.

Such statistics as are necessary for the purposes above outlined are more or less of a general nature, and their value to the management of a road is much or little, just so far as the detailed analysis of the various comparisons is comprehensive, and no farther. Considerable time of officials and their staffs is frequently lost in replying to criticisms based on such general statistics, due to the immature condition or lack of detail back of them. Instances are not rare where an official has been roughly handled by the management for an apparently poor record, which, upon investigation, and more complete analysis of the situation, he has been completely exonerated. This, after laboring under a stigma extending anywhere from a week to two or three months, almost insensibly tends to harden that official's mind against such general statistics, whereas with proper data available in the first place, the loss of time and annoyance would be avoided.

When one speaks of statistics, the inference is almost natural that train and locomotive performance are specially implied, and while each of the matters already touched upon affords a large field for discussion, the fact is that of all branches of statistics that relating to train and locomotive movement is the most important. The revenue derived from freight traffic usually represents about 70 per cent. of the entire revenue of an American railroad, and while the expenses incidental thereto do not form such a large percentage of the total operating expenses, the proportion is sufficiently large to demand the closest possible analysis. Passenger business is to some extent the creature of circumstances; it is also in part governed by local conditions or considerations, and whether a train pays or not, it sometimes happens that legislative requirements, or the irresistible demands of an enlightened public, compel a company to furnish service not warranted by the financial returns. Competition also sometimes has here an important bearing. Owing to these special conditions statistics relating to passenger train performance have not the same disciplinary value as have those relating to freight traffic; but while these conditions exist there are certain features of passenger train work which cannot be overlooked, such as comparative fuel performance and repairs, and subsequent reference to these branches of statistical information for the freight train service may be applied to that of passenger trains also.

Until within a comparatively recent period it was considered sufficient to know only the distance traveled, as shown by train and locomotive mileage, to confidently criticize a superintendent on his train performance, or a master mechanic on his locomotive performance. Train mileage at first glance looks innocent enough, but has proved misleading. It did not take into account the number of cars in a train, and it ignored the fact that perhaps two or three engines were used to haul the train, one possibly capable of hauling 3,000 tons, while another could handle only 1,200 tons. More than this, statistics based on train mileage failed to furnish any information as to the financial benefits obtained by outlays of capital for the reduction of grades and curves, or to supply any basis for arriving at the saving in cost of transportation effected by the introduction of larger capacity locomotives and cars. Locomotive mileage, as a basis of criticism of locomotive performance has also signally failed, for similar reasons. With the large investments of capital made during recent years for the purchase of large capacity locomotives and cars, it was but natural that the cost per train or locomotive mile would show considerable increase for fuel and repairs, and it was necessary for a new unit to be introduced which would contain at least the elements of weight and distance and so we have what is called the ton-mile unit. This unit when

*A paper read at the December meeting of the Canadian Railway Club.

used in conjunction with train or locomotive mileage, has now become the principal basis of analysis in the railroads on this continent, and by its use it becomes possible to arrive at the results obtained from capital investments for the betterment of the line, and to obtain a fair index of operating efficiency on individual sections of a road.

The need for a unit which should combine the features of locomotive capacity, tonnage hauled and distance traveled, became evident as soon as modern large locomotives began to be used, for it was found that the Superintendent who happened to have the larger power on his division could do all the shouting when it came to a question of the size of train, or of tons hauled per train mile, and while it was a simple matter for the statistician to explain that Mr. Jones ought to make a better showing than Mr. Brown because he had larger engines to work with, it was not considered good statistics to stop there, for there was a possibility that Mr. Brown was really doing better work than Mr. Jones, considering the power at his disposal. Such a unit was designed and put into use on the Canadian Pacific by the writer, nearly three years ago, and was called the 100 per cent. capacity unit. It was decided that the only fair way to deal with the question was to bring all available power to the 100 per cent. basis, which represents 20,000 lbs. pull on drawbar; show the quantity of power each Superintendent had to dispose of, and set off against that quantity the actual work performed. Incidentally it might be said that this unit has proved a valuable one for purposes of comparison in connection with locomotive repairs. Another question still arises, "what percentage does your actual freight ton mileage bear to the potential freight ton mileage?" In other words, if a 150 per cent. engine is capable of hauling 2,000 tons over a given section of the road, 100 miles long, at an average speed of 12 m.p.h., it has a potential freight ton mileage of 17,280,000 ton-miles per month of 30 working days of 24 hours each. We all know that a large portion of an engine's time is used up in the roundhouse or shops for repairs, a considerable portion occupied in taking on fuel and water or in switching and light running, but were the actual percentage of lost potential power figured out the results would probably be startling. Why not compare one superintendent's division with another on this basis for a month every now and then?

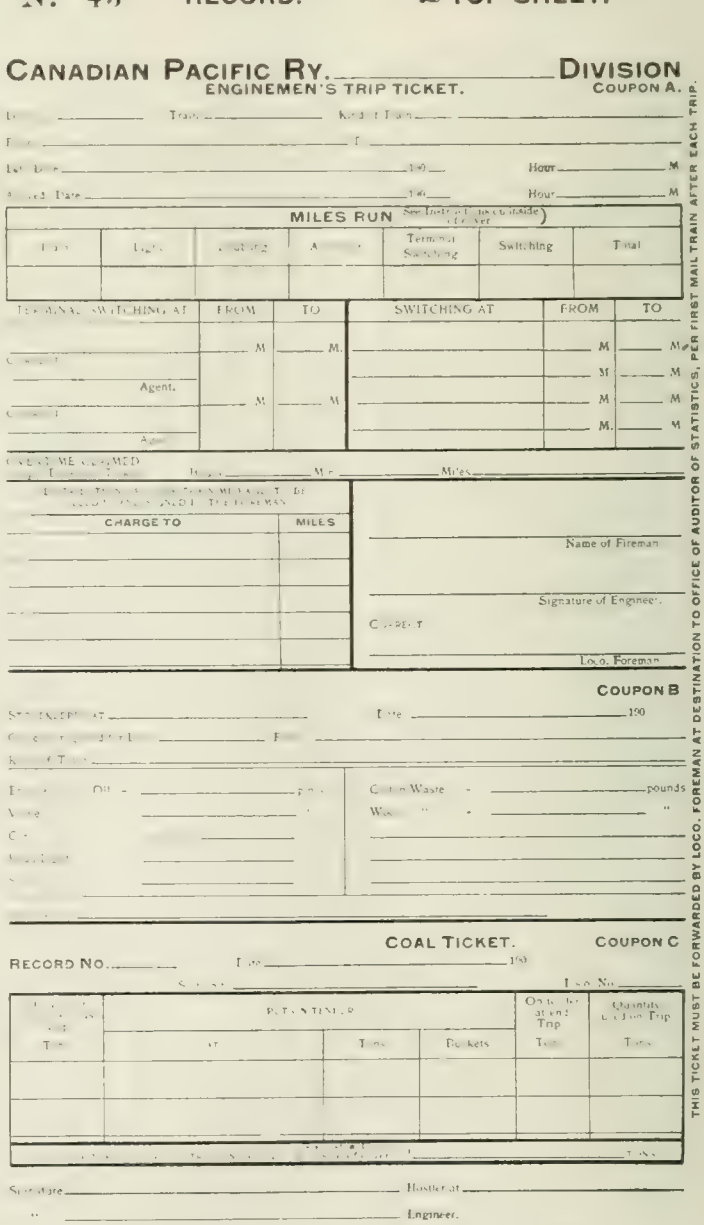
Very few roads are as yet taking any cognizance of the matter of "speed" in their statistics. A unit which will incorporate this factor is not only desirable, but imperative, for it carries in itself reconciliation of those diverse interests, the transportation and mechanical departments. Under the present system, an engineer who brings his train in on schedule time, and transforms his power into speed, frequently finds it necessary, in so doing, to make increased demands on the coal pile and "his ton miles per ton of coal" presents a wretched appearance. The superintendent or despatches discovers a "gem" of an engineer, while the master mechanic puts a big black mark against the performance. Per contra, the engineer who converts his power into load is a model driver from the master mechanic's point of view, but the superintendent will probably avail himself of the first opportunity of calling him down hard. The engineer naturally becomes discouraged, and may be pardoned if his language is more forcible than polite with reference to statistics in particular. What is necessary is a unit which will give the engine and the engineer credit for the full amount of power expended, both in attainment of speed and hauling of load, and the opinion that such an unit would be found by taking the minutes occupied in actual running between terminals and dividing the figure into the ton-miles hauled per 100 per cent. of capacity, seems justified. It might be called the "operating unit." Fuel, or pounds of coal used per operating unit, should then furnish statistics, satisfactory at once to the mechanical and transportation departments.

There is one other suggestion with a view of bettering present day methods, and it relates to the direction of traffic. Most roads divide their statistics as between east and westbound or north and southbound. Such division may be useful as denoting the general trend of traffic, but it seems more than probable that a further sub-division setting forth such traffic as is in the direction of the balance of traffic, as distinct from that in the direction of returning power, would be a truer basis from which to criticize locomotive or train performance. With the present system, assuming the balance of tonnage for an entire month is eastbound, it is possible that during a large portion of the month the balance was in the opposite direction, and, as a consequence, eastbound results as shown are misleading, and the good actually attained by careful loading, proper handling of empty cars, and economical fuel performance is largely lost sight of. The tonnage rating system in use on the Canadian Pacific was fully discussed by Mr. Thomas Tait in a paper read before the New York Railway Club in January, 1901 [*Railroad Gazette*, Jan. 18, 1901], and it is not necessary to refer to the matter further than to state, that with the aid of tables or charts, which are available for the use of all transportation officials and employees, it is simply a matter of reference to determine the size of load an engine of any capacity should haul over any section of the entire Canadian Pacific system. The engine capacity can be found by reference to the engine list printed on the cover in which these charts are bound, the figures being arrived at by the generally accepted formula for single-expansion locomotives $\frac{C^2 \times S \times P}{D} = T$ in which

C = Diameter of cylinder in inches.
S = Stroke of piston in inches.
P = Mean effective pressure in pounds (85 per cent. boiler pressure).
D = Diameter of driving wheels in inches.
T = Traction power in pounds.

Mr. Tait's paper also explained the method by which the prescribed allowance for the extra resistance due to the proportion of tare being greater than one-third of the actual gross tonnage, and the figure termed "equivalent tonnage," is arrived at. This "equivalent tonnage" is used not only for the proper loading of engines, but as a basis for criticizing the engineer's fuel performance, and with such an equitable figure, the excuse that "my train was all empties, while Bill had all loads and ought to have a better record than I," cannot be advanced.

The importance attaching to an economical fuel performance is manifested in the close attention which is being given to the question by all railroads, and when the vast amount of money involved in the item of "fuel" is borne in mind such interest cannot be wondered at. Many devices have been invented with a view to securing correct returns of fuel consumed, and apart from the methods of


№ 43 RECORD. TOP SHEET.

CANADIAN PACIFIC RY. _____ DIVISION
ENGINEMEN'S TRIP TICKET. COUPON A.

MILES RUN

TERMINAL SWITCHING AT | FROM | TO | SWITCHING AT | FROM | TO

CHARGE TO | MILES

Name of Fireman

Signature of Engineer

Loco. Foreman

COUPON B

COUPON C

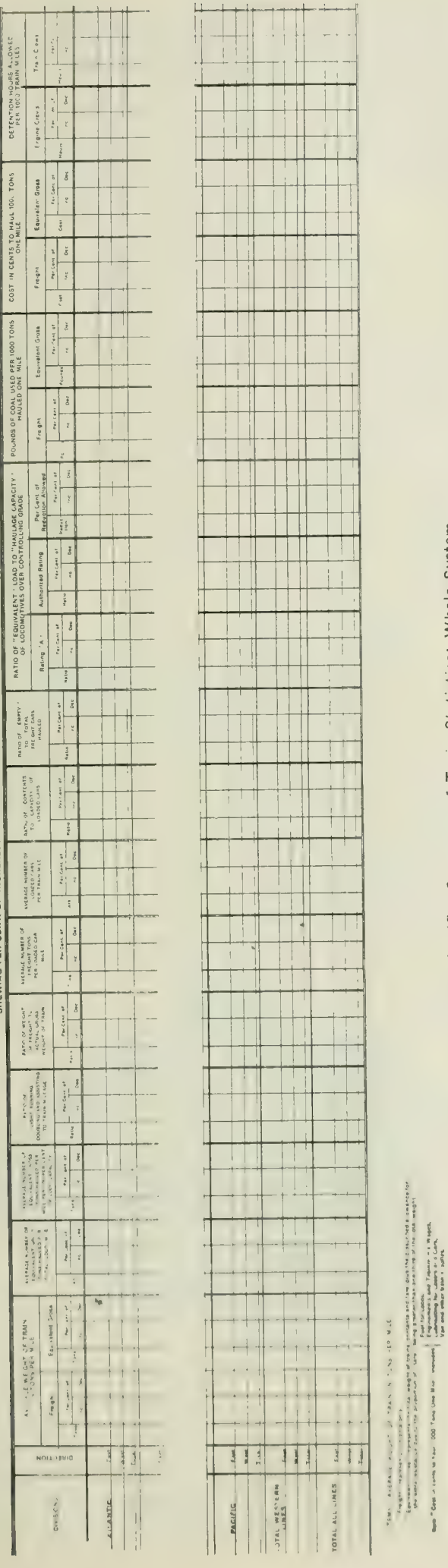
COAL TICKET.

RECORD NO.

THIS TICKET MUST BE FORWARDED BY LOCO. FOREMAN AT DESTINATION TO OFFICE OF AUDITOR OF STATISTICS, PER FIRST MAIL TRAIN AFTER EACH TRIP.

Canadian Pacific; Engineman's Trip Ticket.

delivery, which is a problem that railroad managements must themselves be satisfied upon, the question of accounting for deliveries as recorded is one of considerable difficulty. This is done on the Canadian Pacific by an "engineman's trip ticket," form 67E. [See illustration, Fig. 1.] On the lower portion thereof is the fuel coupon "C." This ticket is made in triplicate, the first two sheets having carbon backs. The book of tickets belongs on the engine and must not be taken away by the engineer. When a quantity of coal is put


CANADIAN PACIFIC RAILWAY COMPANY.

SUMMARY STATEMENT_____TRAIN STATISTICS_____190

SHEWING PER CENT. OF INCREASES AND DECREASES OVER CORRESPONDING PERIOD FOR PRECEDING YEAR.

Canadian Pacific; Summary of Train Statistics; Whole System.

on a tender the fuel man enters the amount on coupon "C" 1, and tears out the duplicate copy, which is forwarded to the fuel department as a voucher. At the end of the trip the engineer estimates the quantity of coal remaining on the tender, and records same in space provided on coupon "C." He then deducts this from the quantity shown to be on hand at the commencement of the trip, thus arriving at the quantity actually used, which he also enters in the space provided. The entire front sheet of this ticket is detached and sent to the statistical office by first train, after having been noted and approved by the locomotive foreman at destination point. Questions sometimes arise as to the correctness of the estimate of quantity left on tender by the engineer making the succeeding trip, against whom such quantity is charged; but the locomotive foreman or hostler has authority to settle such differences of opinion, and disputes are not frequent. When it is stated that, with the use of this ticket, the figures arrived at by the statistical office show a variation of considerably under 1 per cent. with those of the fuel department, it would seem that the question of accounting for fuel issues has been practically solved.

Oil and waste supplies for locomotives are handled in a somewhat similar way. The oil coupon "B," on the same trip ticket, is made out for the necessary supply of oil, and is signed by the man who receives it, and coupon "B" is detached from the second sheet as a stores department voucher. It has been found convenient for the statistical office to accept the statement of issues as compiled by the stores department from these coupons, rather than make up an independent record, but it is at all times a simple matter to check either the stores or fuel departments' charges by referring to the tickets. The question of devising some method of checking the quantity of the different kinds of oil used more effectively and simply than the present method of figuring the miles run per pint, is occupying attention. The Canadian Pacific has in use what is termed an excess oil ticket, and if an engineer requires a quantity of oil in excess of the schedule allowance for the run, he must fill out one of these excess slips and hand it to the locomotive foreman for approval, with a brief statement of the reasons for his requirements. Should the locomotive foreman approve this slip, he makes a requisition on the stores, and sends the approved slip to the divisional master mechanic, also a copy attached to the trip ticket to the statistical office. All of which routine is assumed to act as a check on the demands for "more oil." Mr. Vaughan has recently suggested a statement to take the place of the present record, which will show "quantity used," "quantity as per schedule," "quantity issued on excess slips," and "quantity used less than schedule allowance," also the percentage which the last two items bear to the authorized or schedule allowance. A statement of this sort would not involve as much work in compiling as does the present one showing the "miles run to a pint," and the expensive engines or engineers could readily be detected by simply glancing down the column "percentage of excess." "Miles run to a pint" does not represent anything unless you know how many miles *should* be run to the pint, and this proposed method has the appearance of being very nearly a solution of an old standing difficulty. The unused coupons of the engineer's trip ticket are disposed of as follows: Coupon A2, enginemen's record of mileage, is retained by the engineer, while the oil and fuel coupons B2 and C2 remain in the book, which is turned into the locomotive foreman at the roundhouse to which the engine is attached, at the end of each month, or as soon as all tickets are used, to be retained by him for reference or check, should any questions arise as to the correctness of the performance sheet.

Statistics, to be of value, should be subdivided in such detail as to furnish the results of operation on the smallest sub-division of a railroad. With the Canadian Pacific this sub-division is represented by engine districts, which average from 100 to 120 miles. Comparisons of performance should only be made by one district against itself, unless it is known that the conditions are similar on another district. A study of this matter of comparisons leads one to the conclusion that much valuable time is lost by endeavoring to compare results of trains on one road with another, or even one division with another. Weather conditions, water, grades and fuel, have each a share in producing differences in cost which it is difficult to estimate, but apart from this, there is an even more serious difficulty in making comparisons between two or more railroads. The data used in compiling results are rarely available, and when available are still more rarely harmonious. By comparing one division or district with itself for a corresponding period the difficulties of water and grades are largely eliminated or at all events any change is on record, and fairly reliable conclusions may be drawn from such comparisons. A locomotive performance sheet should be so arranged that all the engines on a district be shown side by side, preferably in order of capacity, and separately for each class of service. This arrangement enables one to correctly appreciate the relative economic value of the different types of engines. It has been a pleasure to the writer to see the practical use to which such an arrangement of records was put up by Mr. Vaughan in his very able paper on superheaters for without any further need than a reference to the regular month-

ty performance sheets of the Canadian Pacific it was possible to arrive at exact data regarding the performance of superheated locomotives and compare them with other locomotives of similar capacity not equipped with the superheater devices.

The forms used by the Canadian Pacific in compiling and reporting train and locomotive statistics may be briefly described. The conductor's journal, form 125, in conjunction with the engineer's trip ticket, already described, is the basis of the entire records. The necessary information is abstracted on form S.O.1 and worked up on the train and locomotive performance sheets, forms attached. Each engine on each section of the road is given a separate card (form S.O.1) for each class of service in which it is engaged, provision being made on the top of each card for the engine number by a series of "tags" running from 1 to 0 for the last figure of the number. This card is opened from the train despatcher's sheets, the first entry being the date of trip which is taken therefrom. The engineer's trip ticket is then taken and the fuel used on trip entered, while from the conductor's journal is entered all information relating to train and locomotive mileage—car mileage, tonnage, etc., as provided. This method ensures a triplicate check of the entries on the card. At the close of the month or week, or as often as such record is required, the cards are added up and the locomotive performance sheet (form S.O.60) is compiled directly from them. This sheet can be issued within two days after the close of the period for which such information is desired. The generality of locomotive performance sheets show "cost" of fuel and supplies against each engine. Such information is unnecessary. The man operating the engine has nothing whatever to do with the question of "cost," but simply "quantities" used. Form S.O.62, the summary of locomotive performance, properly takes care of all expenses incident to the work performed, including repairs. Apart from the consideration of total cost of repairs compared with the total work performed, all details pertaining to repairs should be dealt with directly by the mechanical department. For the train performance sheet, the various items of performance of all trains operating on each section are summarized, and the totals of these sections represent the work done on a superintendent's division. A summary is then compiled of each general superintendent's division showing the totals of each superintendent's district, and a final summary of the figures of each general superintendent's division gives the grand result for the entire Canadian Pacific system, form S.O.53. [See illustration.] Having the figures of work performed it is a comparatively easy matter to arrive at the cost per ton-mile for hauling. The wages of enginemen and trainmen are compiled in the office of the superintendent for each district for which train records are compiled; likewise the amount of train supplies, while the oil and waste, as before explained, is compiled from the storekeeper's statements of the issues sent in to the statistical office. The fuel is already compiled as to quantity, and all that is needed is the price per ton to arrive at its total value. By dividing the freight and equivalent gross ton mileage into the total cost of each item, we get the resulting average cost per ton-mile for "freight" or "equivalent gross" (form S.O. 52). This average cost furnishes a very fair basis for determining the profitableness or otherwise of any special trains, or any special class of business, on any section or division of the road, when set off against the revenue derived from such business. The results of train operations and car performance summarized on form S.O.53 comprise all information necessary for a complete and intelligent survey of the entire field of train performance with this qualification that the value of item "per cent. of empty to loaded cars" is impaired owing to the fact that all classes of cars in freight service are comprehended under the general caption "freight cars." It frequently happens that empty flat cars are being hauled eastbound on the same section at the same time as box cars are being hauled westbound and the statement gives the appearance of cross-hauling or bad railroading, which would be avoided were the movements of the various classes of freight cars kept separate. The great difficulty in the way of working up such a record, as undoubtedly should be done, is one of expense, although it is quite possible, that with the introduction of the Hollerith system of tabulating, that this desirable record may be obtained in an easy and cheap manner.

This question of expense is the serious one to a railroad management. Statistics cost money, and some statistics are dear at any price, but what is worth doing is worth doing well; and well devised statistics should without question become to the railroad company using them a source of profit. The return on the investment cannot be stated in dollars and cents, but it can be stated without peradventure that the company, whose officials are best posted in the details of operation, is the company which supplies its officials with the best possible analysis of work accomplished. It may be further stated that the official who studies such analysis and is guided thereby, must inevitably lead the way on the division or railroad where he is employed.

Finally, there is this to be borne in mind about statistics. We want to know when we have a sufficiency of them. A man may eat a big meal, and enjoy it, but he sometimes suffers for it afterwards. Do not overdo the statistical food it may react. I believe in getting at the root of a matter, and in putting statistics in as simple a form as possible, and making them as *just* as possible to all concerned. I remember the question coming up in reference to the fuel performance on a certain division, there being a very large increase in consumption per 1,000 ton miles over the whole *division*. The figures certainly looked very bad, but on analyzing them it was found that on *every district* there was a *decrease*. It was found that traffic conditions had altered to such an extent on two expensive sections as to cause an *increase* in fuel consumption per 1,000 ton miles for the division as a whole. I can assure you this discovery made me careful when criticizing results as shown in statistics and impressed upon me the necessity of getting down to details.

Single-Phase Electric Locomotives and Power Equipment of the St. Clair Tunnel Company.

The single-phase electric locomotive adopted by the St. Clair Tunnel Company for the operation of the St. Clair tunnel, which connects the American and Canadian divisions of the Grand Trunk Railway System, will weigh approximately 62 tons, and will develop a drawbar pull of 25,000 lbs. on a 2 per cent. grade at a speed of 10 miles an hour. It is of the rigid frame type with driving axle boxes held in the same frame that contains the draft gear. It will be mounted on three pairs of driving wheels which will sustain the entire weight, distributed by equalizer bars similar to those used in steam locomotive practice, will have an outside frame supported on semi-elliptical springs, and will be equipped with Westinghouse friction draft gear, M. C. B. automatic couplers, air sanding apparatus, and bumper steps, front and back. The cab will be of sheet steel mounted on a framework of iron which supports both walls and roof.

The principal dimensions will be approximately as follows:

Length over end sills	27 ft. 9 in.
Rigid wheel base	12 " 0 "
Width over all	9 " 6 "
Height from top of rail to top of cab	12 " 6 "
Diameter of driving wheels	62

The operating apparatus will be arranged along the sides of the cab, leaving a free passage-way 3 ft. 6 in. wide the entire length. The cab will be lighted and heated by electricity, arrangement being made to screen the instrument lights while the locomotive is running. Westinghouse combination automatic and straight air and American driver brakes will be used. The air supply will be provided by a two-cylinder, motor-driven air compressor having, with a 5-in. stroke and a speed of 190 r.p.m., a capacity of 45 cu. ft. of air per minute. Air reservoirs, signal outfits, whistle, bell with pneumatic ringers, autimatic pump governor, tools, instruments, gages, headlights, push poles and other details complete the auxiliary equipment.

A motor will be geared to each axle, giving each unit an aggregate rated capacity of 750 h.p. The motors are of the Westinghouse single-phase, alternating-current, series-wound, compensating type, whose successful development was first publicly announced in the paper read by Mr. B. G. Lamme before the American Institute of Electrical Engineers in New York, Sept. 26, 1902. They are of the same general character as the motors selected by the New York, New Haven & Hartford for the operation of the line between New Haven and New York. Each motor will weigh complete approximately 14,500 lbs., the armature weighing approximately 5,600 lbs.

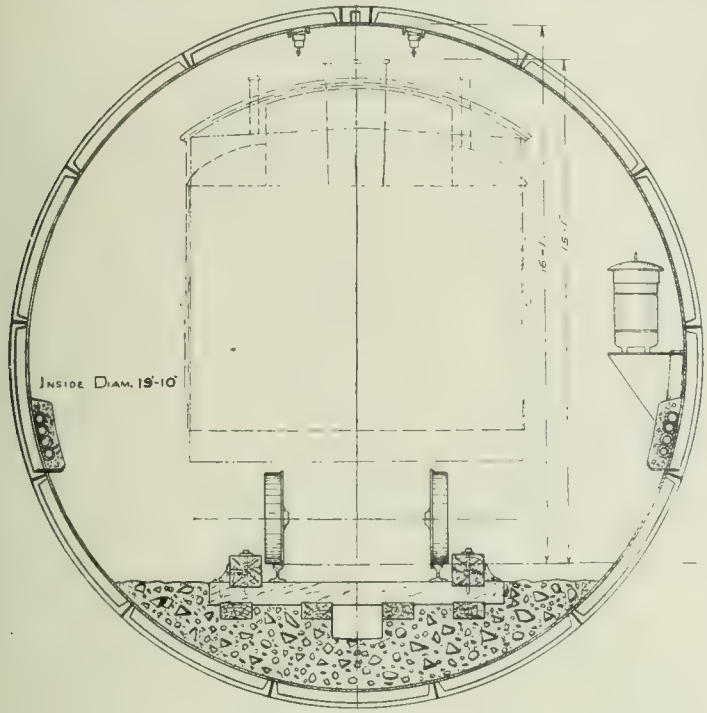
The motor frame consists of a steel cylinder cast in one piece and enclosed at the end by brackets of the same material, which carry the bearings and oil reservoirs. The suspension noses and safety lugs form a part of the main casting. Seats for the axle bearings are cast solid with the frame. All bearings are of phosphor-bronze lined with babbitt and are divided into two parts. They are of exceptionally large dimensions, are arranged for oil waste lubrication, and are provided with large openings on the low pressure side, giving a thorough lubrication of the entire bearing surface. Oil is fed into the reservoirs through openings separate from the waste pockets and therefore reaches the waste from below and is thoroughly filtered before entering the bearing.

The motors are swung between the locomotive frame and the driving axles by a flexible nose suspension from two hangers supported by a truck transom and passing through heavy lugs with helical springs above and below the lug. The motors are held to the axle by means of caps which are split at an angle of 35 deg. with the perpendicular, so that the greater part of the weight is borne by solid projections from the motor frame which extend over the axle rather than by the cap bolts. Large openings above and below provide access to the commutator and brush holders.

Within the cylinder of the motor frame there is built up a core of soft steel punchings, forming a completely laminated field. The punchings are dovetailed into the frame and clamped between end rings of cast steel. The field coils are wound with copper strap insulated between turns and about the coils by mica and finished by taping and dipping, and are impregnated in the best grade of

varnishes, providing a sealed coil which can withstand the most severe internal heat and is practically indestructible under the usual conditions of heavy railroad service.

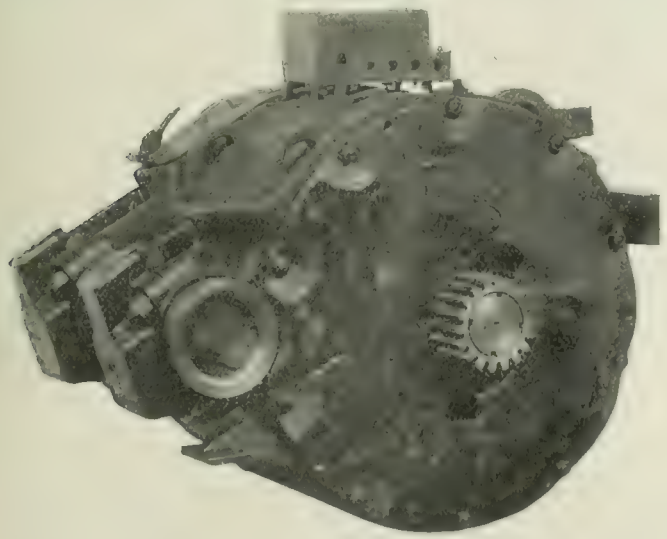
In addition to the main coils the field carries a neutralizing winding which consists of copper bars placed in slots in the pole faces and joined at the ends by connectors of copper strap, so as to form one continuous winding which is connected in series with the main field winding and with the armature circuit. The magnetizing effect of this auxiliary winding is directly opposite to and neutralizes that of the armature winding, thus eliminating the effect of armature re-action and improving commutation and power



Cross-Section of the Sarnia Tunnel.

factor. The main coils can be easily removed without disturbing the auxiliary winding.

The armature cores are formed of slotted soft steel punchings built up upon a spider and keyed in place. The spider is forced upon the shaft with heavy pressure and secured by a steel key. Coils of copper strap are embedded in the slots and joined to form a closed multi-circuit winding which is cross-connected, like the multi-circuit winding of a direct-current generator. The basis of the insulation is mica. A preventive winding is connected between



250-H.P. Single-Phase Alternating Current Railway Motor.

the commutator and the main coils, introducing a preventive action which is effective only when the coil is passing under the brush.

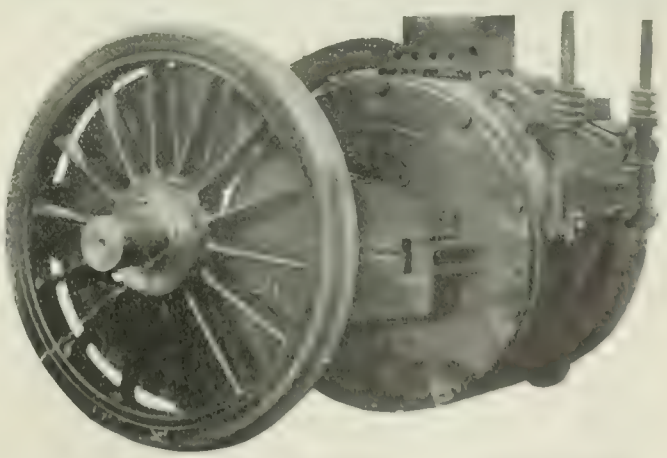
During operation a forced circulation of air supplied by motor driven blowers enters at the rear, distributes itself thoroughly throughout the motor and escapes through the perforated cover over the commutator. This system of forced ventilation of both motors and auxiliary apparatus forms one of the most interesting innovations in electric railroad construction. It secures a maximum output from a given weight of material, and a high ratio of continuous output to the one-hour motor rating common in railroad practice. It also provides effective ventilation while the locomotive is not in operation as the blower may be driven while the locomotive is standing at the station or the end of the line. Motors ventilated in this manner are enclosed and are thereby protected from internal damage by dirt and water and from mechanical injury. These motors are wound for 240 volts and 25 cycles per second, and have a nominal rating of 250 h.p. each, on the basis of usual electric railroad practice.

The essential elements of the control equipment include the collecting devices, the auto-transformers, the unit switches, the preventive coils, the reverser and the master controllers. A multiple-unit system of control is provided with pneumatically operated switches and circuit breakers, low voltage control circuit, and other characteristics standard in Westinghouse practice. Any unit may be controlled from either end, and two or more units may be coupled together and operated from a single cab and by a single crew. The tractive effort which can be readily applied to a single train is therefore limited only by the number of units available, and the hauling power is limited only by the mechanical strength of the coupling between locomotive and cars. A control circuit is carried from one unit to the next by means of connecting sockets and jumpers in the usual manner.

Speed control of the driving motors is secured by variation of the voltage at the motors obtained by means of taps taken from the winding of the auto-transformer which receives current from the trolley at 3,000 volts and reduces it to 240 volts or lower, according to the tap employed. These taps are connected to unit switches from which current is led through the preventive coils to the motors. Four unit switches serve to reverse the field of each motor.

The unit switches are of standard Westinghouse design, and are, in effect, pneumatically operated circuit breakers of great power and reliability. The mechanism is such that a rolling and sliding contact is obtained when the switch closes and opens. The arc is broken at the tips, leaving the contact surfaces smooth and unscarred. Each unit has a magnetic blow-out coil with laminated core. The switch cylinders are controlled by magnetically operated valves, current for which is obtained from a 50-volt tap from the auto-transformer. The sequence of operation is governed by the master controller in conjunction with a system of interlocks which prevents short circuit of the steps between taps from the auto-transformer or improper operation of the controlling mechanism. At any running point four controlling switches are closed. Through the preventive coils approximately the same amount of current is drawn from each of these switches and the leads to which they are connected. To change to a higher voltage on the motors, the master controller is moved to the next notch, opening the last switch of the group that is closed and closing the switch next higher, with the result that the motor voltage is shifted up one step. By this arrangement the voltage at the motor will be completely under control of the locomotive driver and may be varied up and down at will without opening more than one-quarter of the load current. Small switches in the circuits to the magnets of the reversing switches will enable any motor or combination of motors to be cut out without disturbing the others.

Every one of the 17 controlling connections provides an efficient



Motor and Gear Case Mounted on Locomotive Axle.

running point. This number is ample to prevent any slipping of the driving wheels due to increase of current from one notch to another. Whether empty or heavily loaded, operated in single or multiple units, torque and drawbar pull may be gradually applied and the locomotive started without jar.

Each locomotive unit will be equipped with a pneumatically operated pantagraph trolley to collect current from the overhead lines outside the tunnel and throughout its entire length. The proper

tions of the pantagraph will be such that when extended, it will make contact with the trolley wire 22 ft above the rail, and when closed down, the contact shoe will not extend more than 18 in. above the roof of the locomotive. The pantagraph will have a broad base and will be constructed of light and stiff material.

A No. 0000 grooved overhead trolley wire will be suspended from a single 5/8 in. high strength, double galvanized steel strand, messenger cable by hangers of varying length in such a manner that the trolley wire will be approximately horizontal. The messenger cable will be swung from structural iron bridges located throughout the yards and of suitable length to span the proper number of tracks. There will also be a small section of track equipped with a trolley line swung by catenary suspension from bracket arms which are supported on lattice-work poles.

For the operation of the electric locomotives a complete power plant will be installed, including two 1,250-k.w., 3,300-volt, 3-phase, 25-cycle, rotating field, Westinghouse steam turbine units running at 1,500 r.p.m. with the necessary complement of switchboards, exciters, lightning protective apparatus, etc. This station will also supply current to light the buildings, yards and tunnel, to operate motor-driven centrifugal and triplex pumps which drain the tunnel and approaches and operate the sewage systems, to run motors in the roundhouses and for other purposes.

The new equipment will be used on that portion of the Grand Trunk Railway System which connects the divisions terminating at Port Huron, Mich., and Sarnia, Ont., on opposite sides of the St. Clair river. The tunnel proper is 6,032 ft. long and the line to be electrically operated is 19,348 ft. from terminal to terminal.

A pair of the new units will be capable of hauling a 1,000-ton train through the tunnel without division. Mechanical considerations limit the advisable weight of train in the tunnel to these figures. Heavier trains can be divided or sent through together with locomotives in front and behind. The service requires that each unit shall take a train of 500 tons through the tunnel block from summit to summit in 15 minutes under the following conditions: It will be coupled to the train in a level track at a point 1,200 ft. from the summit and must accelerate it up to a speed of 12 miles an hour in two minutes, at the end of which time it will have reached the summit of the grade leading down into the tunnel. It will then run down a grade of 2 per cent. to the level track in the tunnel at a speed not exceeding 25 miles an hour, continue on the practically level stretch under the river, and then draw the train up a 2 per cent. grade at the rate of 10 miles an hour to the level track beyond the tunnel approach on the other side. It must then gradually accelerate the train until a speed of 18 miles an hour is reached. Each unit must be capable of exerting a tractive effort of 25,000 lbs. for a period of five minutes in addition to the energy required to accelerate the train at the starting point and to run with it into the terminal yard, from which point it must immediately run back to a position 1,200 ft. from the summit, couple to another train and be ready to start through the tunnel in the opposite direction. It must therefore make a run of the character described every 30 minutes. Six of these locomotives are to be furnished by the Westinghouse Company. It is expected that the electric equipment will greatly relieve the traffic congestion now existing and due in a large measure to the necessity of dividing trains at the terminal points, and to greatly simplify the operation of the road. Its opening will mark the progress of electrical methods in the railroad field under conditions which seem peculiarly fitted to demonstrate its practical advantages in heavy service.

The work of installation will be conducted under the supervision of Mr. Bion J. Arnold, of Chicago, Consulting Engineer for the Tunnel Company, by whom the plans and specifications were prepared. Mr. Arnold was one of the first engineers in America to advocate the employment of the single-phase, alternating-current system in railway service. He is also a Past President of the American Institute of Electrical Engineers, a member of the Commission in charge of the electrification of the New York Central Railroad system in New York and has been closely identified with many electrical developments of great importance.

Steel Rail Outlook.

The *Wall Street Journal* publishes the following summary of the probable extent of the steel rail business in 1906. The rail mills of the country begin the year with close to 2,500,000 tons of business on their books, and the prospects are that the total production of the country in 1906 will be in the neighborhood of 3,300,000 tons, or about 300,000 tons in excess of the high record year of 1903, and 600,000 tons in excess of 1905. If the output is as large as expected the tonnage will represent a gross business of $92,000,000. There has been no extraordinary increase in steel rail production over the last seven years. As a matter of fact rail production has not kept up in this respect with many other classes of finished steel. In 1901 the rail production of the country was 2,874,639 tons, and during the depression of 1904, 2,284,000 tons were turned out. The production of steel rails over the last seven years, together with the price per ton and gross value, follow:

	Tons	Price per ton	Gross value
1906	3,300,000	$28.00	$92,400,000
1905	2,700,000	28.00	75,600,000
1904	2,284,711	28.00	63,971,908
1903	2,942,471	28.00	82,389,356
1902	2,947,063	27.43	82,342,124
1901	2,874,639	27.33	78,563,788
1900	2,385,682	22.29	76,933,671

Estimated.

The feeling in iron and steel circles is that regardless of crop conditions, the rail mills will be kept active all through the current year. It is pointed out that the railroads will be forced to increase their equipment materially in order to conveniently handle the vast and ever increasing amount of freight consigned to them. There are now 1,700,000 freight cars in use, but it is claimed that it would require many hundreds of thousands more to satisfactorily handle the freight. Nearly 1,000,000 freight cars have been manufactured in the last seven years, or at the rate of 130,700 a year. The output of rails generally moves in sympathy with the output of cars. The United States Steel Corporation now has a steel rail capacity of at least 2,500,000 tons, but if the Youngstown mill continues to work on sheet and tin bars in preference to rails the corporation's production this year will not be as heavy as it otherwise would be. The rail production of the United States Steel Corporation over the last four years was as follows:

	Tons.		Tons.
1902	1,700,000	1903	1,934,430
1901	1,210,000	1902	1,920,786

Estimated.

The exports of steel rails for the eleven months ended Nov. 30, 1905, were as follows:

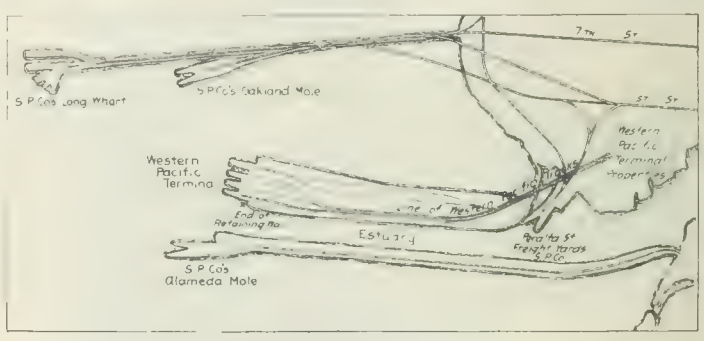
11 mos.	Tons.	Value.	11 mos.	Tons.	Value.
1905	27,3[illegible]6	$[illegible]6,677,737	1904	[illegible]395,849	$10,182,402

As long as domestic consumption continues as large as at present there is no likelihood of rail exports exceeding last year's shipments to any great extent.

Western Pacific Terminals.

The Western Pacific and Southern Pacific Companies have each filed plans at the local office of the United States Engineering Corps for proposed terminals at Oakland, Cal. Each asks permission to fill in ground on the north side of the retaining wall built by the government to define the channel known as the Oakland Estuary, lay tracks on such ground and build depots and docks at the western end. The accompanying sketch shows the Western Pacific's plan; that of the other road differs only in detail.

The Southern Pacific, whose yards are northeast of the property designated Western Pacific Terminal, now has tracks extending out to deep water on two moles built some time ago. It needs more terminal facilities, but the present building of more yards and docks is for the immediate purpose of blocking the Western Pacific scheme. At this time it is impossible to say whether or not the older company will succeed in thus shutting out the new company. Both roads have employed the usual methods: injunctions and the sudden occupation of disputed territory. The Western Pacific has so far been the more successful in the use and evasion of court orders. First, it stopped the Southern Pacific from



Proposed Western Pacific Terminals at Oakland.

building a trestle from the Peralta street freight yard, of the last named road, to the end of the retaining wall. Then the Southern Pacific obtained injunctions from the city authorities restraining a dredging company, which was deepening the channel of the estuary, from dumping sand on the north side of the retaining wall, but as the dredging was being done under a federal government contract the order was disregarded and another injunction, aimed to prevent the Western Pacific from laying track on the made ground thus formed, was also unsuccessful since the ground concerned was federal property.

As to actual construction the present status is as follows: On January 8 the Western Pacific laid rails west as far as the lighthouse on the strip of ground above referred to as adjoining the

north side of the retaining wall. The same company had been building a bulkhead parallel to the retaining wall and some distance to the north of it, and was enjoined against continuing to do so. They then laid ties across the tops of the piles they had driven and spiked rails on them, thereby converting the structure into a trestle, a work which the injunction did not cover but which attained, as well as a bulkhead could have done, their object, which was to enclose the contested strip of ground. On January 9 the Southern Pacific hastily laid a half mile of track from the ferry slip south of its Peralta street yards eastward toward the Western Pacific terminal property, and then drove piles in the marshy ground just east of that property for the foundations of shops. Work on these shops is being rushed, the purpose being to prevent the granting to the Western Pacific of a right-of-way from First street southeast across the freight yards to the retaining wall, the latter road having asked the city council for a 47 year franchise for this route.

Meantime, the Western Pacific has a launch equipped with a searchlight and gatling gun patroling the waters around the retaining wall, and has posted armed guards to protect the line of track already laid, while the Southern Pacific has enlisted the service of the state police to watch the men of the rival road and, if possible, prevent any more surprises.

Shipping Subsidies.*

BY ROYAL MEEKER.

Three "reasons" for subsidy are usually given by those who advocate this method of building up our merchant marine—first, the greater cost of construction in American yards; second, the greater cost of maintenance and operation under the American flag; and third, the bounties given by other nations. The greatest diversity of opinion prevails as to the amount of difference in cost of construction. The Merchant Marine Commission, appointed by Congress in 1903, gathered much testimony on this subject. The cost of construction in American yards was estimated by different witnesses to be anywhere from 20 to 100 per cent. greater than in English yards. Nearly all agreed, however, that it costs more to build vessels in America than in Europe. Most of the witnesses favored subsidies as the proper means of neutralizing this disadvantage in initial cost. In regard to operating expenses there is even greater diversity of opinion. The testimony taken by the Merchant Marine Commission is full of contradictory statements regarding wages of seamen on board American vessels as compared with wages on foreign vessels. Seamen and representatives of seamen's unions asserted that wages were not a matter of nationality at all, but were determined wholly by the port where the crew was engaged. Some owners declared that wages of ordinary seamen were determined by the port, but that salaries of officers were governed by the nationality of the ship. Most ship-owners and all ship-builders asserted with great positiveness that wages were wholly a matter of nationality, and that the port had nothing whatever to do with them. It was asserted repeatedly that Norwegian sailors would work on board a Norwegian ship for less than half the wages they would demand on an American vessel. At the same time it was asserted that sailors of all nationalities preferred American vessels to any others because of the better food and arrangements and the larger and more comfortable quarters assigned to the crew. These contradictory statements cannot be reconciled. They were presented as "facts." It is doubtless true in many cases that laborers, by reason of their own ignorance and shortsightedness, receive no greater pay for especialy hard or dangerous labor than others receive for safe and pleasant labor of the same grade; but it seems hardly possible that sailors are so perversely ignorant that they demand wages in inverse proportion to the danger and irksomeness of their tasks.

The calm assurance with which the advocates of subsidy assume that bonuses to shipping will immediately result in rapid expansion of the merchant navy is rather irritating. The basis of this assumption consists of citations of "statistics" relating to the effects of English, German and other subsidies. The statistics do indeed show rapid growth of English and German commerce and shipping. Since English and German shipping is prosperous and these countries pay subsidies, it is argued that subsidies cause shipping to increase. Such a use of statistics brings contempt upon the statistical method.

Discussion of British subsidies can refer only to postal subventions, since Great Britain never has given general bounties on construction or navigation of ships. *A priori*, it seems unlikely that postal subventions can build up a merchant marine. They help only such vessels as are suitable for mail service. These constitute but a very small proportion of the total merchant tonnage (in the case of Great Britain, about 2 per cent.), and they carry even a less percentage of the entire commerce.

If the mail payments are sufficient only to remunerate the contracting company for the necessary cost of the service it performs, it is reasonable to suppose that the contract will act merely to concentrate the ocean-mail business into the hands of the contracting company. The building and sailing of ships will not be in the least encouraged or accelerated. The contracting line will grow at the expense of other shipping.

If the subventions are larger than the necessary cost of the service, two results are possible. Either the payments serve to remunerate inefficiency for its inability to make profits, or the bonus above the cost of service bestows upon the contracting line a monopoly advantage, giving it power to cut freight and passenger rates under the competitive point. This condition might encourage the contracting line to expand until it had absorbed a large part of the business of its rivals. The motive for this policy would be the hope of enhanced profits, and the only way to secure such profits is to drive out rivals and then raise freight rates above the competitive price. The effects of such a policy are first to stimulate and then to discourage the growth of shipping.

Whether the British imperial mail contracts can or cannot be justified on other grounds, it cannot be shown that they have helped in the least to add permanently to the tonnage of British shipping.

The mail subsidy policy began in Germany in 1885. The mileage rates paid are lower than those paid by Great Britain, though on the basis of the weight of mails carried they are much higher. On the whole, the mail subventions paid by Germany seem no more than a fair compensation for the services rendered, taking account of the speed requirements, the regular times of sailing, and the free carriage of officials and official dispatches. In addition to these subsidies the German government grants free importation of all materials of construction and gives preferential railroad rates on such materials. Besides, the state gives special assistance to certain lines in the way of special through freight rates, which give the railroad an unduly small proportion of the combined rates on exports from Germany. Neither the amount of these indirect bounties nor their effect on export can be accurately estimated. Commerce and shipping have expanded, and it is reasonable to suppose that the preferential rates had some influence in this direction. If larger exports and greater tonnage are the only considerations, then the German system of preferential rates would seem to be a more efficacious method than mail subventions. But if state expenditure should bear any just relation to value received, then the expediency of these state favors may well be questioned. To ascribe the rapid progress of German shipping to bounties, direct or indirect, is absurd. In the first place, this rapid expansion began in 1881, four years before mail subventions were granted and long before preferential railroad rates were inaugurated. Secondly, Germany does not pay large subsidies. The total amount of the mail subventions is but little greater than the amounts which the United States is now paying on account of contract ocean-mail service for much shorter routes and less onerous service. Computed on either a mileage or weight basis, the German rates are much lower. Thirdly, no possible connection between the state aid and the growth of the merchant marine can be established. On the other hand, other economic causes are sufficient to explain Germany's maritime growth. The emigrant movement to the United States built up the North German Lloyd and the Hamburg-American lines. The industrial revolution in Germany since 1880 accounts for the expansion both in commerce and in shipping. The effects of the bounties, both direct and indirect, are insignificant compared to the effects of these economic forces.

Of the countries giving direct bounties on construction and navigation, France offers the most instructive study. * * * This shows a most unhealthy condition—a marine increasing in size and diminishing in utility. While the bounties appear to have brought about an increase in tonnage, they have at the same time sapped the remaining vitality of French maritime enterprise and left it a giant infant which becomes more dependent the larger it grows. The experience of France shows luminously the vast difference between a valuable merchant marine and an expensive one. The French postal subventions are even larger in amount and are therefore probably more influential than are the general subsidies. The cost of constructing steamers is estimated to be 25 to 50 per cent. greater in France than in England. How much of this greater cost is due to natural economic conditions and how much is due to the bounties cannot be determined. French shipowners complain that builders are united in a trust and charge enough for construction to absorb the whole of the bounty to navigation. As foreign-built vessels are not entitled either to navigation bounties or postal subsidies, the builders have the owners on the hip. Under the circumstances it is absurd to speak of a bounty to equalize first costs. Costs of construction increase with the bounty, so that if the government chose to double its mail subsidies the "cost of service" would absorb the whole amount. First cost of steamers, dock etc. would be doubled and so on down the line in continual procession. The service will cost as much as the government is willing and able to pay.

The United States has experimented from time to time with

*Abstract of an article in the Political Science Quarterly of December, 1905.

mail subventions and the results have not been very happy. From 1847 to 1858 the government paid nearly $15,000,000 in mail subsidies to six different steamship lines. The subsidies failed to give any permanent impetus to foreign navigation. From 1865 to 1875 Brazil and the United States paid jointly $250,000 a year for a mail line between New York and Rio Janeiro. When the subsidy ceased the line suspended. The subsidy created and supported the line, but the mere existence of this line had no discernible effect either on commerce or shipping. In 1867 the Pacific Mail commenced a monthly service between San Francisco and the Orient on a subsidy of $500,000 per annum. Five years later the company offered to double the service for another $500,000. After great difficulty a bill authorizing the increased service passed Congress. Later it was proven that the company had spent about a million dollars in more or less direct bribery to secure the passage of the bill. Because of the improper methods used to secure the necessary legislation, the later contract was annulled. During the period of subsidy, imports from China and Japan increased somewhat, while exports actually decreased. The subsidized steamship line was no more responsible for the one than for the other. Trade with South America and Asia remained practically stationary because we had nothing that the inhabitants of those two continents wanted. A subsidy large enough to enable goods to be given away could scarcely have increased exports much. No development of shipping resulted from this burst of subsidy. In a speech before the House of Representatives in 1879 on the occasion of a new subsidy proposition for a line to Brazil, Mr. J. G. Cannon said:

> Beginning with the year 1847, down to the present time, we have paid out of the Treasury over $21,000,000 for the purpose of establishing steamship lines. Seven million dollars would buy all the steamship line engaged in commerce that sail under the American flag on every ocean in the world; and more than that, the subsidizing of these steamship lines, from the Collins line in 1850 up to the present time, has bankrupted every prominent man that favored it.

The disgraceful experience with the Pacific Mail discouraged further subsidy schemes until 1891, when the present ocean mail act was passed. It establishes four classes of steamships to receive respectively $4, $2, $1 and $0.66⅔ per mile traversed as compensation for carrying the mails. At its passage it was confidently predicted that ocean transportation would as a consequence be revolutionized and American shipping would soon cover every sea. Six mail lines have been established under the law, demanding a yearly expenditure of nearly $1,500,000, but no revolutionary developments in American shipping have yet resulted. The impossibility of building up the merchant marine by subsidies, reasonable or exorbitant, for carrying the mails has already been pointed out.

There is a widely prevalent belief that a country must possess a large merchant navy in order to be an independent and self-respecting nation. It is further believed that the nation which must make use of the merchant shipping of foreign countries is economically dependent upon those countries. So far as economy is concerned, there is no reason why we should object to having our freights carried by Englishmen, Norwegians, Italians and Germans. So long as these people can carry them cheaper than we can ourselves, there is nothing but gain for us in the transaction. If we were willing to forego the patriotic joy of manning American ships with native Americans, it would be possible to obtain a merchant marine and to run it under the American flag without any bounties. It would be necessary only to allow our shipowners to buy their ships in the cheapest market and man them on the same terms. If our navigation laws allowed free ships and freedom in the navigation of ships, there would be nothing to hinder American shipping in the foreign trade from expanding rapidly. But those most agitated by our maritime decadence do not want the merchant marine rehabilitated in this most rational manner. A merchant marine, they say, can have no permanence or value unless built at home.

If our marine is to be built at home, the difference in cost of construction, if any, must be made up by a subsidy in some form. Shipbuilders place the costs in American yards anywhere from 20 to 100 per cent. higher than the costs in England. When guesses (they can scarcely be called estimates) vary so widely, it is idle to talk of a subsidy to make up the difference in first costs. It probably does cost more to build ships in the United States than in Great Britain. It would be odd were it not so. The ship-building industry in Great Britain is highly organized on an extensive scale. Where the American builder constructs one ocean-going steamer, the British builder constructs scores. Fixed charges form a much larger proportion of costs in American yards. Duplicate parts are used extensively in the construction of British tramp steamers, cutting down costs greatly. Were the industry organized on a larger scale in the United States, there is every reason for supposing that ships could be built as cheaply here as anywhere else. It is well known that in the production of all other kinds of steel structures our manufacturers can compete with the world.

To-day the world is confronted by an over-supply of ships. Ever since the end of the Boer war freights have been very low. This fact gave Mr. Morgan his inspiration to organize all the steamship lines of the North Atlantic into a big trust. Shipyards are working short time and turning out work at prices very little above cost. There is no great demand for steamships, and a further decrease in prices does not seem likely to create such a demand. Better organization in the ocean transportation business is much more needed than either more or better ships. In fact, a reduction in the number of ships would give a more economical service. One effect of an American subsidy would be to increase an already redundant shipping. Would this bring down freights and so lead to expansion of commerce with all its attendant blessings? Scarcely, for every idle ship is a pauper, depending for support upon active shipping. Furthermore, every unused compartment in every ship in service represents idle capital which earns nothing but which demands dividends. The proposed subsidies would probably increase the costs of ocean transportation by increasing the amount of idle tonnage. Of course subsidies might be made large enough to pay part of the costs of transportation, however high. The government might even pay all the ocean freights. This would certainly tend to the expansion of commerce. Such a policy would differ from other subsidy schemes only in the degree of wastefulness and imbecility.

There is then no good economic reason for granting subsidies to the merchant marine either for construction or navigation. The political arguments are two in number: first, the need of national self-sufficiency, and second, the need of a merchant navy to serve as an auxiliary naval force and to furnish transports and seamen for the war navy. As to the first count, it is impossible for any nation to be entirely independent of other peoples. To hire foreign ships is no more an indication of inferiority or dependence than to buy foreign fish or flannels. Secondly, as to the military value of a merchant fleet, it is obvious that it is a source of danger and not a protection in time of war. Witness our own Civil War, when a few Confederate cruisers swept half our great merchant marine off the seas in spite of our powerful war navy. The more shipping a nation possesses the more vulnerable it is to attack. It is much cheaper and better for the government to build cruisers that can cruise than to subsidize private corporations. The war vessel has become so highly specialized that no mail steamer can be successfully converted into an efficient cruiser. The fastest are too slow to run away from a real cruiser built for speed, and the strongest are too weak to fight. As regards the ordinary merchantmen which make up nearly the entire commercial navy, canal boats could as readily be converted into engines of war as these lumbering ocean-drays. If we had no merchant vessels, the argument for a merchant navy to train up seamen for the war navy would have great force. But the United States ranks next to Great Britain in the tonnage of her merchant fleet, and close after Germany (*i.e.*, third) in the tonnage of her ocean-going vessels engaged in foreign trade. There is no pressing need of hiring vessels to train up seamen.

If we want to acquire a merchant navy in any case, whether we need it or not, we must pay the price. The childish faith in subsidies manifested by some of our oldest and therefore, according to a popular superstition, wisest politicians is depressing. The report upon the last bill introduced into and finally passed by the Senate (1902) reads in part as follows:

> The purpose of this bill and its reasonably certain results will be within ten years to establish the maritime supremacy of the United States in the trade on the Pacific with Asia and the Philippines and on the Atlantic in the trade of the Gulf of Mexico and the Caribbean Sea; to establish on a secure basis the trade between the United States and the republics of South America, and to give the United States a respectable representation in the trade of the North Atlantic. Incidentally it will give to the United States an auxiliary navy second only to Great Britain's, an ocean mail service superior to that of Great Britain, France or Germany in all respects except for a few years more possibly, the service between New York and England and the North Sea ports. It will so extend shipbuilding as to transfer in time, certainly from Germany, and possibly from Great Britain, to the United States, the center of that industry, as the centers of other industries recently have been transferred. Finally, it will give to the United States a measure of maritime independence corresponding to our industrial and agricultural independence. This object and these results are perfectly well understood abroad, and afford the reason why the measure is regarded with undisguised apprehension and hostility by the shipping interests of Europe.

All these grand results are to be accomplished by the yearly expenditure of a paltry $4,700,000 in mail subventions and a million in general subsidies. The total is but little more than the mail subsidies paid by France, and not a million dollars greater than the subventions paid by Great Britain. Yet the American people are seriously asked to believe that the costs of construction and of navigation are 25 to 100 per cent. greater under the American flag than under the British flag! Surely to overcome such great differences an appallingly large subsidy would be necessary. Briefly, there appears to be no way of getting something for nothing, even by the occult means of government subsidies. If we dance we must pay the piper. Possibly we may be allowed to pay the piper though we do not dance. For were costs of construction, etc., in the United States no greater than in Great Britain, they could be made to appear so for the sake of a bounty, and when once a bounty is given the costs can be made to conform to its size.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Shop Apprentices 73
- Insulation of Pole-Line Signal Wires..... 73
- The Essentials in Rate Regulation..... 74
- Cast Steel 75
- December Accidents 76
- Southern Pacific 76
- New Publications 77
- Trade Catalogues 77

ILLUSTRATED:
- Daily Train Tonnage Chart—C. & E. I... 80
- The Thief River Falls Extension of the "Soo" Line 82
- Washington Street Subway in Boston... 86
- Accidents on the Brooklyn Elevated..... 91
- Automobile Testing Plant at Purdue University. 92
- The Cost of Locomotive Operation..... 94

CONTRIBUTIONS:
- Shipping Subsidies. 77
- Loading Equipment for Panama. 78

MISCELLANEOUS:
- Operation of a Busy Terminal District.. 79
- Visible Supplies of Grain 83
- Recent State Railroad Commission Legislation. 83
- Award of the John Fritz Medal..... 85
- The Local Agent 85
- Local Freight Agents' Problems 91
- Washington Correspondence 91
- The Education of a Station Agent..... 92
- Prussian Discipline (Note)..... 95
- Train Accidents in the U. S. in December 95

GENERAL NEWS SECTION:
- Notes 23
- Obituary 26
- Elections and Appointments 26
- Locomotive Building 27
- Car Building 27
- Bridge Building 28
- Railroad Construction 28
- Railroad Corporation News..... 30

VOL. XL., No. 4. FRIDAY, JANUARY 26, 1906.

The beginning of a system of instruction for shop apprentices designed to enable them to gain an elementary knowledge of the technical part of their trade was recently made by the Southern Pacific at its Sparks, Nev., shops. The work was started by giving instruction in mechanical drawing to the apprentices, and a small building was put up for this special purpose. Arrangements were made with the president of the State university to have the Associate Professor of Mechanical Engineering, Mr. J. G. Scrugham, devote two evenings a week to the instruction of the boys. Although the work has been in progress only a short time, the results are regarded as being sufficiently encouraging to justify considering its extension to the Ogden and Pocatello shops; also of adding to the course some instruction by the electrical engineer. A good deal has been written and said of late regarding the benefits to accrue both to apprentices and to the company from suitable instruction of this sort, in the production of well-trained, educated workmen, among whom will undoubtedly be found material from which foremen can be selected, and which in turn will supply material for higher positions. It is therefore of interest to know what degree of appreciation the Southern Pacific apprentices are manifesting toward this instruction and the opportunities afforded thereby. It appears that perhaps 50 per cent. of them are taking great interest in the work and are turning out mechanical drawings that are said to average up better than freshman class work in the technical schools. Among the remaining 50 per cent. there are some that apparently are entirely without interest in the work—a condition to be expected, since in any given number of students selected at random it would be exceptional not to find some who slight their opportunities. Quite likely, in the present instance these latter are unsuited to the trade they have set out to learn, and would be better off in some other kind of work. While there are always some men in the ranks who, through native ability and ambition, will rise in one way or another, it is said by men in position to know that the majority of mechanics nowadays are not ambitious for promotion, because of a seeming lack of confidence in their ability to assume executive duties or other responsibilities. But education develops latent talents and creates confidence; the apprentices are started thinking on their own account, broadening their ideas and in time their usefulness, In such results the railroad company will be repaid many times over for its outlay in providing a course of training.

INSULATION OF POLE-LINE SIGNAL WIRES.

A number of protracted discussions in the Railway Signal Association concerning the insulation of aerial electric signal wires have resulted in little or no definite advance in knowledge; and the last one, at the meeting in New York City, January 9, differed materially from the earlier ones only in making the defects in the wire service a litle plainer than they were before. It may be useful to briefly restate the case.

Considering automatic signals only, line wires on poles are used for:

(1) Control of indicators or switches by signals or by track relays.

(2) Control of signals by switches.

(3) Control of distant signal from tower or from home signal

(4) To supplement the track circuit, as when a relay is placed at the end of the track circuit farthest from the signal; that is to say, at the battery end.

(5) In single track working, to control a signal at one end of the block section or signals remote from the track section

The importance of the wire question may be appreciated when it is considered that a single railroad company has several thousand miles of signal wires on poles.

All of the uses mentioned would have been called necessary uses up to a few years ago, when the polarized relay was introduced and the "wireless" system began to find favor. Except on single-track lines, the introduction of the polarized relay made it possible, under favorable circumstances, to control all signals and switches by means of the track circuit. The most necessary function, that of throwing a distant signal to the clear position immediately after the corresponding home signal clears, is readily accomplished by changing the polarity of the track circuit which extends between the home and the distant signal. This is done by causing the home signal, when it completes its stroke to the clear position, to

move a pole changer for the battery of the track circuit in question. Indicators and switches can, by well known means, be managed even more easily than the distant signal.

But not every signal engineer has adopted the wireless system, and not all of those who have adopted it claim for it the highest perfection; and the question of the adaptability and sufficiency and economy of line wires still remains an important one. One road which has introduced line-wire adjuncts and safeguards quite extensively, claims that by reason of the stray earth currents in the ground throughout considerable portions of its lines, the use of the track circuit alone for the control of automatic block signals is unreliable and even dangerous. Whether these stray currents are caused by terrestrial magnetism which is uncontrollable, or come from electric railroad or light circuits, which might perhaps be controlled, or at least be recognized and intelligently dealt with, may be considered as not affecting the present inquiry. If the weak currents used to work signals through rails are forever to be susceptible to disturbance by foreign currents, the mere possibility of such disturbance is a sufficient reason for taking all practicable precautions against it. New sources of disturbance, expected or unexpected, may arise at any time. Other roads have borne similar testimony to difficulties with track currents, though but very few companies have had such extensive and varied experience as the one mentioned. Several roads which have made much use of the wireless system have found at least a few places on their lines, where it has been decided to be necessary to use line wires for all purposes for which the line wires are adapted, and not to put full dependence for everything on the track circuit alone.

Wires being necessary, there are two question to be settled: First, is it necessary to insulate them, and, second, if insulated, can the insulation be made reasonably durable? In other words, what is the annual cost of insulated wire for a long term of years?

The chief danger to be apprehended with line wires is the danger of crosses. With automatic block signals, the first essential is safety. Line wires are so connected to the instruments that a failure in any part will turn the signal to the stop position, a safe position. But a cross is a failure which no one has yet successfully provided against. A cross with a telegraph wire may divert current from that into the signal wire and wrongfully turn the signal from the stop to the clear position; and thus lead a train to destruction. A cross between two signal wires might do the same thing, if it connected the batteries in the right way. Theoretically, bare wires may be made safe. With poles set near enough together, and wire, insulators, cross arms and bolts of ample strength a pole-line might be made to defy the storms with almost ideal certainty, and decay of poles would be the chief danger to be guarded against. But is it not cheaper to envelop each wire in an insulating coat and thus use fewer poles and less expensive wires? This is a question which ought to be decided on accurate data, for each situation, and one on which the world is waiting for signal engineers to give their experience in lucid figures; so that it will not be necessary for the representative of a prominent road to say—as one said at the last meeting of the Railway Signal Association—that he believes insulation necessary, but does not know exactly what he wants.

The immediate difficulty most talked about by the signalmen at that meeting was poor insulation. "Weather-proof," as applied to the wrapping of a wire, may be interpreted as meaning not proof against any destructive agencies worse than the weather; nothing that is more severe than rain, hail, snow, sleet, frost and solar heat. In so far as an insulating braid is not proof against abrasion it is not even weather-proof, for wind, which is an element of weather, may quickly wear off a considerable thickness of the braid on a wire by swinging the wire against a tree or post. There was much complaint that the compounds used to saturate the braid on wires became disintegrated very quickly and dried out. But, as the manufacturers at once asserted, that trouble was probably due to scrimping prices. Good weather-proof wire can be had by paying for it. But how will do we know the value of good insulation? None of it is claimed to be as durable as the copper which it encloses; what, therefore, is to be done when the braid becomes unserviceable by age, while the copper remains sound? Can copper be taken down, rebraided and put up again? If not, it must, when taken down, be sold as scrap. If, as was once or twice suggested, the copper, after the loss of its coat, is to be used for an indefinite further time as bare wire, the whole argument for insulation fails, for if it is safe to use bare wire to-day the money spent for insulation last year was wasted.

From present practice and opinions, therefore, it would appear that we must close, as we began, by asking: Do we want insulation? Do we want it all the time? How much does it cost? And in how many instances have dangerous conditions been caused by lack of, or by defects in, insulation?

THE ESSENTIALS IN RATE REGULATION.

A National Congress of Boards of Trade, which takes as its name "The National Board of Trade," is now in session at Washington, and has passed the following resolutions with regard to rate regulation:

The National Board of Trade, believing that the interests of the people demand not only that the rates of transportation should be reasonable, and that there shall be no unjust discrimination or preferences, but also that there shall be effective governmental supervision of all interstate transportation agencies, expresses the earnest hope that Congress will, in its wisdom, and as speedily as possible, enact such further legislation as may be necessary, with justice to all concerned, to secure prompt and complete correction of any abuses in transportation methods or operations which may, upon due inquiry, be found to exist, and, to that end, that rebates and personal discriminations, in whatever form they may occur, and by whatever device they may be accomplished, be prohibited; that the corporations and individuals who in any manner participate in them be subjected to severe penalties, and the most effective machinery practicable be provided for their detection and punishment; also believing that the Government should, in the interest of the general public, including the purchasers of transportation as well as the carriers possess means to prevent the naming of excessive rates in the schedules, it is recommended that whenever a United States court of competent jurisdiction, upon complaint of the Interstate Commerce Commission (which complaint shall be given precedence), shall have determined that an existing rate is excessive, the commission, or some other competent authority be given power to compel the substitution of a reasonable maximum rate, such rate to go into effect within a reasonable time and to remain in force for such period, not longer than one year, as may be determined, the rate fixed to be subject to revision in the proper Federal Court upon proof that such rate is less than reasonable compensation.

Perhaps this action shows as well as any single fact which has been recorded the remarkable way in which the people of this country have been educated with regard to the whole subject of railroad rates and rate-making and discriminations. Last year the National Board adopted a resolution, in common with many similar organizations, which was in line with the unworkable and undesirable provisions of the Esch-Townsend bill. This year their recommendations are clearly thought out; they aim their measure solely at rebates and discrimination, and they suggest as a remedy a maximum rate, to remain in force for a period not longer than a year, subject to revision in a Federal court upon proof that the rate is less than reasonable compensation. This seems as fair a remedy as any that has yet been promulgated; yet we must again point out, as we have often pointed out before, that a tremendous responsibility in any such case rests with the commission, and that the importance cannot be overestimated of having a commission composed of men sufficiently intelligent to give decisions which will not paralyze industry prior to their reversal by the courts. Granting that some effective way must be found of stopping discrimination, it is obvious that the principal things to be done are two in number. First of all, a board of men must be found—and this is a matter of the gravest difficulty—who can make decisions carrying as intelligent an understanding of traffic situations as those made by railroad officers; second, a law must be formulated which will not permit a stupid or excited commission to do injuries which would be all but irreparable. All who have studied the present situation must be more and more impressed by the fact that most, if not all the difficulties of the present situation, are due to a single element—the law's delay. It is probable that few of the best informed critics of American railroad conditions would deny that the present laws are adequate, if the small shipper who has suffered a real wrong could get a hearing and obtain his remedy in a short time and at small cost; but it is useless to ignore the lamentable fact that where decisions drag through a period of time averaging about four years in important cases, as was brought out in the testimony last spring, the small shipper has at present no remedy.

Much has been said, both before the Senate Committee and in the public press, about the interdependence of railroad rates and the fact that there is scarcely a rate in the country that really stands alone, and that can be changed without affecting a good many other rates as well. It seems scarcely necessary to proceed into a discussion of this question, but several concrete instances are at hand which we quote to add force to the points which we consider crucial in making any rate regulation law, as enumerated above; the requirements that the proposed remedy shall never afford a means of paralyzing industry and that it is absolutely and

vitally essential that the right men administer the remedy. These specific instances, selected to illustrate the way in which the change of the rate on a particular classification, or on a particular commodity, between two points may force a change in the rates on that classification, or on that commodity, between other points, and may frequently affect an extended territory, are as follows:

INTERDEPENDENCE OF RAILROAD RATES.

On February 1, 1905, important reductions were made in the class and commodity rates from Louisville to Atlanta. Simultaneously, similar reductions were made from Cincinnati, Ohio; Evansville, Ind.; Cairo, Ill.; Memphis, Tenn., and New Orleans, La., to Atlanta. These reductions from the western markets forced corresponding reductions in the rates from Baltimore, Philadelphia, New York and Boston. The reductions from the Ohio river crossings were followed by reductions from points north of the Ohio river, and the reductions from the eastern ports necessitated reductions from interior eastern markets competing with the seaboard cities. The reductions to Atlanta necessitated reductions to points competing with Atlanta, such as Macon, Augusta, Columbus, Rome and Chattanooga. The reductions from Louisville to Atlanta brought about reductions from Chattanooga and Birmingham to Atlanta. The reductions from the eastern seaboard cities to Atlanta necessitated reductions from the southern ports to Atlanta. By this process of relative rate adjustment between markets, the initial changes referred to above from Louisville and Baltimore to Atlanta, extended to the traffic moving from the northwestern and New England States to practically every city and town in the State of Georgia, and, in their final operation, reduced the rates on a large number of classes and commodities from Atlanta to Macon; two cities in the State of Georgia less than ninety miles apart. The rates on cotton from Atlanta, Ga., are at present as follows:

	Per 100 lbs.
To Jacksonville, Fla.	43 cents.
" Brunswick, Ga.	43 "
" Savannah, Ga.	43 "
" Charleston, S. C.	43 "
" Wilmington, N. C.	43 "
" Norfolk, Va.	49 "
" Mobile, Ala.	48 "
" New Orleans, La.	53 "

For many years past the slightest reduction in the rate from Atlanta to either of these ports has been followed simultaneously by corresponding changes to all the others. The distance from Atlanta to Wilmington, N. C., is 435 miles, and from Atlanta to Brunswick, Ga., 279 miles, but on account of the competition of the carriers serving these markets, respectively, the same rate applies to both ports. In 1897, by action of the Georgia Railroad Commission, the rate on fertilizers from Brunswick, Ga., to Atlanta, Ga., was reduced from $3.14 to $2.57 per ton of 2,000 pounds. The carriers serving the markets of Savannah, Ga., and Charleston, S. C., immediately made the rate from those points the same as from Brunswick.

These instances show how the change in a rate on a certain commodity extends over a much larger area than would be at first apparent. The instances which follow carry the same idea further and show how the change in a rate on a particular commodity may force readjustments in the rates on other correlated or competing commodities:

Until a comparatively recent date there has been no competition in the southeastern section of the United States between vegetable oils and hog lard, but the development of the cotton seed industry resulted in the production of a large amount of cotton seed oil which has become a sharp competitor for the trade formerly enjoyed by hog lard, the refined cotton seed oil being sold in its native state and after conversion into so-called compound lard. When this competition arose, the railroads in the southeast provided for it by classifying cooking oil the same as lard, and by making the commodity ratings the same on both articles.

The rate on pig iron from Birmingham, Ala., to Cincinnati, Ohio, is $2.75 per ton of 2,240 pounds. This adjustment is the result of efforts on the part of the southern lines to develop the manufacture of iron pipe in southern territory, in competition with the pipe foundries in Pennsylvania. This is only one of many instances of the same character.

Generally, the rates on fertilizers are the same as the rates on fertilizer material, used in the manufacture of fertilizers, such as kainit, nitrate of soda, muriate of potash, blood and tankage, acid phosphate, tobacco stems, fish scrap, cotton seed meal, etc. The values of these commodities vary very greatly, but cotton seed meal, kainit and acid phosphate are sold in competition with the complete commercial fertilizer, generally known as ammoniated goods, and this competition has forced uniform rates upon the ingredients and the manufactured goods. Until about four years ago the rates on wheat and corn from the western markets to points in the southeast were slightly lower than the rates on flour and meal to the same points, but the lines originating this business at the Ohio river forced a reduction in the rates on flour and meal to the grain basis, presumably in the interest of the western miller, who formerly paid a higher rate on the manufactured product to points in the south, where mills were situated, than the southern millers paid on the raw material.

The rate on cotton, in bales, by rail and water routes from Columbus, Ga., to Boston, Mass., is 66½ cents per 100 lbs., out of which the carriers pay a compress fee of 7½ cents, leaving a net rate of 59 cents. The rate on cotton factory products between the same points, via the same routes, is only 55 cents per 100 lbs. This comparatively low rate on the manufactured goods grew out of the efforts of the railroads in the south to develop the cotton milling industry on their lines, in competition with the established cotton milling districts in New England.

CAST-STEEL.

The first steel castings made in this country of which anything is generally known, were crossing frogs made for the Philadelphia & Reading in July, 1867, by the William Butcher Steel Works, now the Midvale Steel Co. These castings were made from crucible steel of about the same hardness as tool steel, and while they had a smooth surface they were honeycombed throughout and far from perfect. Neither the Bessemer nor the open-hearth process of steel making was in successful use at that time. It was not until after the perfection of the open-hearth process, the Tropenas and other improved Bessemer processes 15 or 20 years later that cast-steel began to be used as a commercial material of construction, although the early experiments with crucible steel resulted in the discovery of several important principles of foundry practice, notably a suitable moulding mixture and the use of manganese and silicon for producing sound castings. Within the last ten years the art of making steel castings of high tensile strength and ductility has reached the point where almost any shape which can be cast in gray or malleable iron can be made in cast steel. Large marine castings, stern posts, bed plates, hawse pipes and the like are now almost universally made of cast steel and smaller parts are made with an equally high percentage of perfect castings.

In car and locomotive work, cast-steel is taking the place of cast, malleable and wrought iron for many large and small parts. Couplers, draft sills, body bolsters, platform sills, truck bolsters, truck frames, journal boxes and even wheels are now being made of this comparatively new material. Locomotive frames, wheel centers, cross-heads, axle boxes, rods and other parts are being made in large numbers, and have given good results in service. The greatest difficulty in making such castings of steel is the proper design of the piece, for with cast-steel the shrinkage, tendency to honeycomb, and washing out of cores and small projections in the mold require a different foundry practice from that used in making gray iron castings. Sharp corners and thin ribs or webs must be avoided and proper provision made for risers and gates in the mold. Molten steel, if not hot enough, is sluggish, and if too hot is violently agitated by the gases formed in the mold. It has more of a tendency to wash off small projections in filling a mold unless carefully poured and in shrinking it contracts more than cast-iron, and in a less uniform manner. Blow-holes can be largely prevented by the mixture of manganese and silicon with the steel and perfect venting of the mold, but too high a proportion of these elements results in brittleness. Green sand molding is now used almost entirely instead of the dry baked molds formerly employed, and with equally good, if not better, results. For duplicate work, such as coupler bodies and parts, molding machines are as well adapted for making steel castings as for gray and malleable iron castings.

The manufacture of couplers and bolsters from cast-steel has reached a stage of development beyond which little more could be asked. Where weaknesses have developed, slight changes in the pattern or in the method of molding and location of gates, risers and sinking heads for feeding the casting in cooling have usually overcome the difficulty and the standard makes of these parts of car equipment are turned out with a remarkably low percentage of defects. More complicated shapes, however, like locomotive frames are often difficult to make perfectly, even though they have been designed as nearly as possible in accordance with the best practice in similar parts. The segregation and shrinkage sometimes cannot

be determined until a few trials have been made with the patterns.

A committee of the Master Mechanics' Association in 1904 reported the preference of members in favor of cast-steel locomotive frames based on the number of locomotives in use as more than double the number in favor of hammered iron frames. Specifications for cast-steel frames were reported as follows:

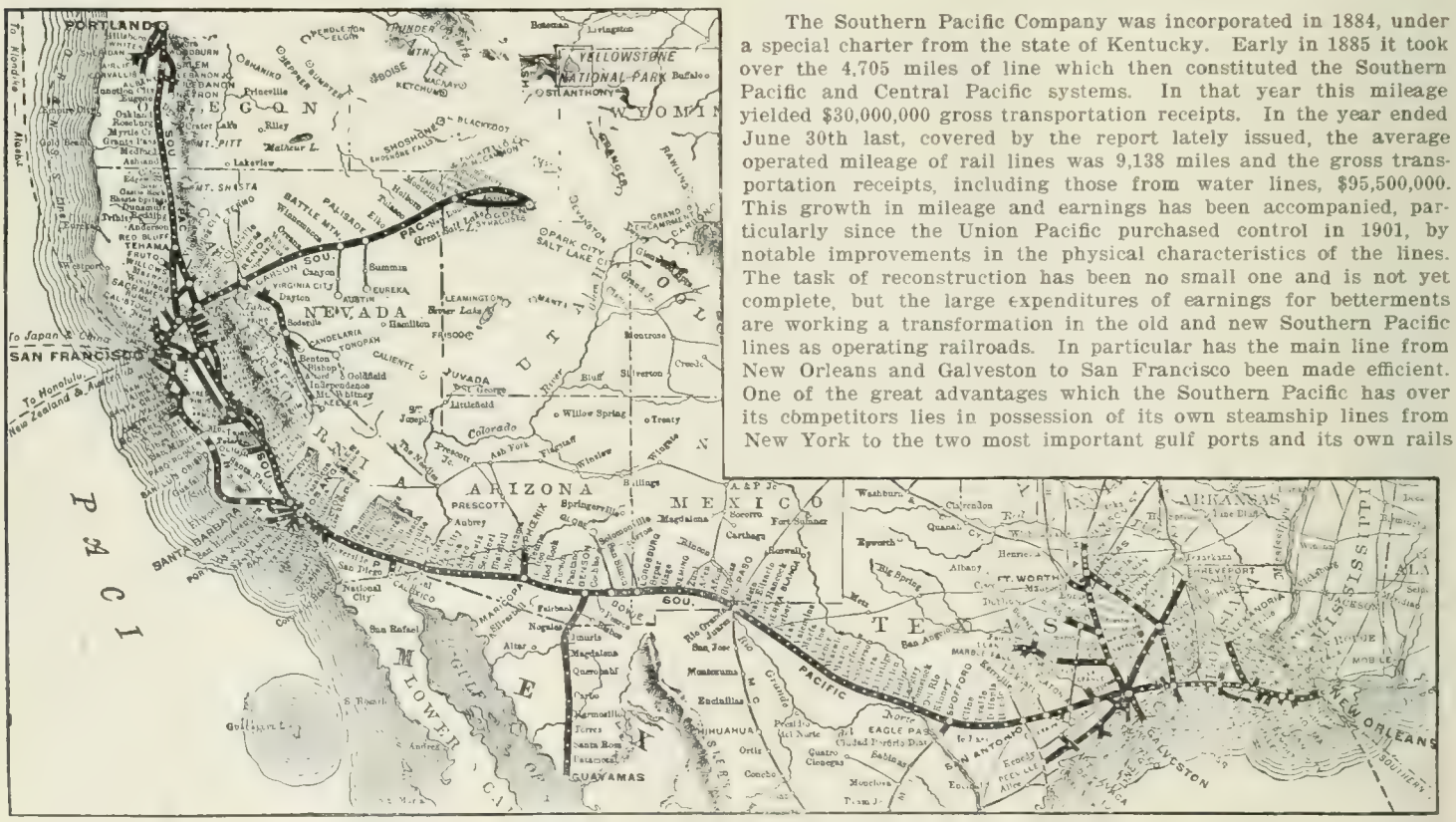
> Acid open-hearth steel; 0.28 carbon, 0.05 phosphorus, 0.05 sulphur, 0.60 manganese; tensile strength not less than 55,000 lbs. per sq. in.; elongation in 2 in. not less than 15 per cent.; all frames to be annealed.

These specifications are well within the resources of the steel founder. A recent bridge specification requires acid open-hearth steel; sulphur, 0.05; phosphorus, 0.05; manganese, 0.80; silicon, 0.35; ultimate strength, 65,000 lbs.; elongation, 20 per cent. in 2 in. The importance of careful foundry practice is emphasized in the committee's report, and also adequate annealing, which is an essential element of the process. Unannealed or poorly annealed steel castings are unreliable and weak.

The comparative strength and ductility of cast-steel is shown by the following table, compiled from tests made in 1891 by a committee of the Master Car Builders' Association:

Material.	Ult. strength.	Comparative strength, c. i. = 1.	Elongation in 4 in., per cent.	Comparative ductility, malleable iron. = 1
Cast iron	20,000 lbs.	1.0	0.35	0.17
Malleable iron	32,000 "	1.6	2.00	1.0
Wrought iron	50,000 "	2.5	20.00	10.0
Cast steel	60,000 "	3.0	10.00	5.0

The saving in weight for equal strength is about in proportion to the ultimate strength, and because of its high ductility cast-steel can be used in places where cast-iron cannot be used on account of the low resistance to shock, as in couplers and bolsters. Large heavy malleable castings cannot be made with strength in proportion to the weight, but with properly annealed steel castings the strength varies almost directly as the area of cross-section. The possibilities of this material have by no means been exhausted in car and locomotive work.



Southern Pacific.

December Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of December, printed in another column, contains accounts of 29 collisions, 25 derailments, and five other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

Dec.	Place.	Killed.	Injured.
7th	Rock Springs, N. Y.	9	19
19th	New York, N. Y.	1	15
22d	Holly Springs, Miss.	1	8

The reader needs not to be told that the brevity of this list has no great significance as affecting the aggregate loss of life and property by train accidents in the month of December, for a glance at the items under the different dates will show that it is only in what may be called big disasters that December presents a less discreditable record than its immediate predecessors. The Government record, when it appears, may very likely show totals even larger than the average—so little does a half dozen wrecks of the $100,000 grade affect the grand total for the 220,000 miles of road on which accidents occur.

The Rock Springs collision is in no way exceptional, so far as the cause is concerned; but a circumstance which is quite exceptional is the killing of so many persons on a passenger train while yet no passenger is killed. High-class long-distance passenger trains now approach the ocean steamship in the variety of services performed for passengers, and consequently in the number of employees carried on the train. The New York City collision is notable, first, by the question of signaling connected with it—and the failure of the state railroad commissioners to get any useful information concerning the culpability of the engineman or others concerned—and second because of its suggestions. It occurred on a line soon to be electrified, and the overturned car was one which would undoubtedly be quickly set afire by the short circuiting of a powerful electric current on or near the track beneath it.

The number of electric-car accidents reported in the newspapers as occurring in the United States in December was 19, in which five persons were killed and 87 were injured.

Southern Pacific.

The Southern Pacific Company was incorporated in 1884, under a special charter from the state of Kentucky. Early in 1885 it took over the 4,705 miles of line which then constituted the Southern Pacific and Central Pacific systems. In that year this mileage yielded $30,000,000 gross transportation receipts. In the year ended June 30th last, covered by the report lately issued, the average operated mileage of rail lines was 9,138 miles and the gross transportation receipts, including those from water lines, $95,500,000. This growth in mileage and earnings has been accompanied, particularly since the Union Pacific purchased control in 1901, by notable improvements in the physical characteristics of the lines. The task of reconstruction has been no small one and is not yet complete, but the large expenditures of earnings for betterments are working a transformation in the old and new Southern Pacific lines as operating railroads. In particular has the main line from New Orleans and Galveston to San Francisco been made efficient. One of the great advantages which the Southern Pacific has over its competitors lies in possession of its own steamship lines from New York to the two most important gulf ports and its own rails from them to the most important Pacific port. Thus, except on perishable freight, it can get the whole haul and the whole rate across the continent.

Gross railroad earnings for the year were $89,403,632, an increase of $2,493,126 over 1904. Operating expenses increased only $243,874, leaving net earnings of $30,873,617, an increase of $2,249,253 over the previous year. The gross earnings came $57,759,312 from freight and $26,412,631 from passenger and extra baggage earnings. Passenger earnings increased $1,200,000, or nearly 5 per cent., and freight earnings $1,160,000, or 2 per cent.

Operating expenses show a fine record of increase in the maintenance charges and decrease in conducting transportation account. Maintenance of way increased $1,416,239, or 11.5 per cent., and maintenance of equipment $939,651, or 7.8 per cent. The decrease in conducting transportation was $2,315,331, or 7.2 per cent. General expenses at the same time increased 10.6 per cent. Increases in maintenance of way account came in those items which most closely reflect betterment of the line. Repairs of roadway increased $742,000; renewals of rails, ties, and other track material, $355,800, and repairs of buildings, docks and wharves, $196,500. Per

mile of main and second track, maintenance of way expenditures were $1,476 against $1,341 in 1904. Maintenance of equipment account includes $143,377 written off against 29 old locomotives; $92,261 for changing 176 locomotives to burn oil, and $45,613 for changing 19 locomotives from compound to simple; also, $37,893 for metal cabs put on 77 locomotives, for equipping 406 locomotives with acetylene headlights, and for 174 steel-tired wheels used in renewals. The same account also includes $102,300, cost of replacing 28 passenger cars disposed of, and $562,053, cost of replacing 1,556 freight cars also sold, destroyed or condemned, including the cost of equipping 45 narrow gage cars with air-brakes and 347 narrow gage cars with automatic couplers. The average cost of repairs per locomotive and per car was $3,473 per locomotive in 1905 against $3,588 per locomotive in 1904; $920 per passenger car in 1905 against $823 in 1904, and $85 per freight car against $81 in 1904. Of the four unit items of maintenance charges, every one, with the exception of cost of maintenance per locomotive, which was larger in 1904, is heavier than in any previous year. The decrease of $2,315,331 in conducting transportation was most of all due to a decrease of $1,665,649 in cost of fuel; wages of enginemen and trainmen decreased $235,688. The company was also much more fortunate than in the previous year in the amount of payments necessary for injuries, loss and damage, in which item there was a decrease of $433,100, or 21.5 per cent.

There was an increase of 23,348,638, or 1.87 per cent., in the number of passenger miles, and a decrease of 1,298,829, or 0.02 per cent., in the number of ton-miles. Excluding ferry and suburban passengers, the average receipts per passenger mile were 2.183 cents against 2.141 cents in 1904. The ton-mile receipts also show a small increase, from 1.014 cents in 1904 to 1.046 cents in 1905. The average passenger traveled 84.39 miles against 82.83 miles in 1904. The average distance a ton of freight was carried was 268 miles against 277 miles the previous year, a decrease of nine miles, or 3.2 per cent. The average number of passengers per train increased from 63 to 65, or 3.4 per cent. There were 18.96 tons on the average in each loaded car, a slight decrease from the preceding year. The train load, on the other hand, increased from 275 tons to 290 tons, an increase of 15 tons, or 5.4 per cent. Largely through the working of the equipment clearing house, described in detail in the *Railroad Gazette* of January 19th, there was a gain of 2.95 per cent. in the percentage of loaded freight car mileage to total freight car mileage, and a decrease of 11.4 per cent., or 18,188,813, in the number of empty freight car miles. This corresponds roughly to the running of 433,000 freight train miles.

All these figures show increased operating efficiency and large expenditures for the up-keep of the property. The company's record is, in fact, to all but one class of persons, exceedingly satisfactory. These are the holders of that part of its $197,849,000 common stock over and above the $90,000,000 through which the Union Pacific holds control. The surplus after charges a year ago amounted to 4½ per cent. on the capital stock. This was all put back into the property. Since that time, $40,000,000 7 per cent. preferred stock has been issued. Allowing for the $2,800,000 charges thus placed ahead of the common stock, the surplus for 1905 equals 4.96 per cent. on the common. In view of these surpluses, and the strengthening, through refunding during the year, of the company's financial position, many of the common stockholders believe that a dividend is clearly due them. No dividend has ever been declared on the common stock, but just at the time when the long record of expenditures out of earnings on the up-building of the property seemed about to result in such increased efficiency of operation that dividends could consistently be declared, a new factor has come up, which, judging from a statement made in the report, will delay for some time longer any such distribution. This is the necessity of building new lines of railroad for two purposes: To develop local areas tributary to the existing lines and to offset the aggressive building of competitive lines. At least 400 miles of new line, including an extension eastwardly from the San Francisco-Portland line into central Oregon, have already been authorized, at an estimated cost of about $14,000,000. In addition, the Mexican Government has granted a concession for building 775 miles of line on the west coast of Mexico from Guaymas, the present terminus of the Sonora Railway, to Guadalajara. In order to take advantage of opportunities which in most cases must be seized at once, the management announces that in its judgment the resources of the company must be held in reserve and carefully husbanded.

Thus, disappointment still seems to await those who have been hoping for dividends. Patience may in this case appear to be a difficult virtue to exhibit, but eventually holders of the common stock must get the advantages of this broadening of influence. With the first class main lines which have been wrought out of the properties taken over in 1885, and the strategic importance which the new extensions will give the company, the time must sooner or later come when the Southern Pacific will be in profits to its stockholders, as well as territorially, one of the most important of the country's railroads.

The following are the principal statistics of operation of the rail lines:

	1905.	1904.
Mileage worked	9,138	9,014
Freight earnings	$57,759,312	$56,602,651
Passenger earnings	26,412,631	25,201,488
Gross earnings	89,403,632	86,910,406
Maint. way and structures	13,731,801	12,315,562
Maint. of equipment	12,989,732	12,050,081
Conducting transportation	29,691,601	32,006,932
Operating expenses	58,530,015	58,286,141
Net earnings	30,873,617	28,624,365
Gross income*	98,140,582	95,522,992
Net income*	13,124,416	9,593,215

*Including water lines.

NEW PUBLICATIONS.

Biographical Directory of the Railway Officials of America. Edition of 1906. Cloth. 694 pages, 6x8½ ins. Price, $3.00. Railway Age Company, Chicago.

Following the five preceding volumes, the earliest issued in 1885, this latest edition of the Directory of Railway Officials brings down as nearly as possible to date the record of service of most of the principal railroad officers of the United States, Canada and Mexico. It is a collection of brief personal histories of the men now, or formerly, occupying important railroad positions, giving, in general, in each case, the date and place of birth, institution where educated, and, so far as possible, a continuous record of positions held since first entering railroad service. The present volume contains such a brief biographical record of 5,000 different men. Included in the list are the names of many men who have left important positions in railroad service to engage in other business, but whose railroad records are of general interest. Also, in recognition of the increasing influence of government in railroad management, there are included sketches of the personal history of 96 national and state railroad commissioners. Many of the individual records are exceedingly interesting as showing the steps in the career of some of the country's most successful men. The chief value of the book is, of course, as a reference volume for railroad libraries.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal card circulars	3¾ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Foundations and Setting Machine Tools.—This is the title of a neat little booklet published by the Niles-Pement-Pond Company, New York. It contains valuable information for those who have to do with the building of foundations and the setting of machine tools. Brick foundations are referred to in a brief way, but concrete foundations are recommended unless there is some good special reason for using brick.

Steam Shovel News.—No. 1 of Vol. 2 of this interesting little magazine contains an announcement that hereafter it will appear monthly. The current number has as its leading article, "A Competitor of the Panama Canal." There is also an illustrated description of an interesting sewer and ditching job, and other short articles and notes of interest in this line.

Hammers.—Illustrations and price lists of all kinds and sizes of hammers forged from solid-crucible cast steel are given in a catalogue published by The David Maydole Co., Norwich, N. Y.

Incandescent Lamps.—A handsomely illustrated catalogue descriptive of the Sawyer-Man incandescent lamps is being distributed by the Westinghouse Electric & Mfg. Co.

CONTRIBUTIONS

Shipping Subsidies.

New York, Jan. 22, 1906.

To the Editor of the Railroad Gazette:

Your excerpts from Mr. Royal Meeker's article contributed to the *Political Science Quarterly* for December, "Shipping Subsidies," contain one or two statements inviting examination. Comparing certain questions and answers in the report of a Parliamentary Committee on Packets and Telegraphs (Blue Book VI., 1859) with

Mr. Meeker's. "From 1847 to 1858 the government paid nearly $15,000,000 in mail subsidies to six different lines. The subsidies failed to give any permanent impetus to steam navigation." We find Mr. Cobden asked Q. 588. "You are aware that it (the Collins line) ceased because the American Government withdrew the subsidy?" And Mr. Wilson followed. Q. 613. "The Cunard's contract is £191,000 is it not?" A. "Yes, £191,000."

Q. 617. "Three hundred and twenty thousand pounds is the amount which is now paid by this country and the colony for the transmission of postage, including the Galway line?" A. "Yes."

Q. 618. "And in the face of these increasing subsidies the American Government have altogether relinquished the practice of subsidizing their vessels, and their vessels, of course, have been driven off the passage."

No one, I think, can read the above without conviction that Mr. Meeker was not fully seized of the subject of which he was writing. In fact, the value of subsidies to British shipping and British commerce is very generally underrated by our advocates of subsidies. In 1846, see reports of committees, XV., p. 30, Cunard testified: "If I had got this contract (for a line to New York in addition to his line to Boston) three months sooner there would have been no American line." A statement which leads us to infer that it took cash in hand to secure legislation adverse to American interests. Neither the Peninsular and Oriental nor the Royal Mail could have built up their large fleets without the commercial confidence given by their subsidies, and as the Collins vessels always beat the time of the Cunarders, they probably would have been driven off the passage if it had not been for their subsidy.



Loading Cars for the Panama Canal on the Steamship "Colon."

In addition to the Collins line our lines to Havre and Hamburg were "driven off the passage" by relinquishment of the practice of subsidizing our vessels." Our Hamburg line has expanded into the Hamburg-American line, and if we had continued our practice in the British spirit its magnificent fleet and immense political influence would have been American.

In its issue of Jan. 5, 1906, the *Iron and Coal Trades Review*, London says: "The total volume of British shipbuilding turned out in 1905 has exceeded that of any previous year in the history of the trade. It amounted to 1,806,000 tons. . . . The year closes with excellent prospects. The quantity of work on hand on Dec. 31, 1905, is estimated as being about equal to one-half of the output of an average year. In other words, British yards may be regarded as closing the year with about six months work on hand which is an unusual and highly enviable position." But Mr. Meeker tells us: "To-day the world is confronted by an over-supply of ships. . . . Shipyards are working short time and turning out work at prices very little above cost."

It is not intended by the above citations to imply that Mr. Meeker, who is undoubtedly a thinker, has relied entirely on his internal consciousness for his views as to the commercial status of the shipbuilding industry. This is the third time that a boom in British shipbuilding has been coincident with American ululations over the depressed state of maritime interests. And you will remember that during a large part of the first calendar year in which our exports of iron and steel products exceeded our imports our best statisticians and publicists were proving that such an excess was impossible.

EDWARD P. NORTH.

Loading Equipment for Panama.

New York, Jan. 24, 1906.

To the Editor of the Railroad Gazette:

Where a gigantic enterprise, like the Isthmian canal, is undertaken, and after years of unsuccessful effort, there finally results failure, both financially and from an engineering standpoint, then, in order to make a new beginning there necessarily is much that must be undone, and there are many created obstacles that must be removed before the real work can properly be started. From those who express their opinions before they have formed them, we expect criticism and impatience, without an attempt at practical suggestions for the solution of the problem. The actual labor to be performed simply to get ready to do the work in the right way, is necessarily enormous, and it would be surprising if there were not a few individuals to be found who did not understand the conditions and who therefore should feel called upon to severely criticise.

In order to appreciate in a measure the nature of the obstacles to be overcome in even the preparatory measures, it is only necessary to follow a few of the details of securing adequate equipment for the proper carrying out of the plans. It is comparatively an easy matter for a committee to settle upon the proper equipment; but few persons understand the difficulties to be overcome in securing, shipping and setting up the necessary ponderous equipment in a new country where but few of the implements required for the proper handling of this equipment are available at the outset when they are most needed. The large cranes, the Bucyrus pile-drivers, hoisting machines and cars already shipped on the Panama steamers are in themselves more ponderous and difficult to secure and place in their proper locations than the subsequent material to be handled. The reason the first attempted cutting of this Panama Canal failed was that adequate preparation was never made to begin the work in the proper manner. The present Isthmian Canal Commission has begun in the only possible way to assure successful progress and achievement.

In the speech recently made by the Hon. Theodore P. Shonts before the Commercial Club, in Cincinnati, he said: "Preparation is a part, and a most important part, of the work of construction." This stupendous work cannot be achieved without adequate equipment of the most approved and thoroughly tested designs, and I believe all practical engineers will agree with Mr. Shonts in his views as put forward in this speech and see the necessity of doing just what he says is being done. He says:

> "We are approaching the end of the preliminary work. We have made the Isthmus a healthful place in which to work. We are getting the line of the canal into a condition which will enable us to operate an excavating plant to the best advantage, and we are assembling the plant with which the work is to be done."

He further explains that although most of this equipment had to be manufactured to order the bulk of it is now on the ground. Just how much labor, and energy and time this represents is only fully appreciated by those who have attempted even in a small way to perform similar tasks. The accompanying photograph will give a slight idea of what extraordinary efforts have been made to secure the necessary equipment to push the work forward at the Isthmus. This photograph shows the loading on the Panama steamship "Colon" of some of the large steel Goodwin cars used for transporting and distributing excavated material. This material is wasted by discharging trains of these cars operated by compressed air from the locomotive. These huge cars are to be loaded by steam shovels with 5½-yard buckets that scoop out masses of earth and rock weighing 10 to 12 tons in a single scoop. The French in their efforts to accomplish this work used small cars and small locomotives with the idea that the saving in labor to keep up the roadbed for a light equipment would offset the smaller amount of material hauled in a train; but the fallacy of their methods has been too plainly shown to need argument, and the present Com-

mission has shown its ability to cope with the problem by arranging to use an adequate equipment and by "getting the line of the canal into a condition which will enable them to operate an excavating plant to the best advantage." JOHN M. GOODWIN.

The Operation of a Busy Terminal District.*

BY C. H. KETCHAM,
Division Superintendent, Delaware, Lackawanna & Western.

"A Busy Terminal" covers a good deal, and the writer must admit that he has hardly known where and how to begin. The busier a terminal the more need of a good organization and system. When a terminal is crowded and demands are exacting then is the time that good organization and system counts and enables the yard to give better service and handle more cars with its facilities.

Considering tide-water facilities where freight is allowed to be held 10 to 30 days for lighterage, and 60 days for export, to save delay to car equipment, and handling of cars in continued switching, and have freight handy to deliver to boats, ample closed piers should be provided, classifying freight for the different piers, the yard having standing orders to place the commodities to piers on arrival. For open freight, ample storage tracks should be provided where possible to have the cars convenient for placing along the string piece for delivery. A large outer hump yard should be supplied with ample receiving tracks and storage tracks for coal, sufficient number of tracks to switch coal to sizes, when train is switched, and holding capacity large enough to hold two days' unloading. A holding freight yard should be provided with tracks of from 40 to 50 car lengths, and enough of them to classify freight when the train is switched. When cars are ordered from freight yard to water front or piers, cars for each pier should be clustered together when not enough for solid trains for each pier, to save switching at the inner yard. Tracks to different piers should be so arranged that cars can be pulled from the shed track and cars lined up on other tracks ready to be placed to pier, thus saving delay to labor waiting for more cars. Transfer engines should be used for transferring to and from outer yard, not doing any switching. Team track room should be sufficient to place cars at night, and not interfere with unloading during the day. Enough float bridges should be supplied to enable loading and unloading of floats with least possible delay. Leading to floats, a receiving yard of five or six tracks, long enough to hold the longest train, should be provided, and tracks leading from this to tracks for the lining up of freight for New York piers, and so constructed that cars can be shoved on to floats without any more switching. The eastward provision pier for export freight and westward pier, where barge freight is loaded into cars, should be located in connection with a receiving and despatching yard, so that cars received can be placed while switching trains of manifest freight, and westward freight can be placed without delay in westward trains. All switching possible should be done in outer yard, where it can be done cheaper and keep the force down in the inner yard, where fewer the engines worked more can be done by those worked.

We may have all the tracks and piers required, but without good power and without good management, by those who have charge of the work, we may not give good service or get the best out of the facilities furnished. It should be borne in mind that because we have room to get the car unloaded on the pier, it is none the less important to get the car moved from pier to destination and that good service must be rendered by the lighterage department, or else the final successful movement has not been accomplished.

The freight agent and his department has much to do with successful handling of terminals or the undoing of same. The writer believes that enough attention has not been given to the necessity of proper organization of this department. This department deals directly with shipper and handling of a freight station. Much depends on this department, whether the shipper is satisfied or otherwise with the service rendered by the company. A man filling the position of freight agent at a large terminal should have the ability to discern what is necessary to do to serve the shipper, and at the same time protect the company. He should be a man broad enough to realize that he should not agree to demands upon the yard that are unreasonable and not practicable. He should realize that it is easy to write out switching orders, but not so easy to do the swiching. He should be careful to not promise service that may not be accomplished in the time asked for and in the end disappoint the patron. He should have his foremen and heads of different departments so lined up that they will work to this end, and feel their responsibility in this direction; he should know that simply ordering cars placed does not serve the company, but getting the work done does. The agent's office should be liberally supplied with telephones, should issue freight notices promptly, answer correspondence promptly, not only to patrons; but to officers, so that all can give information asked for promptly, thus giving the public satisfaction. In these matters alone, business may be held or lost—and solicitors of freight do not know why we lose the business. We do not hesitate to put on enough engines to move the number of trains required, or allow enough switch engines to do the work. Why should we fail in giving ample or efficient force to collect the revenue or serve the public as it should? The agent should be the directing power or the medium for the public. The yardmaster must realize this and they should be in close touch.

This can be helped very much if the superintendent will hold conferences with the agents of the terminal. The general yardmaster should attend these. He then learns the situation as a whole, can better appreciate the necessity of good service, the agents get a good insight of this work and they can see matters from the best standpoint. This means better handling of a terminal. All are in touch with the situation.

The company should provide a liberal number of district yardmasters, well paid, with a good office building having good conveniences, well taken care of, with a sufficient and efficient office force to keep proper records; the men should be trained to the necessity of following up detail matters, making the office organization as strong as the offices of the different heads who are compelled to get information from that of the general yardmaster; installing a system of records that are complete, not burdensome, but giving quick information. There should be a good telephone service with a liberal number of 'phones located at points where the district yardmasters can be reached easily, and good results will follow. The superintendent should feel that he is responsible not only for moving the traffic over the road and through the terminal, but that he is responsible if the company loses a good patron. He should keep in touch with public demands, and his actions in these matters will be an incentive to the employees. After all, there should be no department; in fact, all should work together, thus serving well the company. Superintendents should keep in touch with the traffic department, taking advantage of their assistance, calling upon them to give their services in the way of getting shippers to accept freight or placing for a time the acceptance of certain freight. When this is done the traffic department can give great assistance. They are then conversant with your difficulties, and not in the dark, and thus working at a disadvantage with the public. With this co-operation a large terminal can and will be handled successfully.

A brief description of the working of the terminal of which the writer has charge may be of interest. There are greater and probably more complicated terminals to handle, but it is probable that we have had more upset conditions to deal with. Possibly the increase of passengers handled per day, and coaches handled per train since 1901 has shown greater growth than most roads.

According to a statement dated March 10, 1902, we were handling 29,847 suburban passengers in and out of Hoboken per day. At the present time we are handling 40,163 per day, 45 per cent. of this number being handled in four hours.

In the passenger yard we have a track capacity for 410 coaches, consisting of 10 tracks; eight to 11 cars each, for receiving and despatching trains, three storage yards situated north and south of the eastward and westward main tracks, all equipped with gas, steam and water, so located that train can be switched from receiving tracks, storage yards or *vice versa.* Yard arrangements include "scenery track," Pullman car track, express, and track for the handling of 44 cars of milk per day.

In order to promptly clear the receiving tracks to take care of suburban trains arriving during rush hours on a minute headway, road engines are used to kick their own trains out of the receiving yard into the storage yard. Otherwise the receiving tracks would not be cleared fast enough. Trains made up of sleeping cars, or private cars, are handled only by engines attached.

While some of the cleaning of coaches is done in outer yards on the division, such as sweeping and dusting, the thorough cleaning of all coaches, milk cars, baggage cars and sleeping cars, is done at Hoboken Terminal, necessitating prompt handling of these cars to and from cleaning tracks in order to get them in proper shape prior to the despatching of trains. At one time certain cars were assigned to certain trains, but with increased business and to get the best movement out of the total number of cars, this has been done away with, with the exception of a few trains, such as club trains, where regular equipment is assigned. A combination baggage car is, however, assigned to each conductor.

In the despatching of trains, they are built up in the storage yards located on the northerly and southerly sides of the main tracks, from which yards they are kicked into the train shed, often two trains at a time, the separation being made before they pass through the interlocking. While these movements are being made into train shed from the southerly side trains may be moving out of the yard on the northerly side, or they are moving out on the southerly side while trains are being kicked in on the northerly side. In some cases the road engines may be used in backing in their own trains.

The passenger terminal service is taken care of by three yard

*From a paper read before the New York Railroad Club, Jan. 19.

engines by day, and two by night. The day engines have a conductor and six brakemen; night engines, a conductor and five brakemen. The switching movement to and from train shed, receiving yard, express yard and engine-house track is controlled by an electric pneumatic interlocking plant, consisting of 70 levers handled by three directors and six levermen on a shift of eight hours.

All eastward trains are scheduled to boats at Hoboken, with arrival shown at New York. In rush hours we have some cases where there trains are scheduled to a boat. The total number of eastward trains in suburban service is 104 in 24 hours, requiring 925 coaches averaging 45 passengers per car during the hours mentioned. From 8 a.m. to 9 a.m. 17 trains arrive, an average of 55 people per coach, or about 10,000 people in the hour. It is important that these boat trains should arrive at Hoboken on time, giving the passengers sufficient time to move from trains to boats and enable the latter to maintain their schedule. This necessitates the clearing of the receiving tracks very rapidly. All suburban trains carry baggage and the baggage goes on same boat as the passengers. It is the duty of the station master and assistant superintendent of ferries to see that trains make boats for which they are scheduled.

Westward trains are scheduled from New York and Hoboken. Trains are held for boats. Trains porters leave New York with each boat, and are the last to leave the boats, delivering a ticket to the assistant station master which indicates that the passengers have arrived for train for which they are scheduled. The conductor punches this ticket, acknowledging arrival of boat, then pushes indicator to main interlocking tower, giving notice that the train is ready to proceed. Switches and signals are then given for the movement of train, the director in the main tower passing the information to three other towers using a code of signals that indicates to the towermen at west end of tunnel whether train is going via main line or Morristown branch.

The rush movement westward is between 5 and 6 p.m., requiring 17 trains, 121 coaches, moving 7,134 passengers, an average of 58 passengers per coach. The make-up of these trains is seven to ten coaches each. A total of 106 passenger trains west in 24 hours is required for the suburban movement. We have, in some instances, three and four trains scheduled from one boat; consequently, if first train does not leave on time the two or three following trains are delayed, which affects the movement of following trains. This is due to boats being delayed by fog, weather conditions or barges or floats interfering with their movement. At the present time we have ten despatching tracks, but after our fire and up to a short time ago we were compelled to handle the service on six tracks.

In the entire movement of passenger trains it requires the handling over the turntable of 288 engines for the 24 hours, the greater number being handled between 9 a.m. and 3 and 4 p.m., averaging at that time an engine on table every three minutes.

The freight terminal consists of the Hoboken city freight station and team tracks located north of the passenger main tracks west of passenger yard, where local business is handled to and from Hoboken and steamship docks located at this point. The Hoboken terminal station is located south of the canal. We have an open pier, storage tracks, three covered piers, a canal 3,000 ft. long where lumber and other rough freight is handled direct to boats and to cars, three float bridges, and two coal dumps all located south of canal. From 1,400 to 1,600 cars, freight and coal are handled daily between passenger trains in and out of Hoboken, requiring a freight train movement of 85 to 95 trains. From 6 a.m. to 10 a.m. and 2.30 p.m. to 6.50 p.m. nothing but manifest trains can be moved in and out of freight yard. The switching required for placing cars on team tracks, open docks, covered piers, coal docks, grain trestle, float bridges, etc., show an average of five movements to each car, or 200,000 movements for 40,000 cars handled.

Because of closed hours, this leaves but 16 hours for the movement of freight and manifest trains. The latter must leave the yard on schedule or serious delay will follow. All orders for the placing of freight are given by the agents on a regular switching form to be placed in the hands of the yardmaster not later than 6 p.m., and call for the special delivery of from 800 to 1,000 cars to be placed in position for unloading by 7 a.m. This includes orders issued for cars to be delivered to floats, etc. Manifest and local trains are built up in the Hoboken yard, the others being handled in an outer yard (Secaucus).

All coal is cut out at Secaucus and there switched into 32 different sizes, according to the number of consignees, in preparation for moving into Hoboken and there placed in size lots for unloading to boats.

Ten engines, double crewed, are required in the Hoboken freight territory, making a continuous performance except during the time they stop to take their meals, clean fires and coal engines. The traffic from Secaucus to Hoboken and return, except manifest movement, is handled by transfer engines.

Owing to the large number of passenger trains moved, transfer engines have to be handled during the hours of the day that will enable them to accomplish their work without interfering with passenger trains. The freight movement easterly through tunnel is accelerated by the use of pusher engines, but these engines are not allowed to enter the tunnel.

Movements in and out of Hoboken, freight and passenger, are governed by the tunnel. Trains are operated through tunnel under control of slotted semaphore signals, they being controlled by track circuit, and trains moved only on clear block. The train movement through tunnel, including passenger, freight and transfer engines, shows an average movement of every 13½ minutes east, and 12½ minutes west during the 24 hours. From 7.30 to 9.30 a.m. the eastward movement averages a train every 3½ minutes and from 4.30 p.m. to 6.30 p.m. westward every four minutes.

Daily Train Tonnage Chart.—C. & E. I.

The possibilities for increasing the tonnage moved per train by systematic loading of each locomotive to its practicable maximum are fully appreciated by operating officers, particularly those whose facilities are taxed to the limit by the volume of traffic offered, or perhaps are unequal to the task of moving it. But in order to accomplish this effectively each officer must know the results day by day and have the individual and collective performances constantly under his eye. A daily examination and analysis of the superintendents' records of train movements is, of course, out of the question for the busy manager or vice-president; therefore he will need to have the results submitted to him in some compact shape that will inform him quickly and comprehensively of the situation. This is the purpose of the accompanying chart, which was devised by Mr. H. I. Miller, Second Vice-President and General Manager of the Chicago & Eastern Illinois, in setting out to secure an effective increase in the average train load of his road. This chart presents for his instant inspection all of the essential information relative to one day's northward freight train movements; northward only, because the line being primarily a coal road, the heavy traffic is mostly one way—toward Chicago.

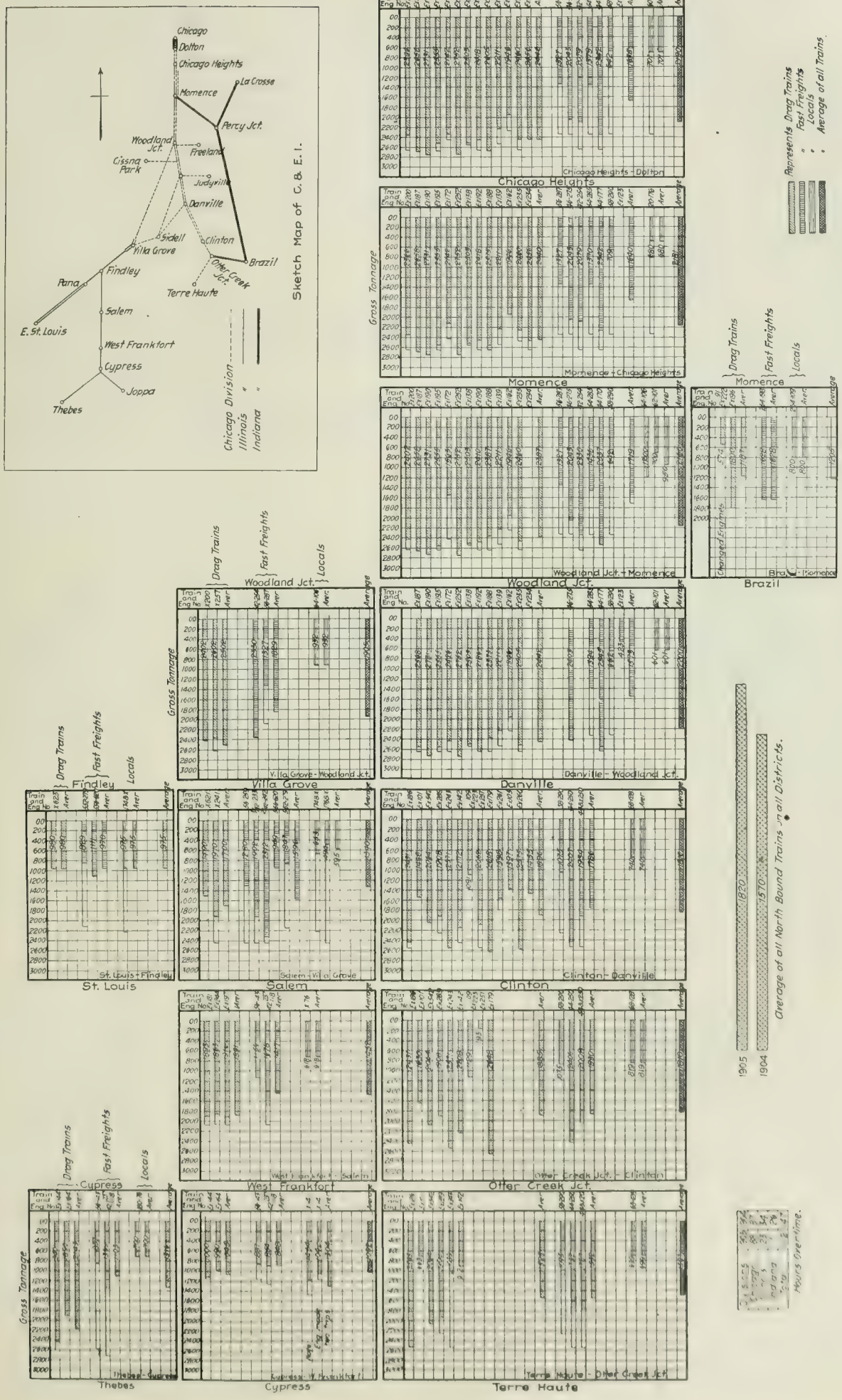
Besides the main line from Terre Haute to Chicago, which carries the heavy traffic, the chart includes the lines of the Chicago & Eastern Illinois to Brazil, Ind., and to Thebes, Ill., and shows the St. Louis trains, which run over the joint Big Four-C. & E. I. line between St. Louis and Pana, Ill. It should be noted that in its general arrangement the chart conforms to the layout of these lines, as may be seen by reference to the sketch map in the upper right-hand corner, included for that purpose.

In explaining the chart, the main line only need be considered. The original of the chart is drawn on profile paper, the size of the sheet being about 18 x 33 in. The spaces from right to left in each of the large divisions or rectangles represent gross tonnage, in increments of 200 tons. Each small elongated rectangle or block within the large rectangles represents a train, the engine and train numbers, identical in many cases, being entered at the right-hand end of each. The "drags," or heavy coal trains, which on the main line constitute the heaviest traffic, are set down first, in the upper portion of each large rectangle. Next to them come the fast freights, and then the local freights. The average for each of the three is shown in connection therewith and the average of all appears at the bottom. The length of the train block indicates the rating or hauling capacity of the locomotive and the shaded portion the actual tonnage of the train, which also is entered in figures in the block. On the actual chart the portions of the blocks shaded in the engraving are colored, four different colors being employed. The "drags" are blue, the fast freights red, the locals green, and the total average, yellow.

The divisions into the large rectangles indicate the several points on the line where important changes in the make-up of the train usually occur. At the bottom of the sheet the average tonnage of all northbound trains for the day is set down to suitable scale in comparison with the similar figure for the same day a year ago, the actual tonnage also being given. These also are colored yellow. In addition to the data enumerated, the temperature for the day is recorded on the sheet, also the hours of overtime, by divisions, compared with a year ago. Any reduction in locomotive rating due to the weather is also noted. While the record shown herewith is not the reproduction of an actual day's performance, it is representative of performances daily being obtained.

The charts are prepared in the drafting room. The blanks on which the information is entered are printed from a Van Dyke negative, the large rectangles being blank where train tonnage and train numbers are entered. These are filled in by the draftsman from information furnished by the car accountant. The chart does not reach the general manager until several days after the date of the record. Meantime the general superintendent's office makes up a report regarding delays and other matters affecting the train movements, which is used in checking up results as recorded by the chart.

In connection with the chart shown herewith, a graphic record


Sketch Map of C. & E. I.
Chicago
Dolton
Chicago Heights
La Crosse
Momence
Percy Jct.
Woodland Jct.
Freeland
Cissna Park
Judyville
Danville
Sidell
Clinton
Villa Grove
Brazil
Otter Creek Jct.
Findley
Pana
Terre Haute
Salem
E. St. Louis
West Frankfort
Cypress
Joppa
Thebes
Chicago Division
Illinois "
Indiana "
Drag Trains
Fast Freights
Locals
Dolton
Chicago Heights - Dolton
Chicago Heights
Momence + Chicago Heights
Momence
Woodland Jct. + Momence
Woodland Jct.
Danville - Woodland Jct.
Villa Grove - Woodland Jct.
Findley
St. Louis + Findley
St. Louis
Villa Grove
Salem + Villa Grove
Salem
Clinton - Danville
Clinton
Otter Creek Jct. - Clinton
Otter Creek Jct.
Terre Haute - Otter Creek Jct.
Terre Haute
Cypress
Cypress + W. Frankfort
Thebes
Thebes - Cypress
Gross Tonnage
Represents Drag Trains
" Fast Freights
" Locals
" Average of all Trains
Chicago & Eastern Illinois Train Tonnage Chart.
Average of all North Bound Trains on all Districts.
1905
1904
1820
1570
Hours Overtime.

is kept of the daily temperatures, the sheet on which the record is kept showing the temperatures by days for a month. The current record is superposed on that of the corresponding month of a year ago and the mean temperatures for the two months suitably indicated.

This system, which is original with Mr. Miller, has been in use on the C. & E. I. only a short time, but already a gratifying increase in the daily average of tons per train has resulted.

The Thief River Falls Extension of the "Soo" Line.

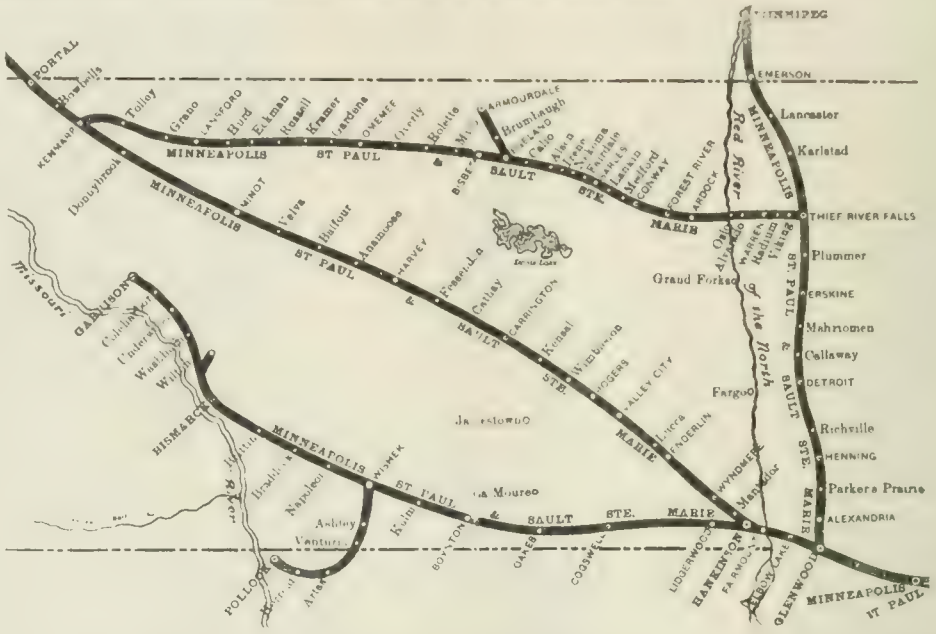
In many respects the most notable piece of railroad construction in 1905 was the building of the Thief River Falls extension of the Minneapolis, St. Paul & Sault Sainte Marie. Starting at Thief River Falls, Minn., on the Minneapolis-Winnipeg line of this road, it runs almost directly west through the counties of Red Lake and Marshall in Minnesota, and Walsh, Cavalier, Towner, Rolette, Bottineau and Ward in North Dakota, to Kenmare, on the main line from Minneapolis, the objective of which is the Pacific Coast. The total distance is 296½ miles, and the rapidity with which it was built is one of its features of note. The first dirt was moved on April 7, grading was completed November 15, and track laying four days later. The season was unusually wet, in fact the wettest experienced in this region in 14 years, and there was also a scarcity of laborers due to the great demand for harvest hands. These conditions caused unexpected delays to the contractors, both in grading and tracklaying.

Location was begun in September, 1904, and completed in April, 1905. It was made under a great many difficulties owing to the severe conditions of the winter weather. The location being practically all the way in a prairie country, the members of the engineering parties living in tents suffered a great many hardships owing to the numerous snow storms and blizzards. On the prairies it is very rare to have a calm day and with the thermometer ranging from zero to 45 deg. F. below for weeks at a time, a great deal of time was lost. On account of these conditions the practicability of doing any locating work during the winter on the prairies is very seldom counted on.

The line is remarkable in regard to its alinement and grades, there being one tangent of 50 miles and one of 40 miles, and numbers of others of 20 miles. The curvature is very light, there being but one 3-deg. curve at the extreme west end at Kenmare, two 2-deg. curves, and the rest 1-deg. and 30-min. curves, principally the latter. The grades are very light, being three-tenths of 1 per cent. eastbound from Grano, 275 miles west from Thief River Falls; westbound grades are principally three-tenths, with the exception of the grades getting out of the Red River valley and the Mouse River valley, 20 miles east of Kenmare, which are five-tenths of 1 per cent. The line is well built with roadbeds in cuts 30 ft. wide and embankments 16 to 20 ft. wide, depending on their heights. The grading and construction work was let to Winston Brothers Company, of Minneapolis, the latter part of March 1905, to be finished by October 15, the company furnishing all bridge and culvert material.

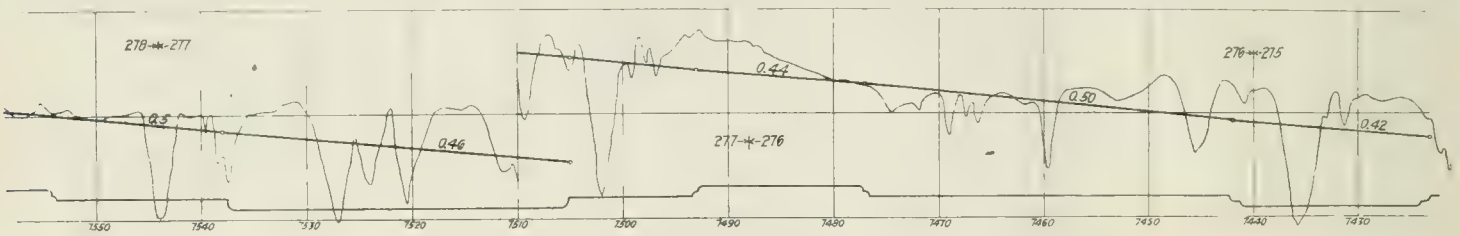
At the east end of the line the country was very flat, wet and without drainage, necessitating practically all material being hauled on the first 15 miles, with extreme hauls of 1½ miles where it was contemplated being able to borrow along the sides. These conditions required the changing of the plant from wheelers and slush scrapers, which had been hauled in during the winter, to dump cars and track, and was the cause of considerable delay in getting the grading finished.

At the west end for the first 30 miles the work was heavy, averaging about 35,000 cu. yds. per mile, and being a hard clay material, it was very difficult to handle and very slow progress was made. The rest of the work was ordinary prairie work, averaging about 15,000 cu. yds. per mile, and no difficulties were met with except in obtaining laborers, which at all times were very scarce and difficult to get. The country traversed is practically without waste land and is one of the richest wheat belts in the country. It is said to be practically one continuous wheat field for the entire length of the line. A conservative estimate of the men shipped out from Minneapolis is 10,000, and not over 10 per cent. went to work on the railroad, the remainder mostly going to the harvest fields where wages of $2.50 and $3 a day and board, and $6 a day for teams and board, were paid, against $2 a day for men and $4.50 for teams without board paid by the contractors. Under such conditions it is remarkable that the contractors were able to maintain a sufficient force and to get the work done



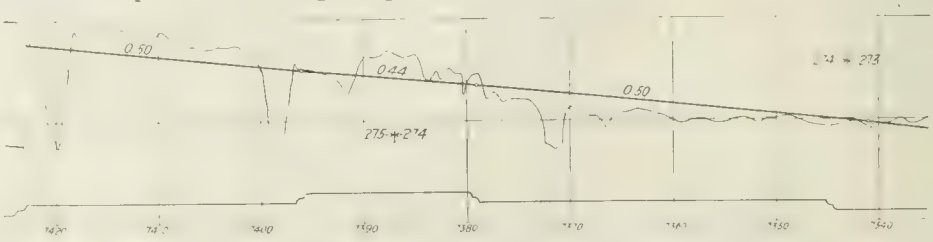
Map of the Thief River Falls Extension of the Minneapolis, St. Paul & Sault Ste. Marie.

The plant force engaged on the work consisted of 30 grading machines used in connection with dump wagons, 14 of these machines being hauled by traction engines with a great deal of success, the rest of the machines being hauled by teams; three steam shovel plants, 300 dump cars and the necessary track, and 300 to 400 wheel and slush scrapers. The average daily force of men was 1,500, including teamsters and 800 teams. The actual number of working days was reduced to 120 after deducting loss of time on account of rainy weather and Sundays.



Profile of Heavy Work Done on the West End, Mile Post 275 to Mile Post 278.

In grading the line there were 4,500,000 cu. yds. of earth handled, averaging about 38,000 cu. yds. each working day; 4,000,000 ft. b. m. cedar timber were used in culverts and 2,000,000 ft. Washington fir and white pine in bridges, all bridges being of timber construction, excepting the Red river crossing, which consists of a single-track, 241 ft. metal draw span and one 50-ft. metal through girder span. An outline drawing of this bridge is shown herewith.

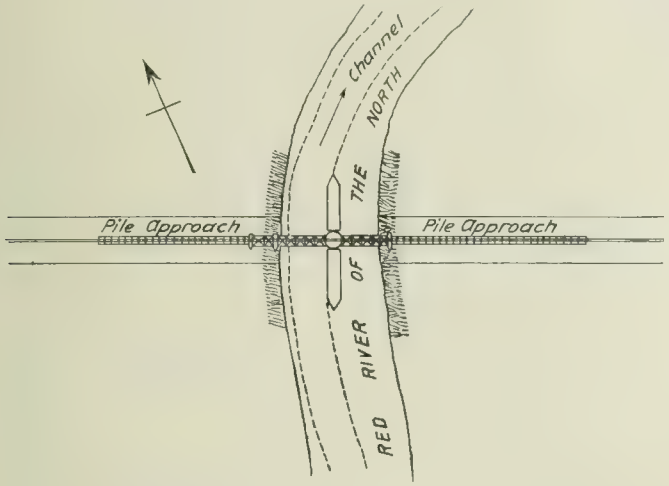


Profile of Heavy Work Mile Post 273 to Mile Post 275.

The track was laid under contract by E. J. Brennan, of St.

Paul. Roberts tracklaying machines with rail and tie trams operated by steam were used. Track was laid from each end, commencing at the east end July 1 and at the west end August 11, which was about 40 days behind the time originally intended to commence at these ends, due to unfinished grade work. The tracklaying was finished November 19, and for each working day each crew averaged 2.1 miles of main line mileage besides laying 18 miles of side tracks and passing tracks and seven miles of tracks at two division points. The average daily force of each tracklaying crew was 110 (a full crew being 130 men), which would lay 6,500 ft. of track in 3½ hours, being full tied (3,000 ties to the mile) spiked and lined. This record of tracklaying is very remarkable, taking into consideration that the average per day did not include mileage of sidings, etc., and the delays caused in putting in 12 railroad crossings.

The road was put in operation for business December 4 with all depots, terminal plants, etc., built. A great many elevators, lumber yards, etc., were built at the stations in advance of the track; also townsites were platted and towns started. As a result business started the moment the road was open for operation. Thirty-two stations were located on the line, including 11 junction towns.



Plan of Crossing of the Red River, North of Grand Forks.

In regard to the townsites, it may be interesting to know that of the 30 townsites owned by the railroad company, additions have already had to be platted at 24 of the 30 and towns of 400 and 500 people have sprung up with great rapidity, giving an idea of the character of the country passed through and the haste of people to locate therein.

In addition to building the Thief River Falls line, the company built the Underwood extension of 20 miles on the Bismarck line, and the Egeland branch of 21 miles, the latter a branch of the Thief River Falls extension, both branches being in North Dakota. It also did 10 miles of revision work on its main line in Minnesota, making a total main line mileage built for the season of 347½ miles.

We are indebted to Mr. Thomas Green, Chief Engineer, for the foregoing information.

The danger of making hard and fast general rules from headquarters has been illustrated in instructions intended to relieve car famines in Russia. There, the lack of cars is felt chiefly after harvest, when in certain parts of the country not only grain but great quantities of beet-roots are shipped, and the latter, of course, must be shipped before winter. Ordinarily, freight must be shipped in the order of its delivery at the stations; but in order that stone, timber, and such like freights which suffer less by waiting, might not prevent the shipment of grain, etc., which might spoil if left long, the authorities classified freights, and those of the first class had the preference over the second and third. The wiseacres who made the classification put lime in the third class, as an article which could very well wait. Now, lime is indispensable in making beet sugar; and last of all, where the factories were deluged with the great crops of beets, they could not get any lime, and so could not use the beets till this little regulation was modified.

Visible Supplies of Grain.

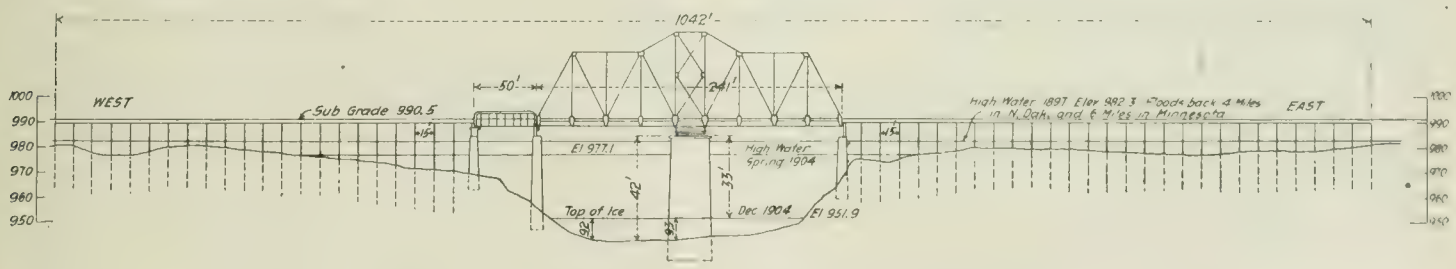
The *Crop Reporter*, published by the Department of Agriculture, prints the following compilation of grain stocks, January 1, as compared with previous periods. The figures represent stocks of grain available at 62 of the principal points of accumulation east of the Rocky Mountains, stocks in Manitoba elevators, and stocks afloat on lakes and canals. Pacific coast stocks are shown only in the case of wheat.

	Grain stocks					
	East of Rocky Mountains					Pacific C'st
Dates.	Wheat, bush.	Corn, bush.	Oats, bush.	Barley, bush.	Rye, bush.	Wheat, bush.
1899, Jan. 1	50,126,000	26,936,000	10,893,000	4,372,000	1,573,000	15,923,000
1900, " 1	89,265,000	19,024,000	12,004,000	3,122,000	1,806,000	9,022,000
1901, " 1	87,911,000	14,313,000	15,861,000	5,395,000	1,651,000	8,686,000
1902, " 1	94,900,000	16,825,000	8,680,000	4,580,000	3,257,000	7,186,000
1903, " 1	80,769,000	9,345,000	8,794,000	4,389,000	2,454,000	4,992,000
1904, " 1	61,827,000	9,547,000	13,785,000	6,907,000	1,833,000	3,282,000
1905, " 1	61,240,000	15,351,000	31,343,000	10,403,000	2,504,000	3,458,000
Feb. 1	57,697,000	19,721,000	26,095,000	8,801,000	2,259,000	3,051,000
Mar. 1	52,907,000	16,752,000	22,570,000	6,952,000	1,961,000	2,726,000
Apr. 1	46,865,000	16,124,000	22,667,000	4,674,000	1,554,000	2,486,000
May 1	40,158,000	14,661,000	19,355,000	3,354,000	1,336,000	1,860,000
Jun. 1	28,532,000	8,374,000	11,325,000	2,231,000	1,064,000	1,461,000
July 1	20,476,000	9,571,000	11,174,000	1,557,000	920,000	839,000
Aug. 1	20,075,000	10,101,000	8,007,000	1,031,000	823,000	589,000
Sept. 1	21,705,000	8,808,000	20,597,000	1,358,000	1,081,000	1,230,000
Oct. 1	28,894,000	8,796,000	28,018,000	5,524,000	1,627,000	3,156,000
Nov. 1	47,841,000	5,183,000	37,526,000	8,509,000	2,251,000	4,486,000
Dec. 1	62,402,000	10,236,000	40,236,000	10,217,000	2,703,000	5,866,000
" 9	61,694,000	12,253,000	39,767,000	10,722,000	2,817,000	.....
" 16	65,760,000	14,088,000	39,279,000	10,798,000	2,923,000	.....
" 23	66,349,000	16,513,000	38,700,000	10,602,000	3,128,000	.....
1906, Jan. 1	69,867,000	17,830,000	39,301,000	10,657,000	2,990,000	.....

Recent State Railroad Commission Legislation.*

BY FRANK HAIGH DIXON.

Not since the passage of the Interstate Commerce Act has so much attention been given by the people at large to the "railroad question" as during the present year. President Roosevelt's vigorout stand for an Interstate Commerce Commission with powers adequate for the performance of its duties, was the opening work in the discussion. For the hastily prepared measure which was rushed through the House, the Senate substituted a committee to take testimony. The sessions of the Elkins Committee provided the opportunity for a general expression of opinion on the question of railroad control, including the views of railroad men, shippers and students of the problem.



Profile of the Red River Crossing, Thief River Falls Extension.

But the attention of the people has not been turned toward questions of interstate commerce alone. The state legislative sessions of the year have been unusual in the amount and character of the legislation introduced and enacted, which has aimed to give greater control to the states over transportation agencies, especially in the matter of charges. Missouri enacted a maximum freight rate bill and one relating to the classification of freight; railroad commission bills passed one house in both Idaho and Colorado; in Oklahoma a commission bill which combined features of the Texas and Kansas laws failed through non-concurrence of the two houses in amendments; in Nebraska one attempt was made to create a railroad commission, and another to restore the Board of Transportation abolished in 1901, but both failed, and in their place a constitutional amendment was submitted to the people for the creation of an elective railroad commission. In Montana a commission bill failed to become a law through the governor's veto, in New Jersey a bill providing for a supervisory board was introduced, and bills were under discussion in Iowa and West Virginia.

Finally, acts were passed in four states—Washington, Indiana Kansas and Wisconsin—providing for the creation of state railroad commissions. It is the purpose of this article to consider these four measures and to point out their significance in relation to the

* Abstract of an article in the Political Science Quarterly for December, 1905.

problems of railroad control now so widely discussed. In Washington and Indiana no legislation of this kind has ever been enacted before. Such slight control as has been exercised heretofore over railroads in these commonwealths has proceeded from the general railroad law common to all states. In Indiana the Grain Dealers' Association two years ago presented a bill to the legislature, but failed to secure its enactment. Their defeat led to a more thorough organization of the forces interested in the movement, and in 1904 the Indiana Shippers' Association was created, containing representatives of thirty commercial organizations. This influential body secured a pledge in the platforms of both parties for an improvement in transportation conditions, both candidates for governor expressed themselves favorably, and pledges were secured from candidates for the Legislature. When they found the Legislature nearly unanimous for a change, the railroads went into a conference with the shippers, and after a three days' session a bill was drawn up which passed both houses of the Indiana Legislature with only two dissenting votes. Kansas has had a much wider experience with legislation of this character. A railroad commission was created there in 1883 which continued in existence for fifteen years. It had power to investigate cases, to discover violations of law and to inspect railroads at its discretion, but no power to prescribe rates except upon complaint. One of the last acts of the Populist Legislature in 1898 was to abolish this board and substitute for it a so-called Court of Visitation, consisting of a chief judge and two associate justices, whose duties covered cases pertaining to rates and traffic and to the physical condition and technical operation of railroads. This august body was disposed of by the state supreme court in a decision which held the act creating it void on the ground that in it "legislative, judicial and administrative powers are so inextricably interwoven as to render their separation impossible." In 1901 another commission law was passed almost identical with that in existence up to 1898. This law has now been amended to such an extent as to constitute practically a new act.

Railroad control in Wisconsin began in 1874 with the passage of the famous "Potter law," under which a definite schedule of rates prescribed by the Legislature was to be administered and enforced by a commission of three men. The law proved to be so stringent and so ill-adapted to the industrial conditions of the state that it was repealed in 1876, and a single commissioner, elected by the people, was substituted, with general supervision of railroad service. It was his duty to discover violations of railroad law and to inspect, at his discretion, the operation and equipment of railroads. But he had no power over rates, and such decisions as he rendered in his limited field could be enforced only through appeals to the attorney general, or, still more indirectly, through reports to the governor. It is needless to say that railroads were little interfered with in matters which vitally concerned the industrial interests of the state. The commission law recently enacted is the outcome of Governor LaFollette's campaign for a reform in the railroad tax laws and an increase in the tax levy. He found that the railroads would probably meet the demand for an increase in the amount of tax by an increase of rates. Therefore he introduced into the Legislature of 1903 a very stringent act based on that of Iowa, providing for the creation of a railroad commission with power to prescribe a schedule of maximum rates. This was followed by a special message to the Legislature which included a detailed study of rates in Wisconsin, in comparison with the commission-made rates of Iowa and Illinois. The result showed that the rates of Wisconsin were from 25 per cent. to 50 per cent. higher than those of either of the other states. The bill passed the House, but was defeated in the Senate by a powerful lobby, consisting of railroad officials, manufacturers and shippers. Then followed an interesting campaign of education. The governor continued his investigations into the rates of Wisconsin and adjoining states, he spoke at almost every county fair in the state, and appealed directly to the people in an endeavor to strengthen and crystallize the reform sentiment. The railroads met these appeals with arguments and addresses prepared by their attorneys and traffic experts. They were aided by a large number of manufacturers and shippers, who insisted that a commission empowered to fix rates would have in view absolutely equality and would be compelled to adjust rates on the basis of distance, thus depriving shippers of the advantages derived from commodity rates under which raw material could be secured advantageously and markets could be controlled. The governor replied that the support of the shippers was won either through intimidation or through secret rates and rebates, and that the welfare of the people as a whole demanded the abolition of all personal discriminations and preferences. The governor in this same year quietly pushed through an act authorizing the railroad commissioner to examine the books of the railroads, in order to determine whether the state had been defrauded of tax payments. According to the administration, this examination accumulated an enormous amount of evidence of the payment of commissions and rebates to favored shippers. Whether these disclosures influenced the shippers to withdraw their opposition, or whether they simply realized that the sentiment was too strong to be resisted, is uncertain. But the fact remains that when the railroad commission bill was again introduced in January of this year the shippers' lobby was absent. The measure in its original form was a stringent one, but it was much modified in the course of its long and arduous passage through the two houses, and as finally passed is so reasonable and conservative that it can hardly be altogether satisfactory to its more radical supporters.

In the four laws under discussion there are a number of significant features worthy of consideration. The method of choice of the members of the boards is interesting. Kansas elects its commissioners at its biennial elections. The other three states provide for appointment by the governor. Fifteen years ago appointment of commissioners was much more common than election, 19 of the 28 states securing their commissions in this way; only six were elected by popular vote. But during the next 12 years the practice was greatly changed. The special report of the Interstate Commerce Commission on state regulation in 1902 shows that out of a total of 30 commissions, 15 were elected by the people and only 14 were appointed. This change was brought about by modifications in the laws of some of the Western and Southern states and by the adoption of the elective method in most of the new laws. That such a policy is out of harmony with the most efficient administration of railroad matters no student of administrative problems will hesitate to affirm. Experience has shown that the election of railroad commissioners on the state ticket has brought the railroads into politics in a most objectionable way, embittering the relations of railroads and people to the detriment of interests for which the commission is created, and giving rise to charges of bribery and corruption of a most serious character. The chances of securing capable men are far greater through appointment than through choice by the nominating conventions of the political parties. It is therefore encouraging to find three of the four new laws providing for this method of selection, and that, too, in States whose populations would hardly be classed among the most conservative in the country. In fact, so unfalteringly did Governor LaFollette stand for this principle that he threatened to resign the office of governor and become a candidate for railroad commissioner in case the elective method (advocated, as he maintained, by the railroads) should be adopted.

Another encouraging feature which reveals itself in these laws is the change in the length of term of the commissioners. In Indiana the term is four years; in Wisconsin and Washington it is six years. Kansas, on the other hand, with the elective method, prescribes a two-year term. It must be apparent to anyone that a commissioner with a two-year term is retired at just the time that he is entering upon his period of usefulness. He becomes valuable to the state in the intricate problems of his office only after a long apprenticeship.

In the power granted to the commissions over rates these four laws are all thoroughly conservative. In no one of them is power given to the commission to prescribe a classification and complete schedule of rates, but in every case the power is limited to the correction of individual rates. The most common form of the law in the past has been that which made it the duty of the commission to prescribe a complete schedule of rates for all traffic within the state. Seven states had this form in 1890 and 13 in 1902, and most of the recent commissions have received this power. The action of these four states is, therefore, all the more striking. It might be fair to conclude that Legislatures are coming to realize the absurdity of expecting three men, chosen without regard to their fitness for their duties, to assume as their first task a problem which it has taken railroad experts years to solve even approximately. In all four acts the railroads are required to file with the commission their schedules of rates. These schedules having been filed, no change of any kind can be made in them in Wisconsin, and no increase in Indiana, without 10 days' notice; in Kansas the adoption of a new schedule by a road must be reported to the board within 10 days. In Indiana the board may alter these rates of the railroads only upon complaint, but in the other three states the board may proceed upon its own motion. In all the states except Kansas the rates fixed by the commission are absolute; in Kansas it is unlawful to raise without permission the rate which the commission has prescribed, but a rate may be lowered if the benefit of the decrease is enjoyed by all shippers. This power to prescribe absolute rates is given to the boards for the purpose of preventing discrimination, which is generally regarded as a more serious and prevalent evil than excessive rates. Power to prescribe a maximum rate has never reached effectively the fundamental difficulty in the railroad situation. In Indiana the commission has power to approve of group rates, and the Wisconsin law permits all forms of commodity, concentration and special contract rates under the regulation of the commission, which guarantees their enjoyment to all shippers alike. It has been the contention of the railroads and the large shippers that the tendency of government-made rates is toward an absolute level of equality, with no adequate consideration of situation, markets and local conditions. These provisions for special rates are intended to meet this difficulty.

Although the jurisdiction of these commissions is limited to State boundaries, the four laws all contain a provision intended to

protect shippers against excessive or inequitable interstate rates. This clause provides for the filing of a complaint with the commission and the reference of the complaint to the offending road, as in the case of unjust state rates. If the roads disregard the notice sent them by the commission, the Interstate Commerce Commission is applied to for relief. This carries out the suggestion of section 13 of the Interstate Commerce Act, which provides that the commission "shall in like manner investigate any complaint forwarded by the railroad commissioner or the railroad commission of any state or territory at the request of such commission or commissioner." This excellent plan secures a complainant before the Interstate Commerce Commission who has no personal interest in the outcome, is well informed, capable of estimating the importance of a grievance and of presenting it in an effective way, undeterred by fears of personal injury or annoyance.

In form of procedure to be followed, appeal may in Wisconsin be taken to the court from the order of the board on questions of law—that is, to determine whether the order is reasonable—but this does not operate to stay the order. If the railroad elects to pray for an injunction against the operation of the commission's order, such an injunction may not issue until after notice and hearing. In Kansas the railroad that appeals to the court from the order of the board is not liable for any violation of the board's order pending the court's decision. In Washington the plan has been adopted which was so many times proposed in the testimony before the Elkins Committee, providing that if the court is of the opinion that the order of the commission is unreasonable or unlawful, it may suspend the order pending litigation, in which case the court shall require a bond from the railroad covering all damages caused by delay in the enforcement of the order, all penalties that would attach under the law and all compensation for sums paid by shippers in excess of the rates ordered by the commission. In Indiana the court may suspend the commission's order pending review, provided a bond is filed to cover damages, penalties and over-payments, as in the case of Washington; but the law further provides that the railroad executing such a bond shall issue to each shipper and passenger a certificate showing the rate charged and containing a promise to repay the difference between this rate and the commission's rate, if the order of the commission is upheld. If the court sustains the commission, these certificates become payable on demand. This cumbersome scheme was the compromise plan which resulted from the three days' conference between shippers and railroads. It would seem probable that its success will come, if at all, from the fact that the roads will be inclined to accept the findings of the commission rather than assume the burden of clerical detail which a contest in the courts will involve.

In the solution of the question as to the value to be placed by the court upon the commission's findings, the Indiana law provides that the court shall hear the appeal upon the transcript of testimony from the previous hearing. In the Washington law the complainant before the board, if dissatisfied with the board's decision, may appeal to the court and the case is then tried *de novo* without jury. The Wisconsin law provides that if upon trial of the action the court finds that evidence has been introduced by the plaintiff different from or additional to that offered in the hearing before the commission, it shall stay the proceeding for 15 days and transmit a copy of the evidence to the commission. The commission may then rescind or amend its original order in the light of the new evidence and report to the court within 10 days. This Wisconsin plan was evidently suggested by the rough manner in which the courts have handled the findings of the Interstate Commerce Commission. Its working will be watched with the greatest interest, and may be worthy of adoption into our national law. It makes the record of the commission final.

Annual reports of the railroads to the commission are required in the usual form. The Wisconsin law introduces the wise provision that the blanks prepared for reports to the commission shall conform as nearly as possible to the Interstate Commerce classification. This practice is being followed voluntarily by many commissions, but a legal provision requiring it has a tendency to hasten a most desirable consummation, when state and national reports will be drawn up on the same forms, and be capable of more intelligent comparison and study. All the laws include in their scope private car lines, sleeping car companies and express companies as well as railroads proper. Street and interurban railways are excluded in Indiana and Washington, and street railways in Kansas and Wisconsin. Kansas, in connection with its legislation in opposition to the Standard Oil Company, gives to its railroad commission general supervision of the transportation of oil by pipe lines, which are made common carriers. The commission is authorized to prescribe maximum rates for the transportation of oil.

Much might be said in criticism of our state railroad commissions. Their apparent inefficiency is, however, in most cases to be attributed to their limited jurisdiction and to the steadily growing importance of interstate commerce over which they have no control, as well as to the fact that much of their most enduring work in harmonizing the relations of shipper and carrier is carried on informally and never comes into public notice. Whether the commissions have justified their creation or not, the people are not prepared to abandon this form of railroad control until something more efficient offers itself. Therefore it is a source of gratification that the most recent legislation of this character should prove to be so conservative and so much in harmony with the best sentiment of the country on railroad questions.

Award of the John Fritz Medal.

The second award of the John Fritz medal has been made to George Westinghouse, for "The Invention and Development of the Air-Brake." This medal was established by the professional associates and friends of John Fritz, of Bethlehem, Pa., on August 21, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress. The award was made by the following board selected for the purpose:

From the American Society of Civil Engineers: Alfred Noble, Chas. Warren Hunt, Charles Hermany, C. C. Schneider.

From the American Institute of Mining Engineers: James Douglas, Charles Kirchhoff, E. E. Olcott. E. G. Spilsbury.

From the American Society of Mechanical Engineers: Robert W. Hunt, S. T. Wellman, James M. Dodge, John E. Sweet.

From the American Institute of Electrical Engineers: Charles P. Steinmetz, Charles F. Scott, B. J. Arnold, John W. Lieb, Jr.

The medal is of gold, of a value of about $100, and with it is presented a certificate of the award.

The Local Agent.*

I first viewed the local agent from the standpoint of a brakeman, and to my mind his only employment consisted of making all possible work and trouble for the brakeman, and reporting him on every occasion that presented itself.

Afterwards, as way freight conductor, I was positive that from the time the train started until we tied up, the agent was doing nothing but making out switch lists that were invariably incorrect. From my point of view it was his constant delight never to have a bill ready and a car sealed on time.

As I grew older in the service, I acquired a determined opinion that when Mr. Agent had exhausted his own mental efforts, he never failed to consult with some higher authority to hatch up other devilishness to delay us.

But a little later in life, as a passenger conductor, I became more observing and lost some of my prejudice. I found out from remarks made by passengers that all agents were not useless ornaments. I heard a great deal in favor of agents who were courteous, well informed and first class servants of the company and the public. Of course, I heard some reports of a few misguided fellows who chose the opposite way of working, and at last it dawned on me that the agent was a very important factor in the organization of a railroad. I saw where it meant a great deal to the company whether or not they had proper representatives; I acknowledged the fact that at competitive points our interests to a great extent depended upon our representatives.

When I reached the position of Train Master, I had a better view of these fellow employees and I went into camp with them heartily. I entered into a partnership that proved most cordial and successful and received as much, if not more, assistance from the agents than from any other men in the service. It was he that called my attention to things requiring remedy in such shape that I could go to the superintendent intelligently. I found when he made a statement it was based on fact and was the result of good, thorough consideration. His loyalty and judgment were such that he was seldom found insincere.

Afterwards, as superintendent, in recognition of the interest which I felt I organized an agents' association. We got together the oldest agents at our meetings, but had all as members, and advised them of what we accomplished. We made our standing committees out of the experienced agents.

We made it a rule to invite a certain number of young men to each meeting so as to give them the benefit of the acquaintance and advice of the older men. I do not doubt that the ideas gained by the members saved much worry and indecision and awakened ambitions. By thus distributing a knowledge of good methods and interesting schemes, many a good man was kept from getting into a rut on account of his isolation.

The agent must carry ready at hand and use generously large doses of courtesy and common sense. There are no factors more important in his list of accomplishments than polite manners and an approachable personality. He must be "all thing to all men" in spirit and in truth. The public demands these things and thinks it pays for them. He must "deliver the goods," he must breed work by being a busy boss and must keep correct in and fault finding far behind him.

*Extract from an article by W. D. Cardon, General Superintendent, in "The North Western Bulletin," a periodical published in the interests of the employees of the Chicago & North Western Railway.

Washington Street Subway in Boston.

The report of the Boston Transit Commission for the year 1905 contains a complete description of the new Washington street tunnel now in process of building. It is a two-track structure for the passage of trains of cars north and south through the congested portion of the city connecting with the elevated structure at either end. These trains of cars at present go through the original subway between Pleasant street and Causeway street but in the future they will run through the Washington street tunnel, and the old subway will be restored to its original use as a route for cars from the surface system.

Work has been in progress on the tunnel during the year from near State street on the north to the southern limit, not far from Oak street. The general layout of the Washington street tunnel is shown in Fig. 1, and the profile by Fig. 2. The plan and profile show not only that portion on which the lines have been definitely fixed, that is, to the south of Cornhill, but also indicate one of the studies for the portion of the tunnel to the north of Cornhill.

Of the whole length of the tunnel—according to the plan referred to—50 per cent. will be straight, 33 per cent. will have a curvature of about 5,000 ft. radius, 2 per cent. of about 1,800 ft. radius and 15 per cent. of about 500 ft. radius. The grades are as follows: Of the whole length of the tunnel 40 per cent. will be level, 7 per cent. will have a grade of less than one foot in one hundred, 22 per cent. a grade of about two feet in one hundred, 13 per cent. from three and one-fourth to four feet in one hundred and about 18 per cent. of about five feet in one hundred.

A train going north and descending into the Subway, will be about 48 ft. lower at Eliot street than when on the elevated structure at Broadway. At Eliot street the track is about 21 ft. below the street surface and 6 ft. lower than mean low water of the sea. Continuing north the train will climb 19 ft. to Temple place. From Franklin street the tracks descend and pass beneath the East Boston Tunnel at State street at about the same level that they are under Eliot street. The lowest place in the tunnel, according to the profile shown, will be nearly under the old subway at Adams square, 28 ft. lower than at Franklin street. Continuing north the train will climb 52 ft. to the elevated structure at Causeway street.

The character of the cross-section of the tunnel varies greatly, determined by its situation and use. South of Kneeland street, where the tunnel is wholly to the east of Washington street and in private land, it was necessary not only to adequately support all of the existing buildings which are over the tunnel but also to provide for taller and heavier buildings which are permissible under the building laws. These conditions were best met by a heavy roof of steel beams and concrete supported by reinforced concrete side walls and by a line of steel posts between the tracks. North of Kneeland street, as will be seen from the map, "staggered" station platforms occur at frequent intervals as near the surface of the street as is practicable, and at these platforms the roof is made of steel beams and girders with concrete arches between. Where there are no platforms, and where a considerable depth exists, the tunnel is covered by an arch with tie-rods. In all parts of the work the contingency has been provided for that the pressure of the earth may be removed on either side of the tunnel while a heavy load is being carried on top and a pressure is exerted by the earth on the other side. This provision is not usually made in masonry subways in other cities, but the conditions of narrow streets and the frequent construction of buildings with deep cellars appear to demand it here.

Little or no provision has been made for the positive ventilation of street subways constructed in other parts of the world. Adequate fans and ventilating chambers were placed in the original Boston Subway and in the East Boston Tunnel, and will be provided in the Washington street tunnel. In accordance with the previous methods, fresh air will in general be admitted at the stations and drawn out of the tunnel at points between stations. In some parts of the original Boston Subway the air from the tunnel was discharged through gratings in the sidewalks, but this might be objectionable on the surface of the crowded sidewalks of Washington street. Tubes will, as a rule, be used to conduct the air from points where it leaves the tunnel to the points where it will be discharged, which will usually be above the subway entrances. These tubes will in some cases be below the tunnel and in other cases above.

The tunnel in Washington street is in no place far removed from and for most of the way comes close to the lines of the building. On account of the narrowness, crookedness and irregularity of the street and the frequency of the tunnel station platforms, the cross-section of the tunnel is very irregular and is rarely uniform for more than a few feet in length. Most of the sewer, water and gas pipes and other structures under the street, required to be moved to a new position and many service pipes are

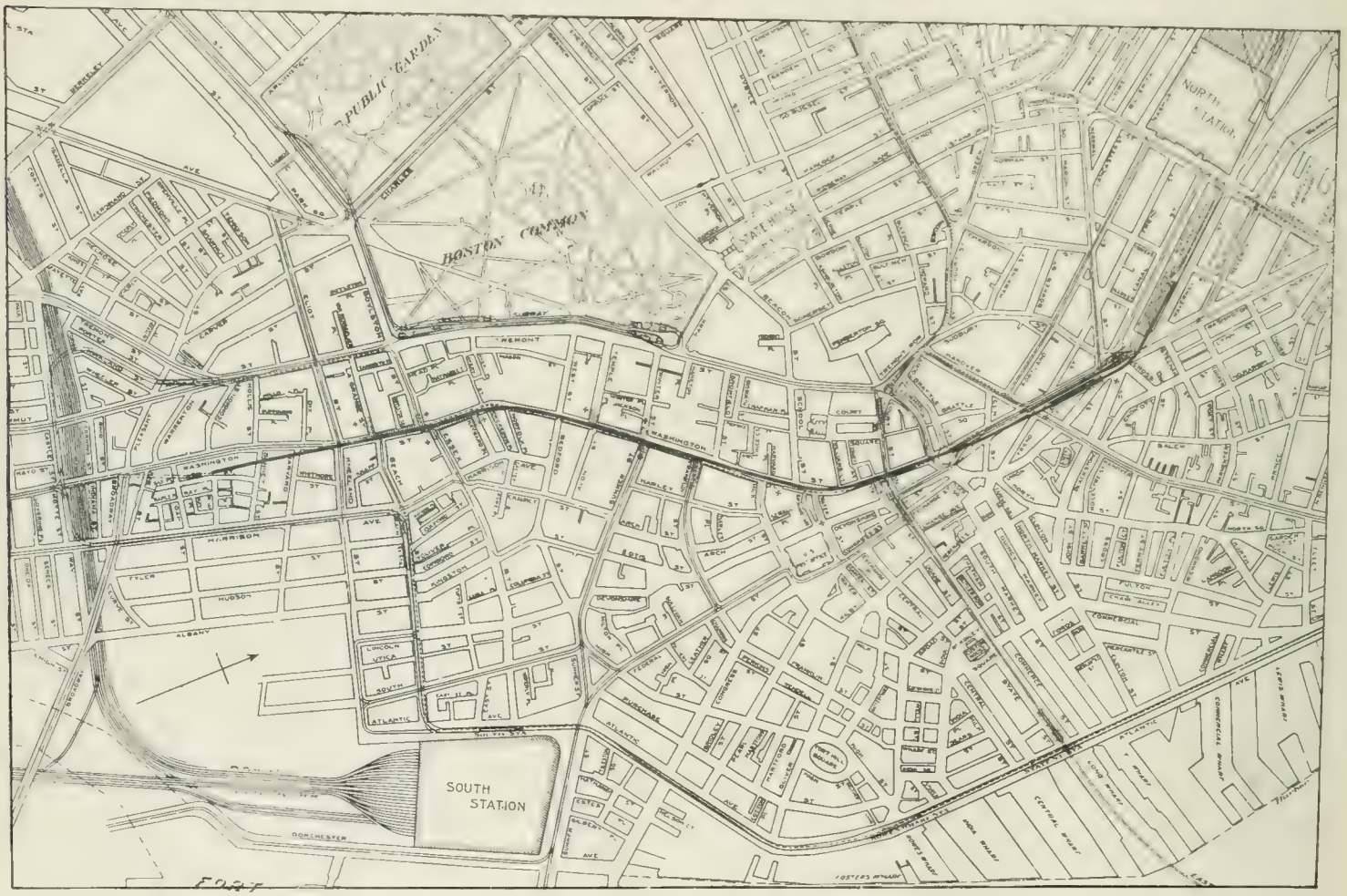


Fig. 1.—Map of Business District of Boston Showing Elevated, Surface and Subway Lines.

Washington Street Subway Indicated by Heavy Black Line.

to be laid cross-wise to connect with the different buildings. For these reasons most of the earth from the pavement down to the bottom of the tunnel is necessarily taken out. The work, however, has been carried on in such a way as to interfere but little with the traffic of the street. The method of doing the work has been similar to that employed on the streets when the original Subway was built. The paved surface of the street has been replaced little by little with heavy planking laid flush with the original surface of the paving and supported on timbers, and most of the work in the daytime has been done under this bridging. During the night much more of the surface of the street is occupied, but nevertheless enough space is left free so that fire engines and apparatus can pass through Washington street and in and out of any adjoining street, and this provision permits the passage of the

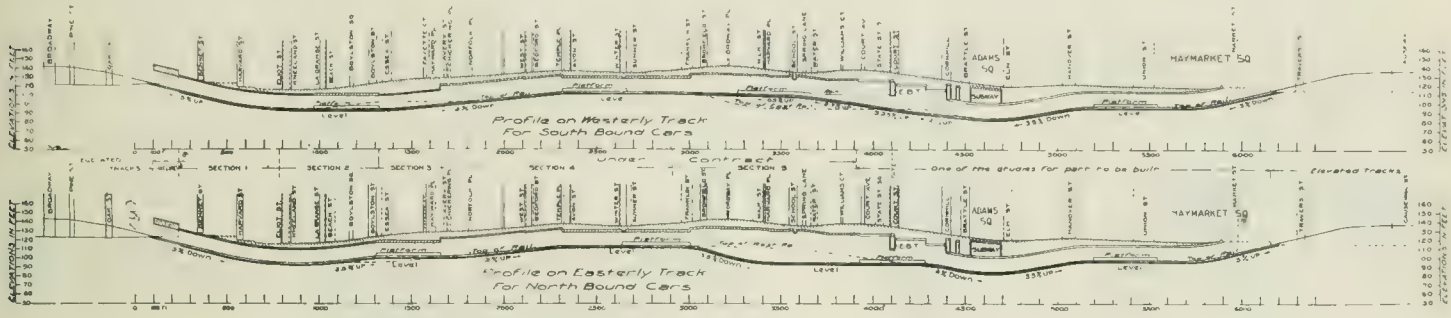
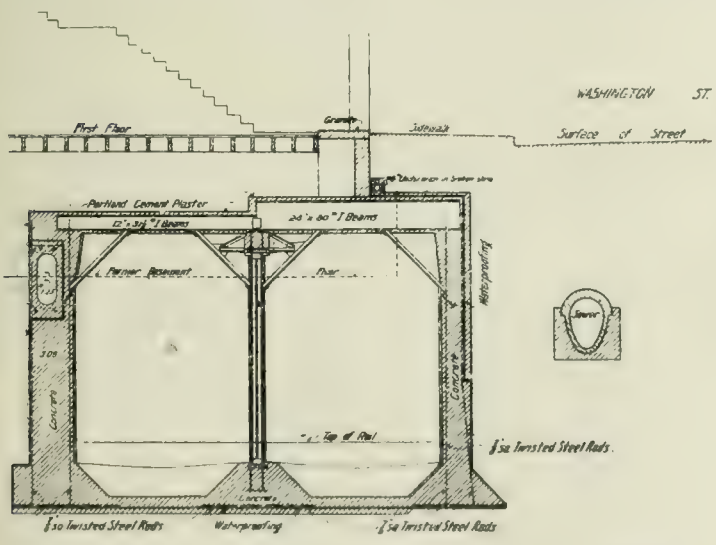


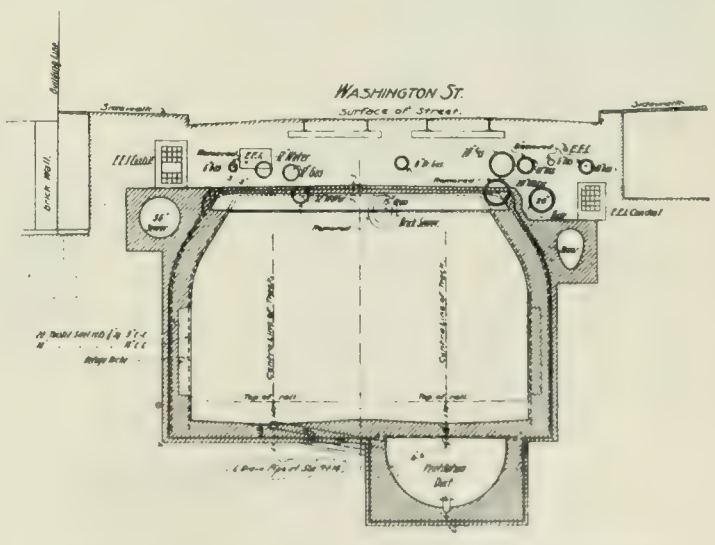
Fig. 2.—Profile of North and South Bound Tracks in Washington Street Subway.

comparatively few teams used in the night. On Sundays and holidays the street surface is occupied in places in putting down new bridging and in doing other work for which the time in a single night is too short. The street railway cars are not diverted from Washington street in the day time except in case of emergency, but either the north or the southbound line, or both, are often diverted at night and on Sundays.

The work has been necessarily irregular and of a piece-meal character, but the order of doing the parts has generally been some what as follows: Underpinning is done where necessary; side walls are built in narrow trenches, one at a time; new sewers are built in or near them; interior posts, if any, are placed in a narrow trench; the roof is put on; the core is dug out; and finally the invert is completed. During this series of operations a large number of pipes of various kinds must be supported and changed



Cross-Section of Section No. 1, North of Harvard Street.



Cross-Section of Section No. 2, South of La Grange Street.

and considerable rearranging of braces and props must be made.

The work is divided into six sections; the southerly incline, section No. 1 542.5 ft. long, section No. 2 525 ft. long, section No. 3 333.5 ft. long, section No. 4 1,251.5 ft. long, section No. 5 1,013 ft. long.

Incline Near Ash Street

The buildings where the incline is situated were taken down and their material removed between Sept. 8 and Oct. 6, 1904. They were mainly four-story brick structures about 60 years old. The retaining walls and roof of the incline are composed of concrete reinforced with steel rods. Above the surface of the ground the sides are open, for light and ventilation. Steel posts encased in concrete support the roof, on which is a monitor, about 8 ft. wide, open on the sides. The side walls from the floor of the incline to copings above the surface of the ground were built in monolithic

sections of 20 ft. lengths with expansion joints between. The roof was made continuous with a sliding joint at the junction with Section 1.

Section 1.

As this portion of the tunnel structure is entirely covered by buildings (except at street crossings), and as taller and heavier buildings may sooner or later replace the present ones, the walls, roof and foundations are strongly built. The walls and invert of Section 1 are of reinforced concrete. The roof consists of steel I-beams imbedded in concrete and supported on the side walls and a row of center columns. These beams vary from 12 in. to 24 in. in depth and are spaced from 1 ft. to 4 ft. apart according to the loading to which they are likely to be subjected.

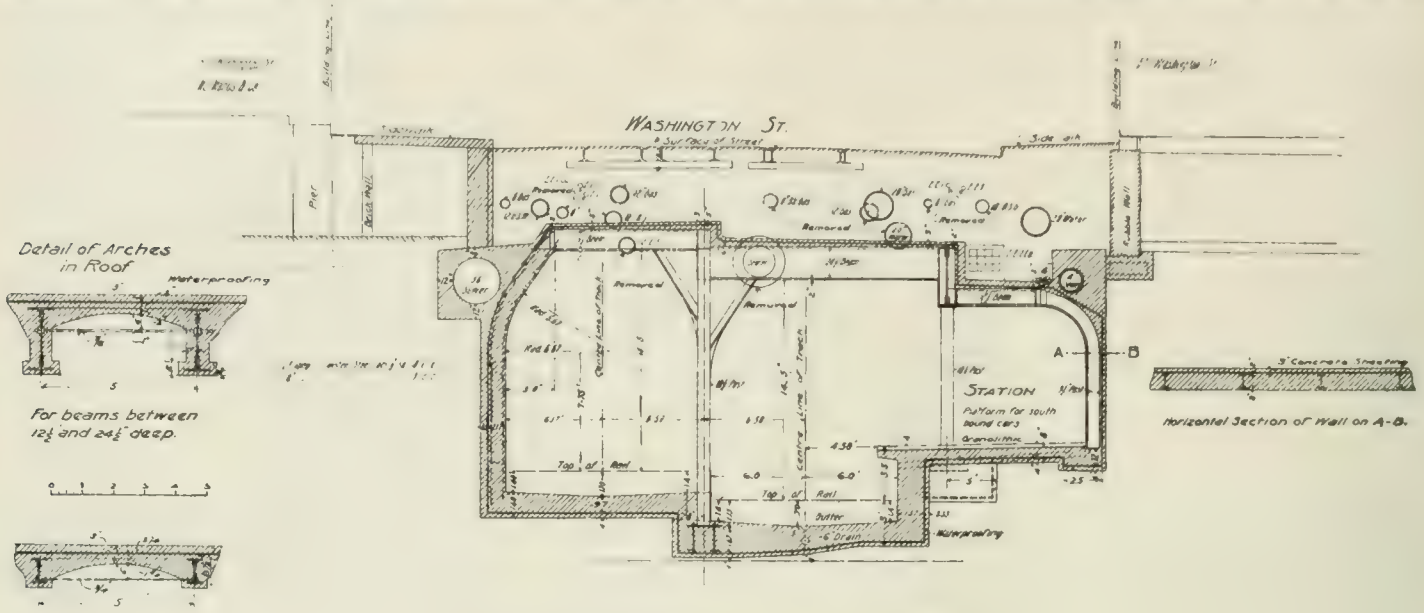
The work was carried on from both ends and from shafts in Bennet and Harvard streets in sections from 12 to 20 ft. in length. In excavating the sections to the required depth, the earth was filled into tubs which were carried on small cars to the shafts, where the tubs were hoisted and dumped into carts. After the excavation was completed, the floor or invert of the tunnel was built; the side walls were next erected; then the center columns and roof beams were placed in position and riveted, after which the roof was completed with concrete which surrounds the beams and fills the space between them. The invert and side walls were made almost wholly of concrete. The concrete was mixed by a Smith rotary mixer and carried to the several openings in iron carts. The building foundations were supported on steel I-beams during construction, and then pinned up on the completed roof with brick masonry. During the excavation and construction of each short section of the tunnel, the I-beams just referred to were supported by blocking or posts resting on neighboring unexcavated earth or on the partially or wholly completed adjacent subway walls.

Generally the division walls and piers of the overhead and neighboring buildings were underpinned with brick masonry from the completed subway roof and on the sides of the subway down to an inclined plane, having an angle of 60 deg. with a horizontal plane passing through the bottom of the side walls. Concrete sheeting was used outside the easterly wall underneath the premises No. 710 710 Washington street, which sheeting was left in place. Everywhere else wooden sheeting was used, which was removed as the work progressed. The roof of the tunnel is below the street floors of buildings, except in the Sherburne building, where it is from 3 to 5 ft. above the street floor. This story is now being remodeled. The grade of the tunnel required the raising of the grade of Bennet street about 2 ft. This new grade run down to

the former grade at Washington street and at 50 ft. east of Ash street.

Section 2.

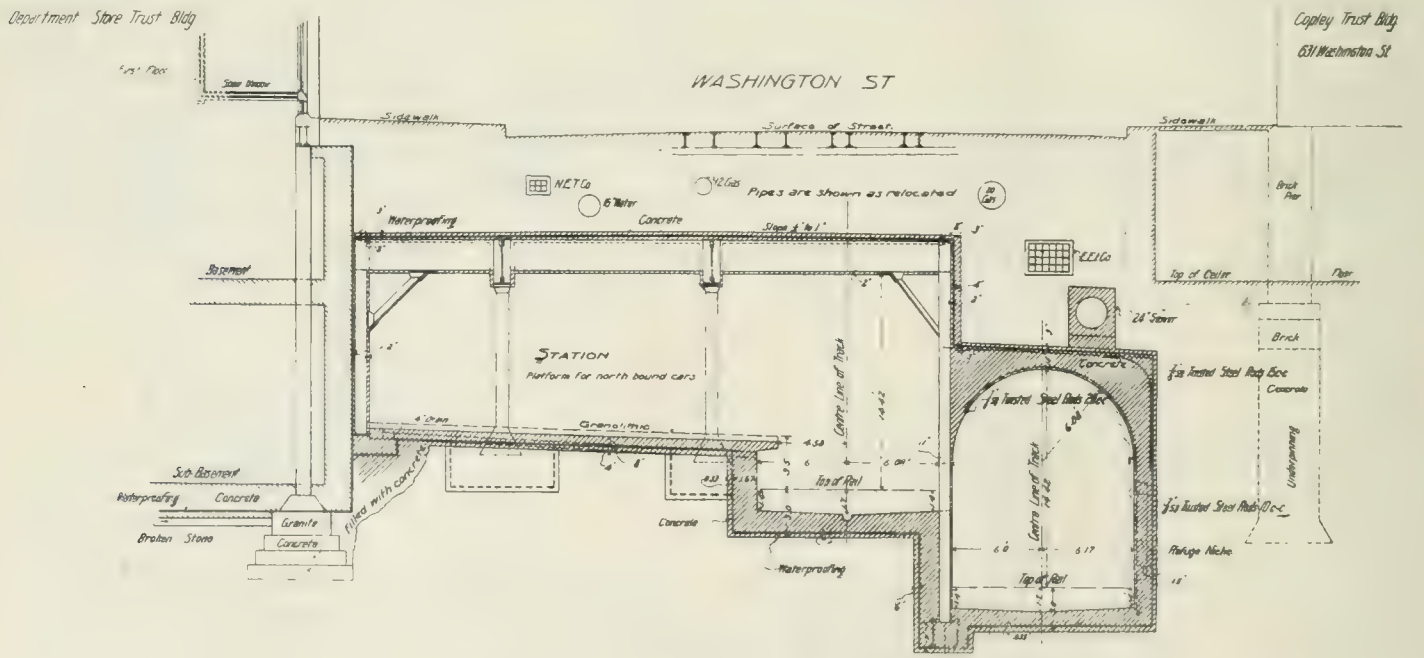
Where Eliot and Kneeland street cross Washington street, for a length of 40 ft., the structure consists of a concrete invert with reinforced concrete side walls and the roof of 15-in. I-beams, 5 ft on centers, with concrete jack arches turned between the beams. For the next 120 ft. going north the invert and walls are of similar construction, but the roof is of a flat arch type with 15-in. beams



Cross-Section of Section No. 2, Near Beach Street.

imbedded in the concrete every 18 in. For the remainder of the section the invert is of concrete and the east wall of reinforced concrete; the west wall consists of steel columns spaced 5 ft. on centers surrounded with concrete; two lines of center columns carry girders extending longitudinally with the tunnel, the roof beams extending across the tunnel resting on the side walls and these girders, and between these beams, which are 5 ft. apart, concrete jack arches are turned. Where this last type is used, there is a station platform from 11 to 17 ft. in width on the west side of tunnel for the accommodation of southbound trains. Approaches

in advance of the main work of construction, and a contract was made for doing a portion of this advance work. Operations began on the evening of Sept. 6, 1904, on the south side wall to the LaGrange street station, opposite No. 12 LaGrange street. Four days later, work in Washington street was begun on an opening for the pump-well at the intersection of Beach street. Work in LaGrange and Washington streets was prosecuted diligently, although great care was required, particularly in the former street, where the tunnel walls were horizontally within a few inches and vertically about 10 ft. deeper than the foundations of the adjoining buildings. After reaching the depth of these foundations, excavation was carried on generally in pockets 6 ft. long and the side wall erected therein before the intermediate pockets were excavated. In spite of the precautions taken, settlment took place on the LaGrange street side of the building situated at the north corner of Washington street. To obviate settlement on the Washington street front, the building was supported by spur-shores before operations were begun there. The foundation was then underrun in pockets about 2 ft. wide, and strengthened by a wider concrete base



Cross-Section of Section No. 3, Near Essex Street.

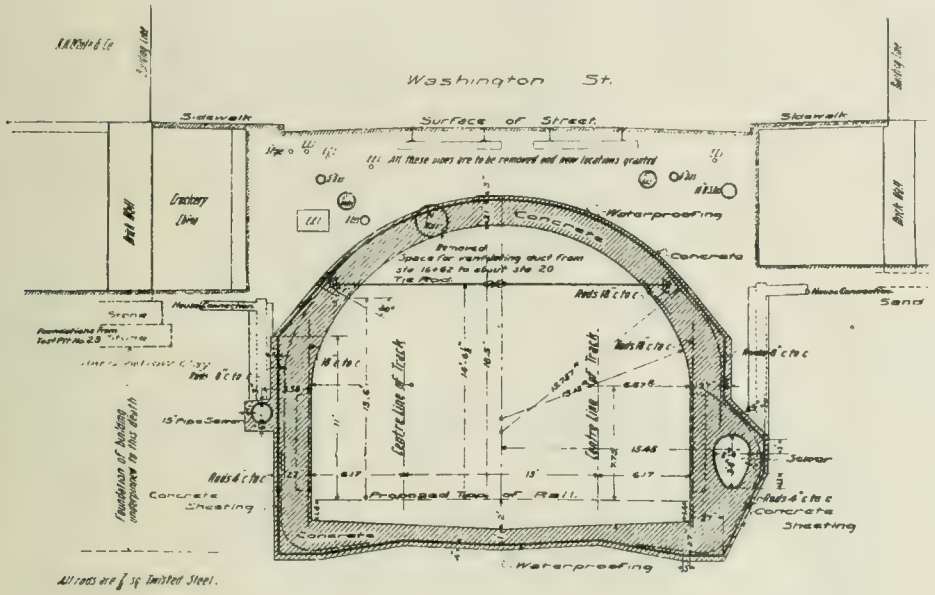
to this platform extend into LaGrange and Boylston streets, distances of about 100 and 45 ft. respectively from the west line of Washington street. These approaches occupy practically the width of the two streets named, and have walls of steel columns embedded in concrete, roofs of steel beams and concrete jack arches, a row of center columns and bottoms of concrete, eventually to be covered with a granolithic surface.

It was deemed prudent to have a portion of the side walls of the tunnel—especially where close to building foundations—done about 18 in. in depth, containing 6-in. I-beams, this process being continued until the whole foundation had been strengthened. In that part of Washington street where the side walls did not come nearer than 8 ft. to the buildings, the length of the pockets excavated was about 16 ft.

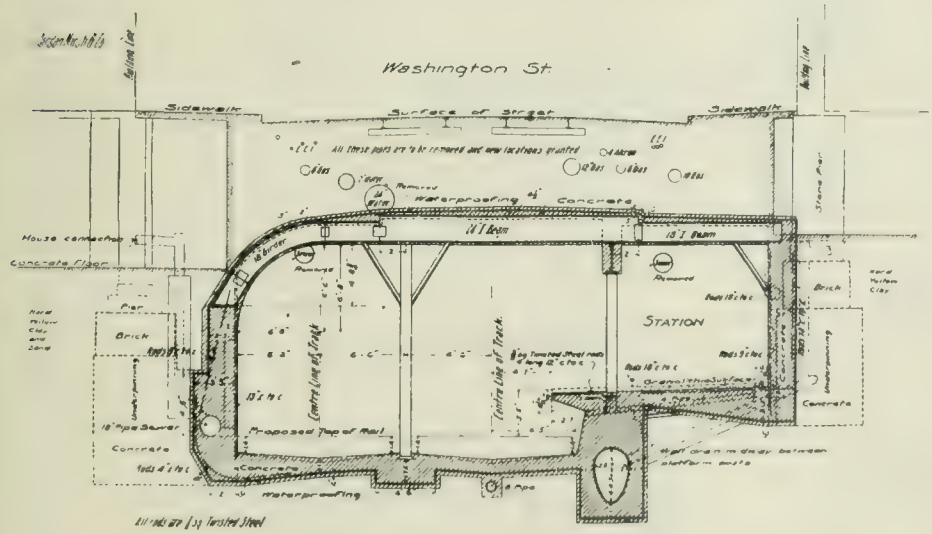
The side walls of the section south of the station platform were built by separate contract. Excavation and masonry were carried on in alternate 16-ft. stretches, and new sewers at the same time built on each side of the street, the intermediate sections being

built afterwards. The Lyceum building and the Washington street front of the building at the south corner of LaGrange street were underpinned to the depth of the tunnel wall before excavation for the wall was begun. The buildings were spur-shored and the foundations carried on steel beams. Excavation was made to the required depth, and concrete walls and piers brought up to within 18 in. of the old foundations, the final pinning being done with brick masonry.

The construction of the side walls and sewers where the other contractors had left off was finished south of Boylston square, while the easterly side was practically completed to the south line of Boylston street. The house connections were then connected into the new sewers, and the old sewers abandoned. The work of excavating the core was then pushed ahead in LaGrange street and that part of Washington street where the station was located; in the former case the full width of the structure being taken, while in the latter a trench was dug first and the platform posts and



Cross-Section of Section No. 4, South of West Street.



Cross-Section of Section No. 4, North of Temple Place.

roof placed, after which the remaining width of the street was excavated in stretches about 40 ft. in length, the bottom concreted and the steel then erected and the roof finished.

In that part of Section 2 south of the station a different method was adopted. The street was excavated to a depth sufficient to allow the roof-beams to be set in position from side wall to side wall and the roof was finished first. The core was then excavated underneath and the earth taken in cars to near Kneeland street, where it was hoisted through a hatch and dumped into carts. As the excavation was completed, the ventilation duct and invert were concreted in short sections.

The contract for Section 2 included the underpinning of the buildings at the corners of Washington and Boylston streets—the Boylston and Shuman buildings. The Boylston building was underpinned by partitioning off a space about 12 ft. square about each one of the main piers, successively, cutting through the piers, and supporting them by heavy steel beams put through and under them. A hole underneath was then dug of the required size and depth and heavy brick piers built up to the old piers. These brick piers were connected by a concrete wall which supported the lighter piers of the building. In the case of the Shuman building small cross-drifts were driven under the piers, and I-beams about 20 ft. long were inserted under the foundation. Another set of I-beams parallel with and close to the front of the piers were placed above the first beams and supported at the end on timber blocking, the first beams being supported from these by iron bolts. A large box was built upon the outer ends of the lower beams and filled with paving stones, thus forming a cantilever, the weight of the building being upon the short arm. The excavation and masonry work then proceeded as usual in similar cases.

Section 3.

The structure varies in width from 53 ft. at the north corner of Essex street to 35 ft. at the north end of the section. The inverts are of concrete. The west side wall is also of concrete. From the center columns steel I-beams cross over the easterly track to a line of girders resting on columns in the station platform. The platform girders are connected to the east side wall by I-beams, the east wall consisting of I-beam posts every 5 ft. surrounded by concrete. The spaces between the beams are spanned by concrete jack-arches, the concrete being carried high enough to cover the whole structure.

The platform mentioned above is from 8 ft. to 26.5 ft. wide on the east side of the structure and is for the use of the northbound trains. Approaches to these platforms extend into Essex street and Hayward place about 60 ft. from the east line of Washington street. These approaches have side walls of steel columns surrounded by concrete, steel center columns, and roofs of I-beams spanned between by small concrete arches.

The contract for this section included in addition to the construction of the tunnel, the tunneling for and laying of about 600 ft. of 18-in. and 24-in. pipe sewers in Hayward place, Harrison avenue and Essex street as part of the necessary sewer changes in connection with the work. The contractors began on this sewer work on Dec. 20, 1904, at the intersection of Hayward place and Harrison avenue. Two days later, operations in Washington street were begun. During the first month the work was confined to these sewers and to excavating and building the west wall of the tunnel where it was not very near to building foundations.

Because of the depth and proximity of the tunnel, it was deemed necessary to underpin the walls of the buildings on the west side of Washington street from the north end of Section 2 to and including the south corner of the Bumstead building, a distance of about 140 ft., and also the walls of the Arioch Wentworth building fronting on Washington street and Hayward place. Excavation for this underpinning was begun in the Hotel Cecil on Jan. 20, 1905. The general method was to partition off a portion of the basement and to cut through the walls and piers and support the building on heavy steel beams.

The general method in Washington street after the building foundations have been underpinned has been to build the west wall of the tunnel to the height of the springing line of the arch, and then to excavate for and build the center wall to the springing line, after which the arch is turned.

In Essex street the first work consisted in connecting the 24-in. sewer already referred to by a new 24-in. sewer on the south side of Essex street to the new 3-ft. concrete sewer on the east side of Washington street. After this had been completed the sidewall columns were placed and concreted in. Work on Washington street has been simplified by the diversion of the old sewer by a temporary wooden box sewer into the new sewer in Hayward place so that there is now not much sewage to contend with in Section 3.

Section 4.

From the south end of the section to Temple place the structure consists of a concrete invert, reinforced concrete side walls and a concrete arch with steel tie rods of 1.25 in. diameter spaced about 2 ft. apart. Between Temple place and Winter street there is a platform on the west side of the street for southbound cars, which is about 350 ft. long and from 16 to 17 ft. wide. From Winter street north there is a platform on the east side of the street for

northbound trains. This platform has about the same length and width as the other.

North of Temple place the roof of the structure is composed of steel roof beams placed 5 ft. on centers, with concrete arches between them. Between Temple place and Winter street the roof beams are supported by reinforced concrete walls and two lines of steel columns. North of Winter street the structure differs from the above in that steel columns are placed in the easterly concrete wall and the roof beams are riveted to them.

Owing to the proximity of the subway walls to the buildings, it was decided to underpin about three-fourths of all the buildings along the line of this section. The foundations of these buildings were carried down to the same depth as the bottom of the subway. The work was commenced about March 1, and was finished in June. The careful levels taken on these buildings showed no settlement greater than ⅛ in., and that in two cases only.

As the new tunnel displaced the old sewer, it was necessary to build the side walls and the new sewers and to turn the flow of the sewage into these sewers in advance of much of the work in the center of the street. Work on this section was commenced on February 21, and has been pushed vigorously. Under the provisions of the contract the contractor was not allowed to remove excavated material south of Winter street between 7.45 a.m. and 6.15 p.m. except on Sundays and holidays. This required the greater part of the excavation to be done at night. The progress of the work indicates that the completion of the section may be expected somewhat in advance of the time set in the contract.

The mixing of concrete has been by machine, the plant being placed on Boston Common at the corner of Charles and Boylston streets. The contractor has also hired land at the Old Providence depot and also on the Boston Elevated property on Atlantic avenue, where excavated material and paving blocks are stored.

Section 5.

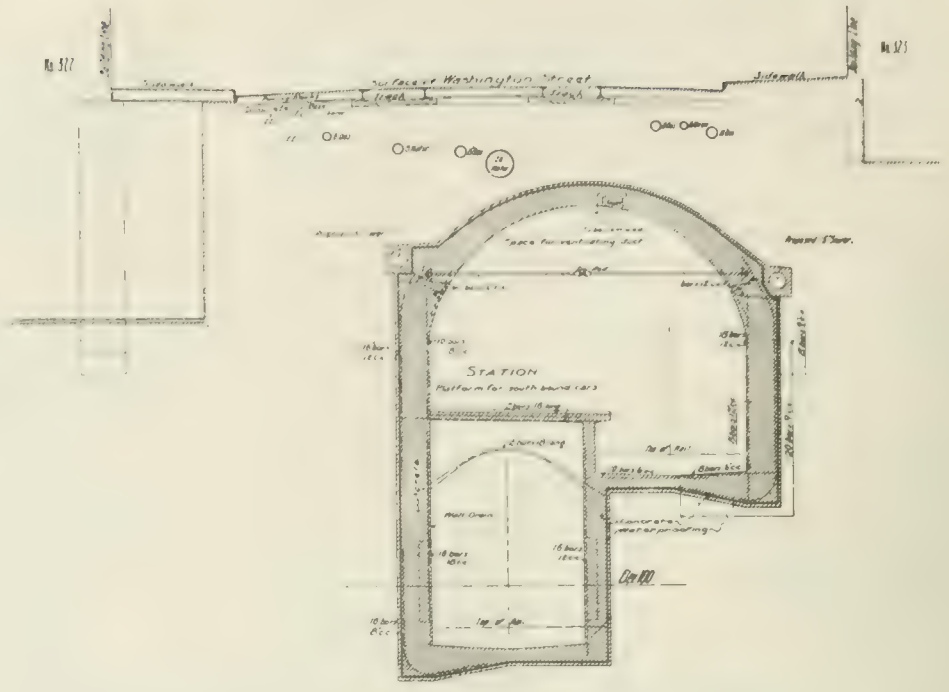
The structure will in general consist of concrete invert, side walls of reinforced concrete and an arch roof with tie rods. For a length of 100 ft. south of and across Franklin street, however, the roof will be constructed of 20-in. and 24-in. I-beams imbedded in concrete and supported by girders carried on two lines of steel columns. Steel columns are also placed 5 ft. apart in the east side wall the same as in the adjoining portion of Section 4.

The side walls between Franklin and Milk streets are under construction, the work being carried on in lengths of about 16 ft. Section 5 is deeper than the preceding sections, the bottom being from 30 to 48 ft. below the street. A feature of interest is that the track for northbound cars from about 90 ft. south of Milk street to the north end of the section is under the platform for southbound cars and the passageway leading to the State street entrance to the tunnel. From the middle of the Herald building north for a distance of about 110 ft. the west wall of the tunnel is under the front walls of buildings.

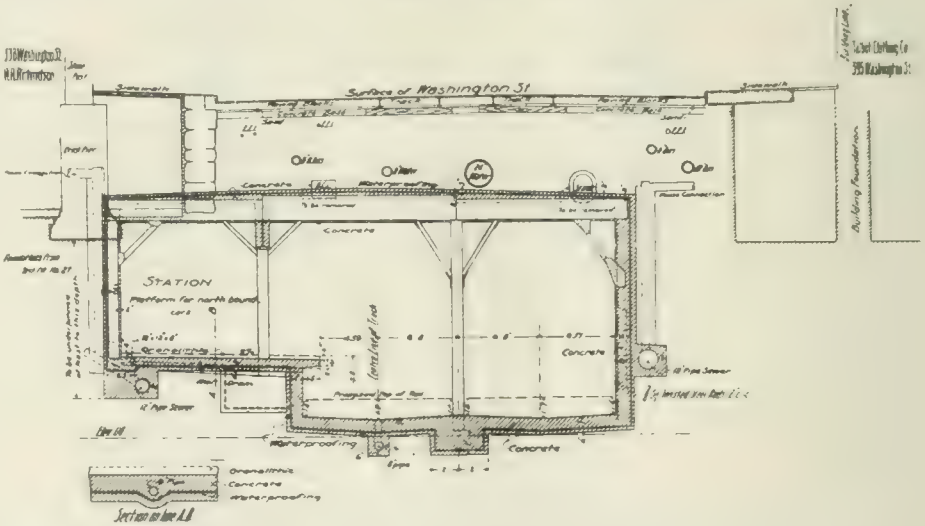
Relocation of Pipes.

In fixing the profile of the Washington street tunnel, a minimum depth of about 4 ft. of earth over the roof was decided upon to allow space for sub-surface structures in the street. The average depth between Kneeland and Franklin streets is 5½ ft., with a minimum of 3½ ft. at Summer street and a maximum of 9 ft. at Hayward place.

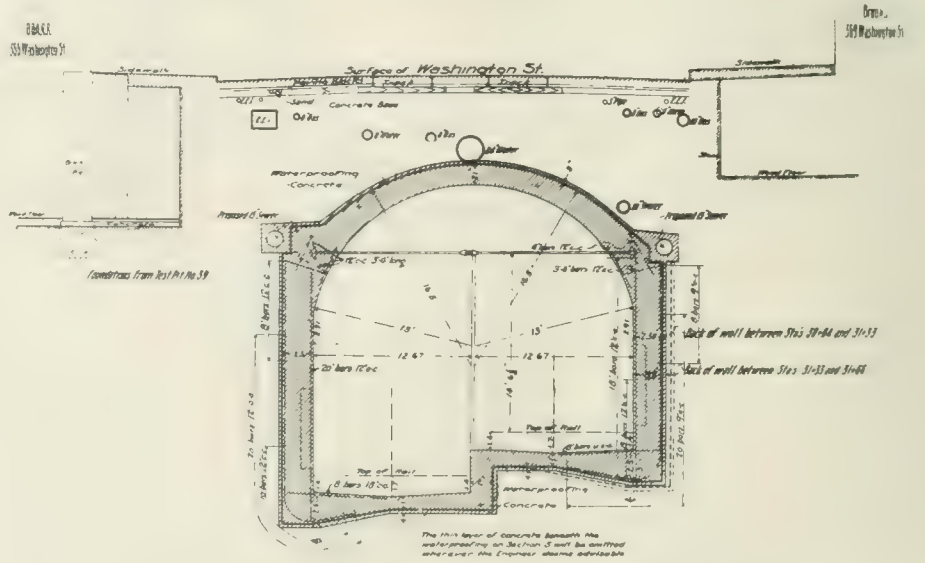
At most of the principal street intersections, and for the entire length of Section 2, the complete relocation of these underground structures has been necessary on account of the tunnel construction. Between these points, companies and city departments represented beneath the surface have asked that they be allowed to lay larger pipes and straighten their lines to conform to the necessary shanges, and the Engineering Department has accordingly prepared precise plans showing a harmonious relocation of all of the principal underground structures in Washington street between Kneeland and Franklin streets. All new locations granted either by the Transit



Cross-Section of Section No. 5, Near Milk Street.



Cross-Section of Section No. 5, South of Franklin Street.



Cross-Section of Section No. 5, North of Bloomfield Street.

Commission or by the city authorities have been consistent with these plans.

The new structures are laid under the direction of the Transit Commission engineers, who designate the precise location and the time of doing the work. In order not to incommode the public, much of the work of relocation is done under the planking which, during subway construction, forms the surface of the street, the contractor making the necessary changes in the timbering at the expense of the Commission. The relocation of all Washington street sewers within the tunnel limits has been necessary. The water pipes have been generally relocated in advance of the tunnel construction. The pipes have been supported temporarily by timbers while work was going on and permanently by brick piers resting on the tunnel roof.

The gas pipes have been removed at once by the Gas Company on being uncovered, so as to avoid danger of explosion, and small pipes have been substituted where necessary to supply the buildings, either under the planking or through the basements between side streets. Over two miles of gas pipes have thus been removed between Harvard and Franklin streets, a distance of about 2,400 ft. The permanent gas pipes have not been replaced in any locality until after the tunnel in such locality has been completed and the street backfilled.

The concrete of the electric conduits has generally been removed as soon as the tunnel excavation would allow and the cables hung or looped up out of the way. This with the removal of the gas pipes has given the contractors much additional space in which to work, and has greatly reduced the task of supporting the pipes. The new conduits have been laid for the most part on the tunnel roof under the planking before the street has been backfilled. The capacity of the electric light conduits has been materially increased and eventually all of the old Edison three-wire solid tube system over the tunnel will be removed and replaced by cables drawn through these conduits. The building connections will be made through pipes laid from the manholes. The two 10-in. pneumatic mail tubes crossing the tunnel at Eliot and Kneeland streets were relaid in advance of the construction of the tunnel roof.

Washington street has been continuously patrolled by water, gas, and electric light inspectors, the Water Department men carrying a red flag by day and a blue light by night for identification, and despite the fact that bare electric light and power cables, water and gas pipes, pneumatic tubes, etc., have been carried on timbers in the open excavation where some settlement is inevitable, no accident at all serious to property or person has thus far resulted.

Local Freight Agents' Problems.*

When 800 pounds of small castings are put into a sugar barrel, and handled from the dray to the warehouse, and then to the train, and perhaps a transfer en route, the chances are that the castings are loose, with no marks, and when they are unloaded at destination there is a shortage and a consequent claim. I think there should be some restriction as to the weight of castings put in a barrel, or some kind of a package specified to put them in that would "hold." It seems to me that about all the shipper looks out for is to get something to hold until he gets the receipt from the railroad company; then they can take care of the rest, so long as the classification has been complied with.—*W. O. Allen.*

The local agent is a much more important personage than is usually supposed, and instead of letting the public think he is a funnel through which they are to communicate with and hear from the superintendent, general freight agent, or others, he should let them think he is in a broad sense the general manager of the company's interests in that particular section of the country. The agent is always within reach of the necessary official by wire and can soon give them a reply on any subject. If you seek to work closely in connection with prominent shippers you will always handle their business with energy and satisfaction to them, but if they come to you and you ask them for a letter and say you will submit it you will find they will write to some official direct the next time.

If a rate is not quoted promptly or a shipment is delayed, do not assist the patron in his abuse of the company by offering no defense, but pour oil on the troubled waters and when you get back to the office let no time pass until you have done your full duty in trying to fix it up; then give him the results, so he will know of your interest. Complaints are always right or wrong; if the former, admit it and try to suggest something to prevent similar complaint in future. If they are wrong, explain it, and defend your service; the pursuing of such a policy will cause shippers to think more of you and the company.

Above all, do not dodge the issue and put it up to a superior with the idea that he will turn it down anyway, and that you can show the shipper his reply.

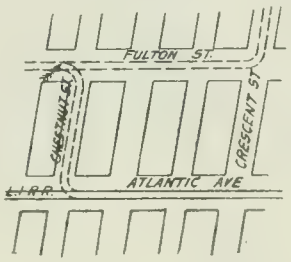
I have a great deal more respect for an agent now than I had when I was one of them. I think I am safe in saying you are of such recognized value to your superior officers that you should weigh your subjects carefully and then make your recommendations, and I am sure the subsequent action will convince you of the consideration given your views, even though they might conflict with others.—*S. F. Miller, A. G. F. A.*

Some time ago we had a lot of choice flour in cotton sacks damaged by being loaded into a car that had been loaded with ice. The floor was wet, so the loader put in a lot of hay and then a layer of boards. Apparently the flour was well protected and would go to destination in good shape, but the hay was sticking up in places between the boards, and the water gradually filled the hay, and each one of these straws carried the water to the flour like so many little siphons, with the result that the lower tier of sacks was wet and caked badly.—*L. O. Matthews.*

*Extracts from articles in "The North Western Bulletin," a periodical published in the interests of the employees of the Chicago & North Western Railway.

Accidents on the Brooklyn Elevated.

On Friday, January 19, the middle car of a three-car train on the Kings County Elevated Line was derailed at the switch at Fulton and Chestnut streets, Brooklyn, and fell to the street, killing one passenger and injuring about 15 others. As will be seen by the accompanying sketch, the main line of the elevated makes a sharp bend just beyond the point where the accident took place. Just before this bend is reached, at a distance of approximately seven miles from City Hall, Brooklyn, a connection leads down a sharp incline on Chestnut street to the surface line of the Long Island railroad on Atlantic avenue, with which connection is made for Rockaway Beach. During the summer months, the switch at this point is connected with the signal tower, but in the winter no trains are run over the connecting track and the switch is disconnected from the tower and spiked in position. On the day of the accident a special train, containing officers of the road, was to be run over the Rockaway Beach line for purposes of inspection. An employee accompanied this train, who was to have unspiked the switch to allow the special to pass over it. Another employee had been sent ahead to assist him upon arrival of the special, but the one sent ahead misunderstood his instructions and unspiked the switch without noticing that it was not connected with the tower. He did this just ahead of the regular train which preceded the special. The first car of the regular train followed the main line; the second car, not a motor car, was derailed by the loose facing point, and the third car turned down the incline. There was nothing in any way obscure about this accident, as the daily press has claimed. It was simply a case of a careless employee who did not follow his instructions.



Location of Accident.

On January 22 the Brooklyn Elevated had another accident, which fortunately did not result in loss of life or injury to persons. On this occasion the motorman of a Myrtle avenue train ran by the signals at the Fifth avenue junction, near Brooklyn Bridge, and a Fifth avenue train from Bath Beach struck the rear car of the first train with sufficient force to twist it about at right angles with the tracks. An inspection made immediately after the accident showed clearly that the motorman had run by his signal since the pipes were so damaged by the derailed car that it would have been impossible to move the signal after the accident occurred.

Washington Correspondence.

WASHINGTON, Jan. 23.—Some progress is being made with the railroad rate bills in the Senate and House Committees. Chairman Hepburn had expected to report his bill to the House last Friday, but the Democratic members of the Committee wanted still more time and the Committee adjourned until to-day, when there was unanimous agreement to report the bill. Unanimity is what has been sought after and what has caused most of the delay thus far. With this end in view the Republican members of the Committee made several modifications in the text of the Hepburn bill to make it more acceptable to the Democrats. None of the changes made is of much importance, but the Democratic members of the Committee have been insisting upon one of a more radical character. They wanted the Republicans to agree to eliminate from the long and short haul clause of the present interstate commerce law the words "under substantially similar circumstances and conditions," so as to prohibit absolutely a less charge for a short haul than for a longer one over the same line of road in the same direction, the shorter distance being included in the longer, subject to a provision authorizing the Interstate Commerce Commission

to suspend the prohibition. This amendment, however, was not incorporated into the bill as finally agreed upon.

An amendment of the long and short haul clause is one of the distinguishing features of the bill introduced in the House by Representative Davey, of Louisiana, the senior Democratic member of the Committee. This Davey bill proposes to go much further than any other measure thus far introduced in either house of Congress in the direction of giving the Commission discretionary power. It would enable the Commission to give or withhold favorable rates through the power to enforce or suspend the long and short haul clause and it would extend to 30 days the time required for notice of an advance or reduction in rates, giving the Commission power to enforce this requirement or to modify it or suspend it at will.

The members of the Senate Committee are apparently as far apart as at the beginning of the session. The Dolliver bill, the Foraker bill, the bill presented by the Interstate Commerce Commission, and the Elkins plan for a compromise bill have each been discussed in turn by the Committee, but without any agreement on any of the important differences between members of the Committee. In the meantime there has been more discussion in the open Senate. Senator Clay, of Georgia, on Monday delivered a long and carefully prepared speech on the question of the power of Congress, under the Constitution, to delegate the legislative power of fixing a rate for the future, contending that it could be done constitutionally. Senator Foraker, who is looked upon as the leading exponent of the idea that the Interstate Commerce Commission cannot be constitutionally empowered to pass upon the question of the reasonableness of rates and to make rates for the future is expected to make a lengthy reply to Mr. Clay in the near future. These two speeches will mark the lines on which the debate will be conducted in the Senate on the Constitutional questions involved. There is no present indication of a division on party lines in the Senate, though it is noteworthy that in the debate that followed Senator Clay's speech on Monday such an adroit politician as Senator Aldrich, of Rhode Island, attempted to give the discussion a political turn. It is apparent that if Senator Foraker and the other conservative Republican members of the Committee on Interstate Commerce can succeed in having the Republican members of the Committee agree upon a bill that will give to the courts the power, at some stage of the proceeding, of passing on the question of the reasonableness or lawfulness of a challenged rate the Senate will divide on the bill on very nearly party lines. A few Republicans may refuse to support such a bill and it may receive the support of Senator Morgan and possibly one or two other Democrats.

J. C. W.

The Education of a Station Agent.*

BY W. C. HUNGERFORD.

Having made up our minds to put our best efforts into our work, the next step is self-control. This is needed in all business, but especially in the railroad business. Look at the groceryman. He puts on his smile with his clothes and carries it all day until he closes the store. See the farmer's wife drive in with the eggs and butter. He goes out to the wagon and takes out the farm products, puts up the groceries, with some candy put in for the children, talks of the crops and makes himself agreeable. He has to, and as you see him you say to yourself, "I am glad I don't have to." You make a mistake. If you could meet the busy world with a happy smile and the kindly attention of the tradesman, how much easier your work would be and how much more business you could accomplish. You would have to learn it if you worked for the grocery man, or worked for yourself.

There is not the same code of morals between the public and railroads as between individuals. The other day I overheard a young lady as she got off the train saying to her friend who had met her, "I have been signing some other person's name so long I have forgotten my own." I learned that she had bought a return portion of a ticket from a scalper in the east and signed the original owner's name. She would not have forged anyone's name to a check, but would do anything to beat a railroad company. When I spoke of this before my minister he stated that he always got a ticket from a scalper if he could. I gave it up and noted that it is evident the ten commandments do not apply to the treatment of railroads. The agent has to stand against this

The condition of the business man is not as good as it was 25 years ago. The combination of capital is fast getting possession of all business that is of any profit, and crowding out the individual dealer. The great department stores are fast eliminating the local dealer.

The tendency to escape from the farm has filled the land with doctors, of schools too numerous to be mentioned or remembered, and lawyers everywhere, until the observation is that few earn more than a mere living, while in our business there has always been a great demand for competent men, and the demand is greater to-day than ever before. We make no investment of money and know that our pay is surer than our best bank. Our hours are shorter than the average business man and they are working under as many restrictions as we, and are more closely subjected to the requirements of the public they serve.

Along the line of sentiment there is no class of men who have more real regard for each other and protect one another's interests more carefully than railroad men, and our experience with the management is that they do the same with us, for when we meet a general officer we always meet a friend, and it would take a longer paper than this to relate the scrapes they have assisted us out of in 25 years, and we are still on speaking terms.

Mistakes that with other employers would only have been settled with money, I have never been asked to pay for. Not long since, when I thanked an official for his help in a matter of transportation, he said: "It gives me pleasure to put any happiness in a railroad man's life." We must look on the bright side and realize that the things which annoy are a part of the business and not allow ourselves to be overcome by them.

Let us take a kindly interest in the business of our patrons, and endeavor to turn dull labor into pleasure. If they are contemplating a trip, give them all the information you can and show your desire to add to their enjoyment. I was pleased with some brakemen I once met in crossing the Continental Divide, who displayed a real and active interest in calling the attention of passengers to features that might have been overlooked by one unacquainted with the scenery. These men found relief from what must have been monotonous to them, by giving pleasure to others, and adding much to the comfort of their trip.

We have the advantage of others, in our ability to travel, and there is nothing that adds so much to the pleasure of life as seeing the different parts of the country, or that helps an agent so much in his business. A man can be more effective in soliciting business when he can describe by actual experience the many objects to be seen and the best manner of reaching them.

There is not much danger of our becoming unsettled in life by comparing our line of railroad with others, or our circumstances with the condition of other men in like positions. I have noticed that when I meet a man who once worked for the North-Western Line, he always speaks of it with pride, and I have yet to find one who said he found things more to his liking on the other line. On the contrary, his advice invariably is, "Stay where you are."

*Extract from an article in "The Northwestern Bulletin," a periodical published in the interests of the employees of the Chicago & North Western Ry.

Automobile Testing Plant at Purdue University.

Purdue University, Lafayette, Indiana, has installed an automobile testing plant. The design of the plant has been worked out under the direction of W. F. M. Goss, Dean of the Schools of Engineering, assisted by Professors J. R. McColl and W. O. Teague. It is quite similar in principle to the locomotive testing plant also

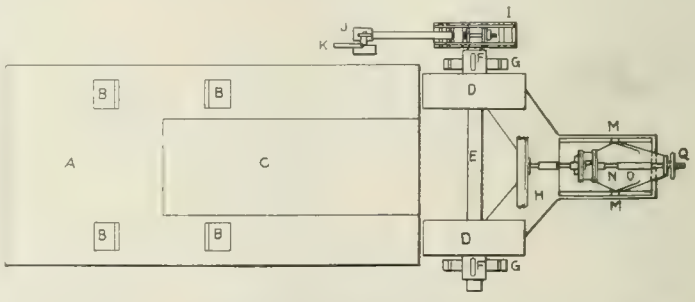


Fig. 1—Plan of Automobile Testing Plant at Purdue University.

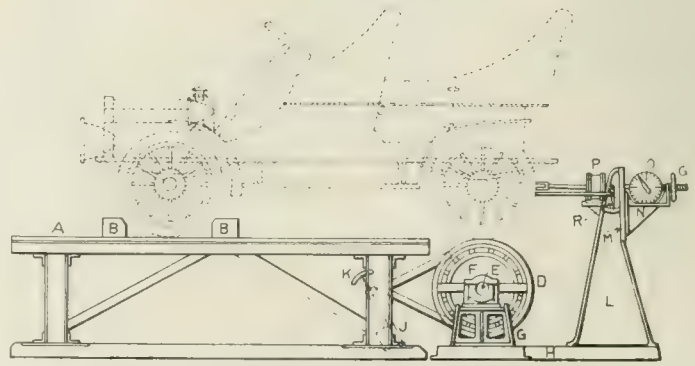


Fig. 2—Side Elevation of Automobile Testing Plant.

at Purdue. An automobile of any type, whether steam, electric or gasolene-driven, may be mounted, operated and tested on it and the power delivered and the efficiency of the machine may be determined. A plan and elevation of the plant are shown in Figs. 1 and 2. It will be seen that an automobile mounted for testing has its driving wheels carried by the supporting wheels of the plant. These wheels are mounted on an axle which revolves in fixed bearings. The automobile is held in position by a connection with a traction dynamometer which, in Fig. 2, appears at the rear of the machine. A friction brake on the axle of the supporting wheels absorbs the energy delivered by the machine. A motor-driven pressure blower delivers air through adjustable piping for cooling the radiators of steam and gasolene machines and a motor-driven exhauster takes air from a point near the exhaust of the machine, thereby freeing the laboratory of obnoxious gases.

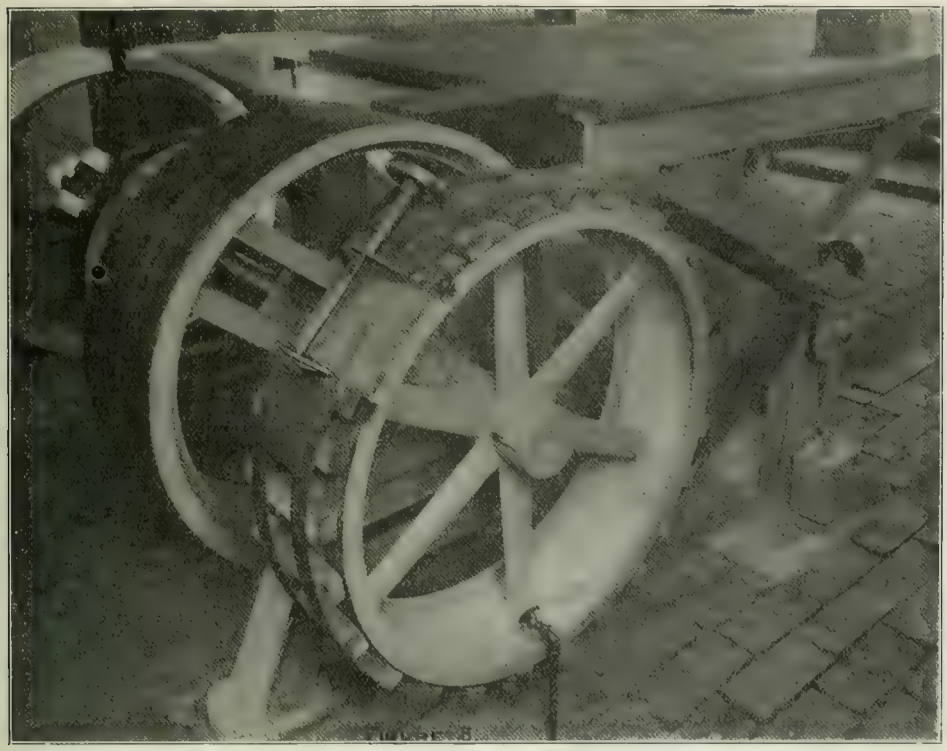


Fig. 3—Driving Wheels and Friction Brake of Testing Plant.

Concerning the theory of action, a glance at Fig. 2 will make clear the fact that if the supporting wheels were blocked so that they could not turn, the automobile would, if started, tend to move forward with its full tractive power even to the extent of slipping its wheels upon the supporting wheels. Its tendency to move forward in this case will be registered as a pull upon the dynamometer. If, on the other hand, the supporting wheels are frictionless, then the turning of the wheels of the automobile through the action of its machinery will not result in any pull upon the dynamometer, for if frictionless, the supporting wheels can offer no reaction for such a pull. The supporting wheels are, in fact, neither blocked nor frictionless, but the design is to have them turn against a resistance the value of which may be varied at will. The arrangement is such that whatever this resistance may be it appears as a stress on the draw-bar. The resistance is regulated by means of a friction brake to which reference has already been made. By its adjustment the automobile may be made to pull any amount on the dynamometer; it may run under a light or a heavy load as may be desired. In all cases the energy delivered by the automobile is the product of the pull exerted at the drawbar into the distance passed over by the tread of the driving wheel. Thus, the horse-power delivered is equal to the pull upon the dynamometer in pounds, multiplied by the space passed over in one minute by the automobile driving wheel, divided by 33,000. The space passed over is most conveniently found by determining the number of revolutions of the supporting wheel since the latter is of fixed diameter; that is, the determination is based upon the length of the path traveled rather than by the revolution of the driver.

Fig. 4 is a photograph of the plant with automobile removed, looking toward the dynamometer. Fig. 5 is a partial view of the opposite end showing the traction dynamometer, and Fig. 3 shows the supporting wheels and the friction brake.

While the plant will lend itself to studies of a highly refined character, it is proposed during the present winter to determine the output of power under various conditions of running of a considerable number of typical machines.



Fig. 4—Mounting Platform of Automobile Testing Plant.



Fig. 5—Dynamometer for Automobile Testing Plant.

The Cost of Locomotive Operation.

XXI.

BY GEORGE R. HENDERSON.

(Continued from page 70.)

UP AND DOWN HILL.

Instead of a continuous slope in one direction only, let us consider a division of 150 miles, with a summit at the middle. This will, perhaps, be nearer to existing cases than the former supposition. The same locomotive will be selected for our calculations, and we will also assume that the down hill trip or portion will be run uniformly at 30 miles an hour. The grade of 1 per cent. will be ample to maintain this velocity without any assistance from the engine; indeed, the brakes will have to be used to prevent the train running away. From this it is apparent that on the down-hill part only sufficient coal and water need be used to run the air pump and make up for radiation. The former would require only about 10 cents worth of coal for the 75 miles down grade, and the latter would be the same no matter what the train load; from this it is evident that we can, without sensible error, consider that coal and water will be used on the 75 miles of up-hill only. As both sides are 1 per cent. we can refer largely to table A (see *Railroad Gazette* Jan. 5, page 11) and proceed to construct table E.

TABLE E.

1. Speed up hill, miles per hr.	5	10	15	20	25	30
2. W't train, tons back tender.	1,450	1,430	1,100	800	560	400
3. Ton-miles per trip.*	217,500	214,500	165,000	120,000	84,000	60,000
4. Run'g time, hrs. bet. trmnls	17.5	10.0	7.5	6.25	5.5	5.0
5. Actual time, hrs. bet. trmnls	21.0	12.0	9.0	7.5	6.6	6.0
6. Average speed bet, trmnls.	7.2	12.5	16.7	20.0	22.7	25.0
10. Cost of coal, per trip.....	$18.75	$30.00	$20.25	$15.00	$12.00	$9.37
11. " " water, per trip....	2.80	4.50	3.05	2.25	1.80	2.40
12. " " lubrication, per trip	.50	.50	.50	.50	.50	.50
13. " " supplies, per trip..	.20	.20	.20	.20	.20	.20
14. " " repairs, per trip ..	16.50	16.50	13.88	10.85	9.00	7.88
15. Allowance, renewals, pr trip	1.50	1.50	1.50	1.50	1.50	1.50
16. Pay, of engineman per trip.	14.70	10.50	10.50	10.50	10.50	10.50
17. Cost of handling, per trip.	2.00	2.00	2.00	2.00	2.00	2.00
18. Interest allowance, per trip	2.60	1.70	1.40	1.25	1.16	1.10
20. Cost, train supplies, pr trip	2.25	2.25	2.25	2.25	2.25	2.25
21. Cost, car repairs, per trip..	32.60	32.10	24.80	18.00	12.60	9.00
22. Pay of trainmen, per trip..	16.90	12.08	12.08	12.08	12.08	12.08
23. Cost of movement, per trip	111.30	113.83	92.41	76.38	65.53	58.78
24. Cost, 1,000-ton miles, net..	.51	.53	.56	.64	.78	.98
25. Million ton-miles pr month	6.00	9.05	8.50	6.89	5.20	3.92

*Tons back of tender.

With Reduced Train-loads, Cost and ton-mileage

400 tons	1.02 / 1.66	.86 / 2.54	.87 / 3.08	.89 / 3.46	.93 / 3.73	.96 / 3.93
600 "	.78 / 2.48	.67 / 3.72	.69 / 4.63	.71 / 5.19		
800 "	.65 / 3.31	.58 / 5.08	.60 / 6.17	.64 / 6.90		
1,000 "	.58 / 4.15	.52 / 6.36	.56 / 7.73			
1,200 "	.54 / 4.98	.50 / 7.62				
1,400 "	.51 / 5.80	.52 / 8.90				

Line 1 gives the running speed for the up-grade portion, same as in table A, and of course lines 2 and 3 will be the same as in table A. Line 4, the running time between terminals, will be half of that in table A (75 miles up hill) plus 2½ hours, as at 30 miles per hour that time will be required to come down the last 75 miles from the summit; thus $\frac{30}{2} + 2.5 = 17.5$, etc. In line 5 we have added 20 per cent., as before, to the values in line 4. The average speed between terminals, line 6, is 150 miles divided by line 5, and we notice that these values are all higher than formerly, except in the last column, which is the same for both.

Lines 7, 8 and 9 need not be extended, as we can take the cost for coal and water at one-half that given in table A, in consequence of considering that steam is required on the 75 miles of up-grade only. Lines 10 and 11 are, therefore, given at one-half the previous values in table A. Lines 12 and 13 follow table A without change, as they are based on engine mileage only. Line 14 is one-half of that in table A plus 75 cents, thus $\frac{31.50}{2} + .75 = 16.50$, as the tractive effort will be identical for 75 miles (half the distance), and the last 75 miles being run without steam, only one cent a mile will be charged.

Line 15, renewals, being based on engine mileage, will remain unchanged. As the average speeds are now greater, we shall have a reduction in the pay of enginemen (line 16) in the first two columns, but after that the amounts will be the same, being based on mileage only. The cost of handling (line 17) will, of course, remain as before. The time of trips being shorter, line 18, interest, will be less, except in the last column, it being computed at 10 cents an hour for the time of trip, plus five hours for lay over.

Lines 20 and 21, train supplies and car repairs, will remain as before but line 22, pay of trainmen, will reduce in a manner similar to that of enginemen, and for the same reason. Lines 23, 24 and 25 were computed in the same manner as in table A, and the effect of the 75 miles of down grade is at once apparent in the reduced cost and greater movement per month.

By a process as explained in connection with tables C and D, the lower portion of table E has been calculated, and the results laid off for graphical inspection in Fig. 12. As before, we have our minimum cost at about 10 miles an hour running speed up grade, but while in the previous case this corresponded to an average speed between terminals of 8.3 miles an hour, it now means 12 miles an hour (as shown by the lower speed figures), or an average running time of 15 miles an hour. The cost is 50 cents per 1,000 ton-miles, instead of 70 cents, and this is the lowest possible figure attainable by any combination of speed and load. (This would correspond to about 3 mills per revenue ton-mile if all expenses were included, but no light engine mileage or empty hauls had to be paid for.)

The total movement per engine month is shown by the right-hand diagram. Here the highest possible figure is 9,000,000 ton-miles a month, which is, however, only two-sevenths greater than in the former case. The crossed dot indicates that the best results, considering both cost and movement, can be obtained by loading to 1,300 tons (150 tons less than the full load for the engine) and running up hill at 11 miles an hour, or average speed including 20 per cent. of delays, of 13 miles an hour. Under these conditions the cost would be about 51 cents per 1,000 ton-miles and about 8,500,000 ton-miles (back of tender) could be taken by each engine per month.

The cost of fast freight and stock trains is again apparent. If a train is to average 25 miles an hour we see that the cost will be $1 per 1,000 ton-miles double what was possible with slow freights, and only about half as much tonnage could be moved per month. Again, if engines are loaded, as they in all probability would be, with 1,450 tons, the average speed would be 10 miles an hour, which would ordinarily be considered quite fair; but if a congestion of traffic occurred by diminishing the load 10 per cent., or to 1,300 tons, 1,500,000 ton-miles more could be made a month, and the cost of movement actually decreased. This being the case, there is little to recommend the extreme load for ordinary operation; except for the personal satisfaction of making a paper record and endeavoring to please the "man higher up" who may happen to be so thoroughly imbued with the advantage of a big train load, that the real cost of operation has been overlooked by him.

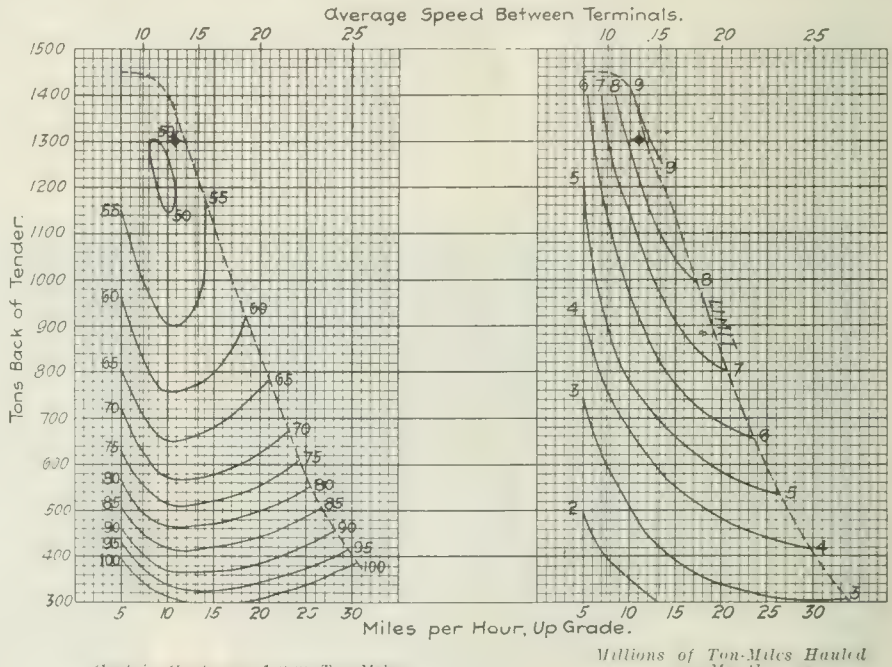


Fig. 12—Cost of Locomotive Operation.

Undulating Profiles.

It often occurs that a division lies across country, that is, over ridges of hills, and so makes a "saw-tooth" profile. Let us consider 150 miles as before, divided into 10-mile stretches of 1 per cent.

grade up, 1 per cent. down and level; that is, there may be 10 miles of level track, followed by 10 miles up-hill and the same distance down grade, this sequence repeated five times over the division. This will constitute an undulating profile and we should see what effect the level stretches will produce.

By means of the thin sheets, Figs. 7 to 10 (see *Railroad Gazette*, March 31, 1905, page 313), we can determine the coal consumption in connection with Fig. 2, also the maximum speed which different loads can be taken on a level. In a similar manner we will calculate the cost of trips running up-hill at speeds of 5, 10, 15 and 20 miles an hour, with train loads of 800 tons and upwards to the capacity of the engine. We will assume that all down-hill movements are made at 30 miles an hour, and on the levels a speed as great as the train load will permit. When we use the greatest load that can be taken up the 1 per cent. grades at the speeds considered, viz., 1,450, 1,430, 1,100 and 800 tons respectively, we find that the engine can make on a level 32, 33, 37 and 42 miles an hour accordingly. With lighter trains, higher speeds can be obtained. By taking these various factors into account we were able to produce Fig. 13, in which the curves have not been extended to

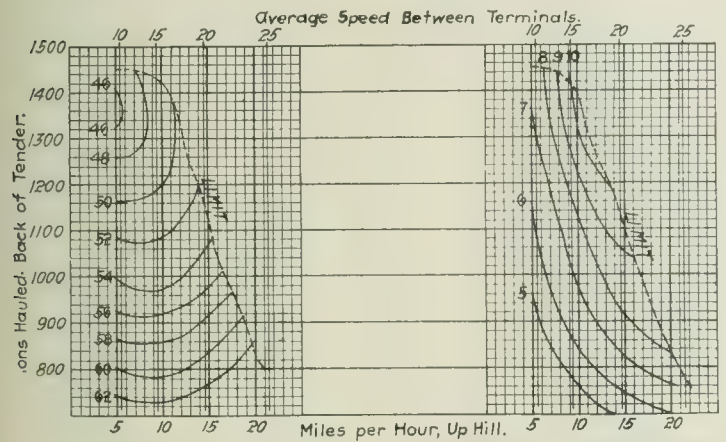


Fig. 13—The Cost of Locomotive Operation.

quite as light trains as in Fig. 12. We are at once struck by the fact that the minimum cost curve (46 cents) is confined to the five miles an hour up-hill line—the average speed between terminals is, however, nearly 10 miles an hour, or a running speed averaging 12 miles an hour, if the lay-over allowance be extinguished. The cost is generally reduced from 3 to 5 cents per 1,000 ton-miles, and the rate of increase for higher speeds is not so great.

The right-hand diagram shows nearly 2,000,000 ton-miles per month more work done for the same up-grade speed and loads, but nearly the same for comparative average speeds, as we should expect. The principal difference is in the wide separation of the schedules of minimum cost and maximum work. In Fig. 12 there is only about two miles an hour difference in speed between these two combinations; in Fig. 13 there is about seven miles difference in average speed, and the variation in cost is about 4 cents instead of 2 cents.

We again see that the most economical rating is not the maximum which the engine can haul on the hills, but is slightly less, perhaps 100 tons. In general the characteristics are similar, for Figs. 11, 12 and 13, but there is sufficient difference to indicate the importance of having a chart made for each operating division, embodying the peculiar physical characteristics of each.

Figs. 12 and 13, indicating that the most economical and also most efficient (capacity) speed is about 12 miles an hour between terminals are corroborated by the recent tests of one of the largest railroads in this country, from the results of which it was found that 12 miles an hour (between terminals) gave the minimum cost per car mile and also the maximum car mileage per engine month. Other roads have lately found the same to be true, though little has been printed on this fact.

(To be continued.)

When there has been a serious accident on the Prussian State Railroads, at the next session of Parliament the Minister of Public Works is sure to be called upon for explanations, and all sorts of suggestions for preventing such disasters are offered by members. Last summer 14 people were killed in a collision, and last December Minister Budde was asked to tell why. His answer indicates that even Prussian discipline does not always secure obedience to orders. "As head of the administration, of course, I made a thorough investigation, which made the causes of the accident clearer than is often possible. A professor teaching train running might have cited this case as an example where an accident on a single-track railroad would not be possible; and when he were told that in this case seven different persons acted directly against their instructions, he would probably have said that was impossible." He reported that all employees directly or indirectly responsible for the accident had been dismissed from the service, which means a great deal more there than it would here, because the larger number of them must have been members of the corps of railroad employees, who have substantially a life service, as much so as our regular army officers. It is also notable that this announcement was received with applause by the Parliament.

Train Accidents in the United States in December.[1]

*rc, 1st, Delaware & Hudson, East Windsor, N. Y., a freight train which had been unexpectedly stopped on account of a hot journal was run into at the rear by a following freight, making a bad wreck. The wreck took fire and a part of it was burnt up. One brakeman was killed.

eq, 1st, Southern Railway, Ramsey, Ind., a freight train was derailed by a broken truck and 13 cars were wrecked. A tramp was killed.

*rc, 2d, Philadelphia & Reading, Annville, Pa., a freight train which had been unexpectedly stopped was run into at the rear by a following freight, making a bad wreck. The wreck took fire and was mostly burnt up. Five trainmen were injured.

dn, 3d, Lehigh Valley road, near Penn Haven, Pa., a freight train consisting of a locomotive and 60 cars became uncontrollable on a steep descending grade and was derailed at a curve. The engine and 15 cars were wrecked.

rc, 5th, St. Louis, Iron Mountain & Southern, Alexandria, La., rear collision of freight trains; one fireman killed and one other trainman injured.

dr, 6th, 3 a.m., St. Louis & San Francisco, Adamsville, Ala., a freight train was derailed by a broken rail near a trestle bridge, and 14 loaded cars fell 60 ft. to the bottom of a ravine. Two men were killed and two injured.

o, 6th, Central of New Jersey, Palinfield, N. J., the engine of a passenger train running at high speed was badly damaged by the breaking of a side rod. A house near the track was damaged and a boy walking along the street was injured by a stone thrown up by the broken rod.

*bc, 7th, Union Pacific, Rock Springs, Wyo., butting collision between an eastbound passenger train and a westbound freight, wrecking both engines and several cars. The wreck took fire and its combustible portion was burnt up. One engineman, one brakeman, three cooks, two electricians and two mail clerks were killed and eight passengers and 11 employees were injured. The freight train had received an order to wait at Ahsay for four eastbound passenger trains, but waited for only three.

unx, 7th, New York Central & Hudson River, Mott Haven, N. Y., a southbound passenger train was derailed at a switch and three cars were ditched. One of the cars fell against the switch tender's cabin and killed the occupant. Another switch tender was injured.

unx, 7th, Chicago & North-Western, Winfield, Ill., the locomotive of a passenger train was derailed and ditched and the engineman was killed. The fireman and two other persons were injured.

xc, 8th, Hoxie, Ala., an eastbound passenger train of the St. Louis & San Francisco ran into a northbound frieght train of the St. Louis, Iron Mountain & Southern at the crossing of the two roads, and one engine and one freight car were wrecked. A man stealing a ride was injured.

dr, 8th, Texas & Pacific, Boyce, La., a passenger train was derailed by a broken rail and the engine was overturned. Three trainmen were injured.

dn, 8th, Atchison, Topeka & Santa Fe, Corona, Cal., a passenger train approaching the crossing of a line of the Southern Pacific was turned on to a diverging track to prevent a collision, and the engine and baggage car were derailed and overturned. The engineman was killed.

o, 8th, Philadelphia & Reading, Pottstown, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler. Four trainmen and three trackmen were injured.

unx, 9th, Wadley & Mount Vernon, Kite, Ga., a mixed train was derailed and one passenger car and five platform cars broke

---

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more persons.

through a trestle bridge and fell into a river. The conductor and several passengers were injured.

rc, 11th, Northern Central, Woodberry, Md., a freight train standing at the station was run into at the rear by a passenger train and eight passengers were injured.

bc, 11th, Atchison, Topeka & Santa Fe, Newkirk, Okla. T., butting collision between an eastbound passenger train and a westbound freight, wrecking both engines and several cars. Three trainmen and several passengers were injured.

bc, 11th, 11 p.m., Kansas City Southern, Cawthorne, Tex., butting collision of freight trains; one trainman was killed and three others were injured.

xc, 12th, Cleveland, Cincinnati, Chicago & St. Louis, Batesville, Ind., a freight train collided with some freight cars which a moment before had been accidentally pushed out of a siding to the main track. The conductor and one brakeman were killed and the engineman was injured.

dr, 12th, Southern Railway, Curls, Ala., a passenger train was derailed by spreading of rails, and two passenger cars fell down a bank and were overturned. Seven passengers were injured.

unx, 12th, 3 a.m., Southern Railway, Littleton, Ala., a train consisting of a locomotive and a caboose was derailed and wrecked and five trainmen were injured; one of them, the engineman, fatally.

xc, 13th, Chicago, Rock Island & Pacific, Waterloo, Iowa, a passenger train ran over a misplaced switch and into some freight cars standing on the side track, making a bad wreck. Three train men and several passengers were injured.

dr, 13th, 8 p.m., Gulf, Colorado & Santa Fe, Lyons, Tex., a freight train was derailed by spreading of rails and 15 cars were wrecked. The fireman was killed.

rc, 15th, 4 a.m., Pennsylvania road, Coverts, Pa., rear collision of freight trains, wrecking 12 cars and throwing one locomotive down a bank. One engineman and one brakeman were killed and two other trainmen were injured.

rc, 15th, Pennsylvania road, Coatesville, Pa., an eastbound passenger train ran into the rear of a preceding freight, wrecking the engine and four freight cars. The engineman was injured.

dr, 15th, 1 a.m., Illinois Central, Evansville, Ind., a passenger train being transferred from the I. C. to the L. & N. was derailed at a broken rail and the engine was badly damaged. A brakeman was killed.

unx, 15th, St. Louis, Iron Mountain & Southern, Monroe, La., a freight train was derailed and the engine and two cars were overturned. The fireman was killed.

bc, 16th, Seaboard Air Line, Plymouth, Fla., butting collision between a passenger train and a freight; three trainmen killed and three injured.

xc, 16th, 3 a.m., Philadelphia & Reading, Perkiomen, Pa., collision of engines at a crossing. One fireman killed and one fireman fatally injured.

bc, 17th, El Paso & Southwestern, El Paso, Tex., butting collision of freight trains, wrecking the engines and 13 cars. Three trainmen were injured.

rc, 19th, Baltimore & Ohio, Hedgeville, W. Va., a freight train standing at the station was run into by a following freight. The fireman jumped off and was struck and killed by a passing passenger train, and a brakeman riding on the engine jumped off and was killed by being struck by pieces of the wreckage.

bc, 19th, Chicago, Rock Island & Pacific, Waurika, Okla., butting collision of freight trains, making a bad wreck. One conductor killed.

†xc, 19th, New York Central & Hudson River, 106th street, New York City, a northbound passenger train of the New York, New Haven & Hartford running through a crossover from track No. 4 to track No. 3 was run into at the side by a passenger train of the New York Central, also northbound, on track No. 3, the N. Y. C. train having run past distant and home signals set against it. One car of the New Haven train was overturned; one passenger killed, 15 injured. This accident was reported in the *Railroad Gazette* of Dec. 20.

unf, 19th, 3 a.m., Atchison, Topeka & Santa Fe, Lang, Kansas, passenger train No. 17 was derailed at a point where the track had been weakened by the malicious removal of spikes, and the engine and several cars were wrecked. The engineman and express messenger were killed and six other persons were injured.

o, 19th, Philadelphia & Reading, Birdsboro, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler, and the engineman, fireman and one brakeman were killed.

xc, 20th, Illinois Central, Paducah Junction, Ky., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking four cars. A man stealing a ride was killed.

dn, 21st, Pittsburg, Cincinnati, Chicago & St. Louis, Hartsdale, Ind., fast freight train No. 87, first section, was derailed at a misplaced switch and the engine and many cars were wrecked. The engineman and three other trainmen in the engine were injured.

bc, 22d, Southern Railway, Linn, Ala., butting collision of freight trains, wrecking both engines and 16 cars, many of which fell down a bank. One engineman was injured and one tramp was killed.

xc, 22d, Philadelphia & Reading, Perkiomen Junction, Pa., collision between a mink train and a freight train; three trainmen killed, two injured.

*‡22d, Illinois Central, Holly Springs, Miss., northbound passenger train No. 6 was derailed at a loose joint, and six cars fell down a bank. The baggage car and smoking car took fire and were burnt up. One passenger was killed and one trainman and seven passengers were injured. It is believed that the rail joint had been maliciously loosened.

o, 22d, Lehigh Valley, Van Etten, N. Y., the locomotive of a freight train was wrecked by the explosion of its boiler; two employees killed, five injured.

eq, 23d, Lehigh Valley, Catasauqua, Pa., a freight train was derailed by a brake-beam which became loose and fell on the track, and a derailed car ran against the station building, tearing down a part of it. The telegraph operator in the station was killed.

unx, 24th, Denver & Rio Grande, Durango, Colo., a passenger train was derailed and one passenger car fell down a bank. Two trainmen and 15 passengers were injured. John Acord, a passenger, prevented the burning of the wreck by carrying a red-hot stove out of a car to a place of safety.

†rc, 25th, Alabama & Vicksburg, Chunkey, Miss., a passenger train standing at the station was run into at the rear by a freight, and one passenger and the fireman were killed.

o, 25th, New York, Susquehanna & Western, Passaic, N. J., the locomotive of a freight train was wrecked by the explosion of its boiler and two men were scalded, one of them fatally.

bc, 26th, Albany & Hudson (Electric), Kinderhook, N. Y., butting collision of passenger cars; three employees and two passengers injured. One of the cars had failed to stop at an appointed meeting station.

*bc, 27th, Pittsburg, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio, butting collision of freight trains, making a bad wreck, which took fire and was partly burnt up. One trainman was killed.

bc, 27th, Central Vermont, South Royalton, Vermont, butting collision between a northbound passenger train and a southbound freight train, wrecking both engines and several cars. Two trainmen were injured. It is said that the passenger train had run a short distance beyond the station where it should have met the freight, because the engineman, seeing a way freight train standing on the side track, assumed that it was the through train for which he was on the lookout.

bc, 27th, Southern Railway, Flovilla, Ga., butting collision between passenger train No. 15 and a freight train; six passengers and one trainman injured.

unx, 27th, Gainesville Midland, Bethlehem, Ga., a passenger train was derailed and all of the cars were overturned and fell down a bank. Two passengers were injured.

bc, 28th, New York, New Haven & Hartford, New Britain, Conn., butting collision between a freight train and a work train; one trainman and nine laborers injured.

xc, 28th, Pennsylvania road, Aspinwall, Pa., an eastbound train consisting of an engine and two freight cars ran over a misplaced switch and collided with another train consisting of an engine and a caboose, overturning one of the engines and fouling the westbound main track. A westbound passenger train coming along a moment afterward ran into the wreck and every car of the passenger train was knocked off the rails. Two passengers and two trainmen were injured.

unx, 28th, New York & Ottawa, Bay Pond, N. Y., a southbound passenger train was derailed and four cars fell into the ditch and were overturned. Seven persons were injured.

unx, 29th, 4 a.m., Baltimore & Ohio, Baltimore, Md., a car in a freight train passing through the tunnel, not far from the Camden station, was derailed and ditched, and ruptured a compressed gas pipe. The gas rushing out of the broken pipe was ignited from a lamp, and the caboose and cars of the train and a signal cabin were damaged.

*unx, 29th, 1 a.m., Chicago & Erie, Disko, Ind., a freight train was derailed and the engine and 10 loaded refrigerator cars were ditched. The wreck took fire and was partly burnt up. Three trainmen were killed.

xc, 30th, Mississippi Central, Prentiss, Miss., a westbound passenger train ran over a misplaced switch and into the head of a freight train standing on a side track. The engineman and one passenger were injured.

unx, 31st, 2 a. m., Pennsylvania road, Lock Haven, Pa., a passenger train was derailed and several cars were overturned. The fireman was killed and the engineman and several passengers were injured.

unx, 31st, Atchison, Topeka & Santa Fe, Kendrick, Okla., a freight train was derailed on a bridge and the tender and all of the 14 cars of the train broke through and fell to the stream below. The fireman went down on the tender and was killed.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Government Accident Bulletin 97
- Cotton-Piece Goods Rates 97
- New Block Signals in 1905 97
- Politeness to Passengers 98
- The Effect of Sea Water on Concrete 98
- Pressed Steel in Car Construction 98
- New Phases of Railroad Finance 99
- An Important Arbitration Decision 100
- Another New Haven Electric Purchase 100
- Running Engines with Tender in Front 100
- A Mile in 28⅕ Seconds 101
- New Publications 101
- Trade Catalogues 101

ILLUSTRATED:
- Delaware & Hudson Locomotives with Young Valves and Gear 102
- 1906 M. C. B. and M. M. Conventions 106
- New Ore Cars for the Chicago & North-Western 108
- The Acme Rotary Thread Rolling Machine 113
- Beecham Car Transcribing System 114
- Motive Power in Mines 116
- New Record for Turning Locomotive Driving Wheel Tires 118
- The Piper Friction Draft Rigging 119

CONTRIBUTIONS:
- The Care of Locomotive Boilers 101
- To Do Good Work in a Poor Yard 102

MISCELLANEOUS:
- A Chinese Railroad Magnate (Note) 103
- Washington Correspondence 103
- Progress in the Use of the Block System 104
- More About Armour's Refrigerator Business 106
- Green Lights for "Proceed" at Night 108
- Accident Bulletin, No. 17 110
- Telephones on O. R. & N. Telegraph Wires 111
- The Cost of Locomotive Operation 112
- Foreign Railroad Notes 118
- Canadian Railroad Notes 119
- Numbering of Forms 119
- Mr. Stickney on Rate Legislation 120
- Collision in Spite of Automatic Stop (G.N.S.) 33

GENERAL NEWS SECTION:
- Notes 31
- Obituary 34
- Elections and Appointments 34
- Locomotive Building 35
- Car Building 36
- Bridge Building 36
- Railroad Construction 37
- Railroad Corporation News 38

VOL. XL., No. 5. FRIDAY, FEBRUARY 2, 1906.

The Government Accident Bulletin, which is reprinted in this issue, gives the cause of the disastrous butting collision of August 13 (Vermillion, Ohio), in clear terms. As in so many cases in the past, two or three men were in position to check the engineman's recklessness if they had acted promptly. The account of the drawbridge disaster at Bruce, Va., in the same month, confirms the statements, printed at the time, of the astounding way in which an engineman unacquainted with the road was entrusted with a heavily loaded passenger train. Collision No. 16 illustrates a combination of two operators, both young and both lacking in experience, with a "control" apparatus for block signals, which, it appears, did not control. Why should boys of 19 be entrusted with delicate duties at three o'clock in the morning? A wise old superintendent said once, in this connection, that "growing boys" should be expected to sleep in the night, not keep awake. The value of a detector bar, which is so short that it does not always detect, is illustrated in two accidents in this bulletin.

The railroads running from the Missouri river westward are told by the Interstate Commerce Commission that they ought to carry cotton piece goods to Denver at a rate much less than that for ordinary dry goods, simply because most of the roads in the United States east of the Missouri have long made such a reduction. Is not that a highly scientific reason? Another part of the decision against the Boston & Albany and its connections (printed in our news columns) is based on the dictum that the freight rate from Boston to Chicago is a "local rate," which will hardly be acceptable to railroad theorists. When the Commission decides that the rate to Denver (2,000 miles) should be reduced from $2.24 to $1.50 because the railroads accept $1.50 for 3,400 miles, it has a more plausible argument, for freight cannot be carried 1,400 miles for nothing. But even this is based on an assumption the assumption that the $1.50 rate to San Francisco is not below cost. And this assumption is based on the belief that a wise railroad man would not carry for less than cost. There might, however, be good reasons for this, if the volume of traffic were not large. But suppose $1.50 does cover the bare cost of handling (without paying anything toward bond interest, or dividends, or loss on passenger business); and that on the same basis the rate to Denver should be ten-seventeenths of $1.50, or 88 cents; does it follow that $2.24 is too high to Denver? Not necessarily, for it may well be that the Denver traffic ought to pay its full share of interest and profit. In short, it seems to us that the best reason to give in a formal decision for reducing the difference between the Denver rate and the lower rate to San Francisco, is that the Denver merchants will make an intolerable row if their demands are not met—will make life miserable for both the Government authorities and the railroad officers, which is, no doubt, the real reason.

The salient fact about the progress in block signaling which has been made in the United States within the last year, as shown in the table published in the *Railroad Gazette* to-day, is that about 50 per cent. more automatic block signals have been installed than were installed in the year preceding. The increase in 1905 over 1904 is 1,082.6 miles of road signaled; in 1904 over 1903 it was 725 miles. And the increase the year before that was only 500 miles. The increase shown in the total mileage, manual and automatic combined, is not much larger than it was a year ago; but this figure has a different significance, because a considerable mileage of the new automatic signaling takes the place of manual signals. That is to say, a good deal of money has thus been spent in making shorter blocks, providing more safeguards and introducing a more complete equipment of distant signals, which has not made any increase in the aggregate mileage of road signaled. The roads appearing in the table this year for the first time are the Hocking Valley, the Louisville & Nashville, the Oregon Railroad & Navigation Company, the Seaboard Air Line and the Yazoo & Mississippi Valley. The amount of new work proposed for the present year, 2,599 miles, is much smaller than the amount proposed a year ago; but there are probably fewer items which represent good intentions and nothing more. Certain prominent lines which gave us their estimates for 1905, withhold all information on the subject for 1906; but there is no doubt that they will put up many new signals. The Southern Pacific and its allied lines make a remarkable showing. In 1905 they extended their block signaling 470 miles, and this year they intend to do almost 50 per cent. more than that. Some railroads east of the Mississippi, which defer the introduction

of block signals on some of their lines because the business is not thought to be heavy enough, might possibly take a lesson from the wilds of Wyoming and Idaho.

A stationman or a trainman, in giving information to a passenger, should do it in such a way as not to discourage questioning. This is only reasonable treatment of a reasonable passenger, and the duty is so obvious that when the railroad commissioners of Massachusetts, in their annual report, lay it down as a law, one is somewhat surprised and almost inclined to query whether such a commonplace remark deserves a place in a dignified public document. Unfortunately, a very little experience in traveling will usually show to any one the necessity of the Massachusetts admonition; and the need is not confined to the South station, or to Boston or to any state, or to the year 1905. The few passengers who deserve to be kicked out of the station seem to greatly exasperate the tired ticket agent, and the multitudes who ask one or two foolish questions each are constantly helping to confirm the agent's unpleasant feeling; the acquirement of information concerning delayed trains is a difficult and unpleasant task for even the wisest passenger, and the stationman frequently has to give answers which are inevitably received with disappointment or anger; and so the average railroad employee goes on building up for himself a bad reputation. Yet it will be comparatively easy for any superintendent to change the tone of the talk in any or all of his stations if he will only issue a very simple order in line with the Massachusetts recommendation. The first element in such an order is to make it clear that the superintendent himself really desires to give the public prompt information concerning delayed trains, and the second will be to convince the employees that those who are politest and most patient will receive recognition. Those two points cover the ground. A premium for excellence in this line certainly ought to be as profitable to the company as one to a track supervisor whose skill in sandpapering the ends of ties is one-tenth of one per cent. above the average of his fellow-trackmen's records. The only way the superintendent can make agents believe in his good intentions is to carry them out. When a despatcher notifies the superintendent that a certain train is going to be an hour late, why wait half an hour before giving the same information to intending passengers? Or why tell the passenger 40 minutes when the delay is more likely to be 80? If information for the public must all go through the strainer at headquarters, the person who adjusts the meshes of the strainer should be always on duty. Employees are required to be courteous at all times; but here is a piece of machinery which is often essential to the company's courtesy, but which is very likely to be rusty from lack of care. The advice to freight agents by Mr. W. C. Hungerford, which was given in the *Railroad Gazette* of January 26, page 92, is good also for ticket agents, telegraph operators, brakemen and all who deal with the public. It is good to put on your smile when you put on your clothes. And with the telegraph and telephone in use everywhere, the company's part of the smile—prompt and full information—is easily practicable at all times. The telautograph, by which a yardmaster or signal-tower clerk in a large terminal yard gives train announcements in advance to a dozen places in and around the station simultaneously, and without the aid of a receiving operator, embodies a principle which ought to be put in use in multitudes of places. When a reputable newspaper says—as the *New York Times* said recently in connection with a snowstorm delay in New Mexico—that all railroads have, and act on, "an instinctive hatred for explaining their own mishaps and shortcomings," and that there is no sign of improvement, it convicts the railroads generally; for its statement is sincerely indorsed by a jury of the public on which sit many respectable and conservative people.

THE EFFECT OF SEA WATER ON CONCRETE.

Much more attention and investigation has been given in Europe to the matter of the action of sea water upon concrete than in this country. It is, of course, generally known that where Portland cement concrete is exposed to sea water, chemical action between the acids contained in the water and the lime of the cement ensues; and if the composition of the concrete be such that the sea water can penetrate the mass, the concrete will be disintegrated and the masonary ultimately destroyed. Mr. R. Feret, Chief of the Laboratory of Bridges and Roads, Boulogne-sur-Mer, France, an acknowledged authority on the subject, has recently said that no sure means of preventing such failures has been found. And although it has been pointed out that a great many existing marine works which have been standing for a long time demonstrate that Portland cement mortar may be thoroughly durable in sea water, Mr. Feret says that it is not at present known why they have resisted so well, as there is little doubt that the cements from which they were made might have decomposed rapidly if they had been used under different conditions, there are many cases where similar structures have been ruined in a few years. The tests in La Rochelle harbor, France, showed the wisdom of awaiting the lapse of sufficient time before coming to conclusions regarding the durability of marine concrete structures. These tests covered a period of about 40 years, and by the end of that time they served to demonstrate conclusively that if the sea water penetrates the mass the hydraulic binding media cannot resist its action.

In a contributed chapter to Taylor and Thompson's treatise on concrete, Mr. Feret says the real cause of the decomposition has been found to be sulphuric acid combined as a soluble sulphate, the final product in the concrete being a sulpho-aluminate of lime, which causes the disintegration; therefore, cements rich in lime are the most quickly decomposed. Moreover, for cements intended for marine use the aluminum should be kept as low as possible. The Administration of Public Works in France limits the amount for such uses to 8 per cent.

Experiments disclosed a distinct difference in the method of decomposition, depending on whether the sea water in which the concrete is immersed remains perfectly quiet, or conditions enable a continuous filtration to occur. In the latter case the mortars or concretes from coarse sand remained intact during the life of the experiment, while the degree of activity of the decomposition increased correspondingly as the amount of fine sand was increased. It is of considerable interest to know that instances of destruction of concrete or mortar by sea water have in most cases been proven to be due to the use of too fine sands, and the obvious remedy is the use of a concrete of great density, which will be as nearly impervious as practicable. As fine sand should be omitted from this concrete, and a screened coarse sand would in most cases make the mixture too costly, the use is suggested, where possible, of a good puzzolanic material, which assures a mixture of great density when ground in with the cement.

In a recent number of London *Engineering* Mr. J. Watt Sandeman, M. Inst. C. E., writing on this subject, asserts that he has had abundant proof of the permanent stability of dock and pier works he has built of impervious concrete. He fails to say how long these structures have been standing, so that in the absence of that information and in consideration of the La Rochelle results his assertion will have to be accepted with some reserve. He submits four tables of proposed standard proportions for concretes, two of which are for sea works; one giving mixtures for certain specified special parts of such works, and the other giving mixtures for such structures as sea piers and dry docks, reservoir walls, etc. Since the maximum of life for such structures, according to present knowledge, is proportionate to the degree of imperviousness of the concrete, these tables will be received with interest.

PRESSED STEEL IN CAR CONSTRUCTION.

In its issue of January 19 the *Railway Age* took exception to some statements made in an editorial on "Car Building in 1905," which appeared in these columns on the twelfth of January, and made it appear that we were preaching "a pressed steel funeral sermon." The paragraph most severely criticized said:

"The use of pressed steel shapes is becoming less each year. Most of the steel cars built last year had structural steel underframes or sills built up of plates and angles."

The *Railway Age* says:

"The *Railroad Gazette* fell into error doubtless by not studying more closely the detailed statistics of cars ordered during 1905, published in the *Railway Age* of January 5. The Pennsylvania ordered 50,000 cars, the Baltimore & Ohio 10,000, the Harriman Lines 10,000, the New York Central Lines 4,000; a total for the four systems of 74,000 cars, all of which were specified to be built of pressed steel or with pressed steel underframes. We are informed on the authority of manufacturers who know what they are talking about that among the cars enumerated in our tables, 81,143 are known to have been specified to be built of pressed steel or to be equipped with pressed steel underframes. Doubtless some small items have been omitted, and the real facts, if they could be known, would show that the number is closer to 100,000 than to 80,000. Furthermore, a careful checking of our freight car list for 1905 by competent authorities places the number of cars in that list known to be of steel at 148,493. That is to say, that of the total number actually known to be specified for steel construction, at least 55 per cent. called for pressed steel."

If we fell into error by not studying our contemporary's detailed statistics, we are thankful that we did not look to them. Had

we given them study we might have fallen into almost as serious errors as has our contemporary. It is quite true that the Pennsylvania ordered a large number of steel cars last year, but not all of them were equipped with pressed steel underframes. At least 8,500 were class Gla hopper cars, having structural steel underframes, this design having been adopted as standard by the Pennsylvania some time ago. It is also interesting to know that all of the recent designs of other classes of cars for this system which employ deep pressed steel center sills have reinforced flange angles riveted to the webs giving a flange on each side of the web. The Baltimore & Ohio still uses pressed steel sills for box cars, but the most recent designs of gondolas have sills built up from flat plates and angles, and in the standard hopper cars, channel center sills are used. Of the 10,000 cars ordered by this company which our honored contemporary says were to be built with pressed steel underframes, 6,500 are known to have been ordered with structural or built-up sills. The Harriman lines ordered 10,000 cars in 1905 with pressed steel underframes under a royalty agreement with the Pressed Steel Car Co., but of this number only 3,745 were delivered up to the end of tne year; and it should be remembered that we were not basing our statement on the number of cars *ordered*, but on cars BUILT. This was made clear in the editorial to which the *Railway Age* took exception. The Lake Shore ordered 4,000 steel cars, but the drawings of these cars show them to have channel center sills. If we deduct from the total given by the *Railway Age* the number of cars erroneously included in its figure and calculate the per cent. of the total by their estimate, the result is nearer 30 per cent. than 55 per cent. *specified* to be built of pressed steel. It may be well to define here what we mean by pressed steel underframes. The generally accepted definition of a pressed steel underframe is an underframe in which the principal members (the longitudinal sills) are formed from one piece of plate and pressed into the desired beam section with forming dies; the section may be a Z or a channel.

There are only three car building companies equipped for making pressed steel underframes. Three other plants built cars with pressed steel underframes which were bought from one of the three makers. The combined output of cars of pressed steel construction by five of these companies in 1905 was less than 11,000 cars, and the output of the other one company was but little more, which makes the total figure for pressed steel cars built in 1905 about 30 per cent. of the total output, or in the same proportion as cars ordered. The five builders first mentioned each built a much larger number of cars with structural steel underframes than with pressed steel underframes, and the other one built several thousand cars with structural underframes.

The real tendency in car construction cannot be shown by totals and per cents. The surest indication is the development of new designs, the change from one type of construction to another. When the Pennsylvania adopts structural construction for hopper cars, and is obliged to reinforce its pressed steel designs with angles riveted on the flanges, when the Baltimore & Ohio goes even farther and designs new cars with sills built up of flat plates and angles as in any plate girder, and when almost without exception every new design brought out last year by other railroads and by all but one of the large car building companies employed structural or built-up sills we think the statement that "the use of pressed steel shapes is becoming less and less each year," is entirely justified by the facts. Again, our friendly contemporary, in concluding its obituary based on our "pressed steel funeral sermon," places the *Railroad Gazette* in a false light as to its attitude toward the use of steel in car building. We have never argued against the use of steel in any form in that industry.

NEW PHASES OF RAILROAD FINANCE.

The observer of railroad finance who, during the last half decade, has seen the periodic upward flights of railroad securities in the stock market, has also had opportunity for some acute historical contrasts. His records, and if he is old enough, his personal memories, go back to earlier days, when a few railroad stocks and a very occasional bond at a high interest rate comprised the whole Wall Street list. Next he finds a time when stocks have somewhat subdivided into common and preferential, and bonds separated, too, into classes. And so moving down the years he reaches the present impressive epoch with its multiplied groups of bonds of late expanded into the "short note" idea common stocks that a few years ago were far behind the preferentials now soaring far above them and the convertible debenture coming to have a place of its own. Variety, volume, novelty are the characteristics of the railroad security market; and their bearings both on investment value and on the future of railroad financing becomes a subject worthy of thought.

When we speak of investment values we, of course, refer to values that are genuine, and to the investor in railroad securities who seeks real values. We do not refer to "fiat" values or to the mere speculator who buys them for a turn, and who may be called the creature of a day. But, taking even this test of a value more or less genuine, and of an investment that is not transitory, the railroad investor of to-day faces some rather confusing conditions. Great railroad corporations continue to pour out new issues of bonds, most of them necessarily of the junior type, the legal limit of the senior mortgage having expired long ago. The company itself is showing probably immense earning power, and the new securities range pretty high in the market. But the investor has had no test of experience by which to make his forecast for a long investment. No such conditions of immense railroad expansion and systematic consolidation have ever faced him before, and in the vast diversity of securities alone there is perplexity. He has considerable reassurance in the fact that the new funds are going into actual improvements, not a few of them meaning increased earning power, and that consolidation of railroad properties means more economical operation. On the other hand, he sees the "terminal improvement" in great cities coming more and more into the foreground. It signifies the acquisition of lands and stations of great intrinsic value, but which, for many years, can add very little to net earning power. Or take again the convertible debenture which figures more and more in railroad financing. Here the investor has to make his "bet" for a long time or short, as the case may be, on the value of convertibility. Often, as in the case of the New Haven debentures of 1903, or the St. Paul or Union Pacific convertibles, the bet has been a profitable one, but it is a bet just the same.

Conservative railroad investors in their relation to the general subject here under consideration may be divided into two classes. The first class, whom we may call the ultra-conservatives, and which includes trustees and savings banks bound by investment statutes, find relatively few difficulties in the present situation. The double gilt-edged type of railroad bonds are still in the market in considerable volume. They have been amplified by refunding into the general consolidated mortgage class of bonds; and even some of the old long sixes and sevens still outstand. So long as this group of investors confine themselves to such railroad securities and are content with an annual return ranging from 3.5 to 3.7 per cent., the present situation is simple, even alphabetical. Not so with the vastly larger, but yet conservative, group seeking the railroad investment that ranges from a 4.1 per cent. return upward. For them the complexifies of the railroad bond market have become very positive facts, exacting acute judgment. For the last few years they have been passing through a veritable campaign of education not yet ended. To secure a good railroad bond returning, say, 4.5 per cent., requires, if we may so put the case, twice the fiscal brain matter that it did ten years ago.

The boom epoch of voluminous issue of railroad securities has also its suggestive bearing on the railroad property itself as well as on the investor. The reassuring facts here are, generally speaking, the expenditure of the derived funds in concrete ways improvements and new equipment both, as a whole, increasing earning power, net as well as gross. Nor do the chills and fevers of the Street on the ups and downs of stocks affect the good steel rail once laid, the train-load of improved cars or the bedrock value of the new bridge structurally perfect. Nevertheless, looking forward to that period of industrial depression which must come sooner or later, the economist must regard as perhaps its most absorbing feature what we may call the ratio of improved operation to expanded fiscal liability. In other words, how far will better roadbeds, heavier rails, stronger bridges and larger terminals offset, in bad times, the great increase of liabilities created to secure those improvements in good times? The period of prosperity and expansion has now been so long that when the new test period of reaction comes it will be by far the most instructive in our railroad annals. Incidentally, it will test as never before the policy of "cutting melons" on the one hand and conservating the dividend on the other the new stock theory as against the new bond theory of railroad extension, each of which has its warm supporters.

Finally, in the study of the present epoch of large and varied expansion of railroad securities must not be omitted reference to the fiscal evolution of the street railway. Exactly in form, but much faster in pace, the street railway has followed the analogy of the steam road as regards those liabilities represented by bonded debt

There has been, though on a reduced scale, the same period of pretty high interest rate, followed, as the electric line has become an institution beyond the limbo of experiment, by a reduced rate of return on all the better classes of securities, and of late a period of very free emission of bonds. At a date not very far away we may look confidently also for subdivisions and multiplied classes of street railway debts and beyond, still, to a test period when the wisdom of creating those debts will be searched by the hard touchstone of bad times. As stated, the scale will be lower, but the process—and probably the results—of the trying out of the financing of street railways will be identical with those of the steam roads; for, though the average street railway carries a much larger burden of watered stock—and, often, watered bonds—it has also, as partial offset, its amazing increments of traffic.

An Important Arbitration Decision.

A question of considerable interest and importance in its bearing on the interpretation of agreements or contracts between railroad companies and their conductors, trainmen, enginemen and firmen was settled in Colorado by arbitration week before last. When the Colorado Springs & Cripple Creek District Railway and the Midland Terminal Railway were consolidated last summer, General Manager Waters of the consolidated lines reorganized the train service of the two in conformity with the purpose to operate them as a single line. In the execution of this purpose a joint service of train and enginemen was established, retaining such portion of the employees of each line as was requisite to the traffic requirements of the unified lines. Also, the "Short Line" (C. S. & C. C. D.) schedule, which was more favorable as to rates and conditions than the Midland Terminal schedule, was extended over the latter line. As far as practicable the men of each line were permitted to continue on the runs held prior to the combination, but where conditions of service required, Midland Terminal men were sent temporarily or permanently to the "Short Line" and vice versa. "The Short Line" men objected to any such transfer of men, holding that it was a violation of the arrangements with enginemen and trainmen regarding their rights to preferment entered into with the management of their road prior to the consolidation. In other words, they objected to men from the Midland Terminal being assigned to rights and standing on the C. S. & C. C. D. over men older in the service of that road. They wanted the employees of the two lines kept separate, just as when the roads were independent of each other; and if the demands of the service necessitated Midland Terminal men being brought to the "Short Line," they must quit the former and be hired on the latter as new men under the 50 per cent. clause.

As a matter of fact, the Midland Terminal is five years older than the "Short Line," but General Manager Waters recognized that the employees of the younger line had seniority rights acquired thereon which he desired to regard as fully as was compatible with the new conditions, and as they had declined to join the Midland Terminal men in preparing a seniority list for his use, he adopted a plan that was more than fair to the "Short Line" men. He permitted the senior man on this road to retain his rank, regardless of the line on which he served, putting the oldest Midland Terminal man second on the joint-service roster, and thus alternated the men down the list until the requisite force had been made up.

But despite its magnanimity, this arrangement was not acceptable to the "Short Line" men and they appealed to the grand officers of their respective national organizations. Efforts of these grand officers and committees representing the conductors, trainmen, enginemen and firemen to have the management acquiesce in their views and modify the organization in accordance therewith lasted through the fall without any settlement being reached. The situation became considerably strained, and, in fact, reached a stage where the possibility of a strike was indicated. However, at this point, which was early in January, an agreement was reached by General Manager Waters and the committees to refer the matter to a board of arbitrators composed of three members, the question to be arbitrated being substantially as outlined in the foregoing, regarding the right of the general manager of the consolidated lines to transfer men from one to the other and accord them the standing described without violating the agreements dated prior to the consolidation and claimed still to be in effect on the C. S. & C. C. D. It was agreed that in case of a decision for the company, the roster already made up should obtain; but if in favor of the men, the employees would be returned to their respective properties with their former rights and standing.

Mr. W. E. Symons, late Superintendent of Machinery of the Kansas City Southern, was chosen by the company, and Mr. P. H. Morrissey, Grand Master of the Brotherhood of Railway Trainmen, was chosen by the employees. These two agreed upon Mr. Charles Dyer, of Denver, formerly General Superintendent of the Colorado & Southern, and now engaged in business, as the third member. After a careful hearing of the evidence and argument the Board of Arbitrators sustained the general manager, basing their decision on the doctrine that unless rates of pay were reduced or other similar loss or hardship resulted from the joint service, no violation of agreement existed; the changed conditions not only giving the general manager the right but making it his duty to reorganize the two forces into an efficient unit. In accordance with their agreement, the men accepted and will abide by the decision.

Another step in tightening the control of the New York, New Haven & Hartford road over the electric railroads of Connecticut and in lessening the possibilities of through electric competition was taken last week in the New Haven's purchase, through its holding company for electric properties, the Consolidated Railway, of the property and franchises making up a proposed through electric line from Hartford, Conn., to Worcester, Mass. The new line was to have been built by interests in control of the Boston & Worcester Street Railway, which operates a double-track electric line from Boston to Worcester. About a year ago they bought the Hartford, Manchester & Rockville Tramway, which owns a line from a connection with the Hartford Street Railway, over whose tracks it has running rights into Hartford, to Rockville, Conn., 16 miles northwest of Hartford. The new owners immediately announced their intention of filling in the gap of some 50 miles between Rockville and Worcester, and operating a high-speed trolley line all the way between Boston and Hartford. The new line was projected by way of Stafford Springs, a point in Connecticut northwest of Rockville and near the Massachusetts line. The New Haven's purchase includes the Hartford, Manchester & Rockville company, the partly-built line from Rockville to Stafford Springs, and the rights to complete the line into Worcester. This purchase brings under the control of the New Haven road a short electric line which parallels one of its branches and makes its ownership of the electric railroads of Connecticut even more secure. As yet the Connecticut Railway & Lighting Company, with its 125 miles of main track, and controlling the electric systems of Bridgeport, Waterbury, New Britain, Norwalk, Ansonia and Derby, and a through line from Stamford to Seymour, 42 miles, paralleling the New Haven's New York division from Stamford to Bridgeport, has not been taken over, but that this will sooner or later be the outcome of Mr. Mellen's electric campaign can hardly be doubted. An interesting feature of the new purchase lies in the fact that the projected line threatened not so much the New York, New Haven & Hartford as the Boston & Albany, whose line the Boston & Worcester already parallels over the first 44 miles out of Boston. Successful operation of the complete Worcester-Hartford electric line would have hurt the Boston & Albany on its 99-mile Boston-Springfield haul more than the New York, New Haven & Hartford on its 26-mile haul from Springfield to Hartford. Nevertheless, even this threatening of one part of the New Haven's monopoly was enough to persuade that company to take over the new line at a price which afforded a good profit to the Boston & Worcester interests.

The railroad commissioners of Vermont, in reporting recently on a grade crossing accident, killing two persons in an automobile, declare the Rutland Railroad partly at fault, because the engine of the train was running backward. If it had been running "chimney in front" (as the English say) the engineman's view would not have been obstructed by the tender and he would have been on the inside of the curve at the point of the accident instead of the outside; and if he had been keeping a good lookout could have so slackened speed as to give the automobile time to cross in safety. The driver of the automobile (and all the persons in it) were very careless and the commissioners justly hold that he was primarily at fault. He was traveling faster than the law allows and took no pains to look out for crossings. But "the Rutland Railroad Company at the time of the accident was operating its train in an unsafe manner. To draw a train with engine backing is a dangerous practice and is excusable only in cases of necessity. The Rutland Railroad Company from choice has elected to so operate the engine on this train (a very short run) for more than two years last past. There are facilities at North Bennington for turning the engine but upon the plea of congested yards the "Y" has been used for storing cars and not left open for the uses for which it was originally intended. . . . It is therefore ordered that on and after the first day of February, 1906, said Rutland Railroad Company cease to operate its passenger and freight trains on the Bennington branch except with the engine ahead and headed in the direction in which the train is to proceed, unless permission in writing to otherwise operate its trains on the Bennington branch is first had and obtained of the Board of Railroad Commissioners of the State of Vermont." At any but very moderate speeds, running the tender ahead is in many cases dangerous to the train, as well as to vehicles crossing the track. Whether or not the Vermont commissioners took this other danger

into account, does not appear; but the strong language used would seem to indicate that they did. Whether it be from poor design or maintenance, making the tender truck unfit to curve, or from a top heavy or ill-balanced load of coal or an unstable load of water, tenders do jump the track, when no other cause is discoverable, and cases of this kind help to swell the column of "unexplained" derailments in the accident records. It would have been a good thing if the Vermont commissioners had embodied in their report a deeper study of the subject.

At Ormond, Fla., January 24, an automobile was driven five miles on the beach in 2 minutes, 47 seconds; or at the rate of 107.8 miles an hour. This was at the races held under the auspices of the American Automobile Association. The machine was a 30 h.p. Stanley steamer, and it was driven by Fred Marriott. There was a strong north wind, which helped the drivers to make high speed. Marriott, as well as his competitors, made a rolling start. On the 26th, Mr. Marriott broke the record for one mile and for one kilometer, traversing a mile in 28⅕ seconds (127.7 miles an hour), and the kilometer in 18⅖ seconds; and on the 29th Victor Demogeot, with a Darracq 200 h.p. motor, made two miles in 58⅘ seconds (122.4 m.p.h.). The speeds made in these, and other trials on the Florida beach, are spoken of as "the fastest time ever made by anything on earth," but the report of the experimental runs with electric cars made on standard railroad track, between Berlin and Zossen, Germany, in 1903, says that a speed of 210 kilometers (130½ miles) an hour was reached at that time (Oct. 27; *Railroad Gazette* Nov. 20). For how many miles this rate was kept up is not recorded; for the whole distance of 14.3 miles the rate was 107 miles an hour.

NEW PUBLICATIONS.

Railway Signal Association. Proceedings for 1905. H. S. Balliet, Secretary, 335 Madison Avenue, New York City. Single copies, 25 cents.

This is a book an inch thick, and the body of the report takes up 360 pages. It contains the full reports of the meetings of January, March, May, September and October. All these were given, in briefer form, in the *Railroad Gazette*. The standard specifications for mechanical interlocking and material for construction work are given in this report, and the heading says that they were adopted by the association on October 11, 1905. The report on organization of the signal department, which was presented at the October meeting, contains 29 diagrams showing the organizations of that number of prominent roads. The Secretary's reports of the several meetings are in brief form, occupying only 32 pages for all the meetings of the year; and the papers read at the several meetings, with the discussions on them, are given by themselves in the pages following the reports of the meetings. All the matter on a given subject is collated by itself, so that a topic which has engaged the attention of two or more meetings can be found in one chapter.

Welfare Work. By H. H. Vreeland. Issued by the National Civil Federation, 281 Fourth Avenue, New York City.

This is a little pamphlet of only 24 pages, 5 in. x 7 in., but it contains much more material than many a book five times its size. Mr. Vreeland is the well-known President of the New York City Railway Company, operating the surface street railroads of Manhattan, New York City, and the pamphlet is the record of an address which he gave recently before the New England Cotton Manufacturers' Association. Mr. Vreeland is nothing if not practical, and without the least rhetorical flourish he has packed his address full of actual examples of good work done by large manufacturing and mercantile establishments for the comfort of their employees when the employees are not on duty. The pamphlet has pictures on nearly every page, so that he who runs may read—by pictures. Among the pictures are a girls' lunch room at the cash register factory in Dayton, Ohio; a street railway employees' pool room in New York City; a can for keeping drinking water cool on Pennsylvania Railroad locomotives; the physical exercise department for girls and women in a New York department store; an athletic field for the employees of a factory in Plymouth, Mass., and a cottage such as the Ludlow Mills, at Ludlow, Mass., rents to its employees, contrasted with a view showing how factory employees live when the company leaves them to their own devices. Mr. Vreeland calls attention to the fact, sometimes lost sight of, that the cotton mills of New England were among the earliest concerns in the country to do "welfare work" for employees. Building their factories along the streams remote from the cities, they had to build comfortable tenements in order to keep their workmen. Mr. Vreeland declares that welfare work in large cities may be profitably extended to "careful, sympathetic and unobtrusive efforts to brighten the homes" of the workers. Mr. Vreeland in his youth had to live in a boarding house where he had no warm room in which to sit in the evening, and his sympathy with young unmarried persons who work in cities is therefore of the most practical sort.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾	in. by	6⅛	in.
Pamphlets and trade catalogues	3½	" by	6	"
	6	" by	9	"
	9	" by	12	"
Specifications and letter paper	8¼	" by	10¾	"

Tie Plates.—The Beaver Dam Malleable Iron Co., Beaver Dam, Wis., sends a pamphlet describing its malleable iron tie plates. Four different styles of plates are illustrated and described, including a shouldered, longitudinal flange plate; a somewhat similar design with beveled ends; a flat bottom plate, and a "pierce" plate with transverse flanges of peculiar construction for tight holding. There is also a combination tie plate and rail brace and the Beaver Dam standard rail brace, of malleable iron. The pamphlet is artistic in design.

Variable Speed d.c. Motors.—Bulletins Nos. 3 and 4, issued by the Lincoln Electric Manufacturing Company, Cleveland, Ohio, illustrate and describe in detail the Lincoln variable speed motors. These motors are made in various sizes, with speed ranges from 2 to 1 to 10 to 1, and greater if required. They give a constant h.p. output at all speeds when running in either direction and are made to operate on 110, 220 and 500-volt circuits. The illustrations show the motors as applied to machine tools.

Woodworking Machinery.—The essential features of two heavy woodworking machines are described in circulars issued by the S. A. Woods Machine Co., Boston, Mass. One of these machines is a car-sill dresser and the other is a planer and matcher. Both machines are especially useful for railroad and car shop use owing to their adaptability for dressing heavy trailer and planing and matching boards with equal despatch.

CONTRIBUTIONS

The Care of Locomotive Boilers.

Logansport, Ind., Jan. 26, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The writer was greatly impressed by the paper on the "Care of Locomotive Boilers" by M. E. Wells in the *Railroad Gazette* of January 19. I believe that too much emphasis cannot be laid upon his remarks regarding the effect of cold feed water upon the flues and firebox sheets. He disposes very briefly of the theory that cold air is responsible for flue leaks, and rightly so, for the air from the firedoor has to pass for 9 or 10 ft. over a fire at about 3,000 deg. Fahr. before it comes in contact with the flue sheet, which is never above 500 deg. Fahr. When an engine has been standing for some time and the fire becomes dead in spots, it is perhaps possible to injure the flues if the rake is not used on the fire before putting on the blower, owing to cold air coming through the grate. But the specific heat of air is so low, and owing to its low conductivity the transfer of heat to or from it is so slow that the effect of cold air on the boiler is negligible compared with the temperature changes produced by cold feed water.

As Mr. Wells points out, hot and cold water will not mix in the boiler unless aided by the mechanical effects of circulation and the motion of the engine. There is a striking contrast between the great care taken by the builders of stationary boilers to distribute the feed water inside, and the common locomotive practice of dumping it in through a check valve on the side of the barrel, where it at once falls to the bottom and passes to the throat still cold.

The writer knows of some engines which have the checks on the back head, and when received from the builders, the pipe which runs forward inside the boiler terminated over the nest of flues about 3 ft. from the front flue sheet. Trouble was soon experienced with the mud deposit which formed on the flues under the end of this pipe, and it was therefore bent to one side so as to discharge against the side of the boiler outside of the flues. When this was done, some trouble was experienced with leaky flues in the bottom rows, where there had been practically none before. Placing the checks on the back head of the boiler is in many respects an ideal practice, and if the pipe running forward inside the boiler were stopped at the end and fitted with a number of small horizontal branches below the water line, each branch having an elbow on the end turned upward, the result would be a

thorough mixing of the feed water with the hot water in the boiler, and the heavy deposit of mud on the flues would be avoided. The writer is convinced that relief from the present serious boiler troubles lies only in soft water, reasonable care in the use of the injectors on the road, and eternal vigilance from the time the locomotive comes on the cinder pit till it is ready for the road.

OBSERVER.

To Do Good Work in a Poor Yard.

Hartford, Conn., Jan. 30, 1906.

To the Editor of the Railroad Gazette:

We are hearing a whole lot nowadays about yard operation. Much of it no doubt of interest to those who don't have to directly run yards, but not so much to the poor fellow who is "against it," who has to tell the old man several times a day why and wherefore cars are not moving as they should, or why penalty cars are now and then overlooked. If some kind expert would tell us of better ways and means of transmitting information from the agent to the yardmaster, and checking delivery of same, as well as some good way of following up orders once delivered, he would confer a favor on the man lower down. It is not the ninety and nine cars which are moved promptly that we care so much about, but the one poor stray penalty that hurts. How to save him is the real question. Our expert friends say but little about the necessity for moving empties, and yet Mr. M. T. is the very fellow who needs prime consideration, for if you can keep him out of the way—and he can be kept out of the way only by keeping him moving—you will not have much trouble in keeping your yard O. K.

We must look outside the yard, however, for much that is necessary to help yard working. If trains are put in shape at their starting point, and kept so during the trip, much work will be saved in yards. If a car has to be taken on at an intermediate point there is seldom a good reason for not putting it in the train with other cars of the same classification. Again, running freight trains on a schedule will help the yard situation immensely. Any yardmaster will tell you that it is the "bunching" of trains that plays the mischief with his calculations. Give him trains at fairly regular intervals, and he will take care of them with but little trouble and considerably less yard power than if trains come in irregularly.

Many yards are not as well worked out in detail as one could wish, but, like the poor, they are with us, and just as likely to stay. Many yards cannot be revised, except at prohibitive cost. In such yards, brain power of the best quality must be used in devising operating methods which do not need big outlays for their accomplishment. Perhaps another switching lead, so that two engines could work without interfering, would help out, or a short track for holding cripples (which are made so after classification) might save the time of a train taking on cars. Perhaps the caboose is more or less troublesome, and would be more out of the way, and give the road boys a little better chance to get a few winks of sleep, if it were placed somewhere out of the line of regular switching movements, and yet where it could be reached easily for outward road movement. Perhaps a machinist on the ground regularly would help keep switch engines running all day by a touch here and there, when otherwise they would be forced to go to the shop for an hour or two. The relocation of a water plug, at which an engine fouls two or three tracks, or a lead, would help out, and doesn't cost much.

But all these things cannot take the place of good organization, without which the best physical arrangement of yard is of little use; while with good organization the poorest track arrangement can be made to do fairly good work.

W. J. D.

Delaware & Hudson Locomotives With Young Valves and Gear.

The Delaware & Hudson has in service two ten-wheel (4-6-0) freight locomotives equipped with the Young valves and gear, which have been running since Nov. 21 and Dec. 24 respectively. They are intended for fast freight service and are the first freight locomotives to which this gear has been applied. A full detailed description of the Young mechanism was given in the *Railroad Gazette* Nov. 4, 1904, together with the results obtained on a Chicago & North-Western Atlantic type locomotive running in the fastest and heaviest passenger service of that road. Since that time only one important change has been made in the valve, which is illustrated herewith. The valve on the North-Western engine had two of its packing strips T shaped in section and 1¾ in. wide on the face. Each of these is replaced on the present valve by two strips as shown, which reduces the width of bearing surface ½ in., thereby materially reducing the friction. Also the narrow strips are constantly self-facing.



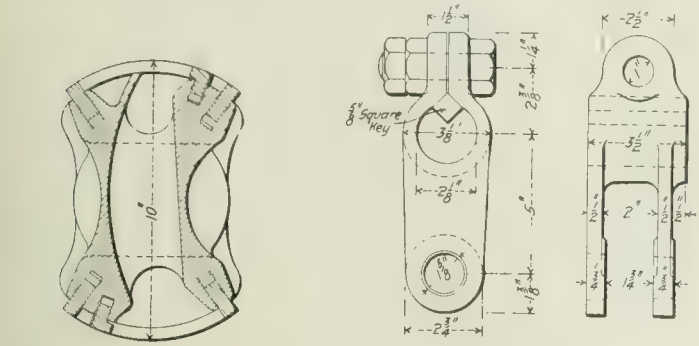
Ten-Wheel (4-6-0) Freight Locomotive with Young Valves and Gear—Delaware & Hudson.

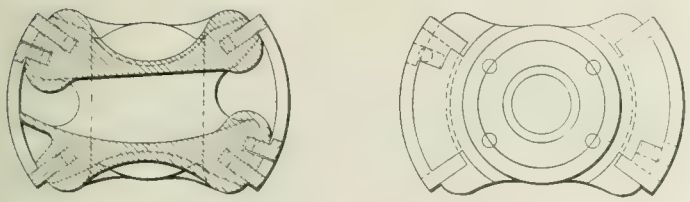
Another detail which has been improved is the valve crank. This was formerly made solid and keyed on the spindle with a drive fit. This made it hard to get off, so the change was made as shown herewith, a clamp fit being used instead, with a key.

The detail of the lead rod also is shown. In the older arrangement there was an auxiliary tumbling shaft across the back of the saddle, to which the wrist-plate bearings were connected. The auxiliary tumbling shaft had connection with the main tumbling shaft through a single reach or lead rod midway between frames, pivoted to a short arm fixed rigidly on the main tumbling shaft. In the present arrangement the auxiliary tumbling shaft is done away with, there being a lead rod to each wrist-plate bearing, which at

its back end is pivoted to the link lifting arm as shown. The two rods are tied together and braced across to make them in effect a single piece.

The valves are set for a constant steam lead for all cut-offs, and for ¼ in. more exhaust lead at a 6-in. cut-off than in full gear; that is, they have ⅛ in. inside lap at full gear, changing to ⅛ in. clearance at 6-in. cut-off. These locomotives have 21-in. x 26-in.

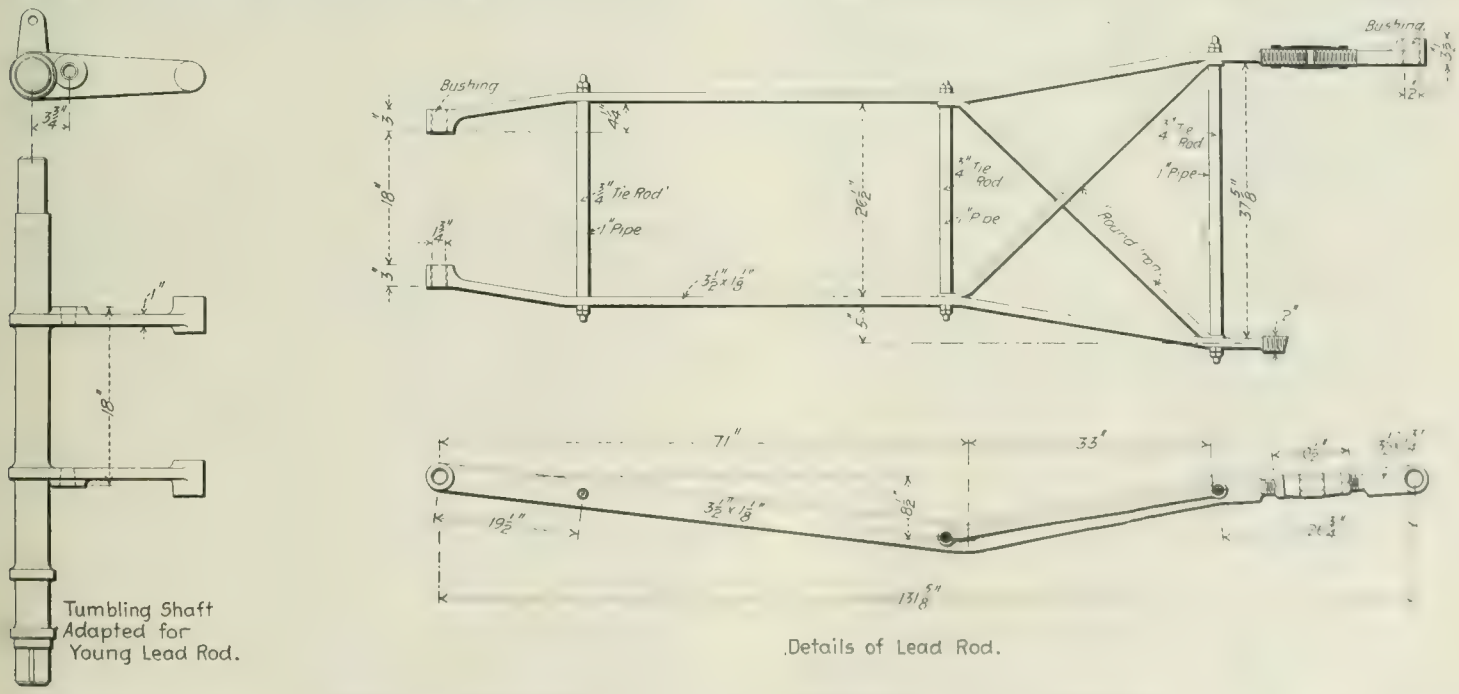




Sections and End View of Valve

cylinders, weigh 130,000 lbs. on drivers and 173,000 lbs. total. They carry 200 lbs. steam pressure and have 63-in. drivers. One of them has been in milk train service for some little time, which has a passenger train schedule, and we understand its performance has been most satisfactory. The other, although intended for fast freight service, has been pulling "drags" in company with consolidations and has also given a good account of itself. The locomotives were built at the railroad's shops.

In this connection it is of interest to mention that the passenger locomotive of the North-Western already referred to ran 133,000 miles before shopping, during which time the tires were not turned, and a $^{1}/_{16}$-in. cut trued them up when the engine finally went to the shop. Other locomotives of this same class with the usual valves and gear have their tires turned three and four times between heavy repairs, which occur on a considerably less mileage than the above.



Details of Young's Valve Gear Applied to Delaware & Hudson Locomotive.

It may be news to most of us that China has any railroad magnates; but we are now assured that one has not only risen but fallen. This is Sheng, once Vice-President of the Ministry of Public Works, and till recently General Manager of the Nanking & Shanghai Railroad, 16 miles of which were recently opened for traffic in American style, with a speech by an adopted son of the late Li Hung Chang. Of Sheng the North China *Daily News* says: "With Sheng disappears doubtless one of the most unscrupulous of all mandarins from the political field. When he had an object to gain, and especially when he feared the loss of his position, he never hesitated a moment to sacrifice a part of his accumulated millions. We all know how much money will do in Pekin." The Ministry recommends the Government to seize the property of Sheng and hold it until an investigation of his conduct of affairs has been made. The accused "happened" to be far distant when he was removed, and a stroke of apoplexy, so his friends say, followed his receipt of the news. His successor is the Mandarin Tang.

Washington Correspondence.

WASHINGTON, Jan. 30.—Debate on the Hepburn railroad rate bill is under way in the House without any special order fixing its limit, but with a general understanding that the vote on the passage of the bill shall be reached about Tuesday or Wednesday of next week. No restriction has been placed on the offering of amendments, as it has been assumed by the House leaders that, the report of the Committee on Interstate and Foreign Commerce having been unanimous, any amendments objectionable to the committee would be voted down. It is not probable that any material amendment will be adopted unless it be one strictly prohibiting the giving of free passenger transportation. The bill will pass the House by an overwhelming majority.

At the Senate end of the Capitol there are indications that progress is being made slowly in the direction of an agreement on a compromise bill that will be able to secure the votes of a majority of the Senate. It is not possible at this time, however, to predict just what that measure will provide, though it seems certain that it will give the courts much more power than is proposed by the Hepburn bill, and will make it possible to have the question of the reasonableness of a rate that has been challenged passed upon at some stage of the proceedings. The idea is gaining ground among Senators that there would be doubt as to the constitutionality of a law that would give the Commission authority to fix a rate and put it into effect without giving the carrier an opportunity to have the question of the reasonableness of the condemned rate or the reasonableness or legality of the order of the Commission passed upon by a United States court. As a consequence of this, the plan of having the question of the reasonableness of the challenged rate passed upon by a court in the first instance, as is proposed by the Foraker bill and the compromise plan of Senator Elkins, is gaining strength. It is impossible to say whether it will be the basis of the final compromise but it is significant that Senator Knox, of Pennsylvania, who has been understood to be one of the strongest supporters of the President, is not satisfied with the Hepburn bill and believes that some provision will have to be made under which it would be possible for the question of the reasonableness of the original rate and of the reasonableness and legality of the order of the Commission to be passed upon by a court.

The importance of the resolution adopted by the House of Representatives on Monday requesting the President to send to the

House all the facts within the knowledge of the Interstate Commerce Commission showing or tending to show a combination or arrangement in violation of the anti trust act between the Pennsylvania Railroad Company, the Pennsylvania Company, the Norfolk & Western Railway Company, the Baltimore & Ohio Railroad Company, the Philadelphia, Baltimore & Washington Railroad Company, the Northern Central Railway Company and the Chesapeake & Ohio Railway Company, has been much magnified. The resolution does not call for an investigation, but only for a report of the information now in the possession of the Interstate Commerce Commission. As the Commission has no information on the subject other than that which has been made public in the annual reports of the several companies involved in the resolution, its report will not add anything to what is already known on the subject. A resolution requesting the Attorney General to report as to why proceedings had not been brought against the Pennsylvania and the other roads, such as was suggested in the Senate on Monday by Senator Tillman, would be a matter of much more importance than the House resolution.

This suggestion was made by Senator Tillman in discussing a letter from the Red Rock Fuel Company, of Philadelphia, that he had had read in the Senate. This company complained that the Baltimore & Ohio road had refused to permit a side track to be built from its line to the tipple of the coal company in Upshur County, W. Va., and said that the road had announced its intention to disregard an order of the Interstate Commerce Commission requiring it to permit the side track to be built. The impression created by the sending of copies of this letter to Senators and Representatives was that the situation shown illustrated a case in which, under the present law, a railroad could discriminate against shippers and no effective remedy could be obtained. The letter said nothing of the fact that either the fuel company or the Interstate Commerce Commission could apply to a United States court for a mandamus to compel obedience to the order of the Commission, nor did it reveal the fact that the company has already commenced proceedings in court. J. C. W.

Progress in the Use of the Block System.

On the opposite page is a table bringing down to January 1, 1906, the statistics of railroad lines in the United States on which the block system is in use. This is the fifth table of the kind which we have published, those of former years having been issued January 11, 1901; February 27, 1903; January 22, 1904, and January 27, 1905. The mileage of road as shown in the tables for the last three years amounts to 50,088, 44,575, 39,264, respectively, the miles of road of the different classes on January 1 being as follows:

	1906.	1905.	1904.
Automatic:			
Single track	1,780.8	1,333.3	964.6
Double track	3,952.6	3,420.2	3,125.7
Four track, etc.	465.2	362.8	301.0
Total	6,198.6	5,116.3	4,391.3
Manual:			
Single track	36,326.4	31,864.5	28,508.2
Double track	7,032.1	6,928.7	5,796.3
Four track, etc.	767.6	767.3	702.6
Total	44,126.1	39,560.5	35,007.1
Total automatic and manual	50,324.7	44,676.8	39,398.4
Deductions*	237.1	102.1	134.5
Total on which block signals are used	50,087.6	44,574.7	39,263.9

*For lines entered twice.

The lines on which block signals ordinarily are used only for passenger trains are:

Buffalo, Rochester & Pittsburg	505.3 miles.
Chicago, Milwaukee & St. Paul	4,320.3 "
Grand Trunk	197.9 "
Michigan Central	113.0 "
Norfolk & Western	198.0 "
Southern	6,438.3 "
Total	11,772.8 miles.

Deducting this mileage from the total (50,087.6) given above, leaves a final net total of lines constantly block signaled, of	38,314.8
Same, one year ago	32,818.1
Showing an increase for the year of	5,496.7

The present total is divided as follows:

Automatic	6,198.6
Manual	32,116.2

In the following paragraphs explanations are given of certain items in the table, the numbers affixed to the paragraphs being references to the names in the table.

NOTES ON THE TABLE.

3. *Alabama Great Southern.*—The proposed new signaling is on the line between York, Ala., and Meridian, Miss. The signals are automatic semaphores and are expected to be ready to go into service February 1.

4. *Atchison, T. & S. F.*—Of the manual signaling 32.9 miles is electric train staff. The proposed new signals are to be automatic.

5. *Baltimore & Ohio.*—The item of 70.8 miles includes 68.3 miles of three-track line.

6. *Boston & Albany.*—The new signaling will be automatic, on the main line, double track.

7. *Boston & Maine.*—The proposed new work (26 miles) means 30 miles on one of the two main tracks on the Fitchburg division, where one of the tracks is already signaled; and 11 miles of double track on the Western division. Both installations will be automatic signals.

8. *Buffalo, Rochester & Pittsburg.*—Block signals usually used for passenger trains only.

9. *Central of Georgia.*—Includes six miles used jointly with Atlanta & West Point and six jointly with the Southern Railway.

10. *Chesapeake & Ohio.*—Of the single track line 256 miles has Leonard's lock and block apparatus, and seven miles is worked by electric train staff.

11. *Chicago & Alton.*—It will be noted that the length of road entered against this company is 225.1 miles greater than the entire mileage operated by the company. This is due to the fact that on some of the lines where the automatic signals have been put in, at curves or other obscure places, and where the sections are not continuous, the telegraph block system is used in addition to the automatic. In footing up the table this 225.1 miles has been deducted.

12. *Chicago, Milwaukee & St. Paul.*—The proposed new signaling is for the line between Galewood, Ill., and Elgin; double track, automatic.

13. *Delaware & Hudson.*—The proposed new work is all automatic; 24 miles single track; 54 miles double track, and seven miles three-track or four-track line.

14. *Delaware, Lackawanna & Western.*—The item of 4.1 miles against this road represents three-track line. The proposed new signaling will be automatic (electric motor signals) on double track.

15. *Erie.*—The 86 miles of new work which is contracted for, or in progress, includes 10.5 miles of automatic signals on the New Jersey & New York Railroad. The remainder is on the New York division of the main line between Bergen, N. J., and Middletown, N. Y. This line is at present worked by manual controlled signals, which will be abandoned when the automatic signals are put in use.

16. *Grand Trunk.*—Block signals used for passenger trains only. The same system is used on the company's lines in Canada.

17. *Illinois Central.*—The manual signals have an electric controlling apparatus connected from station to station. Of the 123 miles of new signaling to be done by this company 28 will be automatic electric motor signals, to be worked by portable storage batteries. This is a double track line. The remainder (95 miles, single track) will be manual controlled signals.

18. *Interborough.*—Six and one-half miles of this company's line is four-track, but only two of the four tracks have block signals. The signals are equipped with automatic stops.

19. *Lake Shore & Michigan Southern.*—Of the 51 miles automatic 31 miles is three-track line; and of the 45.2 miles manual, 20.3 miles is three-track. The new work proposed consists of automatic signals for the main line, on which the telegraph block system is now used but is being gradually displaced by the automatic.

20. *Louisville & Nashville.*—This company is reported as installing block signals on its line between Cincinnati and Atlanta, but no statement of miles equipped is available.

21. *Michigan Central.*—The manual signals are usually used for the rear of passenger trains only.

22. *Nashville, Chattanooga & St. Louis.*—The 45 miles of new signals (single) track will probably be finished and in use by February 1.

23. *New York Central & Hudson River.*—Of the manual signaling 456.1 miles is "controlled"; this includes 156.2 double track, and 299.9 four-track.

24. *New York, New Haven & Hartford.*—Of the manual signaling 229 miles is manual controlled; some two-track and some four-track.

25. *New York, Ontario & Western.*—The new work consists of automatic signals, all for double track line.

26. *Pennsylvania.*—The item of 266.3 miles manual signaling includes 47.4 miles of three-track line.

27. *Philadelphia & Reading.*—The item of 28.5 miles under four-track includes some three-track line. The proposed new work, which will consist of Hall automatic disk signals, will include 3.3 miles of double track on the Philadelphia division; 12.6 miles on the Shamokin division; 41.1 miles on the Harrisburg division, and 17 miles on the Reading division; and 7.2 miles of double track and 5.8 miles three-track or four-track on the New York division.

28. *Pittsburg & Lake Erie.*—The 30.6 miles of automatic signals entered under four-track includes some three-track line.

29. *Southern.*—The short length of automatic signaling now in use on this road is in Atlanta, Ga. Of the new signaling proposed for the present year 106 miles will be automatic, as follows: Danville to Pelham, nine miles; Greensboro to High Point, 15 miles; Spencer to Linwood, nine miles; Armour to Howell, three miles; Austell to Roseland, 21 miles; Weems to Woodlawn, six miles;

MILES OF RAILROAD WORKED BY THE BLOCK SYSTEM, JANUARY 1, 1906.[1]

	Automatic			Manual				
	Single track.	Double track.	Four track.[2]	Single track.	Double track.	Four track.[2]	Total.	Proposed.
Alabama Great Southern.[3]	..	..	..	..	..	..	..	27
Atchison, Topeka & Santa Fe.[4]	91.0	45.0	..	1,147.1	68.0	..	1,351.1	60
Atlanta & West Point jointly with Cent. of Ga.	—	—	—	—	6.0	—	6.0	—
Atlantic City (see Philadelphia & Reading)	..	..	..	..	..	..	..	..
Atlantic Coast Line	..	..	..	275.7	68.6	..	344.3	138
Baltimore & Ohio.[5]	3.8	104.1	..	192.8	465.5	70.8	837.0	—
Baltimore & Ohio Southwestern	..	..	..	..	31.6	2.8	34.4	9
Bessemer & Lake Erie	..	..	..	130.1	52.7	..	182.8	0
Boston Elevated	—	8.8	—	—	—	—	8.8	
Boston & Albany.[6]	0.5	151.9	16.0	..	8.0	..	176.4	6
Boston & Maine.[7]	2.5	101.5	2.2	..	111.7	..	217.9	26
Buffalo, Rochester & Pittsburg.[8]	—	—	—	430.6	74.7	—	505.3	
Central of Georgia.[9]	..	..	..	54.0	15.0	..	69.0	..
Central of New Jersey	..	161.7	32.0	..	..	..	193.7	..
Chesapeake & Ohio.[10]	—	—	—	967.3	200.4	—	1,167.7	
Chicago & Alton.[11]	292.3	110.6	..	678.1	97.1	..	1,178.1	..
Chicago, Burlington & Quincy	..	21.4	6.0	1,470.3	470.0	..	1,967.7	..
Chicago & Eastern Illinois	—	106.0		586.0	57.0	—	749.0	
Chicago Great Western	..	5.0	..	320.0	5.0	..	330.0	..
Chicago, Milwaukee & St. Paul.[12]	6.0	30.5	..	2,157.5	355.7	..	2,549.7	28
Do. for pass. trains and part time for freights	—	—	—	4,320.3	—	—	4,320.3	
Chicago & North-Western	..	304.5	..	3,018.1	486.6	..	3,809.2	Some.
Chicago Terminal Transfer	0.6	5.0	..	..	..	..	5.6	.
Chicago, Rock Island & Pacific	—	15.6	—	1,521.0	—	—	1,536.6	.
Chicago & Western Indiana	..	..	..	..	19.8	..	19.8	7
Chicago, St. Paul, Minneapolis & Omaha	3.5	1.1	..	643.7	20.2	..	668.5	..
Cincinnati, Hamilton & Dayton	—	—	—	73.0	28.0	—	101.0	—
Cincinnati, New Orleans & Texas Pacific	304.5	24.7	..	6.0	..	..	335.2	..
Cleveland, Cincinnati, Chicago & St. Louis	..	..	..	607.4	245.2	..	852.6	27
Delaware & Hudson.[13]	73.1	44.5	—	—	—	—	117.6	85
Delaware, Lackawanna & Western.[14]	3.0	390.7	4.1	..	..	..	397.8	66
Erie.[15]	..	..	..	823.1	572.2	12.0	1,407.3	86
Grand Trunk (Portland Line)[16]	—	—	—	197.9			197.9	
Hocking Valley	..	..	..	46.0	..	..	46.0	15
Illinois Central.[17]	6.0	210.0	14.0	636.0	..	..	866.0	123
Interborough Rapid Transit Co. (New York)[18]	2.4	11.1	—	—	—	—	13.5	
Kentucky & Indiana Bridge & Railroad Co.	..	..	..	8.0	2.8	..	10.8	..
Lake Shore & Michigan Southern.[19]	..	43.0	51.0	..	401.0	45.2	540.2	456[2]
Lehigh Valley	35.7	443.5	27.8	597.9	69.6	—	1,174.5	—
Long Island	..	52.0	..	..	33.0	..	85.0	..
Louisville & Nashville.[20]	..	..	..	..	..	..	..	..
Maine Central	—	—	—	15.0			15.0	—
Michigan Central.[21]	3.0	465.0	..	113.0	..	..	581.0	95
Missouri Pacific	72.0	19.0	..	..	..	..	91.0	..
Mobile & Ohio	4.2	—	—	25.0	—	—	29.2	—
Nashville, Chattanooga & St. Louis.[22]	..	..	..	47.9	5.6	..	53.5	45
New York Central & Hudson River.[23]	..	106.4	12.5	1,529.9	508.8	299.9	2,457.5	30
New York, New Haven & Hartford.[24]	25.0	228.2	—	195.8	168.9	70.6	688.5	—
New York, Ontario & Western.[25]	22.0	67.0	..	..	..	..	89.0	17
New York, Susquehanna & Western	..	..	..	1.4	22.2	..	23.6	..
New York & Long Branch	—	37.0	—	—	—	—	37.0	—
Norfolk & Western	12.0	..	..	1,030.7	131.7	..	1,174.4	..
Norfolk & Western, passenger trains only	..	..	..	198.0	..	..	198.0	..
Northern Central (included in Penn. R. R.)		—	—	—		—		—
Northern Pacific	..	15.2	..	1,037.3	..	..	1,052.5	..
Ohio River Bridge (Louisville)	..	..	..	1.5	3.2	..	4.7	..
Oregon Short Line	31.0	—	—	—		—	31.0	43
Oregon Railroad & Navigation Co.	111.5	..	..	..	..	..	111.5	104
Pennsylvania.[26]	0.5	98.8	211.5	588.6	809.9	266.3	1,975.6	..
Pennsylvania, West of Pittsburg		10.0	29.0	1,106.0	996.0		2,141.0	
Peoria & Pekin Union	..	1.0	..	..	5.4	..	6.4	..
Pere Marquette	..	..	..	..	..	..	..	..
Philadelphia & Reading.[27]	23.9	320.7	28.5	228.7	143.9		745.7	87
Phila., Balt. & Wash. (included in Penn. R. R.)	..	..	..	..		..	..	..
Pittsburg & Lake Erie.[28]	..	106.8	30.6	49.6	3.7	..	190.7	.
Rich., Fredksbg & Pot. (includg. Wash. So.)				32.0	88.5		120.5	
San Pedro, Los Angeles & Pacific	..	2.0	..	..	..	..	2.0	..
Seaboard Air Line	..	..	.	155.0	.	.	155.0	..
South Side Elevated, Chicago	—	8.7					8.7	
Southern Railway.[29]	..	2.0	..	952.9	83.8		1,038.7	534
Southern Railway, passenger trains only	..	..	..	6,438.3	..		6,438.3	
Southern Pacific.[30]	486.7			120.0			606.7	262
Southern Pacific, Texas and Louisiana Lines	26.5		..	..	..	.	26.5	..
St. Louis & San Francisco.[31]	6.5	4.0	..	303.6	27.7		341.8	47
Staten Island Rapid Transit		8.7					8.7	
Terminal R. R. Association, St. Louis	..	14.4	..	..	4.7	..	19.1	.
Union Pacific	131.1	45.5	..	..	..	..	176.6	186
Vandalia		-		241.0			241.0	
Wabash	..	..	..	992.3	58.2		1,050.5	
West Jersey & Seashore (included in Penn. R.R.)	.	..	..	..	..			
Wisconsin Central	—	—			4.5		4.5	—
Yazoo & Mississippi Valley		.	..	15.0			15.0	..
Total	1,780.8	3,952.6	465.2	36,326.4	7,032.1	767.6	50,324.7	2,599

[1] The reference numbers in the table indicate numbered paragraphs in the accompanying text.
[2] The columns headed "Four track," include some three-track mileage, and in one case (Illinois Central, automatic), some six-track and eight-track.

Knoxville to Morristown, 12 miles all double track, and a short piece of single track at Spartanburg.

The manual block signaling now in operation aggregates 1,037 miles, of which about 84 miles is double track. The principal lines are from Alexandria Va. to Atlanta, Ga.; Austell to Roseland, Morristown to Chattanooga, Austell to Rome, and 158 miles on the St. Louis-Louisville line. It will be noted that some of the proposed new automatic signaling is to take the place of some of the manual signals. It is proposed, also, to establish about 428 miles of new manual signaling, as follows, all single track:

Macon to Roseland	84.4 miles
Austell to Weems	140.0 "
Rome to Ooltewah	64.7 "
Morristown to Asheville	87.4 "
North Birmingham to Corona	51.2 "
Total	427.7 miles

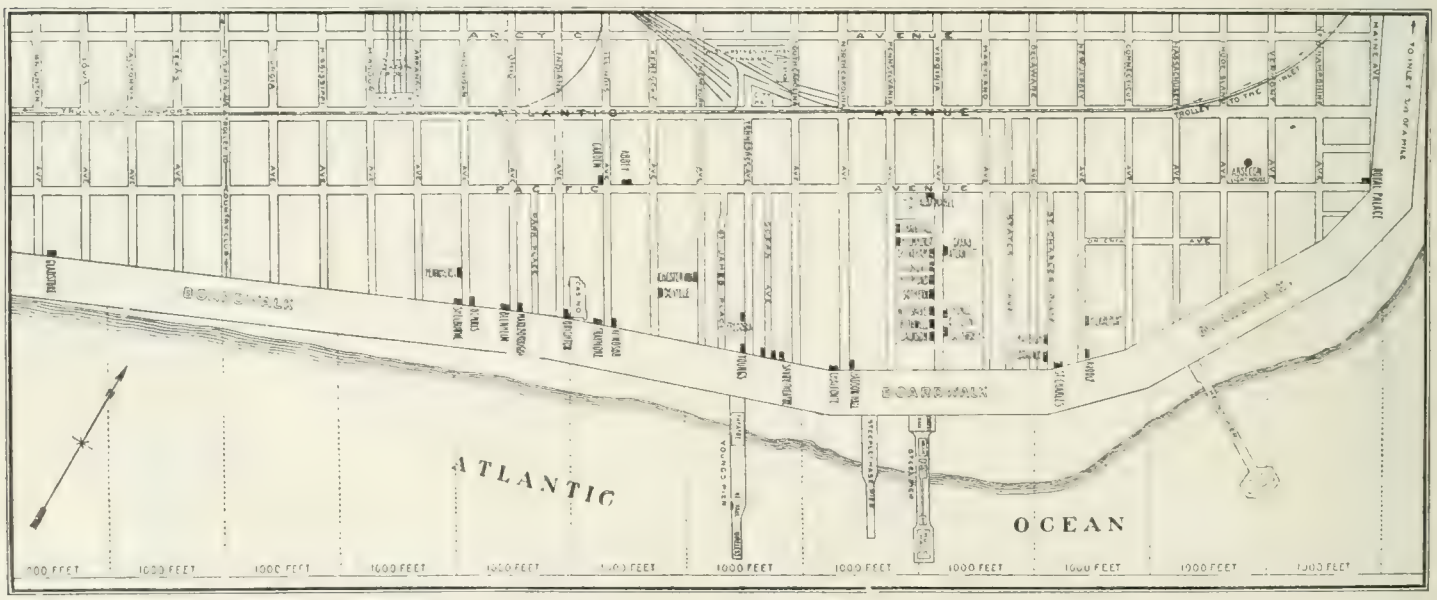
All of the foregoing is represented in the figures shown in the first item in the table under the Southern Railway. The second item in the table, representing lines on which the spacing of trains is managed by the train despatchers, covers 6,092 miles on the Southern Railway and its controlled lines south and east of Louisville, and 347 miles on the Louisville-St. Louis lines.

30. *Southern Pacific.*—The total mileage of road signaled on the Union Pacific, the Southern Pacific and the Oregon lines controlled by these companies, aggregates 1,045 miles, and the new work proposed for 1906 (all automatic and nearly all single track) aggregates 664 miles of road. Of the automatic signaling put in use during the past year 54 miles, between Benicia and Truckee, takes the place of the telegraph block system heretofore used; and of the manual signals now in use 97 miles represents the electric train staff (a manual controlled apparatus) which has been installed in place of the telegraph block system. This also is on the division lying between the places just named. This leaves only 23 miles of the simple telegraph block system in use.

31. *St. Louis & San Francisco.*—The new work proposed on this road this year consists of automatic signals for one mile of double track and for three miles of single track; and the telegraph block system on 43 miles single track.

1906 M. C. B. and M. M. Conventions.

At the annual conventions to be held at Atlantic City, N. J., in June, the headquarters for meetings, exhibits and social functions will be the steel pier. Meetings will be held in the concert hall at the entrance and exhibits will be arranged along the entire east side of the structure; the total exhibit space amounts to 40,000 sq. ft., which provides for exhibits on a larger scale than ever before. Steam and electric power is to be furnished to exhibitors and paid for by them, but there will be no charge for exhibit space aside from the membership contribution of $35. The installation of exhibits may be begun on June 1; they must be completed by June 13 and removed before June 27. The accompanying cut shows the location of the different hotels, whose rates for those who attend the convention were published in the *Railroad Gazette* of December 15.



Site of the M. C. B. and M. M. Conventions at Atlantic City, N. J.

The first passenger train passed through the Simplon tunnel on January 25.

More About Armour's Refrigerator Business.*

The profits of the private car business cannot, with any fairness, be judged on a harvest-time basis which the critics of the enterprise seem to insist upon doing. This is a business of lean years as well as fat years. Then the period of profitable and established operation should be averaged with the years in which the business was in a struggling and pioneer stage. Modern inventive genius may render practically useless and obsolete an equipment now representing an investment of millions of dollars, and this possibility is by no means so remote that good business prudence would not take it into account.

I deny that the profits of the private car line business and the packing business are extortionate. I have no desire to deny that both do pay a profit. Had I put my holdings, at the time I came into them, into railroads, national banks and other enterprises I should have made more money, made it with less trouble and been subjected to less attack. I sincerely believe I should have been of far less service in the industrial development of this country than I have been in the private car line and the packing business. I am not posing as a philanthropist or asking for any credit on that or any kindred score. Just common-sense selfishness and the regard for the well-being of humanity that the ordinary decent citizen has are all the motives that I lay claim to in the conduct of my business. Thousands of men have been enabled to make independent fortunes by the activities of the private car. The whole people enjoy comforts and luxuries otherwise impossible.

The charge for refrigeration service also covers maintenance, repair and replacement of the tools employed in the business—the ice making plants, ice houses, icing stations both in the fruit-growing sections and throughout the country along the routes from the growing locality to the market, repair shops and the cars themselves. These cars cost from $1,000 to $1,200 each—a third and sometimes half more than the ordinary box car. They are easily damaged. Almost every car needs more or less repairs every trip. They wear out more quickly than ordinary freight cars, and are more easily put out of service from many causes. If loaded with anything that leaves an odor—drugs, kerosene oil, etc., as happens often—the car is likely to be made useless for further service in the fruit-carrying trade.

California is a district in which a field organization must be maintained practically the year round. We have to maintain our own car-repair shops and icing stations, and when fruit is moving a band of more than 50 men as inspectors, supervisors, etc., are up and down through the district superintending the loading and icing, enforcing prompt movement of cars and pushing all details of the work. We have a force of more than 200 men in California during the season.

Before the fruit-shipping season opens, cars enough to handle the crop must be assembled at points convenient to the shipping stations. More than half of them go west empty and are subject to many delays; some may be loaded with clean package freight. These will be from 50 to 30 days en route from Chicago to Los Angeles, and unloading there may be delayed. During all this period, before a pound of fruit is loaded, the car line company must keep track of these cars, trace them from point to point,

*Extracts from an article by J. Ogden Armour, in *The Saturday Evening Post*, Philadelphia. A former article was abstracted in the *Railroad Gazette* of Jan. 19, page 64.

and know whether they are empty and available for immediate use or loaded and unavailable. Finally, the car we are following lands at our Los Angeles shop, where they thoroughly overhaul the car, put new padding on doors and hatch plugs, clean and repair tank pans, drains and drain traps. After the car is thoroughly overhauled tanks are filled with about 10,000 pounds of ice. Wonderful things are grown in California, but no one, not even the wonderful Mr. Burbank, has been able to grow a natural crop of ice in Southern California. For Northern California we must haul the ice from the mountains at heavy expense for freight and shrinkage. We also buy enormous quantities of manufactured ice. In 1905 we bought more than 120,000 tons of ice in California.

When the car is iced it is sent out to the loading point and there is a further heavy shrinkage of ice in the tanks. The car may have been standing for days in a railroad yard. The fruit loaded into it and the packages containing that fruit are also hot—soaked, as it were, in California sunshine. The car and its load must be brought down to a low temperature. Every board, every nail, every orange, every piece of wood exudes heat. Much ice must be melted, obviously, to bring the hot car and its load down to a low temperature.

The car, when loaded, is sent back to Los Angeles (to Bakersfield if going east by the northern route), its ice tanks are refilled, it is thoroughly inspected again by car line men and is started on its journey east. If it takes the southern route it stops first at Tucson, Arizona, to be re-iced under the supervision of a car line agent, who not only sees that the tanks are properly filled to capacity, but also makes a personal inspection of all drain pipes, etc. The car then passes on to El Paso, where car line agents are waiting for it. It is again thoroughly re-iced and inspected and sent on to Fort Worth, where another agent is in waiting to perform the same service. This process is repeated seven or eight times more before the car reaches Boston—Kansas City, Davenport, Chicago, Galion, Hornellsville, and East Deerfield. The same facilities are maintained on all the various routes. When the car leaves Los Angeles, the car number, its condition and digest of the waybill are all taken by a car line inspector and Tucson is notified that the car is on the way to him. This checking and notification of stations ahead continues without break until the car reaches destination, under the eye of the car line organization every hour, and is kept moving. When the car finally reaches Boston a car line inspector notes its condition, sees it opened, inspects condition of its load and reports all details to the head office. Nobody in Boston ventures to report to the shipper in California that a car handled and watched as described has "arrived in bad condition." The item of repairs is a heavy one. During a short, rush season, as in handling Michigan and Georgia peaches, time does not permit sending cars to the shops, but car repairers have to be sent into the field. In Michigan last fall three car-repair superintendents were maintained in the field, and each had from five to ten men with him, at the expense of the car line. In view of these facts I submit that a tariff rate of $77.50 Los Angeles to Boston on the car outlined above is as low as good and proper service will permit. It was only a few years ago that this same rate was $95, but we were able to reduce our operating expenses and gave the shippers the benefit of it. Just as soon as conditions will warrant it the rate will again be reduced.

The private car line service also enables the shipper to control the destination of his product and to avoid glutted markets. A shipper starts a car of peaches from Grand Rapids to Boston. After the car has left he learns that the Boston market is full. At any place along the route of that car—Detroit, Buffalo, Albany—he can change its destination to New York, Providence, Philadelphia, Baltimore, or any other point that promises a better market. In 1904, during the one month of July, more than 500 cars of Georgia peaches, an average of more than 16 a day, were caught at Cincinnati alone, diverted from their original destination and sent to other places that promised better results. In 1901 a certain railroad touching Benton Harbor, Michigan, was undertaking to furnish refrigeration service at cost of ice. Private cars were operating on another road reaching that same point. Mr. Roland Morrell, of Benton Harbor, one of the best fruit growers in America, had 25 cars of choice peaches to ship. He was within three miles of a loading station on the road which provided refrigeration at cost of ice. To reach a loading station of the private car lines his peaches had to be hauled five miles, part of the way uphill. Yet he turned his back upon the alleged low price service, made the five mile haul, shipped in private cars and paid the tariff of $55 a car to Boston rather than take a chance on railroad refrigeration service. Asked why he paid this "unnecessary" charge, he said: "I raise peaches to sell. I am not raising peaches to be spoiled in transit and paid for by the railroad." The Fennville *Herald*, which is the organ of one of Michigan's heaviest peach shipping points, a paper that has never shown friendliness toward private car lines, said that had it not been for the good work done by the Armour private car lines in furnishing plenty of first class cars and looking after the prompt icing of same in transit that section would have been ruined the last season.

Almost every fruit and vegetable growing district in this country is a living witness to the pioneering work and the efficiency of the private car line. These lines have served both to develop new fields and to widen the market of the fields already in existence. There are practically no reliable statistics to be had anywhere in the country in relation to the fruit industry save those gathered by the private car lines. Up to ten years ago practically no fruit was shipped out of Michigan under refrigeration. Practically all of the crop was dumped into Chicago by boat and by ventilated cars. The Chicago market was uniformly low in consequence, and Chicago commission men made handsome profits by re-shipping Michigan peaches to other points, even back into Michigan.

The private car line began to investigate the Michigan field some years ago. Eastern fruit dealers were told to send their buyers into that district, and, if they found that the results did not justify the effort, the car lines would pay the expense. This practice of sending buyers to the door of the grower—buyers who buy for cash and do not require the grower to ship on commission—has spread to all parts of the country. The private car lines give a grower a market at his own door.

Since 1889 the fruit and vegetable industry in California has grown practically ten times in volume; and financially it is in better condition than at any previous time in its history. California shipped, in 1905, 30,000 cars of lemons and oranges at an increase in profit over 1904 of more than $100 per car. Right now 200 cars a day are coming out of that state. The orange and lemon industry of California would not have been developed without the private car. A few years ago head lettuce was a rarity in northern markets. The private car line has developed this trade and has made many Florida farmers rich thereby. New York alone now absorbs 40 to 50 cars a day during the winter months.

A car line agent interested strawberry growers around Nashville, in 1903, to ship eight or ten cars as an experiment. Shipments rose to 60 cars in 1905. Humboldt, Tennessee, used to send out about 50 cars of tomatoes a season, six or seven years ago. The tomatoes had to be shipped green and ripened in the commission man's storeroom, which, of course, impaired the quality. Humboldt now ships in a season 500 cars of tomatoes that are allowed to ripen on the vines and therefore bring a much better price. The new prune plum district of Idaho has been developed entirely by the private car line missionary work and within a very few years. The far northwest now sends to market from 2,000 to 3,000 cars a year. Other important new districts are being similarly developed in northeast Texas, in Utah, Colorado, Arizona, Arkansas and Missouri.

The principal fruit-growing districts of the country in 1899 shipped under refrigeration only 9,164 cars; the same districts in 1905 shipped 42,982 cars. In particular districts during this period shipments have been multiplied to 10 and even 20 times over so far as the Armour lines alone are concerned. Michigan peach lands undeveloped are worth only from six to ten dollars; with bearing peach orchards they command $200 to $300 an acre. Florida lands that were almost worthless are now yielding to growers of head lettuce and other early vegetables an annual return of $500 to $1,000 to an acre. There are districts in Georgia where lands bought for one dollar an acre are now worth with peach orchards in bearing, $300 an acre. California orange and lemon bearing lands are worth $1,000 an acre.

Mr. C. A. Sessions, of Shelby, Mich., says "buyers come to us to our very doors because they know this service will deliver in good condition what they buy. In Chicago the market is almost always glutted with fruit that goes across the lake by boat. Chicago commission men work to keep it glutted. We have had commission-house solicitors running up and down our streets here soliciting shipments, when they knew Chicago was already overstocked. That was to get our fancy peaches at a low, glutted market price, so they could be reshipped to other points at a profit."

Mr. J. R. Wylie, of Shelby, says: "This last summer I shipped plums to two points, Chicago and Dayton, Ohio. The same kind of plums went to both places. My Chicago shipment averaged 80 cents a bushel net; my Dayton shipment averaged $1.45 a bushel net."

Last fall two large eastern fruit houses discovered that quantities of Michigan peaches were being dumped into Chicago by boat and by rail from points not covered by the private car service. They went on the open market in South Water street and there bought Michigan peaches for shipment east at lower prices than they would have had to pay over in Michigan at points served by private cars. More than 100 cars were thus handled . . . It may be a fact that in some isolated instances local passenger trains have been sidetracked to let pass a through freight containing private cars. I do not know of such an instance, but it is possible. It is not a fact that this sort of occurrence is a part of the system of our operation or a logical result of it.

Some critics of the private car system are at great pains to create the impression that the mileage which the railroads pay the owners of the private cars as rental is so large that there should

be no charge at all to the shipper for refrigeration. Mr. J. S. Leeds, of the Santa Fe, made this statement under oath: "The fact of the business is, the mileage that a car earns in the California fruit business will not maintain it. It will not pay the interest on its cost and pay for administration expenses or the organization and replacement. If this is true the refrigeration of these commodities should pay a profit and should also pay its share of the maintenance and the expense of the operation of the line."

Freight Rates. Sensational periodicals have indulged in much and violent comment regarding the freight rates on dressed meats and other packing-house products as compared with the rates on live cattle. This matter was thoroughly tried out in the famous "Cattle Case" heard by Judge Bethea in the United States Circuit Court sitting at Chicago. In his opinion, filed Dec. 2, 1905, about a month ago, Judge Bethea made the following findings of facts:

"That the live-stock rates are reasonable in themselves; these rates are equal to or less than the rates on dressed meats and packing-house products between the same points.

"That the cost of carrying live stock is greater than that of carrying dressed meats and packing-house products. The evidence shows that the defendant railroad companies pay out a much larger amount in damages for losses arising from the carriage of live stock than they do for losses arising from the carriage of dressed meats and packing-house products, in proportion to the value of the products carried, and more in damages per car regardless of the value. This makes the risk of carriage greater for live stock.

"That the rates for carrying packers' products and dressed meats were remunerative."

Green Lights for "Proceed" at Night.*

In connection with the inquiries which we have made concerning the extension of block signaling during the past year, those roads which use green for the all-clear indication at night in fixed signals or which intend to do so, have been asked certain questions about their practice, and the answers to these questions are summarized below. Roads named without explanation use green for proceed and yellow for caution.

Atchison, Topeka & Santa Fe.—Road is being gradually equipped so as to use green for the night proceed indication in fixed signals; yellow for the caution indication. It is expected to have the changes all made within the next 12 months. Yellow is to be used as a slow signal by track men. The yellow is a dark hue.

Baltimore & Ohio.—Green is used for proceed in fixed signals on the Baltimore & Ohio Southwestern only. For distant signals, yellow, medium hue. Yellow used also for portable caution signals. On the Philadelphia division purple lights are to be introduced for the stop indication in dwarf signals.

Bessemer & Lake Erie.—Green for proceed. Yellow for caution; hue dark. Yellow and green are used on all siding switches, normal color green, yellow indicating open switch. This to distinguish siding switches from main track switches. Same colors are used on derailing switches, normal color being yellow indicating open switch. Yellow is also used in place of green indicating caution for minor purposes, such as bi-colored green and yellow flag for flag stop, yellow for trackmen, etc.

In addition to the uses above mentioned, yellow is used on the home block semaphore mast, supplementary to the home block indication when home block signal cannot be cleared to indicate that a clearance form, with respect to train orders and the block to be entered, releasing an approaching train from the signal, is to be handed on by the operator by means of delivery hoops; also for a like delivery of a 19 order conferring right or extending right previously restricted by train order, to the end that the approaching train shall not be unnecessarily stopped at points where right is not by time-table or train order restricted. Green and red are used on all main track switches, normal green. Red indication on switch stand indicates open switch on main track.

Boston Elevated.

Boston & Maine.—Blue is used for stop in dwarf signals. In standard semaphores the casings, when renewed, are designed for two glasses, so that green can be used for proceed.

Canadian Northern.

Canadian Pacific.

Chicago & Alton.—Green and yellow (dark hue) have been used for several years with entire satisfaction.

Cincinnati, Hamilton & Dayton.—This road reports that green is *not* used for proceed.

Chicago & North-Western.—Green for proceed; a green light and a red light side by side, for caution.

Chicago, St. Paul, Minneapolis & Omaha.—Same as C. & N.-W.

Cleveland, Cincinnati, Chicago & St. Louis.

Colorado & Southern.

Delaware & Hudson.—The yellow is dark.

Delaware, Lackawanna & Western.—Kopp yellow is used. Purple is used for stop in some dwarf signals.

Erie.—Green and yellow used on Delaware division only. These colors are to be introduced on the New York division.

Illinois Central.—The yellow glasses are "medium to dark."

Interborough Rapid Transit Company.

Lake Shore & Michigan Southern.—Does not use green for proceed; does not use yellow for any purpose except on highway crossing gates. Purple is used for stop in dwarf signals.

Lehigh Valley.—This company intends to use green for proceed and yellow for caution but has not decided when to make the change. Purple is used for stop in dwarf signals.

Long Island.—Uses green and yellow; the yellow is dark. Purple is used for stop in dwarf signals which are situated between running tracks.

Michigan Central.—Green for clear and yellow for caution, adopted east of Detroit Dec. 15, 1905; west of Detroit about a month later.

Missouri, Kansas & Texas.

Missouri Pacific.

New York Central & Hudson River.—Green for clear and yellow for caution are to be adopted soon on the Harlem and the Hudson divisions. Yellow of a dark hue is preferred. It is intended to make the change in all lights used as signals; that is to say, in semaphores, disks and switchstands, and in marker lights on trains. Purple is used for stop in dwarf signals. This has been so used for some time, and has been satisfactory.

New York, New Haven & Hartford.—Besides its use in fixed signals the yellow light is used for slowboards.

Oregon Railroad & Navigation Company.

Oregon Short Line.

San Pedro, Los Angeles & Salt Lake.

Southern Pacific.

Terminal Railroad of St. Louis.

Tidewater Railway.—Road now under construction. Green will be used for clear; yellow for caution.

Union Pacific.—Besides its use in fixed signals, yellow is used for the trackmen's night slow signals. Nels yellow has been used, but a lighter hue will probably be adopted. Yellow flags are of a dark tint.

Texas.—In the state of Texas the State Railroad Commission requires the use of green for proceed at grade crossings of one railroad with another.

*In this article, the adverse indication of a distant signal is termed "caution." In describing the hue of yellow glasses, "Nels" yellow is classed as dark.

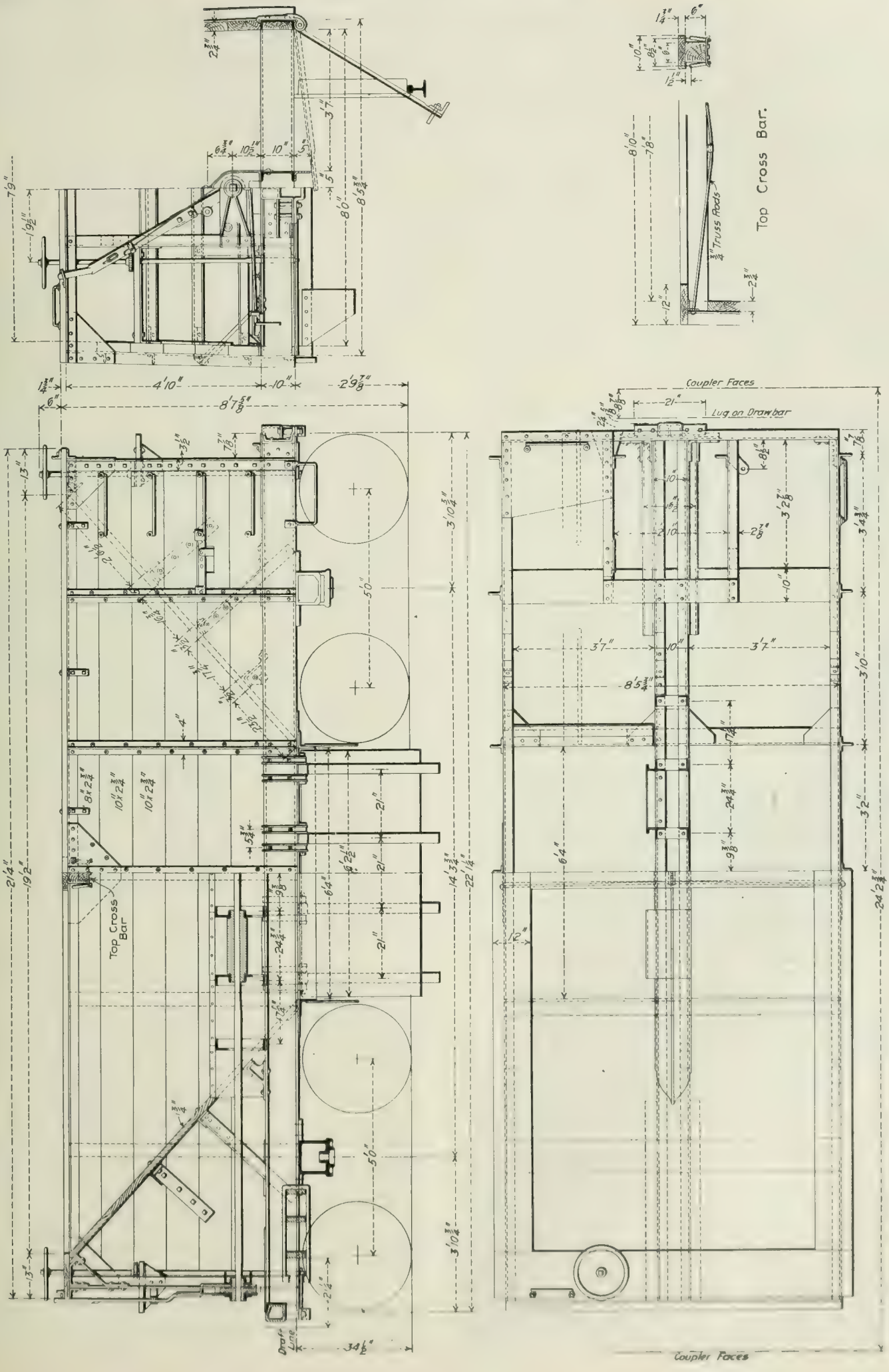
New Ore Cars for the Chicago & North-Western.

The Chicago & North-Western heretofore has used wooden ore cars having the usual side and end slope hopper, sides vertical above the hopper side slope, and doors swung transversely across the car. This design disclosed in service a number of objectionable features, one of the most serious of which was a frequent inability to discharge its load without assistance. If the ore was hauled any great distance it would pack down hard in the car with the result that often when the doors were lowered the principal mass of the load would not move until vigorous means had been employed to dislodge it. To overcome these objectionable features Mr. C. A. Schroyer, Superintendent of the Car Department, designed the car illustrated herewith. A single experimental car was built at the Chicago shops of the road last fall in order to give the design a thorough trial in service and develop any defects or undesirable features that might exist. After several months in service the car has proven most satisfactory and others will be built. Some changes in minor details only have been found necessary.

The new design is of steel construction with a wooden lining, wood being used in preference to steel to minimize difficulty from the ore adhering to the sides in freezing weather. To obtain the most advantageous condition for discharge of the load, the hopper side slope of the older design has been omitted, the entire side being straight. Also, the sides are given a slight inclination inward from the vertical, the car being 4 in. narrower at the top than at the bottom. The door opening has been increased in size, necessitating a somewhat greater wheelbase, although the total length of the car is the same as the old. It will be noted that this dimension on the drawing is given inside of the contact faces of the couplers. This is specified to insure a train of the cars centering properly over the pockets in the ore docks.

Each door opening is 6 ft. 4 in. long by 3 ft. 7 in. wide. The drop doors are hinged to the car sides and each is supported at its opposite or inner side by chains passing around winding drums mounted on a longitudinal shaft. The doors are raised by a lever and ratchet at the end of the shaft and car. They fall by gravity upon releasing the ratchet pawl. An important advantage in the side-swung doors is that in their lowered position they form the side slopes to the hopper, confining the ore between the rails.

The features embodied in this car to facilitate unloading enable


Top Cross Bar.
Top Cross Bar
Coupler Faces
Lug on Drawbar
Coupler Faces
Chicago & North-Western Steel Frame 80,000-Lb. Ore Car.

a full load of ore to be discharged in from one to three minutes, depending on the kind and condition of the ore. Maple is used for the lining, the ore sliding better on this wood than on other kinds. Openings are provided between the side planks and the edges of these planks are beveled so that these openings extend obliquely downward. They were provided on one side only in the experimental car, the idea being that they might facilitate thawing out frozen ore with hot water and also facilitate unloading by the use of an unloading bar to loosen up the ore. It has been decided not to include this feature in the new cars.

Some differences of detail have been made in the revised design from which the new cars will be built. The chief change is at the ends in the bracing for the end slope. In the first car there are four braces secured at their lower ends to the side and center sills respectively. It was found that in service the surge of the load against the slope imposed stresses that caused a perceptible and permanent sag in each end of the car. The design was therefore modified by extending the wooden siding out to the end of the car, bolting the side braces to this siding and omitting the two center braces altogether.

The capacity of the cars is 80,000 lbs. They are mounted on steel trucks. On account of the large door opening there is a brake cylinder for each truck, operated from one triple valve.

Accident Bulletin No. 17.

The Interstate Commerce Commission has issued Accident Bulletin No. 17, giving the record of railroad accidents in the United States during the three months ending Sept. 30, 1905. The number of persons killed in train accidents was 272, and of injured, 3,455. The total number of casualties from train accidents and other causes was 17,439 (1,053 killed and 16,386 injured). These reports deal only with (*a*) passengers and (*b*) employees on duty.*

Table No. 1.—Casualties to Persons.

	Passengers: Classes a and b. Kld.	Passengers: Classes a and b. Injd.	Passengers: Class bb. Kld.	Passengers: Class bb. Injd.	Employees. Kld.	Employees. Injd.	Total persons reported. Killed.	Total persons reported. Injd.
Collisions	15	952	7	97	126	776	148	1,825
Derailments	16	677	5	76	88	491	109	1,244
Misc. train accidents	..	24	..	6	15	356	15	386
Total train accidents	31	1,653	12	179	229	1,623	272	3,455
Coupling or uncoupling	..	.....	..	..	74	819	74	819
While doing other work about trains, etc.	..	.....	.	..	45	3,821	45	3,821
Overhead bridges, structures at side of track, etc.	..	15	.	9	26	373	26	397
Falling from cars, engine, etc.	48	571	2	20	171	2,522	221	3,113
Other causes	20	665	9	57	386	4,059	415	4,781
T'l. other than trn accdts.	68	1,251	11	86	702	11,594	781	12,931
Total, all classes	99	2,904	23	265	931	13,217	1,053	16,386

*In Table No. 1 the passengers have been divided into classes, a, b, and bb. Class a includes all ordinary passengers; Class b includes passengers traveling on freight trains; Class bb includes persons (nor ordinary passengers on passenger or freight trains) who are customarily carried or allowed on trains under special arrangements or privileges, such as postal clerks and express passengers; conductors, porters, and other employees on Pullman cars; employees on private or special cars; newsboys, baggage solicitors, peddlers, live stock tenders and men in charge of freight.

Nearly all of the totals in table No. 1 are larger than in the three months last preceding, and some are very much larger. These figures are doubtless in large measure a reflection of the very heavy traffic done by the principal railroads of the country during the busiest summer months. The number of passengers killed in train accidents, 43, is larger than in either of the two preceding quarters, yet it is far below the disastrous quarter which included the same three months of 1904, when 228 passengers were killed in collisions and derailments. The two most notable accidents in the present report are a collision killing 12 persons and a derailment killing 15. In the table of causes given below these accidents are numbered, respectively, 5 and 10. Flagrant misconduct and negligence characterized both cases.

Table No. 2.—Collisions and Derailments.

	No.	Loss	Persons Killed.	Persons Injured.
Collisions, rear	378	$388,873	36	476
" butting	225	412,956	68	709
" trains separating	216	91,404	4	74
" miscellaneous	826	391,428	40	566
Total	1,605	$1,284,661	148	1,825
Derailments:				
Due to defects of roadway, etc.	284	$159,058	12	408
" " defects of equipment	733	534,701	11	234
" " negligence of trainmen, etc.	115	95,395	24	176
" " unforeseen obstructions, etc.	74	88,482	16	100
" " malicious obstructions, etc.	20	55,026	8	43
" " other causes	304	323,582	38	289
Total	1,530	$1,256,247	109	1,244
Total collisions and derailments	3,135	$2,540,908	257	3,069

In the long table is given the usual list of class A train accidents—all in which the damage is reported at $10,000 or over; notable cases in which passengers are killed, and those doing damage less than $10,000 and down to $2,000, wherever the circumstances or the cause may be of particular interest:

CAUSES OF THIRTY-ONE PROMINENT TRAIN ACCIDENTS (Class A).

[NOTE.—R. stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger trains; F., freight and miscellaneous trains.]

Item.	Class.	Kind of Train.	Killed.	Injured.	Damage, to engine cars and roadway.	Cause.
					Collisions.	
1	R	P. & F.	1	9	$2,375	Failure of torpedoes to explode.
2	R	P. & F.	3	2	2,700	Occurred 2 a. m.; engineman of 13 years' experience on duty 12½ hours, ran past two automatic block signals and a flagman; this engineman was killed.
3	B	P. & F.	1	11	3,800	Watch wrong; conductor and engineman failed to compare watches, as required by rule.
4	M	P. & F.	0	1	4,350	Occurred at 8 p.m.; switch turned under train. (See note in text below.)
5	B	P. & P.	12	54	5,081	Occurred 1 a. m.; westbound freight train encroached on time of eastbound passenger train. (See note in text below.)
6	B	P. & F.	5	10	7,800	Pay car train encroached on time of regular passenger train; pilot in charge of pay car, who was trainmaster of division, miscalculated time available for reaching the next station, by reason of failure of his watch, which had stopped.
7		P. & P.	3	21	8,000	Northbound train wrongfully ran into a crossover track; switch, which had been spiked and ordered kept closed, was unfastened by a track repair man; this employee, who was experienced, decamped.
8	B	P. & P.	0	59	8,500	Train approached meeting station with speed not under control; engineman had inadvertently shut off the connection to air brake reservoir, and had neglected to test air brakes 2 miles before reaching the station, according to rule.
9	B	P. & F.	0	20	8,600	Despatcher gave order, "No. 1 will run 2 hours late" (should have said, "Second No. 1"), did not send order to all interested stations at once.
10	B	P. & F.	1	3	11,200	Operator failed to deliver order to eastbound freight.
11	R	P. & P.	6	35	12,000	Engineman disregarded stop signal. (See note in text below.)
12	M	P. & F.	3	3	12,200	Westbound freight switching at a way station, crossed over to eastbound track without first flagging eastbound train.
13	B	P. & P.	2	83	13,200	Engineman misread time or was deceived by defective watch; watch lost in wreck; engineman being experienced and reliable, conductor did not carefully calculate time to meeting point.
14	B	P. & F.	3	8	14,500	Passenger train started from station in advance of time named in wait order; freight failed to clear time of passenger 10 minutes; passenger conductor, brakeman and fireman left all care to engineman, who forgot order.
15	B	F. & F.	1	6	14,923	Mistake in copying train order. (See note in text below.)
16	B	F. & F.	4	3	15,000	Signalmen, each 6 months' experience, admitted opposing freight trains into "controlled manual" block section on single track. (See note in text below.)
17	B	P. & F.	2	13	18,000	Freight encroached 2 mins. on time of passenger train; men in charge (2 years' experience) "took chances."
18	M	P. & F.	2	25	21,200	Engineman of empty engine (1 a. m.) ran over misplaced switch and through crossover track; it was his duty to see that switch was set right before passing it.
19	R	F. & P.	3	53	21,865	Freight approached station on descending grade with speed not under proper control; passenger train standing at station had insufficient tail lights.
		Total	52	416	$205,797	
					Derailments.	
1	D	F.	1	6	$240	One passenger killed, 5 passengers injured; train consisted of engine and caboose, engine running backward; tender was the first vehicle to jump the track.
2	D	F.	0	39	3,000	Unexplained; large box car loaded with staves and heading was probably unnt to run around curve.
3	D	P.	0	15	5,000	Passenger car overturned by turning of switch beneath moving train. (See note in text below.)
4	D	P.	1	2	5,000	Misplaced switch; speed 40 miles per hour; switch was undergoing alteration and was not suitably signaled. There was no rule requiring reduction of the speed of trains running past the point where alterations were in progress.
5	D	P.	0	4	5,300	Passenger train derailed by striking street car at highway crossing; conductor of street car failed to give required flag signal (3 fatal and 7 non-fatal injuries in street car).
6	D	F.	1	2	6,150	Switch maliciously misplaced.
7	D	F.	2	2	6,450	Runaway on 2 per cent. grade; nonautomatic air brakes inoperative because coupling between engine and tender had accidentally parted.
8	D	F.	1	2	11,600	Excessive speed.
9	D	P.	0	18	13,300	Broken truck.
10	D	P.	15	28	32,000	Open draw. (See note in text below.)
11	D	P.	2	20	35,469	Switch maliciously misplaced; 4 a. m.
12	D	P.	0	20	39,278	Unexplained; supposed that empty baggage car was lifted by sudden application of air brakes; track in first-class condition; wreck burnt up by fire which started from an explosion of acetylene.
		Total	23	158	$162,787	

Collision No. 4 appears to have been due to a combination of an inexperienced towerman and the lack of a suitable detector bar.

The collision occurred at 8 p.m., and though three cars were overturned the personal injuries were slight. A passenger train, running at 40 miles an hour, was diverted by the turning of a switch while one of the passenger cars was passing over it, with the effect that the cars ran against a locomotive on the adjoining main track. The towerman (23 years old) had been in service only nine days. The detector bar, designed to prevent the throwing of a switch while a train or car is passing over it, was only 25 ft. long—not long enough to reach from the rear wheels of a front truck of a car to the leading wheels of the rear truck of the same car. This made it possible for the towerman to throw the switch after the passage of the leading truck and before the passage of the other one.

Collision No. 5, killing 12 and injuring 54 persons, nearly all of whom were passengers, occurred in the middle of the night, and one of the trains was running at nearly full speed. The men in charge of the freight train (westbound) were grossly negligent in occupying the main track on the time of the eastbound passenger train. The freight train had run a few hundred feet beyond the side track at which it should have stopped and have cleared the track for the passenger train. The explanation offered by the engineman, is that he made a mistake in reading the time at L., the last station that he had passed. He says that he read "11.33" when the true time was 12.33. This man is 46 years old and had been in the service as engineman on the same road for 19 years. The company gives him a good record. He had been on duty about 13 hours at the time of the collision and had been off duty 20 hours and 25 minutes immediately preceding this trip. In the case of a man who, at midnight, has been on duty 13 hours, the query naturally arises whether he was not asleep or dozing. This engineman denies that such was the case, and there is no evidence to contradict his assertion.

The conductor is held at fault for not having had a complete understanding with the engineman at L. as to the point at which they should meet the passenger train and for not making reasonable effort to stop his train before encroaching upon the time of the passenger. About two miles before reaching the point of collision this conductor left the caboose and started over the tops of the cars to go to the forward end. He had gone about two-thirds of the way over the train when it reached the point where the engineman should have shut off steam and applied the air-brakes, but instead of at once stopping the train, as might have been done by applying the air-brakes on any car, the conductor continued on to the engine; but by the time he had reached there it was too late to prevent the collision. The fireman and the front brakeman were also held accountable because, knowing that their train was on the time of the passenger train, they took no measures either to caution the engineman or to stop the train. The rear brakeman was also held blameworthy for not acting promptly in the emergency. The air-brakes were in operation on the whole of the train except the caboose and one platform car at the rear. By going over this platform car the brakeman could have applied the brakes.

Collision No. 11 occurred in a yard on a four-track line completely signaled, the semaphore signals being on bridges above the tracks. An accommodation train standing at the station was run into by an express train which should have passed on another main track, but which, in disregard of a stop signal, was run through a crossover track. The engineman appears to have allowed his attention to be drawn away from the signal by the movements of the accommodation train, which he was watching.

Collision No. 15, occurring at 1 a.m., was due to copying "79" instead of "59" in a despatcher's order. The receiving operator claims that after writing "79" he repeated the figures to the despatcher; but four other operators, listening, testify that in repeating the order he sent "59." This operator, with six months' experience as an operator and six months before that as a student, neglected to watch the wording of the same order when it was repeated, on the same wire, by the operators at other stations. He seems to have trusted to his memory, not writing down the words and figures of the message in successive order as they were transmitted.

Collision No. 16, occurring about 3 a.m. and causing the death of one engineman, one fireman, and two brakemen, was due to very irregular and improper action on the part of two block-signal men, each of about six months' experience, and the negligence of an engineman of seven years' experience. Each of the two trains had identical orders from the despatcher to meet at B, and the collision occurred a short distance south of B (between B and C), the southbound train having passed the meeting station without stopping. The operator at B gave to the train (wrongfully) a clear signal and the engineman says that this action of the operator deceived him and caused him to forget the meeting order which was in his possession. The conductor and a brakeman noticed his error and endeavored to apply the air-brakes, but were not able to do so in time to prevent the collision. This was a train of 33 cars, of which 25 were air-braked.

The operator gave the clear signal because of some neglect, not clearly explained, in the preliminary operations which had taken place between his office and the office at C. The block-signal instruments at the two stations are connected electrically, so that either station wishing to permit a train to proceed toward the other must first communicate with the other station. The operator at C had communicated with B, and B had taken the necessary action to permit C to forward the northbound train (which was in collision); and C asserts that eight minutes after this train had departed he received a signal from B that the northbound train had arrived and cleared the block section, whereupon he permitted B to give the clear signal for the southbound train. These two block-signal stations are connected by telephone, as well as by the wires which connect the signal-indicating instruments, and the train sheets at each station, on which are recorded the times of departure of all trains, both at the station recording and at the station in the rear and the station in advance, are filled out on information conveyed over the telephone, but no communication had been made by telephone concerning the northbound train. One of these signalmen was 19 years old and the other 21 years.

Derailment No. 3 is somewhat like collision No. 4, in that the man in charge of the switches in the signal tower was able to turn the switch while a train was passing over it, by reason of the lack of a suitable detector bar. As in the other case there was a detector bar in use but it was not long enough to provide for all conditions.

Derailment No. 10, killing 15 persons, of whom 14 were passengers, was due to the negligence of an engineman approaching an open drawbridge at a high rate of speed, so fast that the engine passed over a 24-ft. opening and struck the truss of the open drawbridge on the pier at the farther side of the opening. This engineman is reported to have had a good record, and he had had five years' experience, but he had been in the service of the road where the accident occurred only seven months and had not run over this part of the line at all until the fatal trip. It is said that he "knew the line pretty well," but this knowledge, such as it was, appears to have been accidental and not the result of any definite instruction or test on the part of the railroad company. At the same time it is to be observed that the line of road approaching the bridge is perfectly straight and that the day was clear. There is a warning signal at a point one-half mile before reaching the draw and a stop signal 300 ft. before reaching it, and the bridge itself, standing crosswise of the track, was in plain sight. Besides this the draw tender had displayed a red flag in the center of the track. The foreman who assigned this inexperienced engineman to this train and the conductor of the train had some conversation with the runner in regard to his knowledge of the line, but they appear to have been satisfied with a very incomplete knowledge of his qualifications.

The warning and stop signals being only fixed boards, in no way connected to the bridge, the rules require all trains to be stopped before crossing. The disregard of this rule and the fact that the engineman gives no rational explanation of his awful neglect indicate not only that he was poorly acquainted with the line, but that he must have been utterly heedless of all landmarks.

At a point about 500 ft. before reaching the bridge the porter of the train applied the air-brakes by the use of the conductor's valve in one of the cars in the forward part of the train, and this application appears to have been effective, as men in the train were thrown down by the sudden checking of the speed; but the porter's action was not soon enough to overcome the momentum of the train, and two of its six cars fell into the gap at the draw.

Telephones on O., R. & N. Telegraph Wires.

The instruments of the National Telegraphone Company have now been in use on the lines of the Southern Pacific in Oregon and of the Oregon Railroad & Navigation Company, for nearly a year, with excellent results. An officer of the company writes: "Last spring we equipped our line between Portland and Roseburg, Oregon, a distance of 198 miles, with telegraphone instruments. Telephones were placed in the despatchers' offices at Portland and Roseburg, intermediate telephone sets were put into the telegraph offices along the line, and portable telephone sets in the cabooses. These caboose sets are connected with the telegraph wire by means of the usual extension pole.

"These instruments have furnished good service, but we found it necessary to break the circuit at Junction City, a point 110 miles from Portland, as on account of the great number of intermediate telegraph offices and relays the telephone circuit was not entirely satisfactory for the longer distance.

"These instruments have been for several months in regular service and are used frequently by the despatcher. They are also used by train crews in securing orders at blind sidings or between stations. I have in mind one instance where a freight train meeting with some trouble between stations, which would delay it for several hours, immediately communicated with the despatcher by means of the caboose telegraphone instrument, and thus enabled

the despatcher to promptly move his other trains and avoid bad delays. We are experimenting with a later style of instrument furnished by the National Telegraphone Company, which is known as the "buzzer" or "howl" signal instrument. This is on our line between Portland and The Dalles, Oregon, a distance of 88 miles. These instruments have an improved signalling arrangement which does away with the slight interruption in the telegraph circuit, that was experienced on the instruments in use between Portland and Roseburg, and which was about the only objectionable feature about them.

The Cost of Locomotive Operation.

XXII.

BY GEORGE R. HENDERSON.

(*Concluded from page 95.*)

COMPARATIVE COSTS.

It often occurs that the comparative cost of operating over different profiles is desired. This may be needed in order to determine the wisdom of constructing a new line over a lower grade, or of altering an existing one. For instance, a survey is being made in order to connect two points 150 miles apart on practically the same level above the sea. One line can be built for a certain sum, but necessitates a 1 per cent. grade each way from a central summit; another line, more costly, can be built with one-half per cent. grades each side of the central summit. The question then arises: "Will the reduced cost of operation pay a sufficient interest on the increased cost of construction for the low-grade line?"

Table E (see *Railroad Gazette*, January 26, 1906), gave us the cost per 1,000 ton-miles for all combinations of speed and train load, and it appeared that 1,200 tons at an average speed between terminals of 12½ miles an hour could be transported at 50 cents per 1,000 ton-miles, including the operating charges embodied in items 10 to 22 inclusive.

Table F.

1. Speed up hill, miles per hour	5	10	15	20
2. Weight of train, tons back of tender	2,550	2,530	1,900	1,350
3. Ton-miles per trip, back of tender	383,000	380,000	285,000	202,050
4. Running time, hrs. bet. terminals	17.5	10.0	7.5	6.25
5. Actual time, hrs. bet. terminals	21.0	12.0	9.0	7.5
6. Average speed, between terminals	7.2	12.5	16.7	20.0
24. Cost, per 1,000 ton miles, net	$0.36	$0.37	$0.39	$0.43
25. Million ton miles per month	10.6	16.1	14.7	11.6

With Reduced Train Loads. Cost and Ton-Mileage.

1,200 tons	.47	.42	.43	.45
	5.0	7.6	9.3	13.3
1,400 "	.44	.40	.41	
	5.8	8.9	10.8	
1,600 "	.41	.37	.39	
	6.6	10.1	12.3	
1,800 "	.39	.36	.38	
	7.5	11.4	13.8	
2,000 "	.37	.35		
	8.3	12.7		
2,200 "	.36	.35		
	9.1	13.9		
2,400 "	.35	.36		
	9.9	15.2		

Table F gives the same information (condensed) for the second case mentioned above—that is, a 150 mile division with central summit approached by one-half per cent. grades. We again find the lowest cost in the column corresponding to an average speed of 12½ miles an hour, and with a train of 2,200 tons back of tender it amounts to 35 cents per 1,000 ton-miles. There would evidently be a saving of 50 — 35 = 15 cents for each 1,000 ton-miles hauled back of tender, but as this includes the deadweight of cars, which may be as great as the revenue load, we should conclude that 7 or 8 cents per 1,000 revenue ton-miles might be saved by such grade reduction. It is evident that the other charges, such as superintendence, maintenance of track, etc., would be little affected by the easier profile, so that the question resolves itself into one of traffic density. If a traffic of 1,500,000 revenue ton-miles per day could be depended upon, the saving per day would be 1,500 × .08 = $120, or for 300 days, $36,000 per year. If money could be borrowed at 4 per cent. interest this would represent a cash capitalization of $900,000, up to which amount the low grade line would be a paying investment. If the traffic were greater, then we could afford to spend still more in perfecting the line. There is still another advantage for the low grade location, and that is, that each locomotive could haul nearly double the ton-mileage each month, so that only about half as many engines would be needed to do a given amount of work.

There is considerable labor in calculating tables E and F, and if we wish to know the difference in cost of operating on two profiles, it will ordinarily be sufficiently close to simply figure the cost per 1,000 ton-miles at the maximum load which the engine can haul. Thus in table E we find this to be 51 cents (see line 24, five-mile column) and in table F, 36 cents. The difference is again 51 — 36 = 15 cents, precisely the amount found by the more laborious method of calculating various combinations of weight of train and speed. While the heaviest trains and slowest speeds do not give the minimum cost, as is apparent from Figs. 11, 12 and 13, yet as a rule the cost of transportation is not greatly in excess of the minimum, where the engine is so loaded, and for quick results figures based on maximum train loads will frequently be found useful, especially for comparisons; but when decisions are to be made as to the actual schedule and loading to be adopted, then the advantages of charts showing the cost and quantity of freight moved will be very great.

Stopping and Starting.—Our analysis would hardly be complete if we did not consider the often discussed problem—the cost of making a stop. In the chapter on fuel we determined the amount of coal necessary for stopping and starting a train of 2,000 tons back of tender on a level track. This was found to be 213 lbs. greater than would have been burned if the train had continued moving uninterruptedly at a speed of 27 miles an hour, which was the maximum speed possible under the assumed conditions. We also found that the stop would require 16 seconds of time and 320 ft. of distance, while to accelerate the train to 27 miles an hour again would require 10 minutes and 34 seconds and 19,113 ft., or a total loss of 10 minutes and 50 seconds (without allowing any time for remaining stationary). The amount of water corresponding to this quantity of coal would be three-quarters of 213, or 160 gallons. Items 12 and 13 would evidently not be affected under our methods of analysis.

The cost of locomotive repairs would be increased, as the drawbar pull would be greater during acceleration than when running uniformly at 27 miles an hour. In the latter case the drawbar pull or tractive force would be about 19,000 lbs., or 9½ tons, so that the cost would be 9½ + 1 = 10½ cents per mile. During acceleration, this force would probably average 30,000 lbs., or 15 tons, and the corresponding cost would be 16 cents per mile, the difference being 5½ cents. As the distance through which acceleration takes place is over 19,000 ft. we can call it four miles, making an increased cost of 4 × 5½ = 22 cents for wear and tear on the engine.

The pay of enginemen will be increased under some conditions. Thus if the average speed for the trip is less than 10 miles an hour, and the 11 minutes lost by this stop is not made up, it will appear as overtime. If it be made up, or if the average speed, with the stop included still exceeds 10 miles an hour, then no overtime will be called for. We are now considering, however, that the time lost by stopping is not made up and must be paid for as overtime. Then at 70 cents per hour we shall have $\frac{11}{60} \times 70 = 13$ cents; so for the trainmen at 80.5 cents an hour, we have $\frac{11}{60} \times 80.5 = 15$ cents. As interest was assumed at 10 cents an hour, the excess will be 2 cents.

We can now tabulate these extras as shown below:

Coal, 213 lbs. at $1.00 per ton	$0.10
Water, 160 gallons at 10 cts. per 1,000	.02
Repairs, 4 miles at 5½ cts.	.22
Enginemen	.13
Interest	.02
Trainmen	.15
Total	$0.64

There should properly be added an amount representing the wear of brake-shoes, wheels, etc., but no data is at hand for this purpose; in a general way, it is covered in regular repair charges. Still, it must be excessive and abnormal at such times, and the money value has been variously estimated at from 9 to 15 cents a stop. If we allow for this, it would put our cost at 75 cents under the conditions which we have considered.

In October, 1905, Mr. J. A. Peabody gave some estimates of cost of stopping trains in a paper presented at the annual meeting of the Railway Signal Association. These were generally what might be called "high-class guesses," but as they were made by competent railroad officials they are worthy of consideration. The values given were as follows:

Passenger trains	530 tons,	50	miles	speed	$0.42
Freight trains	2,000 "	35	"	"	1.00
Passenger trains	400 "	45	"	"	.35
Freight trains	1,500 "	15	"	"	.56

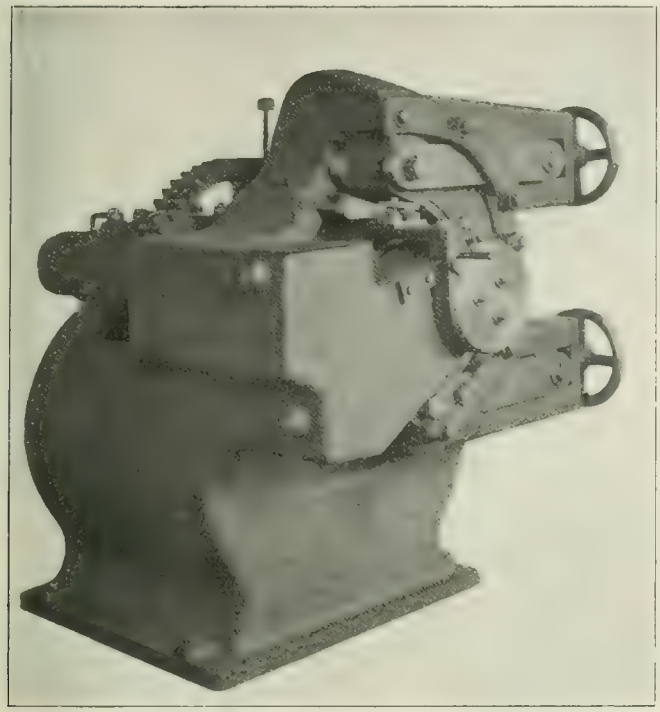
It would appear, therefore, that the amount shown by our calculations, viz., 75 cents, corresponds closely with what might ordinarily be expected by railroad officials, even if the individual items composing this amount do not agree in detail. It is evident that the method just discussed will give different results for different conditions of train load, grade, etc., but it is perfectly proper that this should be so. As with all questions of operating costs, it would be extremely difficult, if not impossible, to compute accurately the cost of any definite stop, yet we have here the elements which evidently enter into the problem, and they will surely affect the total figures in accordance with their relative importance. It

is believed that the results will be sufficiently accurate and reliable for all practical purposes, and especially so for making comparisons, which, it has been stated before, was the particular object sought to be accomplished by this study.

(*The end.*)

The Acme Rotary Thread Rolling Machine.

In the rotary thread rolling machine made by the Acme Machinery Co., Cleveland, Ohio, the threading dies, instead of being of the reciprocating type, are composed of one rotary or revolving die which runs continuously in one direction, and one segmental die which remains stationary after it is adjusted to the work. The bolt or piece that is to have the thread rolled on it is passed between the two threading dies and carried around with the rotating die, which is mounted on the main shaft or spindle. The illustrations show the general construction of the machine, and it will be seen that it differs radically in construction from roll threaders of the reciprocating type. The adjustment of the distance between the two dies which control the diameter of the work, is effected by means of the hand wheels shown. The segmental die is carried in a heavy block that is eccentric to the shaft, and by loosening one of the hand wheels and tightening the other, the adjustable die is advanced or withdrawn from the rotary one. The feeding mechanism is also clearly shown in the line drawing; A is the rotary die, B is the adjustable shoe carrying the segmental die, and C is the driving spindle.



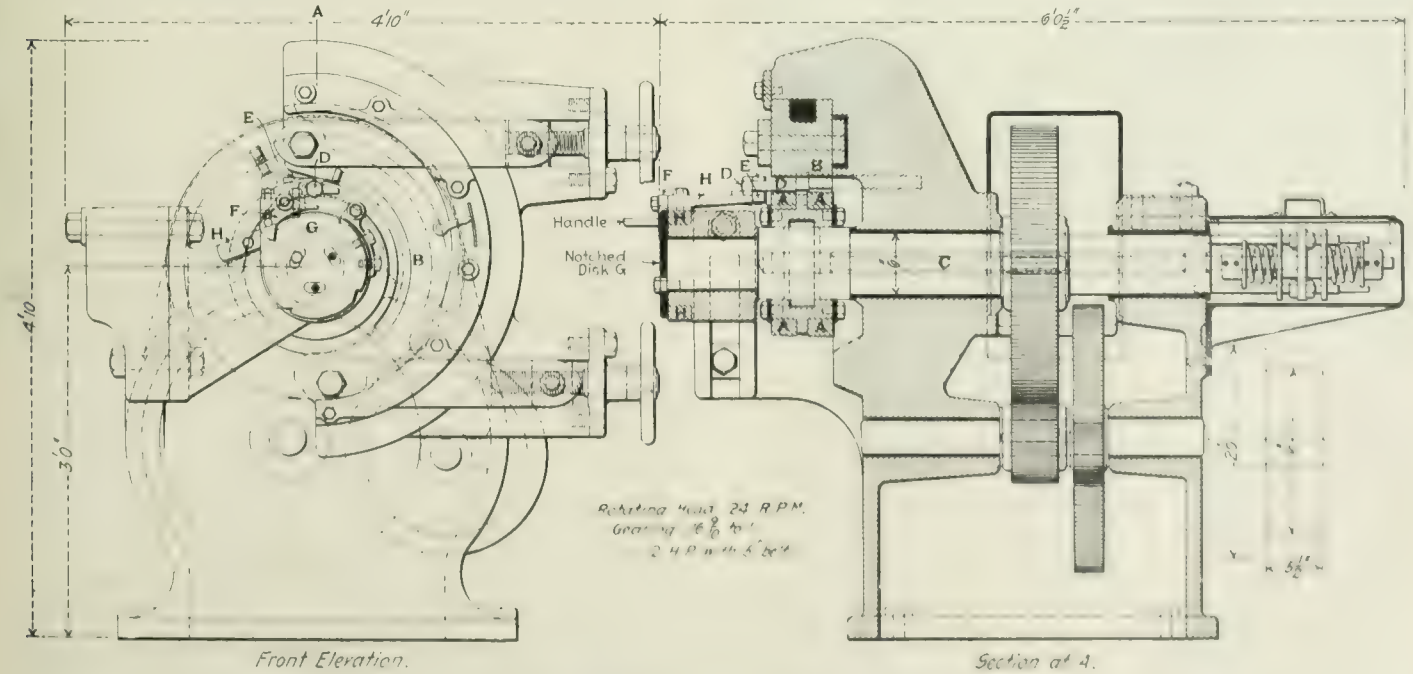
The Acme Rotary Thread Rolling Machine.

The bolt D is placed in the jaws E, the operator starts the bolt into the machine by moving a handle (extending out from the feeding carriage) attached to pawl F. This handle, which is shown in the half-tone illustration, drops the pawl into engagement with the notched disk G, which carries the oscillating carriage H forward and passes the work between the dies, the rolling beginning at once. The jaws then open automatically and allow the carriage to drop back by its weight to the feeding position again. There are four opportunities for feeding in every rotation of the die, as there are four notches in the disk. The bolt or rod is fed into the machine horizontally so that bridge rods, car truss rods or other work of almost any length may have threads rolled on the end. At the rear end of the main spindle there are two spiral springs and means for putting them in tension; this is an important feature, as it keeps the dies in pitch. As the bolt enters and the rolling begins at different points on the dies, the breaking down, or the beginning of the thread, is not confined to one particular place, so that the wear is general and uniform over the whole die surface. The dies admit of fine adjustment for the required size of work, or to compensate for wear.

The following results of a recent test showing the comparative merits of cut and rolled threads may be of interest. The material in both cases was machine steel. A 1¾ in. x 24 in. piece with a cut thread showed a tensile strength of 88,900 lbs., whereas a piece of like dimension but with a rolled thread showed a tensile strength of 95,850 lbs. The rolled thread is, of course, not adapted for every purpose, still the above test shows that where it may be used there is a great gain in strength and a consequent saving of weight and cost. The saving in weight of material is about 20 per cent., that is to say, material 20 per cent. lighter than would be used if the threads were to be cut, may be used if the threads are to be rolled and there will be no loss of strength. It is also claimed that there is a gain of about 100 per cent. in time as at least twice as many bolts may be rolled as may be cut in a given time.

These machines are made in a 1-in. and in a 2-in. size. The 1-in. machine will cut threads from ½ in. to 1 in. Its weight is 10,000 lbs., and it occupies a floor space 4 ft. 10 in. x 6 ft. 6 in. The 2 in. machine will cut threads from 1 in. to 2 in.; its weight is 20,000 lbs., and requires a floor space of 7 ft. x 9 ft.

One of the Prussian State Railroads sought to satisfy the clamors for a branch to a town some 3¾ miles from the nearest station by establishing an automobile service running to connect with five trains daily, and capable of carrying 13 passengers, with fares 7 and 10 cents for two classes. The public was pretty well satisfied except the cab drivers,, who were forced out of business; but the railroad less so, for it received in a year $1,806, while the service cost it $3,198. More than one fourth of the cost was for renewing tires.



The Acme Rotary Thread Rolling Machine.

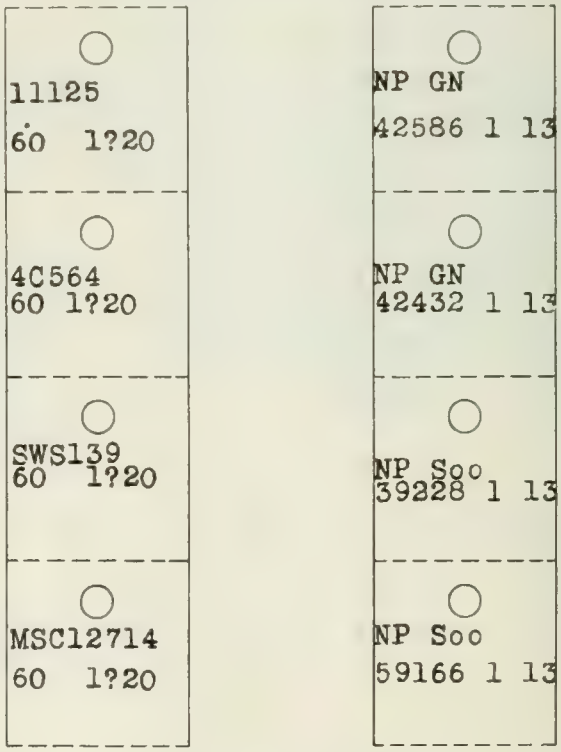
Beecham Car Transcribing System.

The problem of securing prompt and accurate records of car movement has long been one of the most difficult which railroad officers have had to face. To promptly record the facts shown on the hundreds or thousands of conductors' and agents' reports which daily come into the office of the Car Accountant or Superintendent of Car Service has always been a hard thing to accomplish. One particular cause of delay has been that each report has had to pass through the hands of every record clerk in the office, in order to give each man a chance to take off from it the records of such cars as fall within the particular group or series assigned to him for recording. In this process any one clerk may in a list of 50 or more car movements find only three or four of his series of cars. Yet it has been necessary for him, in order to make sure, to read over all the car numbers listed on all the conductors' reports. This takes much valuable time. In order to obviate this loss, and in other ways to simplify the work of car recording, a system of transcribing car records was put into effect eight years ago on the Chicago, Milwaukee & St. Paul by W. E. Beecham, Car Accountant of that road, whose invention it was and who holds the patent for its use. The transcribing feature of this system was on August 1st adopted in the office of the Car Service Agent of the Chicago & North Western, and on September 1st the Atchison, Topeka & Santa Fe began a similar method of car transcribing. In order of its adoption, the Beecham system is now in use on the Chicago, Milwaukee & St. Paul, Illinois Central, Burlington, Southern, St. Louis & San Francisco, Pennsylvania Lines both East and West (which adopted it May 1st), Chicago & North-Western, Atchison, Topeka & Santa Fe and Missouri Pacific.

Under this method of transcribing conductors' and interchange reports, instead of being passed about among the record clerks, are on coming into the office at once turned over to girls who on typewriters transcribe the essential facts of each car movement on a perforated stiff paper ribbon, each division of which represents a car movement. This work is done by an ordinary Oliver typewriter, the marginal stop of which is set to run the width of the tags. At the back of the machine is connected the Beecham attachment, which is a reel over which the strips of tags are run. The tags come in a roll and are rolled from the reel on a guide, which fits on the apron of the carriage of the machine. When a convenient length of tags has been written off, the printed part of the roll is torn off and goes to sorters, who tear apart the perforated slips and sort them according to the requirements of the particular office system. The tags are of different colors, each color representing a different class of car movement. Each tag has in its upper side a round hole, to be used for inserting a pin or spindle. The sorting is done by young boys or girls who put on separate spindles all tags which represent those cars which are assigned to each record clerk. The record clerks then make up their book records directly from the tags turned over to them by the sorters. This is in general the system as used on all of the roads.

Its most complete development is on the Chicago, Milwaukee & St. Paul, where not only are car movements transcribed by this method, but all car records, except those of foreign cars on the line, are actually kept by means of the typewritten tags instead of, as is the general practice, in books. These tags are 1 in. square with a round hole in the top into which will fit an aluminum pin. White tags indicate the movement of loaded cars, both home and foreign, over Chicago, Milwaukee & St. Paul lines; yellow tags cover empty movements of all cars; brown, work train movements, red, delivery of cars off the line (i.e., to foreign roads); blue, return to the line from foreign roads, and green, deliveries of St. Paul cars from one to another foreign line as reported on postal card junction interchange reports. Two strips of four printed tags, each parts of longer strips transcribed in the office of the Car Accountant are reproduced (actual size) in the accompanying illustration. The first strip is on white paper. The top tag shows that C., M. & St. P. car 11,125, loaded, arrived at Milwaukee (whose symbol number is 60), January 20. The interrogation point between the month and the day of the month is made by a particular operator on every tag she transcribes. Each operator is assigned a typewriter character, not used in transcribing, for identification of her work. As in any case, a space would need to be made between the two figures which represent the dates and it takes no longer to strike a character key than a space key on the typewriter, no time is lost by putting in the identification symbol. The second tag shows that Canda Cattle Car Company (familiarly abbreviated as 4 C), car 564, loaded, arrived at the same station on the same date. The third tag gives the same information about Street's Western Stable Car Line, car 139, and the fourth, about Mather Stock Car 12,714. These four tags evidently represent part of a loaded stock train which has arrived at a junction point or terminal on its way from the west. The other strip of five tags is green and represents part of a junction interchange report sent in by the Northern Pacific. The record shows that on January 13 the Northern Pacific delivered C. M. & St. P. cars 42,586 and 42,432 to the Great Northern, and C. M. & St. P. cars 39,228 and 59,166 to the Minneapolis, St. Paul & Sault Ste. Marie. As this strip was taken from an actual record, the tags naturally all show delivery on the same date. There is in this case no mark of identification necessary, because all transcribing from postal card junction reports is done by one operator.

The shape of the tags used on the Chicago, Burlington & Quincy, Chicago & North-Western, and other roads is also illustrated, actual size. This strip was made up from actual transcriptions in the office of the Car Accountant of the Burlington. On this road, white tags represent C. B. & Q. cars moved on the line; yellow tags, foreign cars moved on the line; pink, deliveries of all cars both home and foreign to connecting lines, and lavender all cars received from connecting lines. A salmon colored tag has been used for Burlington & Missouri River R. R. in Neb. cars, but with the numbering of these cars in regular series with C. B. & Q. cars, its use is being abandoned. This strip does not, as in the case of the St. Paul strips illustrated, represent a series of tags as they came in consecutive order of transcription of particular car records, but is made up of tags selected from a large number, to show more variety than is likely to be found in a single record. The strips are shown unseparated to give an idea of the ribbon as it looks before it is torn apart. The first four tags are white, representing C. B. & Q. cars moved on the line. The figure 8 in the first tag means the 8th of the current month. It is not necessary to include the number of the month in the facts given on the tags, because the tags are not, as on the St. Paul, used for a permanent record. The book records are made up long before the 30 days,

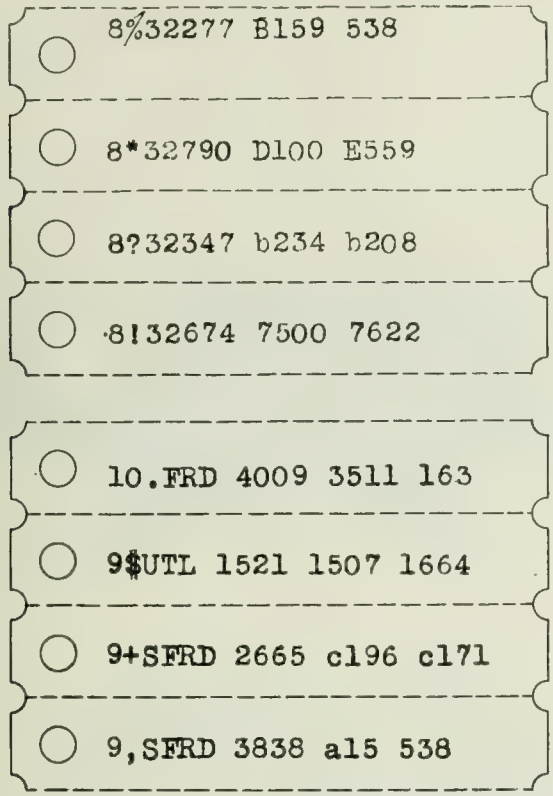


Beecham Car Transcribing System; Specimen Transcriptions; Chicago, Milwaukee & St. Paul.

which would have to elapse to create any confusion, pass. The % sign is the mark of the operator who transcribed the record. The tag then shows that C. B. & Q. car 32,277 on the 8th of the month arrived at the station whose symbol is 538 from the station whose symbol is B159. The second, third and fourth tags, each transcribed by a different operator, show that on the 8th, C. B. & Q. cars 32,790, 32,347 and 32,674, respectively, moved between the stations represented by the symbol numbers given. The second four tags are yellow. The first shows that on the 10th of the month Fairbanks' Refrigerator Despatch car 4,009 moved from station 3,511 to station 163. The other three represent similar movements on the line, on the 9th, of Union Tank Line car 1,521; and Santa Fe Refrigeratar Despatch cars 2,665 and 3,838. Each of these four tags was transcribed by a different operator. The third four tags are pink, representing deliveries of all cars both home and foreign to connecting lines. The first shows delivery on the 9th of Great Northern car 14,902, which left the line at junction point G9, which interpreted means Great Northern Railway, St. Paul. The other three record the delivery of Quincy, Omaha & Kansas City car 2,170, C. B. & Q. car 32,702 (initials omitted), and Cleveland, Cincinnati, Chicago & St. Louis (Big Four) car 23,409. The fourth strip of four tags is lavender, recording receipts of all cars, both home and foreign, from connecting lines. All came on the line on the 10th. The tags were all transcribed by the same operator. The Kanawha & Michigan car 5,714 was received at junction E1; the others, the New York Central, C. B.

& Q., and Toledo, Canada Southern & Detroit (Michigan Central) cars, all at junction point B18. These examples from these two roads cover the general plan of the transcribing.

On the Chicago, Milwaukee & St. Paul an average of about 30,000 car movements are transcribed daily, with a maximum of 53,000 on Mondays. The average number of train reports received daily is about 900, with a maximum of 2,250. There are 29 type-



Beecham Car Tr… bing System; Specimen Transcriptions; …o, Burlington & Quincy.

writers used in tr… bing. The average number of transcriptions per machine per … 320, with a maximum of 570. The tags are distributed by th… e of 40 transcribers and sorters onto pins fitted into a seri… inclined boards. Each C. M. & St. P. car has its own pin… ch board holds 2,500 pins, or 2,500 cars on each side, a tota… 5,000 cars to each board. The boards are in… clined and atta… to each other in an inverted V shape, with the vertex of the angle a little over 6 ft. from the ground. Each pin fits into a space about 1¼ in. square, which leaves room for reading the tags on the pins or for easily detaching the pins from the board. The pins are 8 in. long and will, it has been found, hold on the average the record of every movement of a car for three years. When a pin is filled to its capacity, the oldest year's tags are removed and filed away for future reference. The tags are placed on the pins as they come into the office, so that unless there is some omission or mistake in the records received, each pin represents chronologically every movement of a particular car. When a car is wrecked or for any reason a car number becomes vacant, a pink tag, on which are briefly noted the circumstances, closes the history of that car. By detaching a pin and examining the tags, not only can the detailed history of any car be traced, but simply by a glance at the colors of the edges of the tags as shown when the pin is removed from the board, a rough estimate can be made of the length of time a car has been off the line, or on the line, loaded or empty. In the same way by a glance at the surface of a board it is possible to tell at any time by the proportion of each color on the top tags which meets the eye how the particular block of equipment which it represents is at the moment distributed. The spaces on the boards which are covered by the tags form a rectangle about 31½ in. high. The sections 1¼ in. square in which the pegs are fitted are arranged in a regular series of numbers as in a car record book, with 25 cars in each up and down row or two rows for every range of 100 numbers. As on most roads, the equipment is distinguished by the numbering. Box and furniture cars bear even numbers and stock, flat and coal cars, odd numbers. Thus 50 cars of one class cover a range of 100 numbers. Records of foreign cars are transferred from the tags to a book, but these are the only book records kept. When the system was installed in 1898 there were six such boards; now 12 are in use. In order to distinguish between the records of different years, the color of the typewriter tape used is different each year. Last year a brown tape was used and in 1904 a purple tape. This prevents any possible confusion between the records of these years and of the present year, when a green tape is being used. When a record is missing, the top tag is faced down, until the matter is either squared up, or five successive movements on the home line have been reported, when the tag is turned back and the record proceeds as before.

The principal advantage of this system of keeping car records is that it is easy to get at. If information about any particular car is desired for a tracer it is not necessary to interrupt a man who is working on a record book while the information is being obtained, but simply to go to the board which contains the pin for that particular car and obtain the facts desired. When there is special necessity for finding out the location of the equipment quickly, the whole office force is immediately employed in obtaining the information from the boards, whereas only as many as ordinarily work on books can simultaneously be employed under the book record system. On one board containing the records of 5,000 cars, 12 people can work at once. This number of cars would ordinarily be divided among from one to three books. This means that information can in general be obtained four times or more as quickly under the board record system. Every ten days, when the location of all equipment is reported to the general officers, by thus employing the entire force on the boards, the whole account is made up in no more than half an hour. For a little more than a year, the transcribing system has been applied to the monthly per diem reports from other roads. These are written off on a typewriter by an operator just as though they were conductors' reports, are then sorted into numerical order (which shuffles them out of arrangement by separate roads) and turned over to the most skillful of the girls employed in the office for comparison with the board record of the same cars. Where the two entirely or practically agree, the foreign road's claim for per diem monthly payment is received as correct. In cases where there is an obvious discrepancy, the facts are recorded on the back of the per diem tag and the claim returned to the other road for correction. It is obvious that this checking requires considerable head work, as one needs to know not only the names and general location of all of the important railroads in the country, but the principal connections of the home road, the arrangement of the line, the probable junction point where a car would be received from each foreign line and the length of time which a car would normally take in going between any two points on the home line or between the principal points on foreign lines. If, for example, in the month covered by the per diem statement a green tag shows that the car has been delivered by the New York, Chicago & St. Louis to the Erie and the next tag is a white one, which shows that the car arrived at Milwaukee ten days later, it is necessary for the girl who is checking up the account to know how long it would probably take to haul the car from the most probable junction point between the St. Paul and the Erie to Milwaukee. If the number of days per diem allowed by the Erie corresponds to the length of time which it would have normally held the car if it had been thus forwarded to Milwaukee, the statement is accepted as cor

rect, and no further examination made of the matter. If, however, there is such a discrepancy that by no probable chance could the car have been held by the Erie so short a time as indicated, the record is taken up with that road for further adjustment. According to Mr. Beecham, the girls who do this work, all of whom were entirely ignorant of the business, have become so skillful and intelligent that they not only give complete satisfaction but save over 50 per cent. of the labor formerly required. A two weeks' check of the work after this method of tracing had been in effect for two months showed a loss to the road of only 10 cents out of a total of thousands of dollars.

Before the transcribing system was adopted, there were four men employed in figuring penalties, six in figuring per diem, eight on foreign records and two in tracing foreign cars, a total of 20 men. Under the present arrangement, 11 men are employed on foreign records, one man on penalty work, two on tracing and other similar work and four on miscellaneous work, an actual saving of two men. More than this, while under the old system the record clerks uniformly had to work at least six evenings a month, there is now not only no necessity for such overtime but only half the day has to be spent on record work. The flexibility of the transcribing system is being further taken advantage of by distributing the hours of the working day. In order to have information about car movements as promptly as possible, most of the office force is employed in the morning on transcribing and filing the car records received that day. It has been found that this can all be done by noon, which leaves the rest of the day free for using the records already obtained, when most of the force is transferred from the transcribing and filing work to tracing per diem and other work in which the records are used. That is, the morning is devoted to making records and the afternoon to using them. By this means, the records are obtained promptly, instead of being two or three days late, as not infrequently happens under the book record system. Thus also each member of the force becomes able to do intelligently most of the work of the office, and the employment, because of its variety, is less monotonous. The office force is made up of 83 persons, 19 years old on the average. Fifty of these are girls. At present, the average member of the force has been in the office considerably less than a year, which shows the intelligence and skill with which the new work has been taken up by the beginners. Some of the brighter girls are able to do per diem work successfully with less than six months practice.

On the Chicago, Burlington & Quincy, the Beecham transcribing system has been in force for two years. An average of about 2,800 records daily are transcribed by each operator and individual records have run as high as 4,200 transcriptions. Not only is the operator who makes the record identified, but each person who sorts the tags makes a distinguishing pencil mark on the back of each strip so that it can at once be told by whom each separate slip was sorted. The tags are not used for a permanent record as on the St. Paul. They serve three purposes: First, for entering car movements on running record; second, a record of C. B. & Q. cars on foreign roads; and, third, for use in making up junction cards to be sent out to foreign roads. The shape of the tags and details of the transcribing have already been illustrated. On the Chicago & North-Western, white tags represent loaded cars; yellow, empty cars; salmon, loaded interchange records; pink, empty interchange records, and red, junction postal card reports and shop reports. On August 1st, the first day the transcribing operators were used, the average number of transcriptions was from 1,200 to 1,300 for each of the 20 girls employed. On August 9th one of the girls succeeded in turning out 3,600 transcriptions. There are, in the train reports received daily, about 6,000 interchange reports. About 1,500 junction cards come into the office every day. The information transcribed from the conductors' reports shows initials (except Chicago & North-Western cars), the symbol number of the station where left and the date. On the Pennsylvania Lines East of Pittsburg, where there is a force of 450 people employed, some 4,800 train reports and 135,000 car movements are recorded each day. This requires 60 transcribing operators.

The advantage of the Beecham transcribing system, as shown in this description of its operation, is in a saving of time and money. By the substitution of inexpensive labor for more highly paid labor it costs less to do the same work. Instead of having a clerk spend his time searching out the material which he needs for his records, this work is done by young girls and boys whose time costs the company perhaps half as much and the clerk has all his time to put directly on his work of recording. This redistribution of the work of car recording not only saves money but what is in this case more important, saves time. Records become available promptly instead of often being several days or a week or more late. This is a most important advantage, for it enables operating officers by keeping close track of the equipment to run the road more economically and effectively. In addition to the widely recognized value of the system in transcribing, the experience of the St. Paul shows that it can be used with success as the sole record of car movements. Although the wisdom of transcribing car records has been the subject of debate at various conventions and is not yet officially established, the facts here presented by different users of the system seem good proof of its successful operation.

Motive Power in Mines.

BY C. H. CRUTTERS.

The subject of motive power as used on the railways of mines, may be considered under three heads; haulage by animals, haulage by ropes actuated by stationary engines or water-power, and haulage by steam, compressed air, and electric locomotives. Beginning with animal power, the writer distinctly remembers in his very tender years, standing astonished at the sight of a grimy man and a large dog attached to a small hand-cart as they emerged from a bituminous coal mine near Pittsburg, Pa. Both man and dog were fitted with a sort of harness which enabled them to draw the cart



Grice & Long Mine Locomotive, 1872.

with ease, and as the passing days rendered the sight familiar, I learned that these dogs were cared for in regard to food, etc., by their owners in a way to render them efficient in the service required. Although the mine was a large one, this was the only mode of hauling used in it for several years. Then rails were laid and larger cars drawn by mules took the place of the "mixed" power first mentioned. As the horse and the mule, especially the latter, have been very familiar features around and in coal mines for many years, it will suffice to say that both have proven valuable servants to coal operators, and the mule seems especially adapted to that class of work as he is very sure-footed and is therefore able to safely maintain a high speed ahead of trains of cars when descending steep grades in the uncertain light afforded by the driver's lamp; and he soon develops an almost human familiarity with the different parts of the mine in which he works, so that he obeys the commands of the driver with an intelligent perception of their meaning, and is driven without reins, and often without a bridle.

As the years passed on, the workings of many mines gradually receded to such a distance from the original entrances that it became necessary either to locate new points of loading the output on cars, nearer to these workings and extending the railway sid-

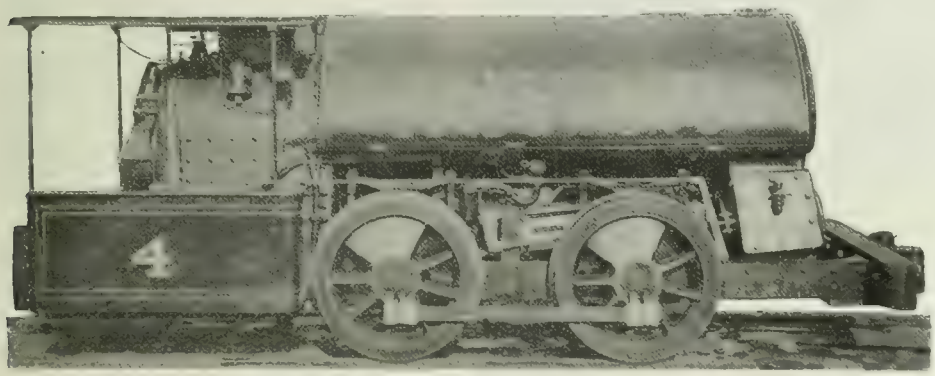


"Grand Mulet," Built by Smith & Porter (Now H. K. Porter Co.)

ings to them, or else to adopt some mechanical means of hauling the coal to the original openings which would accomplish the object more rapidly and economically than was possible with the continued use of the faithful four-footed servants. This latter idea was generally the more feasible and was especially desirable from an economical standpoint as it only involved some slight changes in the entries already opened in the mines, whereas new openings and approaches could only be constructed at considerable cost. The first means of mechanical haulage adopted, as far as can be accurately determined, was the use of rope engines, by engines or other power located at or near the mouth of the mines. Two systems were used; the first consisted of an endless rope arranged somewhat as on street cable lines. The grips attached to this rope at any point and in any number up to the maximum capacity of the engines, by means of "grips." This system was called the tail rope system. In it the rope while in motion maintained a complete circuit of the portion of the mine in which it operated, from as not continuous, and could be so adjusted that the two ends would be distant from each other in proportion to the length of the chain which was at-

tached. These ends were fitted with couplings, by means of which one end was attached to the front of the train and the other to the rear, thus forming, when so coupled, a practically endless rope, but without the advantage of enabling cars to be attached at any point. Signals, in both systems, were communicated to the engineman by a double line of wires connected to an electric bell in the engine room. The "rope-rider," as the man in charge of the train was called, carried a T shaped piece of steel, and by bringing this in contact with both wires, actuated the mechanism of the bell. One disadvantage of the rope systems, especially when the tail rope was used, consisted in the fact of the engineman being at such a distance from the trains, and the consequent delay in receiving signals when an accident occurred; indeed, the rope-rider was often thrown from his seat so suddenly in case of derailments or breakdowns that he was unable to get at the signal wire until considerable damage was done to the cars and the road, or the timbering of the mine. As an offset to this disadvantage, the use of either system required but little change in the contour of the entries in which they were placed, or in the tracks already in use before their installation.

Mine owners next turned to the steam locomotive as a more desirable means of bringing the products of their pits to the surface, and from 1870 to 1900 many were put into service. In most instances the entries or passageways in which they were used rarely exceeded 6½ ft. in height and 8½ ft. in width. Often they were of considerably smaller dimensions, and I recall seeing at the Paris Exposition of 1878 a mine locomotive of the inside-connected type built and exhibited by an English firm, for use in a colliery where the height of the entries did not exceed 42 in. This little engine was not over 3 ft. in height and was built with a very long footplate to enable the driver to partially lie down while the engine was running. On account of the space limits where these mine locomotives were to work, most of those first built in America used inside cylinders, but the difficulty of access to the eccentrics, links,



Mine Locomotive Built at the Baldwin Works, 1872.

guides, etc., when so crowded together, proved a great objection and the outside cylinders were generally used on all that followed. A Philadelphia, Pa., firm which has not only passed out of existence, but of which it seems difficult to obtain any data as to its passing, Grice & Long by name, endeavored to obviate some of these objections by building geared locomotives for mining purposes, and in addition to increased facility of access to the various parts, thought to greatly increase the power in proportion to the space required by the entire machine, as they were geared about two revolutions of the shaft driven by the cylinders to one of the main driving axle. Two types of these engines came under my notice, one, the Geo. W. Huntzinger, of which a photograph was sent me by the builders about 1872, and which had the cylinders, etc., immediately behind the boiler and set at an angle of about 30 deg The engineman sat behind these. The other type had a space for the engineman between these inclined cylinders and the firebox end of the boiler, and was brought to one of the collieries of the Penn Gas Coal Company, about 26 miles east of Pittsburg, Pa., in 1871 or 1872, but proved unsuccessful and was returned to the builder. This lack of success, my later experience with mine locomotives taught me, may have been the fault of incompetence and "crankiness" on the part of those handling it rather than the fault of the locomotive itself. Both types were entirely covered over with a sheet-iron roof, and both had their fire-doors on the side of the firebox.

Some manufacturer in the anthracite coal region of Pennsylvania thought to simplify these mine locomotives by using oscillating cylinders. Several, I believe, were built, but could not have been used to any great extent and even their memory appears to have passed out of the region where they were built, yet in 1903 I saw one at a machine shop in Goldsboro, N. C., to which it had been brought for repairs by its present owner. The badge-plate, if it ever had one, and every other indication of the maker's name had vanished. My most extensive experience with a mining locomotive was at the mine of the Westmoreland Coal Company, at Irwin, Pa., from 1873 to 1880. The company bought and placed in service, early in 1873, a Porter, Bell & Co. (now The H. K. Porter Co.) engine of 8 in. x 14 in. outside cylinders, 28 in. steel-tired drivers, and weighing 14,000 lbs. A steam pressure of 130 lbs. was carried. The service was chiefly drawing empty cars in trains having an aggregate weight of from 36,000 lbs. to 45,000 lbs., a distance of one and one-quarter miles up an almost continuous grade varying from 100 to 200 feet to the mile, and after our men learned to obey orders we had but little trouble, except that caused by the occasional necessity of using water strongly impregnated with sulphate of lime. This, of course, caused foaming, and was also disastrous to the firebox. The engine was seldom used in connection with the outgoing loaded trains as they were handled by gravity, but if by accident they became stalled in one of the two "swamps," or hollows on the line, they never seemed to cost the little machine any great trouble to start them over the "knuckle." This engine, like most of those built for mining purposes by the Porter people, was free from the unpleasant and somewhat dangerous rocking motion of many small locomotives without a truck. This was owing to the use of a somewhat shallow firebox, sloping upward toward the rear, and having the back pair of drivers placed underneath it. Although the main pins were on the wheels of this rear axle, the eccentric were on the forward axle, and we experienced no trouble with our valves from this arrangement, nor did the increased length of wheel-base prevent the engine curving freely, or cause it to leave the rails on the very sharp curves prevailing on portions of the line. We used coal obtained near the outcroppings and did our firing outside, at the main entrance of the mine, while the train was making up, and generally had very little smoke while working in the mine as we used considerably contracted exhaust nozzles, no netting or cone, and had a ventilating fan placed at the mouth of the mine. The small diameter of the drivers and proportionately large stroke of the cylinders threw the rod pins very close to the rims of the wheels, and hence the rods occasionally struck rather hard pieces of coal which had fallen beside the track and loosened the keys. It has always been a mystery to me, anyway, why the builders of mine and other small locomotives have generally persisted in the use of parallel rods fitted with split brasses and the necessary straps and keys, instead of using the more simple solid end rods, as in general railroad practice. This trouble referred to would be obviated to a great extent, and besides as much of the attention given these engines is usually by men of but little mechanical ability, the parallel rods would be kept in better condition, fewer cut pins would be found, and the alinement of the drivers, etc., would be better preserved.

The advance in the use of compressed air as a power for driving machinery led to its use in locomotives adapted to it. Probably that used in driving the Saint Gotthard tunnel was the first instance of such an underground locomotive. This engine was used at the Airolo (Italian) end of the tunnel, and was provided with a large cylindrical tank placed horizontally on the frame in place of the boiler. The air was compressed by power obtained from a waterfall, and the pressure carried in the reservoir on the locomotive was, I believe, 600 lbs. It passed thence to the cylinders through a reducing valve which brought it to a reasonable working pressure Pipes carried into the workings both afforded ventilation and enabled the engine to obtain a fresh supply if necessary. Compressed air locomotives were afterwards installed in some American collieries, and appeared to give fair results.

The electric locomotive next attained such perfection that it has been specified in nearly all orders placed for mining locomotives during recent years, and the Baldwin people inform me that with the exception of a few compressed air locomotives, they have built nothing for mining purposes but electric for a long time Admitting all the convenience of an electric locomotive from a practical experience in that department of mine work I will say that if the builders of compressed air engines will provide reducing valves which are simple, yet perfectly reliable under all conditions, and will also make the storage reservoirs of these engines of such a type that explosions will either not occur, or their effects be nullified, or better still, if effective results can be gotten from much lower initial pressures, the compressed air locomotive will supersede all others for use in mines, as it does not carry with it the danger of igniting gas in a fiery mine and its very exhaust is an aid to the ventilation.

One trouble with which all mine locomotives have to contend in most mines is the great amount of moisture on the rails. This necessitates the use of much sand and this in turn causes a very rapid wear of the tires with considerable cost for turning and renewals. The opponents of the steam mine locomotive urged as an

objection that its exhaust would disintegrate the mine roof and cause dangerous falls, but I have found this disintegration no greater on the engine entries than in the parts of the mine where the engine was never taken

Foreign Railroad Notes.

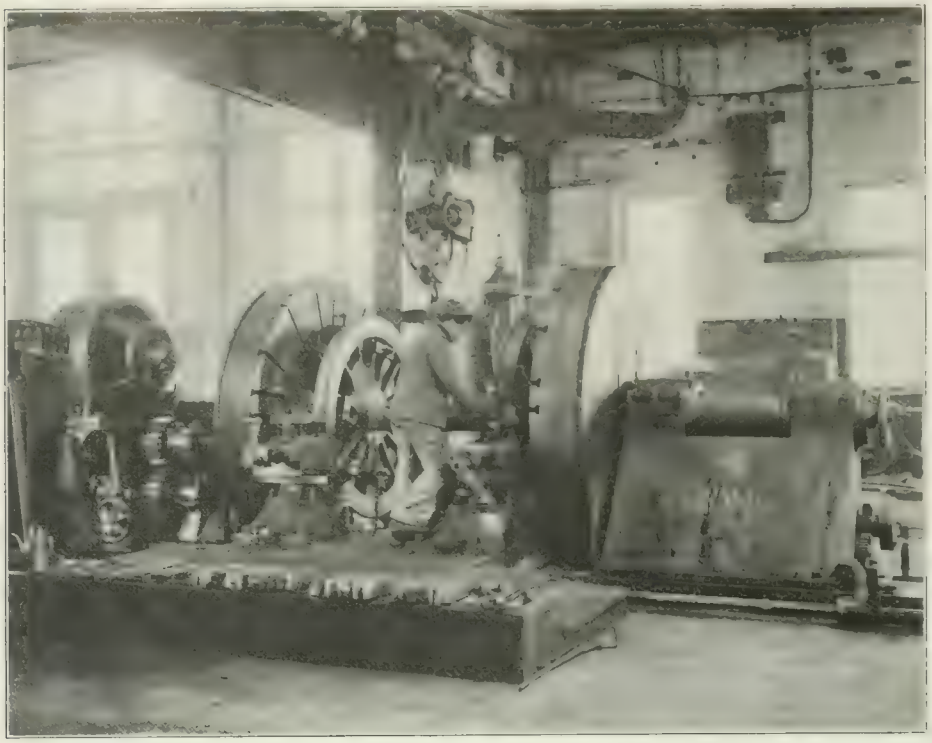
There is an express train between Basel at the northwest corner of Switzerland, and Chiasso in Italy, passing through the Gotthard Tunnel, which has won the name of the "poor man's lightning express," mainly because it carries third-class passengers, and its third-class cars have cushioned seats and head-rests. There are also first-class cars in the train but no second-class. The train leaves Basel at 7.15 a.m. and arrives at Chiasso at 3.49 p.m., and starts back immediately, arriving at Basel at 10.55 p.m. The third-class cars have an enormous patronage, northern Europe being full of Italians who do the kind of work they do here, and pass to and fro, according as their jobs last. It is comparatively a new thing for express trains to carry third-class passengers on the Continent; but there are many routes, like this, where an enormous travel is to be had, often much more profitable than the high-class travels.

The Hungarian State Railroad shops employed altogether in 1904 8,467 men, whose average wages for the year amounted to $257 each. These shops are 15 in number, the most important in North Budapest, employing 1,968 men.

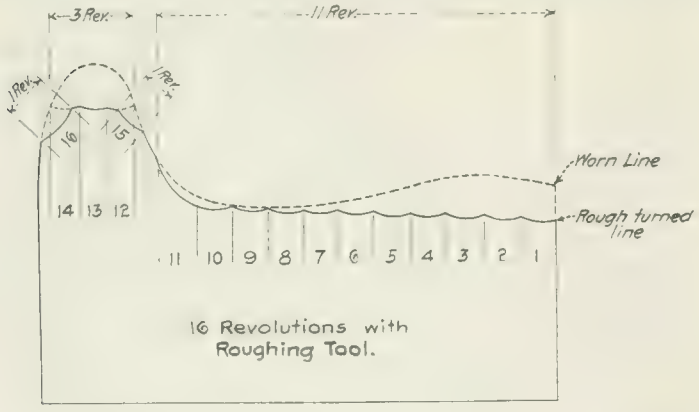
Three employees concerned in the Spremberg collision, which cost 15 lives, were prosecuted criminally. A station assistant was sentenced to 16 months' imprisonment, one switchman to one month, and a second switchman was acquitted.

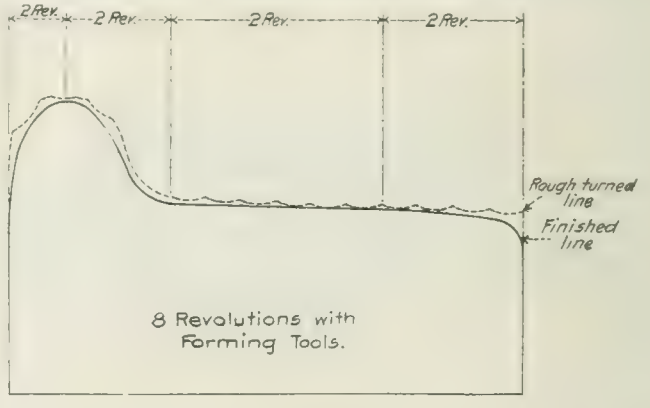
New Record for Turning Locomotive Driving Wheel Tires.

Another example of what can be done with modern high-speed tool steel and a well designed modern machine tool was shown by a test at the West Albany shops of the New York Central & Hudson River Railroad on Dec. 19, 1905, on a direct driven Niles 90-in. driving wheel chucking lathe, made by the Niles-Bement-Pond Company, New York. As shown in the accompanying table, 10 pairs of average locomotive driving wheel tires were turned in 9 hours and 6 minutes, or an average of 54.6 minutes per pair. Eight of the tires were 64 in in diameter and two pairs were 79 in. in diameter. There was a good deal of metal to come off, of an inch to of an inch, as may be seen from the test sheet. The total weight of the metal removed was 2,840 lbs., the motor frequently developing as much as 50 to 60 h.p. A detailed description of the machine used was printed in the *Railroad Gazette*, June 9, 1905, but another illustration of it is given herewith, so that the reader can form some idea of its massive construction. It is about twice the weight of the old style driving wheel lathes, has four to five times the power, and the method employed for holding the tires allows the full power of the machine to be utilized at the tools. The machine was provided with a full complement of the best grade of air hardening steel tools, including forming tools for the flanges, etc., and about a dozen right-hand and a dozen left-hand roughing tools, so that if a tool gives out it could be at once replaced by a new one. The size of the tool steel was 3 in. x 1½ in., which is important, as any smaller steel might break frequently. Good crane service was provided so that the wheels could be quickly put in and taken out of the lathe. In putting the wheels into the lathe the left-hand crank pin was put in the pocket in the face plate. The movable head was then run up until the grip pieces were close to the tire. The head was then clamped and the wedges were driven up with a light hammer. The clamp-bolts were then put on and the nuts screwed up tight. A fair average time for putting the wheels in the lathe and chucking ready for cut with operator, one helper and a crane man is about 12 min., but this has been done frequently in about half that time. The cutting-speed in ft. per min., the feed per revolution and the depth of cut are given in the accompanying table, and the points on the tire from which the cuts were taken are clearly shown in the two diagrams.



Niles 90-in. Driving Wheel Lathe in the West Albany Shops—N. Y. C. & H. R.





Method of Turning Tires with the Niles 90-in. Wheel Chucking Lathe—West Albany Shops N. Y. C. & H. R.

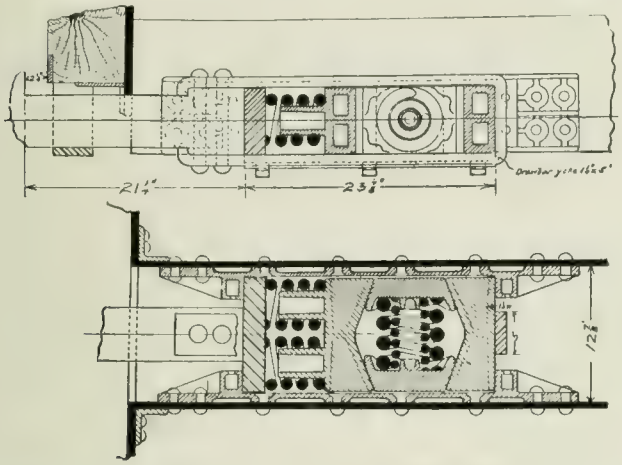
TEST OF NILES 90-IN. DRIVING WHEEL LATHE.
At West Albany Shops, N. Y. C. & H. R. R. R., Dec. 19, 1905.

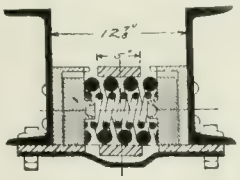
Diam of tire, ins	Cutting speed, ft. per min.	Feed, per rev., in.	Depth of cut, in.	Size of tool, ins	Time, in minutes, Cutting.	Putting in and taking out.	Total.
64	123¼	1/16	1/16	3x1½	45	8	53
64	121⅜	1/32	1/16	3x1½	46	9	55
64	121½	1/16	1/16	3x1½	44	10	54
64	11½	1/32	1/2	3x1½	43	9	52
64	121¼	1/32	1/16	3x1½	42	8	50
64	10⅞	1/32	1/2	3x1½	50	8	58
64	8½	15/32	7/16	3x1½	52	8	60
64	11	1/32	1/2	3x1½	47	9	56
79	14	1/32	3/8	3x1½	46	10	56
79	14	1/32	1/16	3x1½	43	9	52
					458	88	546
Total time							9 hrs. 6 min.
Average time, per pair							54.6 min.

The Piper Friction Draft Rigging.

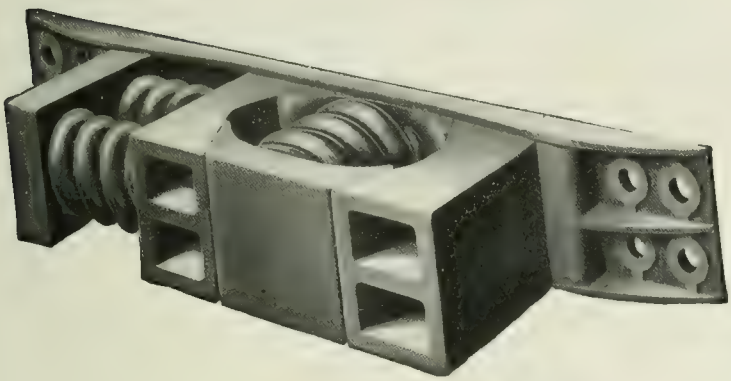
The illustrations herewith show the Piper friction draft rigging, which has lately been placed on the market after several years of tests and experiments on a large number of cars in actual service to bring it to a high point of efficiency. The patent granted W. M. Piper in 1896 covers broadly any mechanism consisting of blocks having oppositely directed inclines with contacting wedges and springs arranged to resist their movement along the inclines.

The arrangement shown is claimed to have been developed after exhaustive tests, in service and in the laboratory, both as to the amount of preliminary spring resistance necessary, and the best angle for the wedges to give an easy movement and a high point of work-absorbing efficiency. The diagram of the tests made at Purdue University in 1903 shows that this particular arrangement is capable, with a preliminary spring movement of 1¼ in. and 25,000 lbs. resistance, of an ultimate resistance of 250,000 lbs. through a total drawbar movement of 2¼ in. One form of this attachment is said to have reached a point of 300,000 lbs. in the compression test before the travel was exhausted.

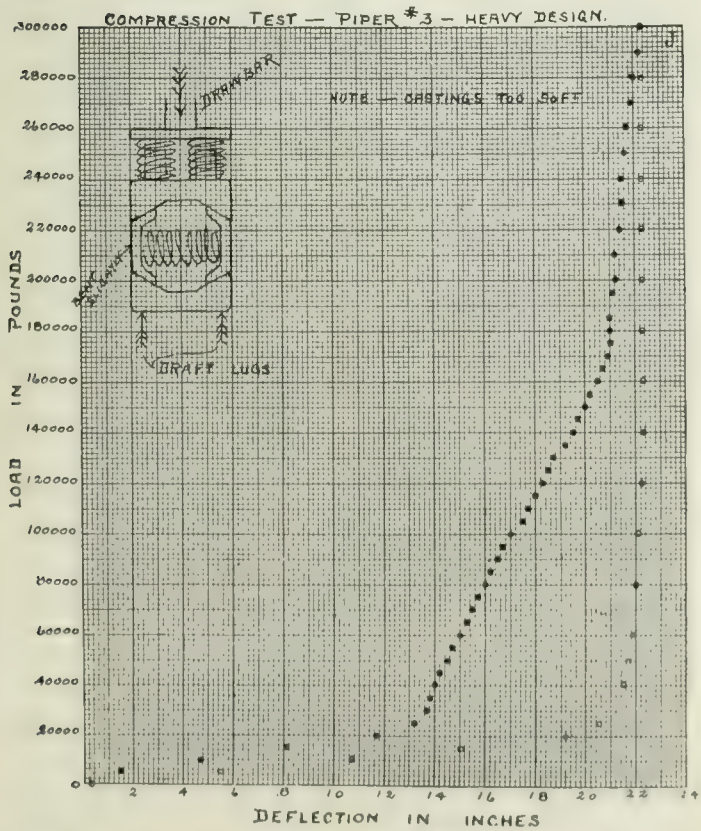




The Piper Friction Draft Gear.



The Piper Friction Draft Gear Assembled.



Test Made on Piper Friction Draft Gear at Purdue University.

A primary requisite of a friction draft gear is that it should not be liable to disorder or repair; that the parts be simple and substantial in design, easily inspected, incapable of being improperly assembled and of such form and construction that it may be cheaply and firmly fastened to the frame of the car. It is claimed that these points have been carefully considered and accomplished in the design of the Piper rigging.

The road tests of this year demonstrated that a considerable amount of easy motion was desirable in the starting of trains and absorbing the innumerable slight shocks incident to train service. This element is taken care of by the front twin-spring arrangement, the friction elements going into operation gradually, with a smooth easy motion, before the springs are completely compressed, avoiding possible shock.

The patents covering the Piper friction draft gear are owned and controlled by the Butler Drawbar Attachment Company, Cleveland, Ohio. The gear will be known as the Butler friction attachment—Piper patents.

Canadian Railroad Notes.

Ottawa, Can., January 26, 1906.

The new transcontinental railroad to be built across Canada, from the Atlantic to the Pacific, is divided into two sections. The one from Winnipeg to the coast, with extension from Winnipeg east to Port Arthur, at the head of Lake Superior, is known as the Grand Trunk Pacific, and is being built by the Grand Trunk Company; the other section, from the Atlantic to Winnipeg, is known as the Trans-Continental, and is to be built by the Canadian Government. A large part of the Pacific section is across open prairie; it is getting on much faster than the Trans-Continental section, which is through almost virgin forest and lone, uncivilized rock almost the whole distance. The idea of the Government in building so far north is to open up this northern country for emigration and settlement. The Grand Trunk Pacific has already a considerable amount of line under construction, and is making every effort to forward the work. Specifications are ready in Montreal, and tenders will be invited in a few days for the section that runs from Touchwood Hills to Edmonton, N. W. T. With this additional amount under way, the company will have more than 1,000 miles under actual construction by spring. Besides this, the line from Winnipeg to Port Arthur, 250 miles, is under construction and will, it is expected, be ready to haul no small part of this coming season's wheat crop to Lake Superior.

An interesting decision as to the liability of a railroad company in unsettled localities was made by Judge Cumberland, of Manitoba, a short time ago. On June 20 last a cow belonging to a resident of Minnedosa, Man., got through a defective fence of the Canadian Pacific's right-of-way, and was there killed by a train. The place in question was on the outskirts of the town. The case came to trial in the County Court on December 1, and a verdict was entered for defendants on January 10. Judge Cumberland found as a fact that the land in that locality was neither settled, improved nor fenced, and that consequently there was no duty devolving upon the company to fence their road at this point under section 199 of the Railway Act of 1903. He also found as a fact that the cow did not get at large owing to the negligence of the owner or his agent, under sub-section 4 of section 237. He, however, held that sub-section 4 of section 237 does not make a railroad company liable for injury to cattle which, because there is a defective fence, get upon its line from adjoining lands at a point where, under section 199, the company is under no obligation to erect or maintain a fence.

J. A. M.

Numbering of Forms.

BY F. LINCOLN BUCHINS.

The aim of every good system is the elimination of all unessential features, and to so co-ordinate that which is systematized as to make it plain and easy to the average mind.

To cumber forms with a complex system of numbering, either by combining the letters of official titles or in any other way endeavoring to separate those coming under any particular authority leads to confusion and duplications.

For instance, take the operating head, however he may be

termed, General Manager, General Superintendent, or other, where will you draw the line upon the blanks to bear his designation? If only those used by him, or by his authority, what can be done with the many strictly operating blanks but entirely distinct from the head official? If all operating blanks are given his particular designation then the number becomes so large as to be confusing, and it is hard to keep the number in true order.

Again, the different departments have similar demands in the way of forms and the separation of them according to departments leads to a needless duplication of blanks that is not economical.

All forms intended for like use should be brought into close juxtaposition. This will facilitate the arranging of stock in the supply department; lessen the labor of picking up to fill requisitions; prevent duplications and printing unnecessary forms; permit of a more orderly arrangement of samples so that they can be more readily found and kept track of; and assist in making and maintaining a proper index.

Two good methods have been evolved by librarians for the proper classification and indexing of books and general knowledge. By the first of these the ten digits are used in making a general classification in ten parts, each of these parts is then divided into ten divisions by the use of a second series, and these in turn may be again subdivided, and so on indefinitely. By the second method the letters of the alphabet are used in the same manner, with the advantage that in place of having ten as the basis, with a multiple of tens, we have twenty six as a basis with a multiple of twenty sixes. Taking the figures we readily see that the basis of ten for one digit makes 100 with two digits and 1,000 with three figures, while one letter gives 26, two letters 676, and three letters 17,576. The first gives us a total number of 1,110, the second a total of 18,278.

The use of letters assists the memory, and thus facilitates the ordering, naming and handling of same.

To illustrate: Assuming that the letter A represents any written understanding between two or more parties, then:

Ag may symbolize	Agreements.
Ac "	Contracts.
Ar "	Releases.

Making the second subdivision we may have:

Aga	Agreements touching Right of way
Agb "	" Baggage.
Agc "	" Cars.
Agd "	" Damages
Aca	Contracts touching Right of way
Acb "	" Baggage.
Acc "	" Cars.
Ara	Releases account Accidents
Arb "	" Baggage.
Arc "	" Customs.
Ard "	" Dogs, or live stock.
Are "	" Employees' transportation
Arf "	" Freight.

Should there be more than one blank for any or all of the above forms they would be numbered consecutively as put into service; any excessive numbering would indicate at once a redundancy of forms, which would call for attention.

To keep a proper record and file of forms, a vertical file should be provided, with folders bearing the symbols arranged in exact alphabetical order, into which should be placed a sample of each form. Each folder may have printed upon it a form requiring the insertion of the following information:

Quantity; Invoice Date; Printed by; Remarks; Price. Or, this could be printed upon a separate sheet and attached to the sample in the folder; or a card index could be made to keep it in more accessible form.

If found necessary, although it will add an element of complexity, a series of numbers could be arranged to symbolize the authority who ordered the form, as for instance:

0 President.
1 First Vice-President.
2 Second Vice-President.
3 Third Vice-President.
4 Fourth Vice-President
10 Comptroller.
11 Auditor.
12 Treasurer.
20 General Manager.

Then 1Aga may be the First Vice-President's agreement to permit the placing of a pipe underneath the track.

In order to make the system perfectly plain to all there should be printed a complete list of the symbols, with their application so far as has been made, leaving blank for future use those that have not been applied.

To properly install such a system will require expert knowledge of classification and indexing, but once established the most ordinary mind need not go astray in its application.

While this system can be worked by the stationery or other department, yet much better results will be attained by having a Supervisor of Forms. Such supervisor should have no authority to institute or abolish forms; yet if the right man is selected he may effect much economy. A good supervisor will be in receptive touch with the authorities who devise and authorize forms, on the one hand, and with those who use them on the other. From the latter he will secure suggestions for improvements in forms, and these he will take up with the former, and those that are valuable will be adopted. Having all forms approved by him would insure the correctness of the printer's proofs and product, would prevent wrong copy being used and assure the correct symbolizing of forms. Having such a focus gives the opportunity to properly file, not only the form itself, but all variations and correspondence regarding it.

The establishment of such a head affords:

First—An opportunity for suggestions of improvements, so that the existing forms may be gradually improved until they become the best that the combined experience of the users may evolve.

Second—A central authority to which all forms would come, so that all needless, exceptional, duplicate and obsolete forms would be eliminated.

Third—A means for holding true to form and symbol and prevents confusion in the system.

In the matter of ordering supplies upon requisitions vised and approved by various officials, there is great waste. To have the subordinate make his requisition for a month's supplies upon one sheet, and that sheet to pass successively through the hands of four or five of his superiors is wasteful of time and effort, and leads to perfunctory work that becomes expensive. The better way is to fix a standard of supply of each article for each ordering unit, this standard to be fixed low rather than high, and after this standard is fixed and approved, orders to go directly from the unit to the supply source and be filled; in case additional supplies, or additions become necessary an application for them should go the required rounds for approval.

In this way the valuable time of officials will not be wasted upon useless detail, nor will it be necessary to turn over to inexperienced clerks this important matter. Nor will the approval become so perfunctory as to make it possible for an agent to order, upon a stationery requisition, a new freight house and office, and have it receive the approval of four different officials and reach the department for supplying, as has been known to have occurred under the system of many approvals upon each single requisition.

Mr. Stickney on Rate Legislation.

President A. B. Stickney of the Chicago Great Western, made an address at the annual banquet of the Chicago Real Estate Board last week and again said some spicy things about rate regulation. The following partial report of Mr. Stickney's remarks is taken from the *Chicago Tribune*:

The railroads have not been altogether to blame for the rebates. Attention is called to the evident fact that no railroad can commit the rebate crime alone. It takes at least two, the shipper as well the railroad. Experience has proved that, until the universal railroad monopoly shall be effected by consolidation into two or three, or perhaps one huge corporation, the large shippers at competitive points have irresistible power to get lower rates than small shippers. Also that under present conditions, without effective support from the law, railroads are powerless to prevent rebates and kindred devices. There is no question but that, as long as rebates exist, no manufacturing or mercantile business is safe. It is a notorious and undisputed fact that most of the great trade monopolies of this country are founded and sustained by the rebate in connection with the protective tariff, which has, in effect, taxed the people hundreds of millions of dollars, not to produce revenue for the government, but to enrich trade monopolies. It is my conclusion that, because the railroads have assumed the common law obligation of common carriers, and because they are public highways, it is fair and right to control their rates by law, and that, because railroads are monopolies, the law of self-preservation, as well as of fairness and justice, demands that the people, through the government, should control railroad rates by law. Such laws, however, to be effective, must be fair and just and intelligently directed to substantial facts, which are the basis of reasonable rates. The country is indebted to Theodore Roosevelt for his courageous course in regard to legislative control of rates. He has recommended that whenever the reasonableness of any rate is challenged, the legislative commission, after full investigation, shall have the power to determine and put in force a rate which the commission shall deem just and reasonable. And if this principle is incorporated in the bill, it will be an assertion on the part of Congress of its right to fix all railroad rates. Such a law would be immensely valuable, because it would be a precedent in future legislation, when the whole problem shall come intelligently before Congress in the final contest which will, sooner or later, come.

Congressional committees and the interstate commission have produced a surfeit of expert opinions by expert witnesses, and I submit that the time has come when Congress should provide a commission to investigate actual facts and by systematic arrangement and consideration discover the principles of reasonable railroad rates.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK

BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- The Railroad and the Municipality..... 121
- Compulsory Two-Cent Fares in Ohio.... 124
- The Park Avenue Cases 121
- Record of Pennsylvania Locomotive Tests 122
- Russian Railroad Labor 124
- A Reporter's Version of a Collision..... 124
- Experimental Electrification Simplon Tunnel 124
- Railroad Courses at University of Illinois 124
- New Publications 124
- Trade Catalogues 125

ILLUSTRATED:
- The D. & H. Gasolene-Electric Car..... 126
- Pennsylvania Station in New York..... 127
- The London Tramway Subway..... 132
- The Application of Card Index Systems to a Motive Power Office..... 135
- Historic Locomotive for Purdue University 139
- Locomotive Handling at Terminals..... 141
- Interborough Rapid Transit Company Test of Subway Engines 143
- General Electric Straight Air Brake Equipment 144

CONTRIBUTIONS:
- Deterioration of Spikes in Black Oak.... 125
- The Cost of Locomotive Operation..... 125

MISCELLANEOUS:
- Railroad Mileage of the World..... 125
- Medal for Heroism 132
- Prussian Car Orders (Note)..... 132
- The Division Engineer 134
- Mr. Wallace Before the Senate Committee 134
- Diversion of Cars..... 138
- Russian Car Famines (Note)..... 139
- Washington Correspondence 139
- The Effect of Nitrogen on Iron and Steel 140
- Pig Iron and Rail Production in 1905.... 140
- Industrial Railroads and Car Service..... 141
- Engine Failures. 143

GENERAL NEWS SECTION:
- Notes 39
- Meetings and Announcements 43
- Elections and Appointments 43
- Locomotive Building 44
- Car Building 45
- Bridge Building 45
- Railroad Construction 46
- Railroad Corporation News 48

VOL. XL., No. 6. FRIDAY, FEBRUARY 9, 1906.

The Pennsylvania Railroad Company is prepared to build a railroad from the harbor of New York through the eastern part of the greater city to and across Long Island Sound, and so connecting with the New England railroad systems, and in connection with the tunnels under the North and East rivers, bringing Long Island, for the first time, into direct railroad communication with the rest of the world, and increasing the value of its real estate by scores, or more likely, by hundreds of millions of dollars. The New York city fathers, in their zeal for the city's interests, would make a condition for the permission of this enterprise that the Pennsylvania Railroad shall carry to New York from that part of the country west of Pittsburg all freight without any charge whatever for the 90 miles between Philadelphia and New York. The requirement that rates to New York shall not be higher than to Baltimore or Philadelphia amounts to just this for the Pennsylvania Railroad Company. The "equality" which would make it impossible to charge for the 758 miles from Cincinnati to New York more than for the 667 miles from Cincinnati to Philadelphia or for the 593 miles from Cincinnati to Baltimore might, it would seem, tempt the carriers to do what they can to favor exports through those more southern cities.

The legislature of Ohio is really going to pass a law limiting passenger fares to two cents a mile throughout the state, on large roads and small; or at least that appears to be the opinion just now of all good judges. For 15 years the proposition has been renewed in every legislature, but each time it has failed to get the necessary number of votes. Now, in consequence of the agitation at Washington concerning interstate rates, or of the agitation caused in pocketbooks by dearth of annual passes, the members of the legislature have formed a purpose which is more definite, intelligent and vigorous than anything known in past years, and they appear to be acting with sufficient harmony to accomplish their object. The proposed law is very crude, for there must be many thin roads on which the reduction of the rate—from, say, three cents—will have so little effect in stimulating traffic that it will be many years before the gross receipts will get back to their present volume. Such a reduction causes the maximum damage to the road and the minimum benefit to the public. As, however, the highest imaginable gross income from passengers on these roads- the weaker roads in thinly settled regions- is insufficient to pay passenger expenses and a fair share of the general expenses and interest, it is perhaps not a matter of great moment. The passenger business must, in most cases, be done at a loss in any event, and a smaller or a greater loss makes no alarming difference. At any rate, we may be sure that this will be the reasoning of the average legislator—if he knows the facts and reasons on the subject at all. An eel gets used to being skinned at last; and after 15 years the railroads of Ohio must be measurably prepared for a change. Indeed, some of them had about concluded ten years ago that a general two-cent rate might have its compensations. The application of the two-cent rate to all tickets would enable the railroads to abolish the 1,000-mile ticket—which the late J. F. Goddard declared was always and incurably an evil. The G. P. A., who threatens if the law is passed to abandon low-rate excursions, may or may not mean what he says. If he refers to the ambitious affairs in which he borrows cars from 500 miles away and aims merely at the gross receipts for a single day, it is to be hoped that he will carry out his threat, for he neither makes money for the road nor promotes the real happiness of the public. But as regards the short-distance excursions, which utilize cars otherwise idle, and gives the slow people brief outings after the fast people have got tired of traveling, we advise the legislators not to be scared. Such excursions have both popularity and profit to recommend them.

THE PARK AVENUE CASES.

In our issue of April 21, 1905, we reviewed at some length the decision of the Supreme Court of the United States in the Muhlker case. The point at issue—the liability of the New York & Harlem and New York Central & Hudson River railroads for easement damages occasioned by the track elevation on Park avenue, New York City—has again been ruled on by the Supreme Court in the case of Anna Siegel and others, plaintiffs in error, versus the New York & Harlem Railroad and the New York Central & Hudson River Railroad. The Supreme Court has now reversed the Court of Appeals, holding it to have been in error, and basing its decision on the Story case of 1890, which the Muhlker decision last spring reversed. The subject is important and interesting as dealing with doubtful points of law and affecting large sums of money, and the decisions of the courts have been tossed back and forth, year after year, without seeming to rest on any firm ground. Our review of the Muhlker case was sufficiently full so that it is only necessary at the present time to recite the main points. Mr. Muhlker, like the present plaintiffs, was a property owner on the portion of Park avenue above which the elevated tracks of the New York Central Railroad run. He brought action against the company to recover damages, and the Supreme Court of the State of New York sus-

tained him. An appeal to the Appellate Division of that court affirmed this judgment, but the Court of Appeals, the tribunal of last resort in the state, reversed the decision of the Appellate Division, and the case then went to the Supreme Court of the United States. The Supreme Court first ascertained that the law of New York, as settled by the elevated decisions beginning with the Story case, recognized the right of an abutting property owner to light, air and access, as easements appurtenant to his premises. Starting from this principle, the Court planted itself upon the Constitution of the United States, which prohibits the taking of private property for public use without compensation, and as the record showed that these easements of private property had been taken from Muhlker by the erection and operation of the structure without compensation, the act was void as to him, whether perpetrated by the state or by the defendant companies.

In analyzing this decision it is necessary to keep in mind the very unusual circumstances which attended the building of the elevated structure on Park avenue—circumstances which would seem to the layman, and which have seemed to many inferior courts, to differentiate it entirely from the Manhattan elevated cases. When the Harlem Railroad was chartered in 1832, Park avenue did not exist except on a layout map. The charter provided that if the railroad company should lay out a line along the street, open or proposed, it must first get permission from the city. This was done. The railroad also obtained deeds from the property owners for its right of way. These deeds purported to give fee for 24 feet in the center of the avenue, with necessary slopes and banks on the sides, but not to exceed the full width of the avenue, which was plotted on the map at 100 feet, across the large tracts of farming lands which then occupied the territory north of the city as it existed at that time. The railroad was built in 1835, 1836 and 1837 as far as the Harlem river; then the avenue was widened to 140 feet, at that time the widest street in the city, on account of the railroad.

In the early '50s the city commenced a regular proceeding to open Park avenue from 38th street to the Harlem river. In 1872 an "Act to improve Park avenue" was passed. All grade crossings were removed, the tunnel was built, and four tracks were authorized, making a railroad structure 58 feet wide, with a roadway on each side.

The troubles of the railroad began when Congress decided that the insignificant Harlem river, already a handicap to the growth northward of New York, must be maintained as a navigable stream, and that all bridges must be raised to 24 feet above mean spring tides. It is fair to say at once that the sacredness of a navigable stream in the eyes of the government has often been a very expensive thing for all concerned, and perhaps never more so than in this case. In order to provide for the quite inconsequential traffic of that river the city has probably spent $20,000,000, at the least, for bridges, and railroad traffic has always been seriously handicapped. About 1890 the New York Central engineers, in accordance with a ruling of Congress, made a plan to raise their Harlem bridge and tracks, with an elevation to extend only as far back as 125th street. A bill to further this plan was passed by both houses of the legislature, but was then allowed to die by mutual consent. A year or so after that, property owners and the railroad got together, and it was agreed that the city should bear half the expense of raising the tracks southward to 106th street, but that the city's share should not exceed one-half of $1,500,000. The bill to accomplish this was passed by the legislature, so that the track raising was done strictly by state order, and the railroad, which spent $3,000,000 as its share of the improvement, obtained thereby a roadbed not as good as it had before, although there were two slight benefits, one of which was that the new bridge, on account of its greater height, did not have to be turned as often as formerly; the other, that one grade crossing north of the bridge was removed.

Immediately after this improvement, fostered by property owners and ordered by the state, was completed, the property owners began their suits. In 1900, in the Lewis case, the Court of Appeals took the remarkable position that the changes in the avenue were made for the benefit of the public at the instance of the state by a governmental agency, and that the railroad companies had no authority or control over the work and could not be responsible for it; that if the Harlem and New York Central railroads had never used the viaduct they had been compelled to build, they would never have been liable for damages, but the court held that their liability began with that use and continued therewith, although the statute authorized and directed the companies to use the tracks on the viaduct when completed. The manifest absurdity of such a position was recognized by the court itself in the subsequent appeal in the Fries case, where the Court of Appeals reversed itself and held that the railroads were liable neither for the construction nor for the use of the new viaduct, although this decision was given by a divided bench. The progress of the law was this, then: That in the first important case the railroad was held free of liability for building the viaduct under compulsion, but was penalized for running over it after it was built, that in the second important case the railroad was held entirely free of responsibility, while in the third legal landmark—the Muhlker case—the position of the railroad was entirely ignored, and the attention of the court was directed only to the property owner, who had apparently had something taken away from him without compensation.

The briefs which have been filed in these cases are so voluminous and the information at hand is so extensive that it is fair to say, after all these decisions and reversals, appeals and divided benches, that not much is really settled from an equitable standpoint except that the railroad has been a consistent loser by state order, and that the cost of providing a modern transportation system into the greatest city of the country, presumably a benefit mutually to the state, to the railroad and to the municipality, has been principally paid for both in the first instance and in subsequent damage claims by only one of the parties of interest, while other parties of interest have not alone been content to evade their natural and equitable share in the cost but have been quick to seize the opportunity on legal technicalities to derive damage benefits from the railroad. The great and fundamental difference between the Park avenue viaduct and the Manhattan elevated cases is that the steam railroad was the first comer in its territory, and, as was pointed out in one of the court decisions, property owners who built alongside its tracks after the railroad was there must necessarily have discounted the effect of the tracks in the price which they paid for their real estate; while in the street elevated road cases the structure, with its unquestioned damages to adjacent property, was a late comer, built after the houses and shops which line the streets had been placed there. As was stated in the decision in the Muhlker case, when the elevated railroads were built no attempt was made by the state to improve the street for the benefit of the public. Instead, it granted to a corporation the right to make an additional use of the street, in the doing of which it took certain easements belonging to abutting owners for which it was compelled to compensate them, as the court in this case held that the New York & Harlem Railroad Company was not vested with any title in Park avenue that permitted it as the owner of real estate to erect its elevated structure without regard to the injury it might work upon the easements of light, air and access enjoyed by abutting owners, and the court decided that the railroad must settle for damages caused by so much of the structure as exceeded established uses.

One advantage of being able to review a legal suit from the standpoint of a layman is that it is permissible to look at the subject all at once, and not bit by bit, in decisions built up through the structure of the courts. The recent Supreme Court decision, which will cost the New York Central Railroad some millions of dollars in damages, apparently without redress, when viewed in this way, presents an aspect of obvious injustice. The non-legal mind cannot pretend to tell where this injustice lies; it only realizes that it exists; since on one side property owners obtain large damages on account of easements which they doubtless never expected to have when they bought the property, while on the other side the railroad pays the cost of doing what the state orders it to do, and likewise pays for the speculative ventures of citizens who are presumably equally benefited with the rest of the community by the establishment of a through, safe connection between New York and the rest of the world.

RECORD OF THE PENNSYLVANIA LOCOMOTIVE TESTS.

The final record of the locomotive tests made by the Pennsylvania Railroad system at the Louisiana Purchase Exposition in 1904 has just been published in a book of some 750 pages, which contains all the data, conclusions, etc., obtained from the tests, together with adequate descriptions of apparatus, exhibits, etc., of that road at the exposition. This work is perhaps the most exhaustive treatise of its kind ever published, and as previously noted in these columns, the tests and the record of them will doubtless endure as an intellectual monument to the enterprise and scientific spirit of the Pennsylvania Railroad System. The tests will bear the same relation to the St. Louis Exposition that the International boiler tests bear to the Centennial Exposition held in 1876. The

art of locomotive construction has been materially advanced by reason of these tests. They have demonstrated the practicability of the testing plant as a means of studying the performance of locomotives; they have established a logical method of conducting tests and of making the necessary observations; and they have determined the efficiency and the limits of power which may be expected from the modern locomotive. Furthermore, they have pointed out the lines along which further investigations should be continued, and as stated in the concluding paragraphs of the book it is the purpose of the Pennsylvania to establish this testing plant at Altoona and make it a part of the permanent organization of the testing department.

The shortness of the time allotted to the tests as well as the unavoidable delays incident to work of this sort made it impossible to test more than eight locomotives. Such tests as were made, however, were very complete and carefully conducted so that the results obtained can be relied upon. Four of the locomotives tested were designed for freight service, and four were for passenger service. Of the freight locomotives, two were simple, one was a two-cylinder cross-compound, and one was a four-cylinder tandem compound. The passenger locomotives were all of the four-cylinder balanced compound type, although each was a representative of a particular system of compounding. It was the original intention to also test simple passenger locomotives, but shortness of time prevented. The tests of the balanced compounds show that, if properly designed, they are economical in fuel consumption as well as non-destructive to the track. It is necessary, however, to design the parts with great care, and carefully calculate the weights and disposition of the several moving parts, otherwise the unbalanced forces, even in the four-cylinder balanced arrangement may become excessive. It is noteworthy that the two American designs of balanced compounds gave better results than either of the foreign-built locomotives. Of course, the Hannover locomotive gave a lower steam consumption under certain conditions than the others, but this locomotive was fitted with a Pielock superheater. The de Glehn and the Hannover, and especially the latter, had a very narrow range of economical working.

The final chapter of the book gives a summary of conclusions from the tests, and while these conclusions by no means cover a complete statement of the entire results obtained from the tests, they nevertheless serve to indicate some of the more important facts which have been learned. These conclusions are as follows:

BOILER PERFORMANCE.

1. Contrary to a common assumption, the results show that when forced to maximum power, the large boilers delivered as much steam per unit area of heating surface as the small ones.

2. At maximum power, a majority of the boilers tested, delivered 12 or more lbs. of steam per square foot of heating surface per hour; two delivered more than 14 lbs.; and one, the second in point of size, delivered 16.3 lbs. These values expressed in terms of boiler horse-power per square foot of heating surface are 0.34, 0.40 and 0.47, respectively.

3. The two boilers holding the first and second place with respect to weight of steam delivered per square foot of heating surface, are those of passenger locomotives.

4. The quality of steam delivered by the boilers of locomotives under constant conditions of operation is high, varying somewhat with different locomotives and with changes in the amount of power developed, between the limits of 98.3 per cent. and 99.0 per cent.

5. The evaporative efficiency is generally maximum when the power delivered is least. Under conditions of maximum efficiency, most of the boilers tested evaporated between 10 and 12 lbs. of water per pound of dry coal. The efficiency falls as the rate of evaporation increases. When the power developed is greatest, its value commonly lies between limits of 6 and 8 lbs. of water per pound of dry coal.

6. The observed temperature of the firebox under low rates of combustion lies between the limits of 1,400 degrees F. and 2,000 degrees F., depending apparently upon characteristics of the locomotive. As the rate of combustion is increased, the temperature slowly increases, maximum values generally lying between the limits of 2,100 and 2,300 degrees F.

7. The smoke-box temperature for all boilers, when worked at light power, is not far from 500 degrees F. As the power is increased, the temperature rises, the maximum value depending upon the extent to which the boiler is forced. For the locomotives tested, it lies in most cases between 600 and 700 degrees.

8. With reference to grate area, the results prove beyond question that the furnace losses due to excess air are not increased by increasing the area. In general, it appears that the boilers for which the ratio of grate surface to heating surface is largest are those of greatest capacity.

9. A brick arch in the firebox results in some increase in furnace temperature and improves the combustion of the gases.

10. The loss of heat through imperfect combustion is in most cases small, except as represented by the discharge from the stack of solid particles of fuel.

11. Relatively large firebox heating surface appears to give no advantage either with reference to capacity or efficiency. The fact seems to be that the tube heating surface is capable of absorbing such heat as may not be taken up by the firebox.

12. The value of the Serve tube over the plain tube of the same outside diameter, either as a means for increasing capacity or efficiency, was not definitely determined.

13. The draft in the front-end for any given rate of combustion as measured in inches of water, depends upon the proportions of the locomotive and the thickness and condition of the fire. Under light power, its value may not exceed an inch, but it increases rapidly as the power is increased. Representative maximum values derived from the tests lie between the limits of 5 inches and 8.8 inches.

14. Insufficient openings in the ash-pan and the mechanism of the front end, especially the diaphragm, are shown by the tests to lead to the dissipation of considerable portions of the draft force.

THE ENGINE.

15. The indicated horse-power of the modern simple freight locomotive tested, may be as great as 1,000 or 1,100; that of a modern compound passenger locomotive may exceed 1,600 horse-power.

16. The maximum indicated horse-power per square foot of grate surface lies, for the freight locomotives, between the limits of 31.2 and 21.1; for the passenger locomotives, between the limits of 33.5 and 28.1.

17. The steam consumption per indicated horse-power hour necessarily depends upon the conditions of speed and cut-off. For the simple freight locomotives tested, the average minimum is 23.7. The consumption when developing maximum power is 23.8, and when under those conditions which proved to be the least efficient, 29.0.

18. The compound locomotives tested, using saturated steam, consumed from 18.6 to 27 lbs. of steam per indicated horse-power hour. Aided by a superheater, the minimum consumption is reduced to 16.6 lbs. of superheated steam per hour.

19. In general, the steam consumption of simple locomotives decreases with increase of speed, while that of the compound locomotives increases. From this statement it appears that the relative advantages to be derived from the use of the compound diminish as the speed is increased.

20. Tests under a partially opened throttle show that when the degree of throttling is slight, the effect is not appreciable. When the degree of throttling is more pronounced, the performance is less satisfactory than when carrying the same load with a full throttle and a shorter cut-off.

THE LOCOMOTIVE AS A WHOLE.

21. The percentage of the cylinder power which appears as a stress in the draw-bar, diminishes with increase of speed. At 40 revolutions per minute, the maximum is 94 and the minimum 77; at 280 revolutions per minute, the maximum is 87 and the minimum 62.

22. The loss of power between the cylinder and draw-bar is greatly affected by the character of the lubricant. It appears from the tests that the substitution of grease for oil upon axles and crank pins increases the machine friction from 75 to 100 per cent.

23. The coal consumption per dynamometer horse-power hour, for the simple freight locomotives tested, is at low speeds not less than 3.5 lbs. nor more than 4.5 lbs., the value varying with running conditions. At the highest speeds covered by the tests, the coal consumption for the simple locomotives increased to more than 5 lbs.

24. The coal consumption per dynamometer horse-power hour, for the compound freight locomotives tested is, for low speeds, between 2.0 and 3.7 lbs. Results at higher speeds were obtained only from a two-cylinder compound, the efficiency of which under all conditions is shown to be very high. The coal consumption per dynamometer horse-power hour for this locomotive at the higher speeds increases from 3.2 to 3.6 lbs.

25. The coal consumption per dynamometer horse-power hour

for the four compound passenger locomotives tested, varies from 2.2 to more than 5 lbs. per hour, depending upon the running conditions. In the case of all of these locomotives, the consumption increases rapidly as the speed is increased.

26. A comparison of the performance of the compound freight locomotives with that of the simple freight locomotives is very favorable to the compounds. For a given amount of power at the draw-bar, the poorest compound shows a saving in coal over the best simple which will average above 10 per cent., while the best compound shows a saving over the poorest simple which is not far from 40 per cent. It should be remembered, however, that the conditions of the tests, which provide for the continuous operation of the locomotives at constant speed and load throughout the period covered by the observations, are all favorable to the compound.

27. It is a fact of more than ordinary significance that a steam locomotive is capable of delivering a horse-power at the draw-bar upon the consumption of but a trifle more than 2 lbs. of coal per hour. This fact gives the locomotive high rank as a steam power plant.

28. It is worthy of mention that the coal consumption per horse-power hour developed at the draw-bar by the different locomotives tested presents marked differences. Some of these are easily explained from a consideration of the characteristics of the locomotives involved. Where the data is not sufficient to permit the assignment of a definite cause, there can be no doubt but that an extension of the study already made will serve to reveal it.

An apparently well-informed correspondent of the *Journal* of the German Railroad Union gives an account of the motives and aims of the organization of Russian railroad employees which has caused so much confusion in the empire by striking. There are nearly a million employees on some 39,000 miles of railroad. With a force as efficient as that in Western Europe, this mileage ought to be well worked with half that number. Most of these, of course, are in the lower grades. The average pay of a track hand is $108 per year, that of a track watchman $89, of women (at crossings, etc.) $72, of switchmen $90; of firemen, enginemen, conductors and yardmen (lumped together by this correspondent), $194; station-masters, an average of $28 a month; bookkeepers, etc., $13 to $21 a month. In the offices clerks get $155 to $465 a year. There is no allowance for clothing or rent, which some of the higher employees get. The men may be required to work extra time without additional pay. The dissatisfaction of the men is indicated by the fact that these grades of employees spend on the average only five years in railroad service. They either find some other employment or are discharged for gross negligence. Gross misdemeanors, such as withholding money collected, selling tickets and thefts of freight, extending sometimes to whole carloads, are common subjects of prosecution in the criminal courts. The organization of employees has formulated its demands, which are doubtless beyond possibility of immediate realization, though most of them may reasonably be striven for. The men have little experience in organization or in proportioning their demands to what it is practicable to obtain, and are easily led to accept the schemes of socialists whose inspiration comes from Germany or France. They cannot command means enough to enable them to leave work for any considerable length of time.

The witticisms of the head-line artist constitute the most pleasing part of some issues of certain papers, for example the New York *Sun;* but now and then he tries too hard and turns the joke on himself. A press despatch from Lima, Ohio, Feb. 3, says that "mistaking the head-light of a freight locomotive standing on its passing track for southbound accommodation No. 9, Engineer Moses Tyler, of the Cincinnati-Detroit limited, on the Cincinnati, Hamilton & Dayton, dashed into the accommodation train a quarter of a mile further on. Both engines were demolished and Tyler and several passengers were injured." This item is headed, "Head-light Fooled the Engineer," which would seem to indicate that the news editor himself was fooled; fooled into thinking that enginemen have to depend on the presence or the character of a head-light for their knowledge of whether or not it is safe to run past a meeting station. The simple duty of the engineman is to learn the numbers of the engines (or trains) that he meets; and at a place where he is liable to meet a train (passenger) which has as good a right to the road as he himself has, he must, if necessary, bring his train to a stop and go and take a close view of the number of each engine that he sees, until he makes sure that the one which he is looking for either is or is not at that station. If it is there he can go on; if it is not there, he must follow the orders which he has, telling him on what conditions, or after what time, he may proceed regardless of the opposing train. Poking fun at the engineman who makes a mistake in this matter would perhaps be legitimate amusement, if it were not so tragic. In the last case that we recall where an engineman was thus "fooled" seven persons were killed.

The Swiss State Railroads have made a contract with Brown, Boveri & Co., who are the contractors for building the Simplon tunnel, for an experimental electrical equipment of the tunnel, to be in working order by June 1 next. The motors (alternating current) must be able to haul passenger trains weighing 660,000 lbs. through the tunnel at a speed of 12 miles an hour and freight trains weighing 880,000 lbs. at a speed of 21 miles an hour, and the tracks and signals must be arranged to permit two trains to pass in each direction within the tunnel at the same time. The firm, if the equipment works satisfactorily, will conduct the train service for one year. Should the equipment not be ready or not work satisfactorily by June 1, the State Railroads will take over the tunnel and conduct the traffic with steam locomotives. The new line from Iselle, the Italian entrance to the tunnel, to Dormodossola, which has several tunnels, and one long one, is outside of the jurisdiction of the Swiss State Railroads, but the contractors agree to make an offer to the Italian authorities to equip and work that line also, in accordance with the original intention that locomotives should run through between Domodossola and Brieg, the Swiss entrance to the tunnel. The engineers declare that the water power used for excavating the tunnel is adequate for developing the electricity to work the railroad. Visitors to the Milan Railroad Exhibition, which is to be opened next May, will, it is hoped, have an opportunity to observe this electrical instalment.

Announcement is made of the establishment at the University of Illinois of a comprehensive school of railroad engineering and administration which will be open for work next September. It will have three departments intended to cover the entire range of railroad work. The problems of construction and maintenance of way, including track both for steam and electricity, will be treated in one division. Power and its application and all that is ordinarily included under mechanical and electrical engineering as applied to railroad problems will be treated in another division. The problems of operation, of organization, financiering, rate-making, and everything which has to do with the actual formation and management of a railroad company will be treated in a third. It is intended to cover the entire field of railroad service, so that anyone who wishes to enter railroad employment in any branch of railroad engineering or management will find an opportunity to prepare himself especially for that work. This distinct and adequate recognition by a leading engineering college of the unique place occupied by the railroads in our modern system of industry is most encouraging. Aside from the special faculty organized to give instruction in these various departments, prominent railroad officials from the various branches of service will be engaged for special lectures and special courses in order to emphasize the increasing value of the practical features of the curriculum.

NEW PUBLICATIONS.

Manual of Recommended Practice for Railway Engineering and Maintenance of Way. 1905 edition. Published by the American Railway Engineering and Maintenance of Way Association, Chicago, Ill. Cloth, 175 pages; 6x9 in. Price, $3.00.

At the fifth annual convention of the American Railway Engineering and Maintenance of Way Association, March, 1904, it was decided to publish a manual of the recommended definitions, specifications, and principles of practice adopted by the Association from year to year after consideration of committee reports submitted on the various subjects included within the scope of the Association's work. This volume is the first edition of the manual, and it is to be supplemented or revised annually after each convention. Particular care has been exercised to include in the book only such matter as has been carefully considered by the Association prior to its adoption by vote so that the manual represents only the approved practice recommended by the Association. The specifications and principles of practice are in the nature of recommendations only and are not binding on the members or railroads which they represent.

The subjects for which recommendations are laid down include Roadway, Ballasting, Ties, Rail, Track, Buildings, Masonry, Signs, Fences, Crossings, Cattle-Guards, Signaling and Interlocking, Records, Reports and Accounts, Water Service, Yards and Terminals, Iron and Steel Structures.

As showing the sphere of influence of the Association a separate pamphlet has been published giving a list of railroads represented and a table of membership classified by the positions or occupations of the 495 members. Of the 207,977 miles of railroad in the United States, December, 1904, 170,883 miles, or about 85 per cent., are represented in the Association, and in addition roads having a mileage of 27,980 located outside of the United States are represented. Extracts from a number of letters are included

in the pamphlet showing the wide extent to which the recommended practice of the Association has been adopted by various railroads as standard.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Electric Hoists and Bridge Riveters.—The General Pneumatic Tool Company, New York, is publishing a series of cards descriptive of its products. Hoist Card No. 1 and Riveter Card No. 1 are now being distributed. The hoist card illustrates and describes more or less in detail the Shepard electric hoist, and the riveter card contains illustrations and a brief description of the various designs of Shepard pneumatic bridge riveters.

Automatic Slack Adjuster.—Full detailed drawings and a clear description of the "American Automatic Slack Adjuster" are given in a 24-page pamphlet published by the American Brake Company, St. Louis, Mo.

CONTRIBUTIONS

Deterioration of Spikes in Black Oak.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Cumberland, Md., Jan. 23, 1906.

The accompanying photograph shows track spikes which were used in black oak ties about four years. This condition existed over about two miles of track located in a narrow valley where fogs were prevalent. The black oak ties were mixed in amongst the white oak ties in which the spikes showed no sign of deterioration,



Spikes Removed from Black Oak Ties After Four Years' Service.

while the spikes in the black oak ties were affected about as shown in the photograph. Can you offer any explanation as to the probable cause of this action?

J. R. LEIGHTY,
Division Engineer, Baltimore & Ohio.

[It seems probable that the inferior texture of black oak as compared with white oak permits moisture to gather around the spike. We should be glad to have the opinion of other correspondents to show whether or not this experience has been general, and whether black oak in a moist climate has chemical properties that are injurious to spikes.—EDITOR.]

The Cost of Locomotive Operation.

New York, Feb. 3, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

On page 112 of your issue of Feb. 2 I notice an error which crept into the manuscript of my article on "Cost of Locomotive Operation." At the bottom of the first column, the saving should be 30 cents per 1,000 revenue ton-miles, instead of 7 or 8 cents, as, if the lading were one-half the total train weight, the cost would be 2 × .50 = 1.00 on 1 per cent. grade and 2 × .35 = .70 on ½ per cent., a difference of 30 cents in favor of the low grade line. This would be a saving of 1,500 × .30 = 450 per day, or $135,000 per year, which is 4 per cent. of $3,375,000, instead of $900,000, to represent the increased capital expenditure which would be permissible under the assumed traffic conditions.

G. R. HENDERSON.

Railroad Mileage of the World.

The number of miles of railroad in the six grand divisions of the world at the end of the year 1903, as tabulated by the *Archiv für Eisenbahnwesen*, was given in the *Railroad Gazette* of June 30, 1905, page 749; but as the mileage of individual countries is a figure frequently sought after, we print below the detail tables. The Bureau of Statistics at Washington has reprinted these tables, in its November *Summary;* and the statistics of area and population of countries which we give are taken from the *Summary.* In many instances these figures differ slightly from those in other translations from the *Archiv*, but not in any case to a sufficient degree to materially alter the averages which a railroad statistician would use.

Europe.

Country.	Area, sq. miles.	Population.	Miles of railroad. Total.	P.c. inc. since 1899.	Per 100 sq. miles.	Per 10,000 population.
Germany	208,830	58,549,000	33,819	8	16.2	5.8
Austria Hungary	261,035	48,300,000	24,120	7	9.2	4.9
Gt. Britain & Ireland.	121,371	42,371,000	22,461	3	18.5	5.3
France	207,054	38,962,000	28,102	7	13.6	7.2
Russia (incl. Finland)	2,095,616	119,925,000	33,093	15	1.6	2.8
Italy	110,646	32,475,000	9,966	2	9.0	3.1
Belgium	11,373	6,694,000	4,237	10	37.3	6.3
Netherlands.[1]	13,646	5,668,000	2,095	6	15.4	3.7
Switzerland	15,976	3,356,000	2,576	10	16.1	7.7
Spain	194,783	18,618,000	8,607	4	4.4	4.6
Portugal	36,038	5,429,000	1,488	1	4.1	2.7
Denmark	15,360	2,465,000	1,963	11	12.8	8.0
Norway.	124,130	2,263,000	1,456	18	1.2	6.4
Sweden	172,876	5,199,000	7,697	16	4.5	14.8
Servia	18,630	2,536,000	359	..	1.9	1.4
Roumania	50,700	5,913,000	1,974	3	3.9	3.3
Greece	25,014	2,434,000	643	7	2.6	2.6
European Turkey.[2]	102,550	9,875,000	1,953	3	1.9	2.0
Malta, Jersey & Man.	402	348,000	69	..	17.2	2.0
Total Europe	3,786,030	411,380,000	186,678	8	4.9	4.5

America.

United States	3,025,600	80,372,000	207,932	10	6.9	25.9
Canada	3,048,710	5,457,000	19,074	11	0.6	35.0
Newfoundland	40,200	217,000	656	11	1.6	30.2
Mexico	767,060	13,545,000	10,356	22	1.4	7.6
Central America	172,449	4,242,000	946	31	0.5	2.2
Cuba	43,000	1,573,000	1,583	..	3.7	10.1
Santo Domingo	18,045	610,000	117	..	0.6	1.9
Hayti	10,204	1,294,000	140	..	1.4	1.1
Jamaica	4,424	785,000	185	..	4.2	2.4
Porto Rico	3,606	953,000	137	..	3.8	1.4
Martinique	380	204,000	139	..	36.6	6.8
Barbados	166	198,000	58	..	34.9	2.9
Trinidad	1,868	274,000	88	..	4.7	3.2
Colombia	504,773	4,000,000	400	10	0.8	1.0
Venezuela	593,940	2,445,000	634	..	0.1	2.6
British Guiana	90,500	278,000	76	..	0.08	2.7
Ecuador	116,000	1,204,000	180	0	0.2	1.5
Peru	713,859	4,610,000	1,036	0	0.15	2.2
Bolivia	703,604	1,816,000	656	6	0.1	3.6
Brazil	3,219,000	14,334,000	9,368	2	0.3	6.5
Paraguay	97,722	636,000	157	0	0.2	2.5
Uruguay	72,210	959,000	1,210	21	1.7	12.6
Chile	279,901	3,051,000	2,884	3	1.0	9.5
Argentina	1,135,840	4,794,000	10,798	8	1.0	22.5
Total America	14,663,061	147,853,000	268,816	10	1.8	18.2

Asia.

British India	1,766,797	294,361,000	26,950	20	1.5	0.9
Ceylon	25,481	3,741,000	391	32	1.6	1.0
Asia Minor	686,385	19,568,000	2,009	17	0.3	1.0
Russian Central Asia	214,191	7,740,000	1,658	0	0.8	2.1
Siberia & Manchuria.	4,832,141	5,773,000	5,664	51	0.1	9.8
Persia	628,000	9,500,000	34	0	0.005	0.04
Dutch East Indies	231,214	29,577,000	1,430	11	0.6	0.5
Japan	147,655	45,862,000	4,366	20	2.9	0.9
Portuguese Possess'ns.	1,428	572,000	51	..	3.6	0.9
Borneo, Celebes, etc..	33,273	719,000	400	92	1.2	5.6
China	1,532,420	407,253,000	1,176	..	0.07	0.03
Korea	84,380	9,670,000	37	..	0.04	0.04
Siam	244,338	9,000,000	426	..	0.17	0.5
French possessions.[3]	.....	.....	1,728	..	...	...
Total Asia	.....	.....	46,320	29	...	...

Africa.

Egypt	383,800	9,833,000	2,953	42	0.8	3.0
Algeria and Tunis	346,396	6,695,000	3,041	15	0.9	4.9
Congo Free State	.....	.....	276	..	...	...
Abyssinia	.....	.....	234	..	...	...
Cape Colony	276,995	2,410,000	3,511	..	1.3	14.5
Natal	36,170	1,040,000	736	..	2.0	7.1
Transvaal	117,732	1,354,000	1,335	..	1.1	9.9
Orange	50,000	385,000	597	..	1.2	15.5
British Africa[4]	.....	.....	1,168	.		
German E. & S.W. Af.	.....	.....	292			
French colonies.[4]	.....	.....	784			
Italian Possessions...	.....	.....	17	.		
Portuguese Africa	.....	.....	616	.		
Total Africa	.....	.....	15,560	..		

Australia and Oceanica.

Victoria	87,884	1,209,000	3,383	8	3.85	28.0
New South Wales	310,700	1,432,000	3,138	16	1.01	21.9
South Australia	903,690	369,000	1,991	1	0.21	51.5
Queensland	668,497	516,000	2,927	7	0.44	56.7
Tasmania	26,215	179,000	620	29	2.1	34.7
West Australia	975,920	227,000	2,144	58	0.22	94.4
Total Australia	2,972,906	3,932,000	14,113		0.47	35.9
New Zealand	104,471	833,000	2,403	6	2.3	28.8
Hawaiian Islands	6,449	154,000	88	0	1.4	5.7
Australia & Oceania	3,083,826	4,919,000	16,604	13	0.54	33.8

Recapitulation.

Europe	3,786,030	411,380,000	186,678	8	4.9	4.5
America	14,663,061	147,853,000	268,816	10	1.8	18.2
Asia	.....	.....	46,320	29	...	...
Africa	.....	.....	15,560	..	...	...
Australia & Oceania	3,083,826	4,919,000	16,604	13	0.54	33.8
Total	.....	.....	553,978	11	...	...

[1] Including Luxemburg.
[2] Including Bulgaria.
[3] In Asia, Malacca and Philippine Islands.
[4] Not elsewhere specified.

The Delaware & Hudson Gasolene-Electric Car.

In sparsely settled districts where the cost of operating a steam drawn train is excessive, and the immediate investment of capital for an electric service uncalled for, there has arisen a need for a self-contained car which shall be independent of a feeder system, and at the same time be cheaper to operate than the ordinary locomotive and train. For this purpose, the General Electric Company in conjunction with the American Locomotive Works, at Schenectady, N. Y., has recently completed an experimental gasolene-electric car which presents many features of interest.

The first trial run of this car took place February 3, when a successful trip was made from Schenectady to Saratoga, N. Y., and return, over the lines of the Delaware & Hudson. During the trip several important features of this method of driving were demonstrated. While the car was not designed for high speed, the average running time was about 35 miles an hour, and several times the car attained a speed of over 40 miles an hour. The smooth and rapid acceleration were most favorably commented upon by the engineers present, as well as the complete absence of vibration which might be thought to accompany the use of a gasolene engine.



General Electric Co.'s Gasolene-Electric Motor Car for the D. & H.

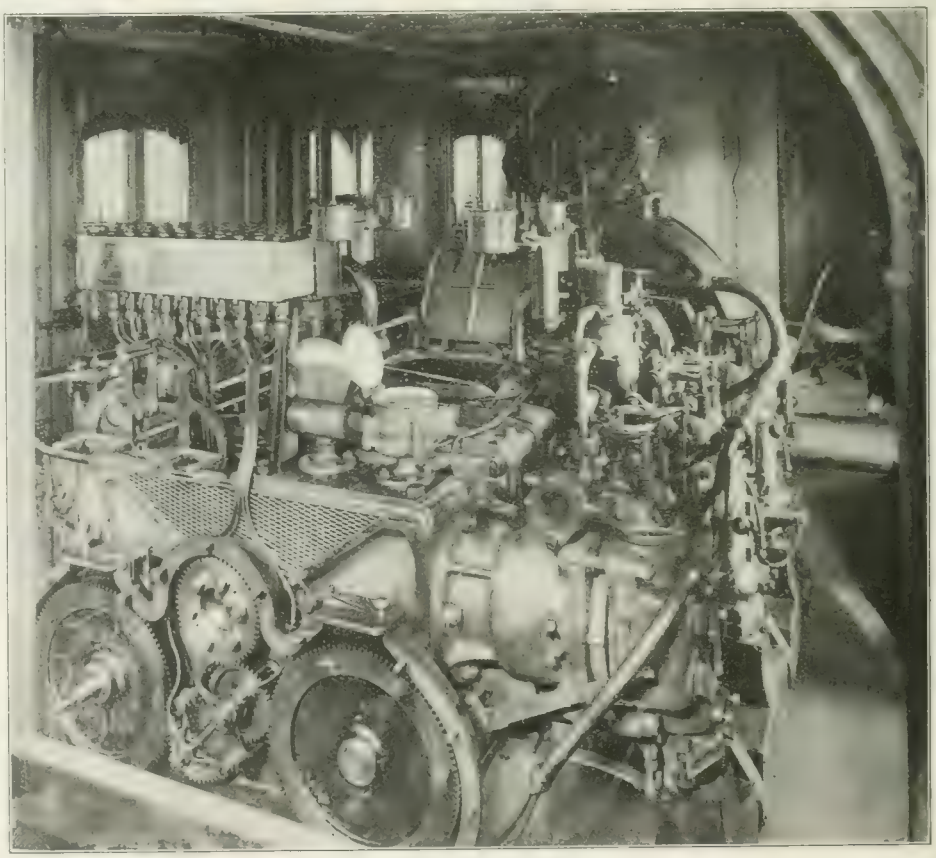
This car consists essentially of a gasolene-driven electric generator furnishing current to electric motors geared to the driving wheels and controlled by a method similar to that employed in the ordinary straight electric car equipment. The car in question, shown in the illustration, is of the combination type, comprising a passenger compartment, smoking room, a baggage room, engine room, one toilet and a motorman's compartment; it is 65 ft. long over all and weighs, equipped, 65 tons. A complete controller equipment is located at each end of the car, the forward controller being located in the engine room, while the rear compartment is self-contained. The car has seating capacity for 40 passengers, including seats for 12 in the smoking room. In general it is built on the lines of a standard D. & H. passenger coach, and is handsomely finished. Within, the passenger compartment is decorated in mahogany with a birch wainscoting; the smoking room in quartered oak and both the baggage and engine rooms in painted poplar. The outside of the car is painted and lettered in the standard D. & H. pattern, and Gould pattern bumpers and drawbars are provided.

The gasolene engine for this car was built by the Wolseley Tool & Motor Car Company, Ltd., of Birmingham, Ala., and is considered the most powerful unit yet made for this class of work; it develops 160 b.h.p. when running at 450 r.p.m. The cylinders are horizontal, six in number, 9 in. x 10 in., and arranged in three pairs, the two cranks forming a pair being at an angle of 180 deg. All valves are mechanically operated and the cylinders are water-cooled. Hitherto, difficulty has been experienced in starting internal combustion engines of this size, but in the present case this has been entirely overcome by using shells filled with black powder to provide the initial charge in one cylinder. On starting the engine, the shell is fired by a hand trigger, the whole being similar to the breach mechanism of a gun. Jump sparks and low tension ignition are both provided, current being furnished to the latter by a small dynamo driven from the engine shaft. When speed is up the jump spark is cut out.

The volatilization of the liquid fuel is produced in two carburetors which form an integral part of the engine. Each carburetor supplies three cylinders and is equipped with two float feed chambers. The chambers are identical and are of the usual needle valve type. Very flexible arrangements are provided to govern the air supply so that it may be taken from the atmosphere or from the crank chamber, or from both according to the conditions required. The mixture is heated to the required temperature in a small chamber which itself is warmed by the exhaust. In temperature in a small chamber which itself is warmed by the all details the engine is very complete. The lubrication is especially so, being force feed for main bearings and pistons and drip feed for all other working parts. Gasolene is stored in steel tanks beneath the car, and the burnt gases pass through the roof into mufflers from which they exhaust into the air. The cooling system for the cylinders consists of radiating tubes located on the top of the car. Water for cooling is contained in the engine base. The heating system for the car forms a shunt with the cylinder cooling system.

The electric current is furnished by a 120-k.w. direct-connected General Electric six-pole unit, designed for 600 volts. This generator is provided with commuting poles, which in connection with the method of voltage control, permits of a very flexible operating system. The advantage of commutating poles is evident when it is considered that the field excitation at starting is weak, and the large current at low voltage is required to give the necessary starting torque. Owing to the peculiar operating conditions of this system, the generator while retaining the characteristics of a shunt wound machine, is separately excited by a 5½ k.w., two-pole compound wound exciter working at 110 volts. This is located on top of the generator and is driven by a Morse silent chain.

There are two motors for the car, each designed to give 200 h.p., and known as the GE 69 type. These are of standard street railway construction and need no special description. For regulating the speed of the motors, as mentioned above, voltage control has been adopted; in other words, the speed of the car is governed by varying the field strength of the generator. With this method the speed of the engine remains constant after acceleration. The controller is semi-automatic, and can be set for any predetermined maximum acceleration. It is arranged for series parallel control, the



Engine Room of D. & H. Gasolene-Electric Motor Car.

motor connections being changed from series to parallel by the reversing handle. This latter has five positions, "series ahead," "parallel ahead," "off," "series reverse," and "parallel reverse." Arrangements are provided to prevent the motor connections from being changed from series to parallel until the resistance is put in the field circuit of the generator.

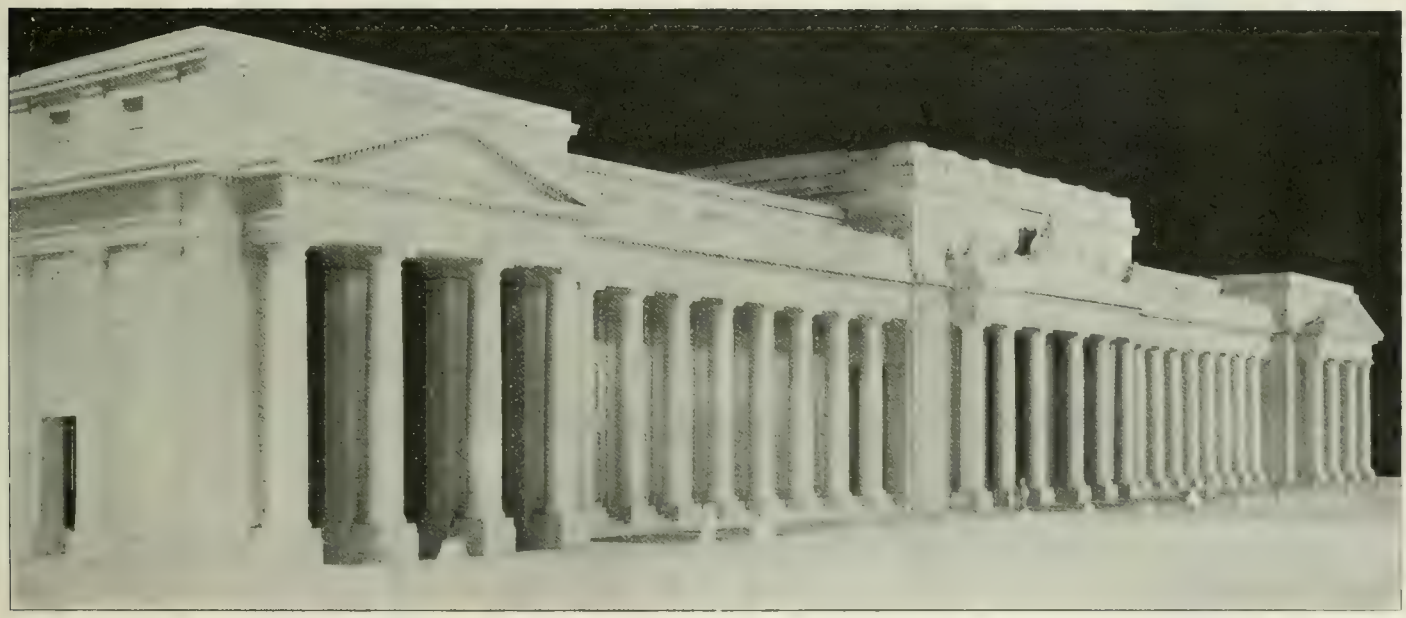
Further operating details comprise a General Electric combination straight and automatic air-brake equipment, and a special lighting equipment. Meridian lamps are used, equipped with Holophane reflectors, the whole affording a very satisfactory system for car lighting. The headlights are supplied with 100 c.p. incandescent lamps of the stereopticon type, one for each end of the car.

The trial trip of this car demonstrated the practicability of this car equipment, and was entirely satisfactory to the engineers of both companies so far as the tests indicated. The opinion was expressed that this was merely a step toward the final electrification of all service. A gasolene car would be useful in establishing a passenger traffic, but eventually the motive power for operation would be electricity.

The accompanying photograph of the car was taken after the arrival at Saratoga.

The Pennsylvania Station in New York.

At the St. Louis Exposition in 1904 the Pennsylvania Railroad exhibited a large scale plaster model of the terminal passenger station to be built in New York city as a part of the tremendous undertaking of tunneling under the Hudson river, across Manhattan Island and under the East river to Long Island City. A number of photographs of this model were reproduced in our issue of Sept. 3, 1904, but at that time we were unable to show any drawings giving a clear idea of the size and arrangement of the building, which will be the largest of its kind anywhere in the world. In this issue we show three plans at different levels and a number of cross-section profiles. A photograph of the model is also shown again to give a better idea of the proportions and appearance of the building. For a general description of the tunnels under the city and the rivers on each side the reader is referred to our issues of October 9 and 16, 1903.



Seventh Avenue Elevation of the New Pennsylvania Station in New York.

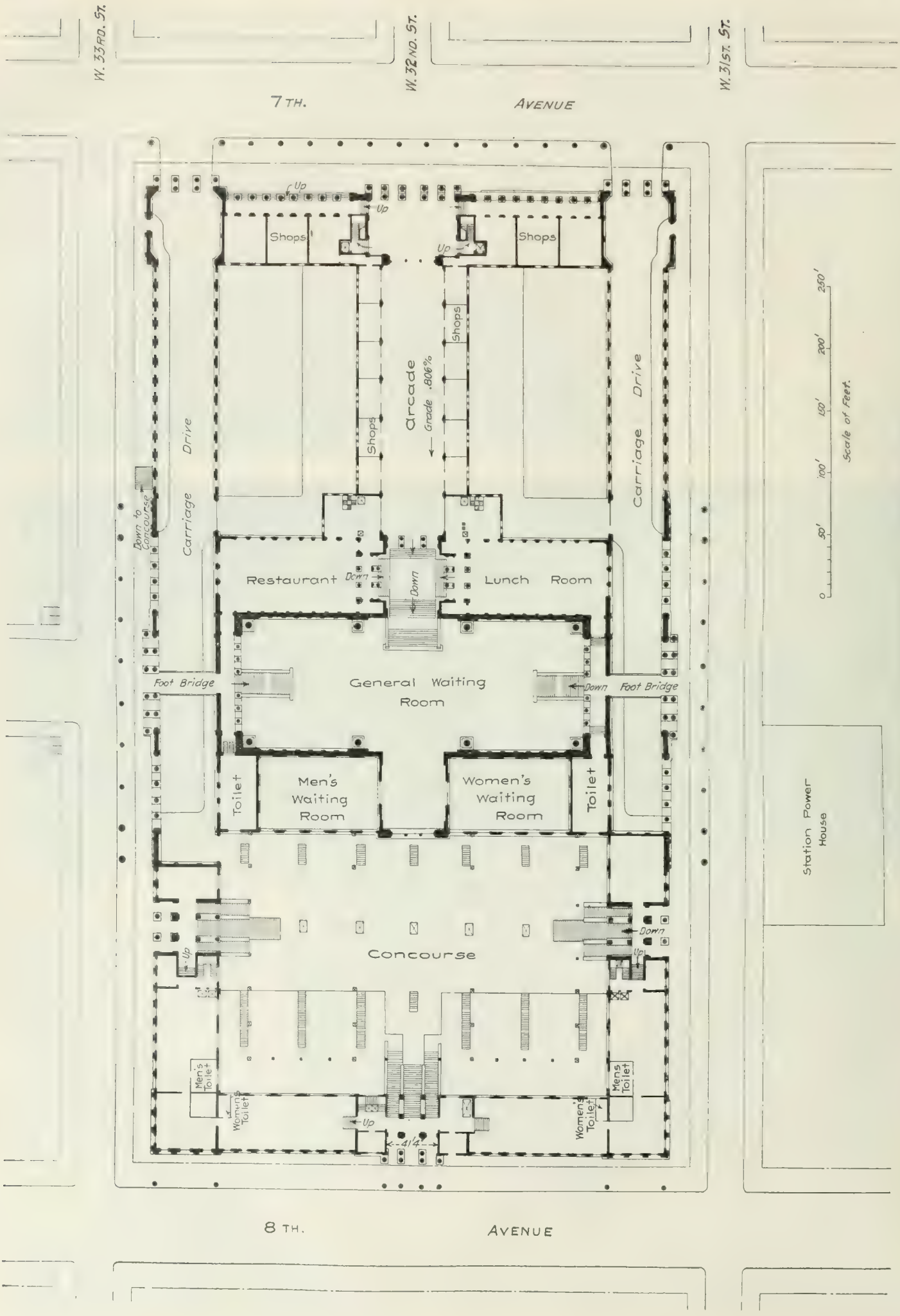
The station will occupy the entire area of four city blocks bounded by Seventh and Eighth avenues, and 31st and 33d streets. Work on the excavation, which will be carried down about 40 ft. below the street level, has been in progress for nearly two years and is not yet completed. The dimensions inside the main foundations are 800 ft. by 512 ft. The building will be of white granite and the architectural treatment is essentially classic, with a long colonnade of massive columns extending the full length of the Seventh avenue side. The entrances on 31st street, 33d street and Eighth avenue will be flanked with large columns supporting the ornamented porticos at the eaves. The main body of the building will be only 65 ft. high above the street, but the arched roof over the main waiting room, extending across the building, will be 155 ft. high.

All the waiting rooms, baggage rooms, concourse, etc., are below the street level. The first plan shows the arrangement at the street level with the entrances and exits on all four sides of the building. The main entrance is from Seventh avenue, opposite 32d street, through a wide arcade which leads into the general waiting room. Small shops will line the two sides of the arcade and also the Seventh avenue front of the building. The arcade ends in a high portico from which a broad flight of stairs leads down to the waiting room floor. The restaurant and lunch room flank the portico on each side, with steps leading up, as they are on a slightly higher level than the floor of the arcade. The passenger entrances from 31st and 33d streets are carried over the carriage driveways below with foot-bridges to the stairways leading down to the ends of the general waiting room. The restaurant and lunch room may be entered from the landings at the top of these stairs. On the Eighth avenue side a separate entrance with ticket offices, waiting rooms, etc., connects with stairways leading directly to the main concourse. The carriage entrances are on Seventh avenue through high portals at the corners of the building. A driveway on a 6.6 per cent. grade leads down from each entrance to the carriage stands opposite the ends of the general waiting room and on the same level. Baggage in wagons is carried around the baggage drive and delivered at the baggage room under the arcade.

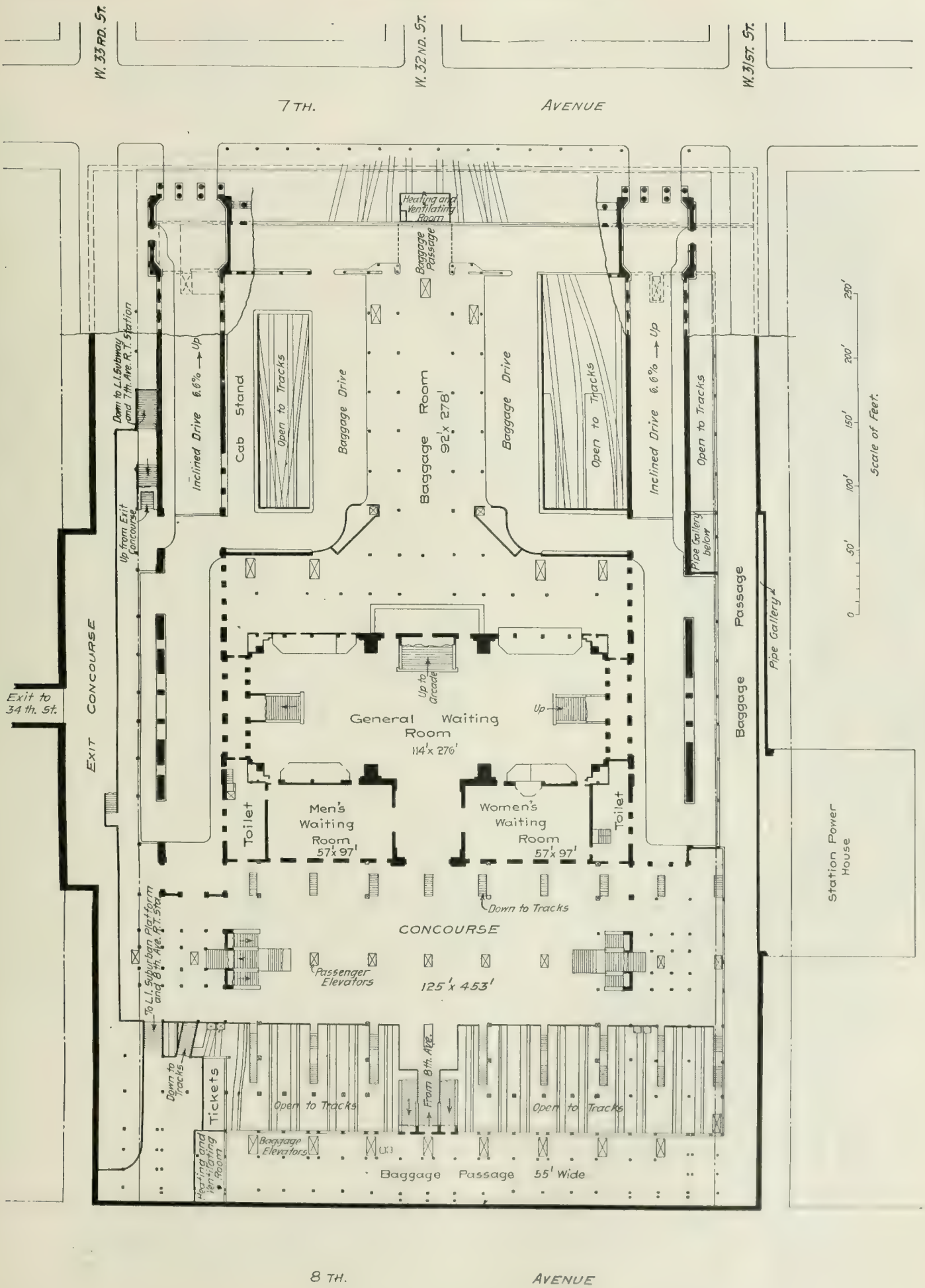
The second plan shows the arrangement at the waiting room floor level. The baggage room, cab stands and driveways occupy all the space in the eastern half of the building. In the center and extending almost the entire width of the building is the general waiting room, 114 ft. x 276 ft. The women's waiting room and toilet, 57 ft. x 97 ft., and the men's room of the same size flank the wide entrance to the main concourse. Ticket offices, telephone, telegraph and news stands are arranged along the walls. The baggage counter is under the stairway leading down from the arcade with entrances from the waiting room on each side of the stairs. The waiting room has a high vaulted roof supported by massive ornamented columns.

The main concourse opening off of the waiting room is 125 ft wide and 453 ft. long, spanning all the tracks on the level below. It will have a vaulted roof with a clear span of 125 ft., which will form part of the roof of the main station building. Broad stairs at each end lead up to entrances and exits on 31st and 33d streets and opposite the entrance to the waiting room are the stairways leading to Eighth avenue. From both sides of the concourse, stairs lead down to each of the train platforms below and in the center nine large passenger elevators will carry passengers down to and up from trains. The space to the west of the concourse is open from the tracks up to the roof of the building. On the same level as the concourse, on the Eighth avenue side, a baggage passage 55 ft. wide extends across the entire width of the station over all the train platforms. Baggage will be raised and lowered on eight baggage elevators and trucked through a passage extending along the 31st street side up to the end of the baggage room at Seventh avenue.

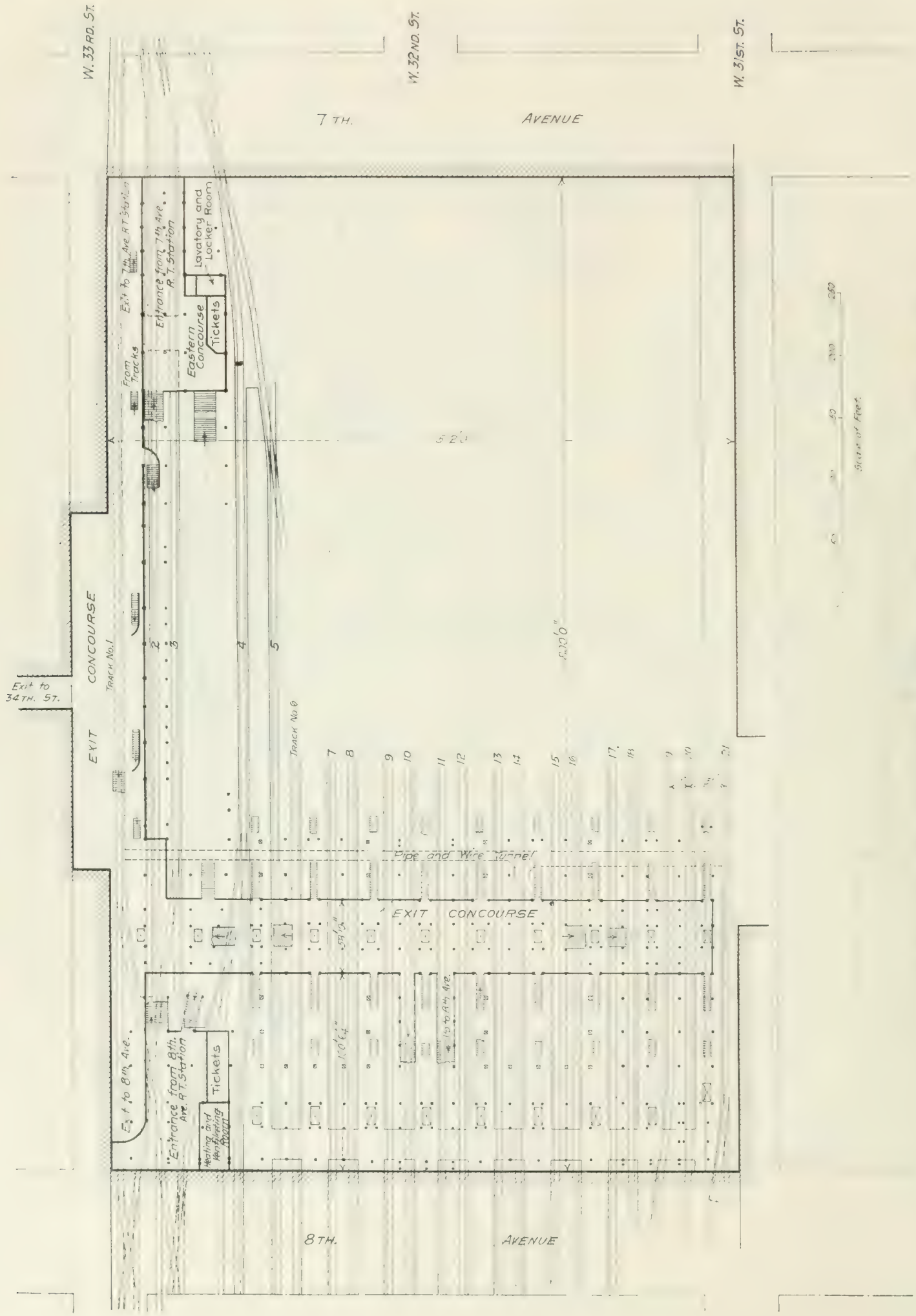
The third plan shows the arrangement at the exit concourse level and the number and location of tracks and platforms. The exit concourse is 58 ft. 10 in. wide and crosses above all the tracks. At the north end it branches, one exit leading to Eighth avenue and the other to Seventh avenue with a tunnel to an exit on 34th street. Connection will be made at this level with the proposed Seventh and Eighth avenue rapid transit subways which will cross the railroad company's tracks on the upper level. Suitable ticket



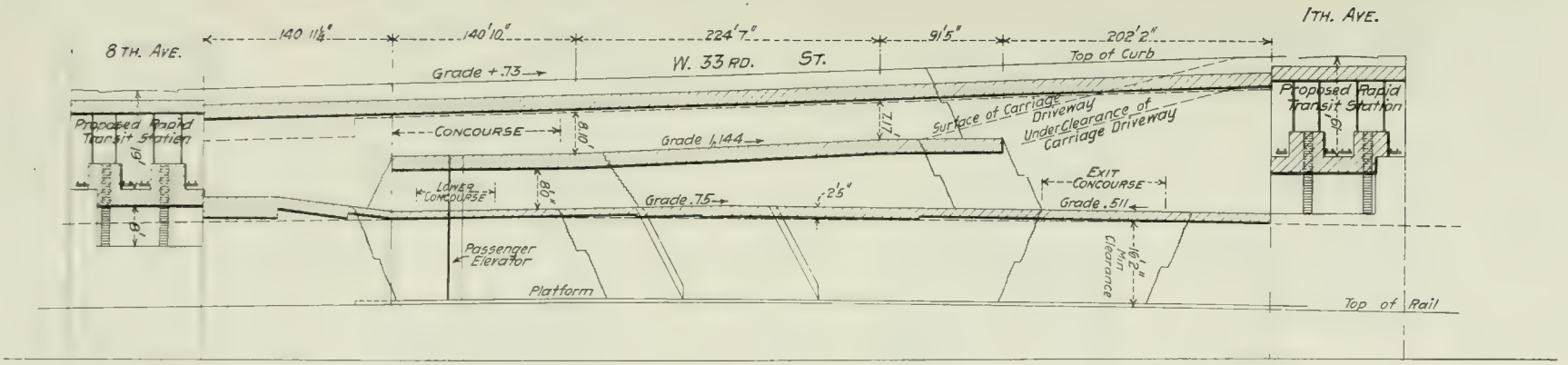
Plan at Street Level—Pennsylvania Station in New York City.



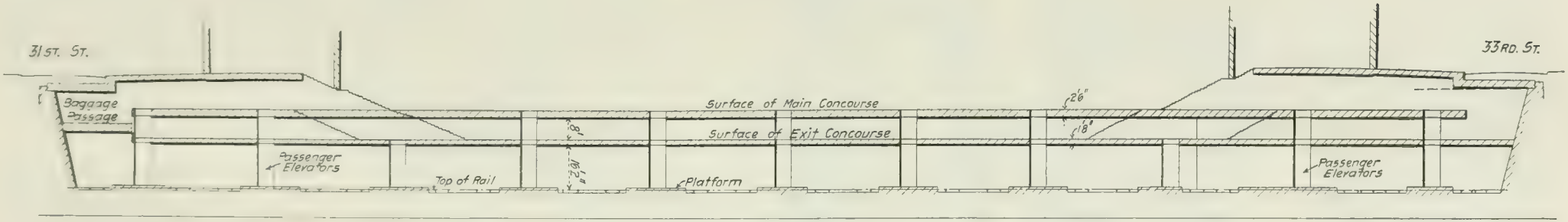
Plan at Main Concourse and Waiting Room Level—Pennsylvania Station in New York City.



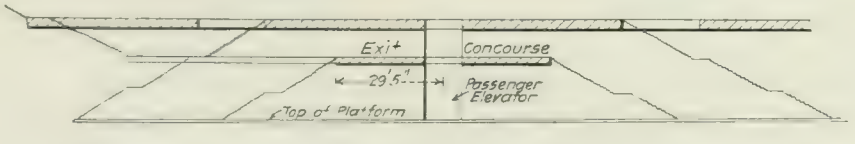
Plan at Exit Concourse Level, Showing Tracks and Platforms—Pennsylvania Station in New York City.



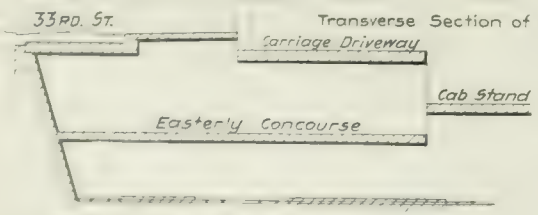
Profile Under 33rd. Street.



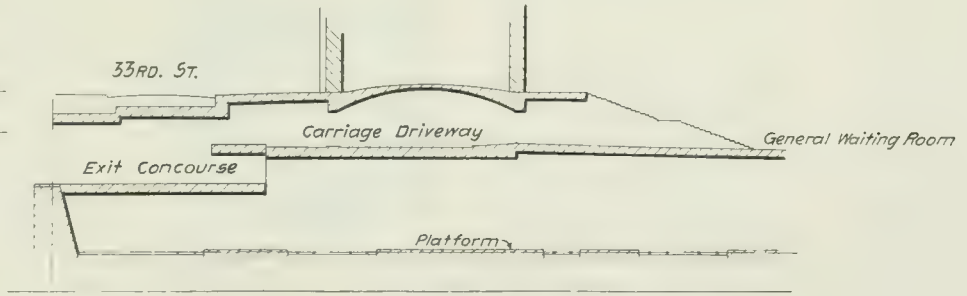
Section Through Concourse Looking West.



Transverse Section of Concourse.



Section Through Easterly Concourse.



Section Through Waiting Room Looking East.

Sectional Profiles Through Pennsylvania Station in New York City.

offices will be provided at the entrances from the subways, and stairs will lead up to the main concourse.

The tracks in the station will be 21 in number with 11 platforms. They will be spaced 31 ft. centers over platforms and 15 ft. centers between platforms. The platforms will be clear and unobstructed by columns, and all baggage and mail will be handled at one end, away from the passengers. West of Eighth avenue the tracks begin to converge into the four-track tunnel under 32d street which leads to the two single track tubes under the Hudson river. At the east end the tracks begin to converge under the station to enter the two double-track tunnels under 32d and 33d streets which meet the four single-track tubes passing under the East river.

The heating, lighting and ventilating plant for the station will be in a separate power house across 31st street. Pipe galleries will extend under the street and distribute the wires and piping throughout the building.

Medal for Heroism.

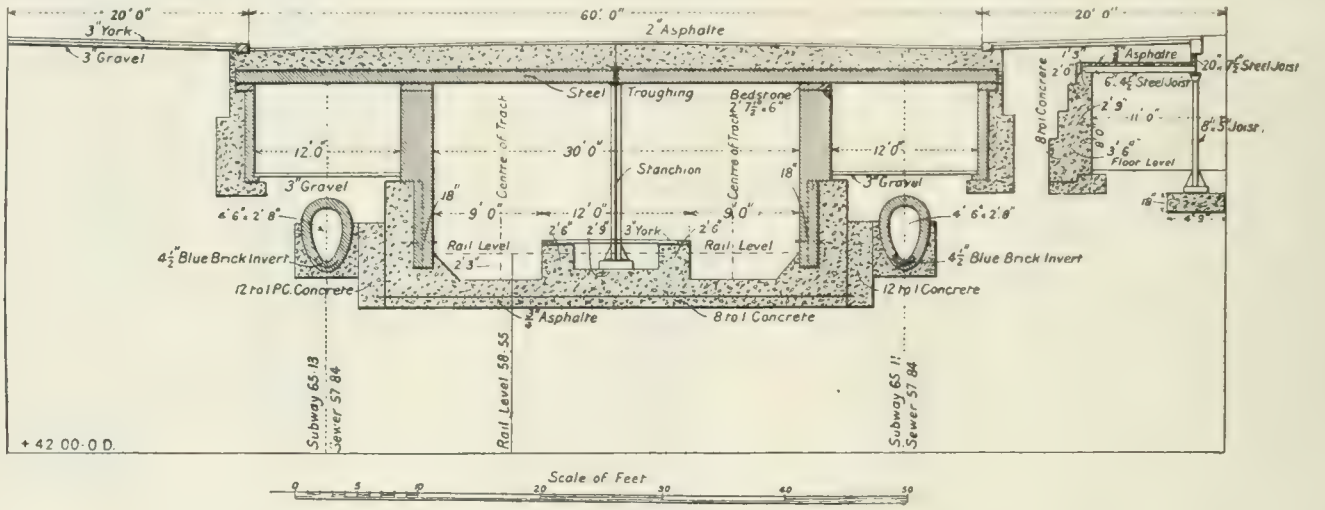
The first medal to be granted to a railroad man for heroism, under the Act of Congress of Feb. 23, 1905, has been sent by President Roosevelt, with a commendatory letter, to Mr. George Poell, of Grand Island, Neb., a fireman on the St. Joseph & Grand Island, who, on June 26 last, near Powell's Station, Neb., saved the life of a child two and a half years old, son of Station Agent John Ussary at that place. The child was standing or walking on the track when Poell's train (freight train No. 16) approached at about 30 miles an hour on a descending grade. Poell noticed the emergency application of the brake, looked up and out of the window and saw that it would probably be impossible to stop the train before reaching the child. He quickly ran out upon the running-board and to the pilot of the engine, where he succeeded in grasping the child by the clothing, while the train was still running about 12 miles an hour, and threw him into the ditch, saving his life. Poell, however, was severely injured—being unable, in his haste, to secure a good footing on the 4-in. step at the bottom of the pilot—and he was nearly killed, losing his left foot and having both arms broken. The committee which awarded the medal consisted of Secretary Moseley, of the Interstate Commerce Commission, and Messrs. W. P. Borland, J. W. Watson, W. R. Wright and G. E. Starbird. All of these men are connected with the Interstate Commerce Commission, the last three as inspectors of safety appliances. Poell is a member of Lodge No. 277 of the Brotherhood of Locomotive Firemen. He has recovered, and has been elected County Clerk. The *Locomotive Firemen's Magazine* prints a picture of Poell, with the child whom he saved.

A war scare has been manufactured out of the letting of contracts for 20,000 freight cars for the Prussian State Railroads. As for some months nearly all industries in the country have been complaining bitterly that they could not get nearly cars enough to ship their products, it is not necessary to imagine any military purposes behind these contracts; especially as the existing car stock would hold all the armies of Europe, and in case of war the ordinary industries would have much less need of it. Germany has had a boom this year, like another country which we need not mention. Early in the year the railroad authorities get together representatives of the chief industries—coal, iron, beetroot, etc.—and ask them to estimate their traffic for the ensuing season, that it may the more intelligently be provided for. Last spring their estimates were that they would do about 4 per cent. more business than the year before; actually, they have done about 8 per cent. more, and the 6 per cent. increase in cars which the railroads provided has not nearly sufficed. The prospect that business may be stifled for some months to come alone could induce the government to consent to have rolling stock born outside of the country. The railroad department, which provides for a large part of the government's expenses out of its surplus, which this year is larger than ever before, is always ready to provide for every possible want; but the Finance Minister is so dependent upon the railroad surplus that he must insist on limiting railroad expenditures.

The London Tramway Subway.

The *Tramway and Railway World*, London, for January 11, contains a description of the first electric tramway subway to be built in London which is soon to be opened for operation. It has been built and is to be operated as a municipal project by the London County Council, which already operates a number of surface tramway lines south of the Thames. This is also the first municipal project undertaken north of the Thames. The line extends from the Strand to Islington and beginning in a subway under Aldwych and proceeding under Kingsway, the cars will emerge at the junction of Southampton row and Theobald's road. The route follows the latter street to Rosebury avenue, along which it continues to Islington. A new and direct route will thus be opened between the Thames and the north of London and a very dense traffic will be dealt with.

The subway, which is the first undertaking of the kind in England, has a marked similarity to the subway constructed in Boston, Mass., in 1900. The London subway was first suggested in 1898, with the proposal for the construction of the new street. The estimate of the cost of the construction of such a subway, and of the tramway for a system of electric traction was £282,000 ($1,368,000).



Section Through Queen Street Station.

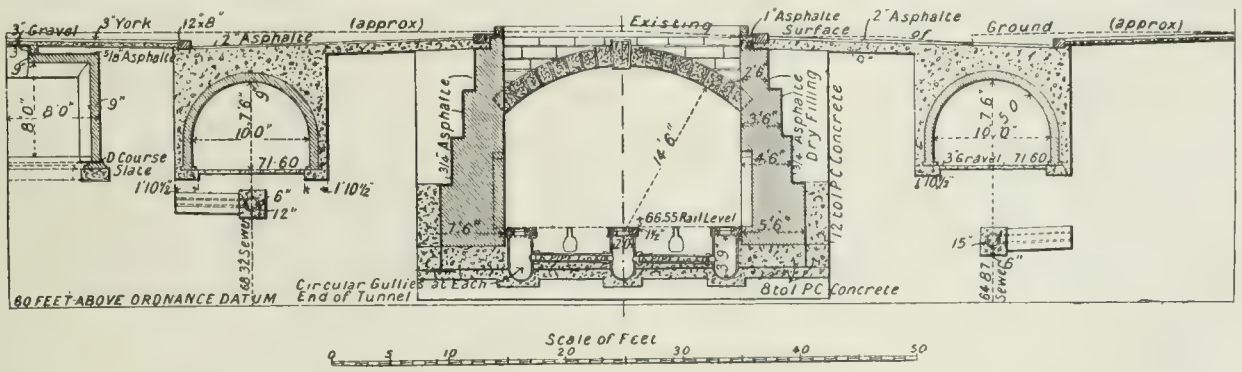
The Council decided that it was desirable, notwithstanding the large capital required, that the experiment should be tried. A bill was accordingly introduced into Parliament to confer upon the Council powers to construct the subway and a tramway within it and extending along the Thames Embankment to and across Westminster bridge. The proposed tramway along the embankment encountered much opposition, and that part of the scheme was rejected. The Council was, however, authorized by the London County Council (Subways and Tramways) Act 1902, to construct a subway from Southampton row, along Kingsway and Aldwych, to the Victoria embankment. They were also given power to construct tramways in the subway, but only as far as the north side of the Strand.

The construction of the subway was carried out at the same time as the formation of the roads. Stations have been constructed at the northern and southern ends of Kingsway, the entrances and exits being placed in the center of the roadway.

The greater portion of the subway is close to the surface of the street, but in the short length of less than a mile between Theobald's road and the Strand there are several kinds of construction. The rails are on the surface in Theobald's road, then they descend below the surface in Southampton row by an open cutting in the center of the street for 170 ft. The two lines then form a double S curve of 500 ft. radius vertically, and dip under Holborn in two deep level cast-iron tubes, which were driven under the street by Greathead shields, and then rise close to the surface at the station in Kingsway, a little to the north of Great Queen street. From this point to the station situated at the junction of Kingsway and Aldwych, the subway continues close to the surface; in fact, the depth from the surface of the street to the top of the subway is only about 3 ft. After turning under the western arm of Aldwych, the subway falls very quickly again, in order

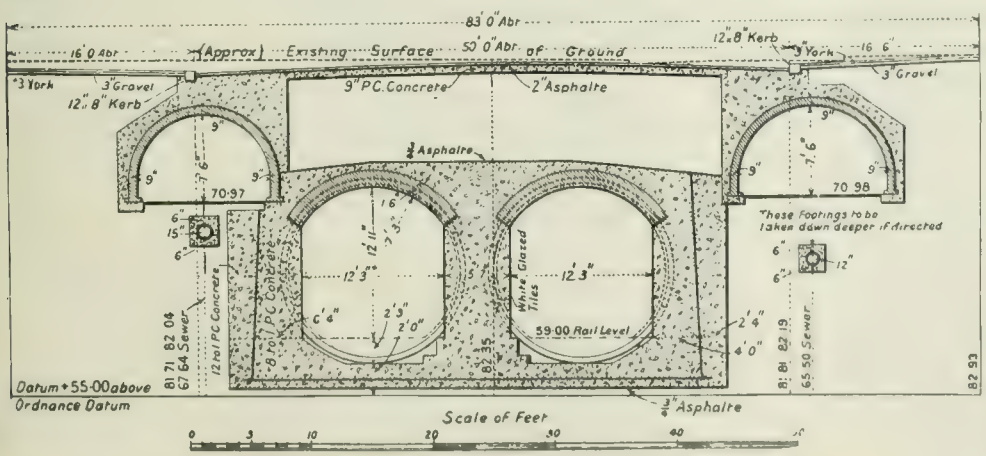
that it may pass under the Strand in cast-iron tubes at a deep level. At present the subway has been carried only as far as the curb at the north side of the Strand. After passing under the Strand it will be continued along Wellington street, and will finally emerge on the embankment at road level. The varying levels at which the subway is built show the difference in construction necessary when going along a new street specially constructed, in comparison with crossing existing thoroughfares. It was necessary to dip the rails to a depth of 31 ft. below the surface of the roadway in Holborn, to avoid existing sewers and other obstructions. At the Strand crossing the rails had to be kept 34 ft. below the surface for similar reasons. Under Kingsway no obstructions had to be dealt with, as the sewers are in duplicate one on each side of the street, and the pipe subways also on both sides, take all gas and water pipes, electric cables, etc.

No inconvenience, however, is caused to the public by the dip



Section at Northern Entrance of Tunnel under Holborn, Showing Retaining Walls of Open Approach.

under Holborn and the Strand, as the stations are fixed at points where the subway is close to the surface. At both Great Queen street and the junction of Kingsway and Aldwych, the platform is only 16 ft. below the street level, so that it is not necessary to provide lifts. The tramcars will run at short intervals, and as passengers will be continually entering and leaving by the short flight of stairs, it is hoped that the platforms will not be unduly crowded. It will never be necessary to break up the surface of Kingsway for the purpose of laying pipes, as ample room is provided in the pipe subways at both sides, and, in fact, the small depth from the surface of the road to the top of the subway will not permit of any pipes being laid in the roadway. At a considerable depth below the tramway subway, the Great Northern & Piccadilly Railway is being built, and it will have a station in Kingsway, a little south of Holborn. This is an ordinary tube railway, which will eventually be carried under the Thames to



Section at Entrance to Iron Tubes under Holborn.

Waterloo Station. There are, therefore, lines of traffic at three different levels in the new street—the ordinary traffic on the surface, the tramway traffic a short distance below the roadway, and a tube railway at a still deeper level.

The conduit system was selected for the new line, and it is continued in the subway. In ordinary conduit work the first operation is, of course, excavation of the roadway. In the subway, on the contrary, it was necessary to build up the conduit and track from the bottom of the tunnel. For this purpose concrete has been used. The rails rest on longitudinal wood sleepers, 12 in. wide by 6 in. deep, to which they are bolted by ¾ in. bolts. Sleeper anchors are secured by ⅞-in. by 15 in. bolts.

The longitudinal wooden sleepers are embedded in 8 to 1 concrete, which reaches to the underside of the head of the rail. Above the concrete is 4 in. of ballast, which is finished off with 4 to 1 cement. The rails are jointed with fishplates of the ordinary type, a sole plate (2 ft. by 1 in. by ⅝ in.) being placed underneath. This plate is secured to the rail with ¾-in. countersunk bolts. As it was not necessary to make provision for vehicular traffic, the form of construction adopted for the conduit presents considerable variation from the type used for ordinary street tramways. Supporting channels, embedded in the concrete, and further secured by bolts, are placed at intervals to carry the slot rails, which are of a special design. They are made in lengths of about 7 ft. 6 in., and can easily be lifted to enable inspection of the conduit to be made. Energy for working the cars will, until the tramway power-station at Greenwich is completed, be purchased from the Metropolitan Electric Supply Company.

For the service through the subway a new type of car has been constructed by the United Electric Car Company, Limited, of Preston. It is a practically all-steel car, and is of the single-deck bogie type. The underframe is built entirely of steel angle and channel sections. The side and end framing is formed of a combination of angle and H sections, which are secured to the sills with rolled-steel angles cut to suit and riveted to the posts and sills. Cant rails and garnish rails run the whole length of the car in one piece, and are riveted to the posts, the joints being strengthened by gusset plates well riveted. The fender rails also run the whole length of the car, but are so divided as to admit of the panels, which are of sheet steel, being removed in sections. The main panels below the window belts, and the fender rails, have curved surfaces in accordance with the usual practice, and the cars have five fixed windows on each side. The roof frames are composed of Z and L steel sections covered with steel panels.

The inside finish of the cars is composed entirely of aluminum, the ceiling being formed by aluminum sheets, on which suitable decorative designs are chased and picked out in dark colors. Above the ventilator lights and the doors will be aluminum mouldings, so designed as to render cleaning as simple as possible.

The ventilating sash in the roof is glazed with decorated glass, the ventilator sashes with $^{3}/_{16}$-in. plate, and the side windows with ¼-in. plate, all the glass being set in with non-inflammable felt. The side windows are furnished with adjustable spring roller blinds, furnished with non-inflammable Pantasote.

The compartment doors are of the twin type, made of steel plates, the upper part being glazed with $^{3}/_{16}$-in. plate glass, set in non-inflammable felt, the lower panel being of aluminum, and the top of the door being furnished with "hit and miss" ventilators. These doors have a twin operating device to enable them to work simultaneously. The platform doors are so arranged as to work with a folding step, which prevents entrance to the car from the front end when in operation. The signal lamps are of the oil type, so arranged as to illuminate the inside of the car in case of failure of the electric lamps.

The seats are of the longitudinal type, and are formed of oak slats screwed to angle steel supports, the slats being rendered non-inflammable. The car bodies are mounted on center-bearing maximum traction trucks provided with steel-tired wheels. A special requirement in the construction of these cars is interchangeability of the various parts from one car to another, and this has been given special prominence in the design and execution of the work. Whether this will be found an advantage in maintenance remains to be seen. All the metal fittings are of brass, copper oxidized finish. The floors will be covered with steel plates and over this with "litosilo." The exterior painting is in the L. C. C. standard colors.

The Division Engineer.

I.

We are speaking only of such experiences as occur to a Division Engineer in railroad work. The purpose is to mention the things common to all of us who have this particular point of view. My own experiences are colored by the conditions surrounding the companies for which my lot has been to be a Division Engineer. And, for the present, at least, we shall speak of maintenance work only.

When a railroad man is first promoted to Division Engineer, his most common mistake is to try to continue in the duties of the position which he has just held. If he was promoted from Assistant Engineer, or from Superintendent of Bridges and Buildings, or from Roadmaster, he will try to continue those duties. He has not learned to let go, and to depend on others' help. Some few of us try to keep up this detail work all our lives. General Grant found it difficult to get some men to be really brigadier generals. They would forget, and persist in leading one of their regiments instead of commanding the whole brigade. If we are promoted to the office of Division Engineer late in life, we often fail to learn the lesson of letting go the details. A somewhat different trouble, but a similar result, is seen when a young engineer with little knowledge of details of track or bridge work is made Division Engineer through family influence or some one's mistake. This young man burns with an ambition to let everyone see he knows track and bridge work, and shows off that scrap knowledge he has picked up. He will criticize a switch, find good ties among those taken out, and condemn bridge bracing, just to convey the idea to novices present that he is a very smart Division Engineer—in his own estimation.

When first put in charge of a division as engineer on maintenance, recognize at once that there are other practical men there and that you are supposed to be rather the scientific one in your line of work. Leave the practical track work to the Roadmaster and his foremen. If you do not know how to put in a switch, do not pretend to know it; and, whether you know it or not, never try to put one in save in emergency and when no one else is there to do the work better. As Division Engineer, yours is the organizing and business side. If you know the practical side of track and bridge work, drop it now at once. There are others to do it, and you should not take the time from your other and present duties. In a word, if you have been a Superintendent of Bridges and Buildings or a Roadmaster, quit it. If you have never been a Superintendent of Bridges and Buildings or a Roadmaster, don't try. You are Division Engineer, and the duties of that one position are what the railroad company expect of you. To think that you must now know how to do any of the work of each man under you is a fallacious notion of 15 years past. The idea is not now admissible in a man under 65 years of age.

In your treatment of Roadmasters and Superintendents of Bridges and Buildings use a judicious mixture of military discipline and the golden rule. Laxness is not kindness to an employee. Good men expect to do their duty. Bad men soon despise you if you do not make them do their duty. Good men never leave you because you make them do their work properly and promptly. Laxness is a weakness on your part, and a shrinking by you from an unpleasant duty. A kind man once had a first-class waitress. After some time she said she must quit. When asked the reason, she said that she was fast becoming careless and would soon be a poor waitress. So she was going back to her former master, who would swear at her once in a while. While profanity is no part of discipline, there is a germ of sound philosophy in the incident. It is easier for you to let things drift, and your ease is sweeter to you than your duty. The best of men sometimes forget and need just enough admonition of the right sort given in the right manner. Men so handled become better disciplined the longer you have charge of them.

Give clear orders. To understand orders as usually given is often not easy. Be definite, and positive, and brief. Give an order in the language the man who receives it speaks. Never mind about diction. Talk straight or write straight just in the lingo of the employee, if you can possibly do so. Point it out, if you can, instead of talking it. We were ballasting, surfacing and lining a difficult piece of track at one time. The engineer party had set stakes. Dropping off there to look it over, I saw that things were not going well. There was confusion between super elevation and run-off. I spent a couple of hours there with Brennan (all roads have a Brennan on track) and won his gratitude. Between us we got praise from the Superintendent for better riding track and faster progress in ballasting. When I left the division old Brennan declared in his patois that I was "the besht d—— mon that ivver shtruck the Mountain" (division). A high compliment. If you must write, use the fewest and shortest words you can. Be positive in orders. Say do and do not. Answer yes and no to queries. Do not dodge. Do not leave an anchor to leeward through obscure or vague orders. If you do not know what you want done, or if you fear the responsibility, then resign. Vague, wordy, slip-shod or equivocal orders made for a cloak on future days of reckoning are unprofessional. A railroad man must be brave.

Should instructions or orders be verbal or written? It is a much-discussed question. Passing over the general case, it is my experience in quite a good many years as Division Engineer and on three different roads, differing in organization, that as a general practice no instructions or general orders should be given in writing by a Division Engineer to Roadmasters and Superintendents of Bridges and Buildings. My reason is that it is not their way. In their earlier work as foremen they were used to receiving their orders verbally. They are little used to letters in their life work. You are using a foreign tongue, or at least new methods. Why not adapt yourself to them? There is but one of you and probably six of them. Is not such a course best for the company's interest? When in an emergency you issue written instructions of some length you must in nine cases out of ten go and explain them verbally. Some may say they want to place themselves on record. Well, if your spoken word is not good, your written one would not stand in court very long, for there could be found people who know you. If a man's word is not good, what is his letter or his bond worth? Letters you must use to a certain extent, but never depend on them. Supervision of track, bridges and buildings on the part of a Division Engineer by letter is practically worthless. There must be some progress reports sent in to you so you can report progress to your superiors as demanded, but these reports are pretty ancient history for a Division Engineer. You should see the work so often and so well that your knowledge of its progress is broader, deeper and better than any report can give. If you give your work office supervision in the main, you make a vital mistake. Soon a wily Roadmaster somewhere is doing ill and as he pleases, and giving you fairy tales by mail. Soon you will think a good man a poor one, when if you had been out on your work much you would have been sure to see his good qualities. If you criticize work by letter without seeing the work, what force has the criticism? Soon no one cares what you think. A Division Engineer is the one engineer who comes naturally in most direct contact with the men of all kinds and grades. Personality counts much here. The touch of the elbow and the grip of the hand are most potent here. Do not sell your birthright for a mess of pottage.

RAILROADER.

Mr. Wallace Before the Senate Committee.

Mr. John F. Wallace, whose resignation as Chief Engineer of the Panama Canal is fresh in the minds of the readers of the *Railroad Gazette*, was this week called before the Senate Committee on Interoceanic Canals, and has given a long explanation of his relations with the Secretary of War and the other officers with whom he had to deal while he was connected with the canal.

Mr. Wallace was before the committee on Monday and Tuesday, and the first part of his testimony dealt with his relations to William Nelson Cromwell, of New York. Mr. Cromwell's only official relation to the canal is as director and counsel of the Panama Railroad.

Mr. Wallace's chief reason for resigning his position was that he "was made jointly responsible with Mr. Shonts and Mr. Magoon for work on the canal, while Mr. Shonts had a verbal agreement with the President that he should have a free hand in the management of all matters. I felt Mr. Shonts was not as well qualified as I was either as a business man or an administrator; and he was not an engineer. I thought I was to be director general of the canal work. I thought it better to sacrifice my ambitions regarding this work, which was to be the crowning event of my life, than remain to be humiliated, forced to disobey orders, or create friction."

After outlining his objections to Mr. Cromwell, Mr. Wallace said, in reply to an inquiry: "I thought about him as being the man who brought about the sale of the canal to the government; who brought about the revolution in Panama; who assisted the government of Panama in making its investments; who is carried on the diplomatic list of that government, and who is interested in public utilities on the isthmus. I felt that a man mixed up in so many things might have his mind perverted, and at some time he might give the wrong advice, and the result would be a scandal. All the interests in Panama look upon Cromwell as their friend. He is the principal stockholder in the Panama-American Company, which handles ice and electricity."

Mr. Wallace had found that the Panama Railroad paid dividends in excess of earnings and then had sold bonds to repair ships and cars; and this made him suspicious of Mr. Cromwell. As to resigning without notice, Mr. Wallace said that he was liable to be dismissed at any moment by telegraph; and he took care that the work in his charge should not suffer by his resignation. When he came to New York to resign he found that he could not see Secretary Taft except in the presence of Mr. Cromwell; and therefore he then gave only a part of his reason for resigning—an offer of larger compensation which he had received. Mr. Cromwell appeared to be the principal adviser of the Secretary of War in all canal matters. He

procured the appointment of Mr. Wallace as President of the Panama Railroad.

On Tuesday Mr. Wallace described the conditions on the Isthmus and the difficulties of his work. He had a definite programme, and intended to make an annual report explaining his whole plan and course, but the report was never made. With the French excavating machines, which had cost $30,000,000, Mr. Wallace experimented sufficiently to discover that the machines were not fit for use. The experiments made in March, showing that excavating could be done at 43 cents a yard, were not sufficient to show with certainty the cost of doing the same kind of work in the rainy season. Mr. Wallace's successor had not had the benefit of his analysis of the year's work because, said Mr. Wallace in reply to a question, "the Secretary of War told me he did not want a report; he had no use for me except on the Isthmus as a directing engineer." Secretary Taft was very angry at the time of this conversation.

Mr. Wallace said that in all his experience in railroad construction he had never seen men better fed and housed than they were on the isthmus. The complaints, he said, came from clerks who went to the isthmus from Washington or New York, who had the idea from musical comedies that to live in a tropical climate was to be in hammocks and enjoy themselves. Efforts to establish a Young Men's Christian Association on the isthmus for the benefit of the canal employees were stopped because Governor Magoon had said that Secretary Taft did not wish the work to go on. Mr. Wallace thought this was because the community was Catholic.

Discussing labor conditions, Mr. Wallace said many Civil Service appointees were sent to the isthmus who were not bad enough to discharge, yet were thoroughly incompetent. He said it had been shown clearly that the Civil Service system was not adapted to procuring expert labor for work on the isthmus.

Speaking of the Bohio dam, Mr. Wallace said he discovered that solid rock bottom could not be found nearer than 167 feet, instead of 128 feet, as had been shown by the Walker borings.

He did not favor the eight-hour day and recommended that as few restrictions as possible should be placed on Mr. Stevens and that the "wolves should be kept off his back." If the canal work should be let by contract, said Mr. Wallace, the eight-hour provision would increase the contract price about 20 per cent. He thought the man in charge should be permitted to get his men in China, Japan, India, Spain or where he pleased.

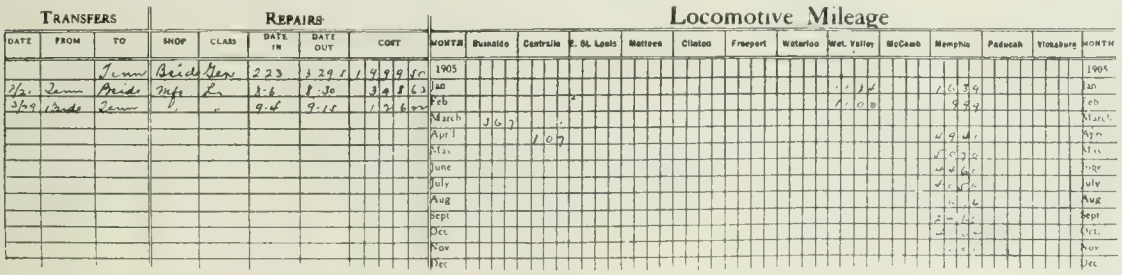
The Application of Card Index Systems to a Motive Power Office.*

With the rapid growth of railroads, the attention of their officers is being turned to simplifying methods of performing work as well as simplifying records, and thereby reducing the amount of clerical work to a minimum. Industrial corporations and manufacturers have long since recognized the usefulness, simplicity and practicability of the index system and card indices are rapidly becoming more popular in railroad offices.

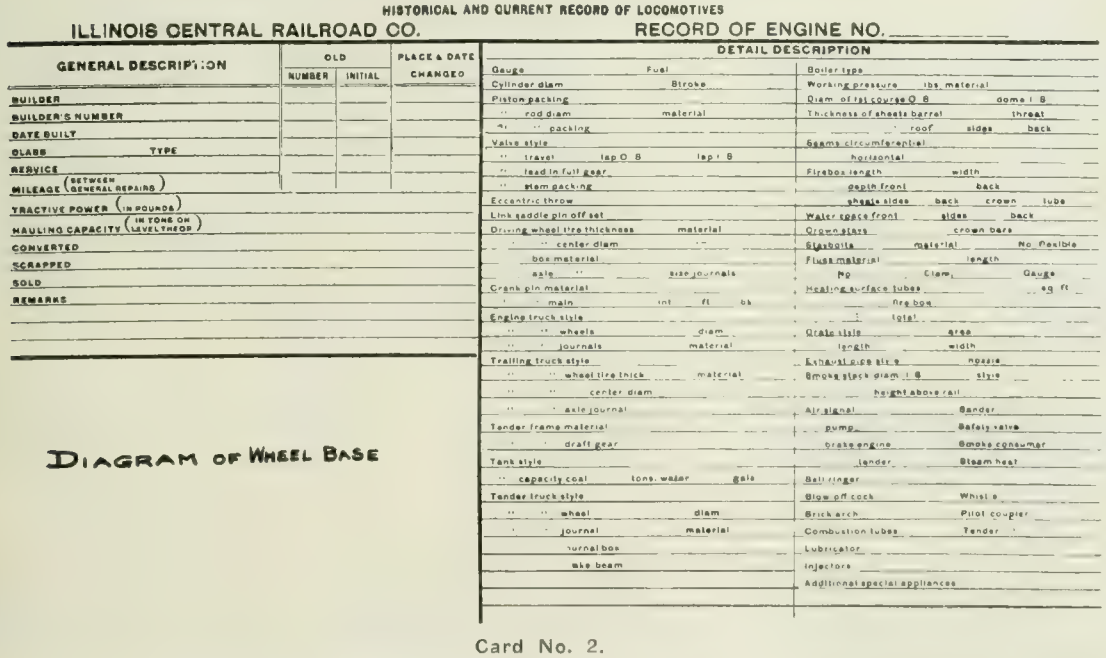
In most railroad offices space is scarce and at a premium, while the most serious objections to general office book records are that they are unwieldy, cumbersome, and they lack the possibilities for alterations and expansion which card systems offer. Particularly in the cases of locomotive, car, machine tool and pattern records, we find book records inconvenient for comparisons over any period of time. Instead of cards, loose leaf systems of filing are frequently preferred, but personally the writer is partial to cards because they are more substantial, less liable to become lost or torn and may be more easily corrected without marring the paper.

Our draftsmen and clerks have evinced great interest in changing from the book records to the card forms, and have in several cases devised card forms which have been adopted. In this connection attention is directed to a card which obviated the use of three book records devised by our account clerk. (Card No. 1.) These cards are 2¾ x 11½ in. and what is known as "tenth cut"; that is, on ten consecutive cards the number tabs have traversed the width of the drawer. The cards just fit the desk drawer, making it handy for entry or reference without necessitating the accountant leaving his seat. Three general heads will be noted, viz.: "Transfers," "Repairs" and "Mileage." Under "Transfers" we find the date and division (or shop) to which the engine was transferred; under "Repairs" the shop at which the repairs were made, class of repairs, dates in and out of shop, together with aggregate cost. Under "Mileage" we find the mileage made each month together with the jurisdiction shop which reported it.

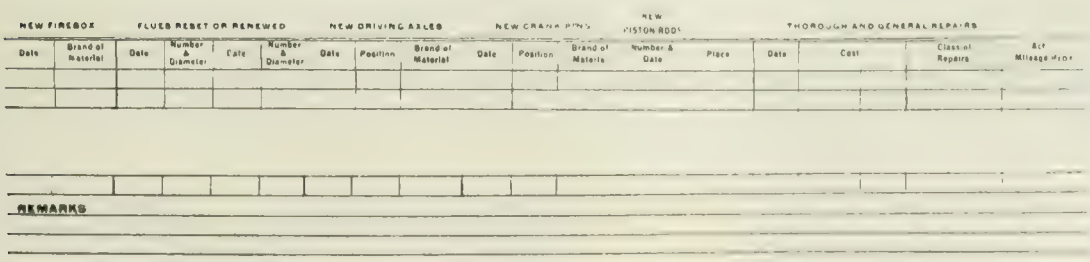
Card No. 2 is a historical and current record of locomotives. On the face we find the historical record and description and on



Card No. 1.



Card No. 2.

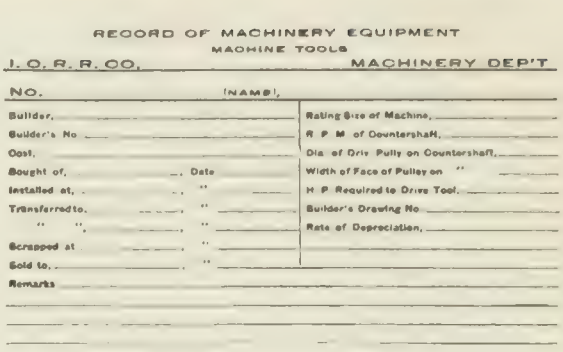


Reverse of Card No. 2.

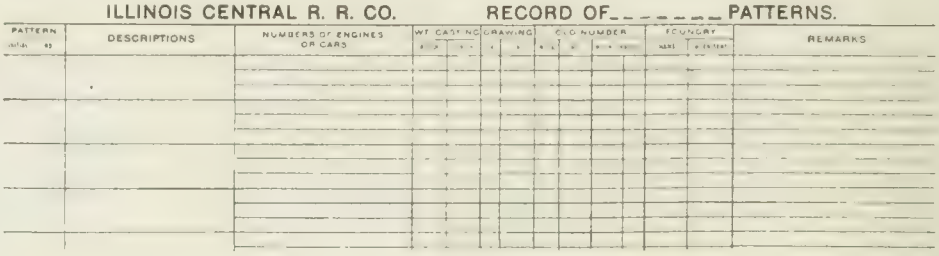
*Presented at the January meeting of the Western Railway Club by J. H. Wynne, Mechanical Engineer, of the Illinois Central.

the reverse side the current record. Note that provision is made for eight changes in number if necessary and that in the current record space is provided for 20 shoppings for classified repairs. In the lower left-hand corner of the historical record a space 2⅝ in. x 4½ in. is left for a diagram for the wheel-base. Where there are enough engines in a class to warrant it, this diagram is stamped on the card; otherwise there is a blue-print pasted upon it, the blue print paper being of as light a weight as practicable.

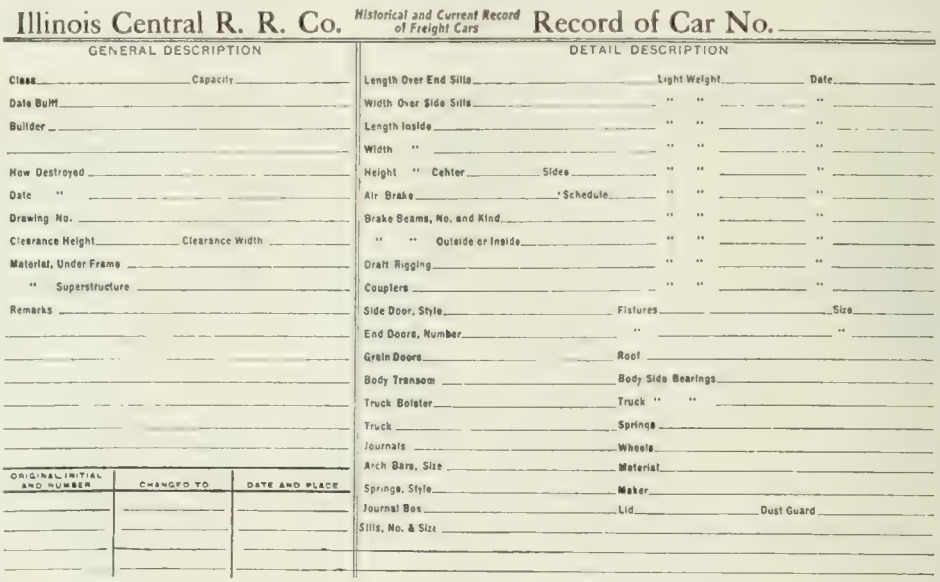
Attention is directed to the flexibility of this particular record, especially in cases where numbers are changed. The old number is erased at the upper right-hand corner, entered in the place provided under "general description" and the new number applied. All motive power men know how changing engine numbers affects book records. This is expensive especially to large railroads, particularly where the old numbers are wanted for reasons of classifications or re-grouping. This record will save about $30 a year for books and more than twice that sum in labor. In addition to this, the changes in book records would probably involve tenfold more time on the part of the clerks than this form. These cards are 6 x 10⅝ in. and are filed consecutively by engine numbers, suitable guide cards being provided.


RECORD OF MACHINERY EQUIPMENT
MACHINE TOOLS
I. C. R. R. CO. MACHINERY DEP'T
NO. (NAME)
Builder. Rating Size of Machine.
Builder's No. R P M of Countershaft.
Cost. Dia. of Driv Pully on Countershaft.
Bought of. Date Width of Face of Pulley on "
Installed at. " H P Required to Drive Tool.
Transferred to. " Builder's Drawing No.
" " " Rate of Depreciation.
Scrapped at "
Sold to. "
Remarks

Card No. 6.


ILLINOIS CENTRAL R. R. CO. RECORD OF_____PATTERNS.
PATTERN DESCRIPTIONS NUMBERS OF ENGINES OR CARS WT CAST NO DRAWING CLO NUMBER FOUNDRY REMARKS

Card No. 3.


Illinois Central R. R. Co. Historical and Current Record of Freight Cars Record of Car No._____
GENERAL DESCRIPTION
Class Capacity
Date Built
Builder
How Destroyed
Date "
Drawing No.
Clearance Height Clearance Width
Material, Under Frame
" Superstructure
Remarks
ORIGINAL, INITIAL AND NUMBER | CHANGED TO | DATE AND PLACE
DETAIL DESCRIPTION
Length Over End Sills Light Weight Date
Width Over Side Sills " " " "
Length Inside " " " "
Width " " " "
Height " Center Sides " " " "
Air Brake Schedule " " " "
Brake Beams, No. and Kind " " " "
" " Outside or Inside " " " "
Draft Rigging " " " "
Couplers " " " "
Side Door, Style Fixtures Size
End Doors, Number " "
Grain Doors Roof
Body Transom Body Side Bearings
Truck Bolster Truck " "
Truck Springs
Journals Wheels
Arch Bars, Size Material
Springs, Style Maker
Journal Box Lid Dust Guard
Sills, No. & Size

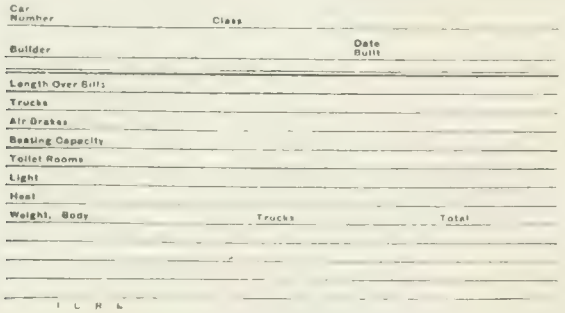
Card No. 4.

As a convenient desk record for the Assistant Superintendent of Machinery, in charge of the car department, card No. 5 has been devised. These cards give the general descriptions of the passenger car equipment and are filed in numerical order. They are 3 x 5 in. On the reverse side is a current record for repairs, painting and varnishing.

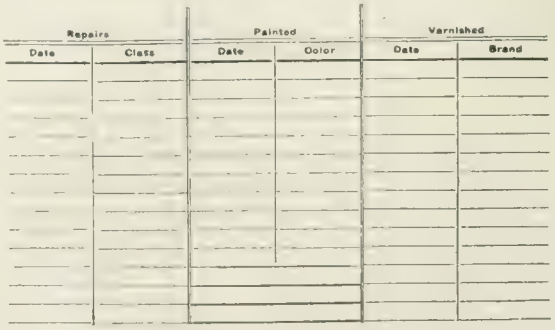
Cards Nos. 6, 7 and 8 are self-explanatory. It is absolutely necessary to have a complete record of shop machinery equipment on a railroad system of any size. General descriptions such as would be provided on these three forms for machine tools, stationary engines, pumps, air-compressors, stationary boilers, etc., assist in obviating unnecessary correspondence, provide data for arranging for transfers of such apparatus from one shop to another, as well as necessary information for ordering duplicate parts in emergencies and together form a detailed inventory. These cards are 3 x 5 in. and are filed by location, and, where necessary, are arranged by departments or shops, the groups being separated by guide cards.

Card No. 9 is a form used for recording water analyses. These are filed by operating divisions and are arranged alphabetically by names of water stations under each division. They are 3 x 5. The trades and supplies catalogues are indexed on card No. 10, which is a common form. It also is 3 x 5.

We file our drawings by drawer and drawing number, the letter prefix denoting the size of the sheet. Cards Nos. 11 and 12 serve as indices for locomotive and car drawings respectively. The locomotive index is kept separate from that for cars, and either set is arranged alphabetically according to subject. To further avoid


Car Number Class
Builder Date Built
Length Over Sills
Trucks
Air Brakes
Seating Capacity
Toilet Rooms
Light
Heat
Weight, Body Trucks Total
I. C. R. R.

Card No. 5.


Repairs Painted Varnished
Date Class Date Color Date Brand

Reverse of Card No. 5.

RECORD OF MACHINERY EQUIPMENT
STATIONARY ENGINES, PUMPS,
I. C. R. R. CO. COMPRESSORS, ETC. MACHINERY DEP'T

NO. ..... (NAME) .....

Builder,	Dia. of Cyl ____ Stroke,
Builder's No.	Type,
Cost,	Horse Power,
Bought of, ____ Date	Rev. per Min.
Installed at, ____ "	Dia. and Width of Driver,
Transferred to, ____ "	Size of Steam Pipe,
" " ____ "	" " Exhaust " ,
Scrapped at ____ "	Builder's Drawing No
Sold to ____ "	Rate of Depreciation,

Remarks,

Card No. 7.

RECORD OF MACHINERY EQUIPMENT
STATIONARY BOILERS
I. C. R. R. CO. MACHINERY DEP'T

Builder,	Type,
Builder's No	H. P ____ Working Pressure,
Builder's Drawing No	Heating Surface,
Cost,	Grate Area,
Bought of, ____ Date	Style Grate,
Installed at, ____ "	Diam and Length of Tubes
Transferred to, ____ "	Smoke Consumer
" " ____ "	Dust Burner
Scrapped at ____ "	Stoker,
Sold to, ____ "	Safety Valve

Remarks

Card No. 8.

ILLINOIS CENTRAL RAILROAD COMPANY.

Boiler Water from ..... Division .....
Sample taken ..... 19 .. Source of Supply .....

SCALE INGREDIENTS.		NON-SCALING INGREDIENTS.	
Insoluble Residue		Sodium: Chloride	
Silica		Sodium: Sulphate	
Iron and Alumina		Sodium: Carbonate	
Lime: Carbonate		Sodium: Nitrate	
Lime: Sulphate		Organic matter	
Magnesia: Carbonate		Total Non-Scaling	
Magnesia: Sulphate		Suspended Matter	
Magnesia: Chloride.		Total Scaling	
Total Scaling Ingredients		TOTAL SOLIDS	

REMARKS:

... ANALYZED BY

No.

Card No. 9.

No.	FIRM.	ADDRESS.

Card No. 10.

DR.	No.	DATE.	DESCRIPTION.	ENG. Nos.
E-7	2344	3/99	Driving Box	85-99

Card No. 11.

DR.	No.	DATE	DESCRIPTION	CARS
F-1	1942	10/05	Bolster, Truck-30 Ton "Common Sense"	54001-54600 54901-55600

Card No. 12.

DR.	No.	DATE.	DESCRIPTION.	CARS--CLASS. ENG. Nos.
A4	892	6/87	CAB	901-904
" "	893	2/11	BOILER	301-306
" "	894	9/04		

Card No. 13.

ROLL.	No.	DESCRIPTION.	REMARKS.
6	82	EXCURSION CAR PLANS	P.P. CAR Co

Card No. 14.

B

F 3-205 H. SMITH	8/03	TWO RIBS LENGTHWISE 2½" DEEP AT CENTER IN PLACE OF ONE 1⅞" DEEP. TO PREVENT BREAKAGE OF GRATE

Card No. 15.

Dwg No D-6-3287

DATE	DESTINATION		DATE	DESTINATION
3/13/03	BURNSIDE MM	2		

Card No. 16.

any confusion which might arise from the similarity of the two forms, card No. 11 is printed on salmon paper, while card No. 12 is white. As a check and a cross index, card No. 13 is used for both locomotive and car drawings, same being filed in numerical order.

Where foreign prints are preserved for reference, they are indexed by cards of the form shown on No. 14, alphabetically arranged according to the subjects. Class No. 11 to No. 14 inclusive are 3 x 5.

Occasionally it is desired to know upon whose authority or for what reason changes in drawings (or patterns) are made. Accordingly, when such changes are made, a brief description of the alteration, the drawing number, date and the name of the officer authorizing same are entered on a card like that shown on No. 15, bearing a serial number. This serial number is placed within a little circle drawn in the lower right-hand corner of the tracing. Should a discussion arise as to this particular feature on a drawing, by referring to the card index we find the necessary information.

Card No. 16 serves as a "follow up" system in connection with drawings issued with circular instructions. Cards of this form are filed in numerical order. They show the date issued, to whom sent and the number. They also serve the mechanical engineer or the chief draftsman as a check upon the person having the disposition of blue-prints directly in charge. They are 3 x 5.

In conclusion, careful investigation of each case and good judgment will always determine whether it is best to maintain a book record or adopt a card system.

Diversion of Cars.*

The following is an abridged record of the discussion at the meeting in regard to the diversion of cars on foreign lines away from the home road:

Mr. Drew (Wisconsin Central).—Every heart has its sorrows, Mr. President, and I have mine. My sorrow just now is diversion of cars. I have collected a few examples from our experience on this subject:

Road A. Large number of cars diverted to date. Thirty-seven individual cases taken up with the road. Some of these cars badly delayed before being moved to their connections.

Road B. Despite numerous promises our cars still move to their connections after being held on their rails some time, instead of being returned to us.

Road C. Several of our cars have been loaded back to New York and New England points from Chicago.

Road D. Thirty-five individual cases of diversion have been called to Mr. ————'s attention to date. He has repeatedly assured us that our cars would be looked after and returned. Reports received to-day, however, show he is still disregarding our requests and loading our cars away from us.

Road E. Sixteen of our cars have been loaded at their outfreight house at Chicago during the past three weeks.

Road F. Twelve of our cars loaded back east instead of being returned to us.

We sent a man around to personally look into the thing. He found two of our cars in a cut of 30 cars placed to a long freight house. He went to the yardmaster and said, "What are you doing with those two Wisconsin Central cars in there, loading them to the east, when we are just perishing for cars?" The yardmaster replied, "Do you suppose I am going to get an engine and haul out those 30 cars and switch out those two cars for you? They are in there and they are going to stay, and you will have to hunt them up when they come back." When you find that is occurring 20 or 30 times a day, it amounts to a good deal. What I object to is the seemingly conscienceless way people handle cars because they say they need them.

Another thing we have to contend with is this: We turn a car over to a switching road to be put at a certain place to be unloaded. By all the rules of equity that car ought to be brought back to us. Do you think it is? Not by a large majority. Those cars are simply gobbled up and taken away from us. We are in an unfortunate position because we originate a great deal of freight, and when our own cars are kept away from us, and especially in a shortage like the present, connecting roads will not furnish any of their cars, our business suffers very materially. We have certain embargoes in force now. We are obliged to say to shippers, you cannot load a car to such a railroad. They have five times as many of our cars as we have of theirs. It is a pretty strenuous thing to do. They say, "We have lost a good customer on that road if you will not let us load a car to them." They have to lose it.

Mr. Kearney (Baltimore & Ohio).—I presume the B. & O. is one of the roads that Mr. Drew has been hitting at, but I want to say that I think we held out as long as any road in the country did against this diversion. We were trying conscientiously to handle cars correctly and properly, but when we found that all our appeals, penalty tracers, etc., were of no effect and we had 7,000 of our cars off the line, almost 10 per cent. more than in the previous year, our own people got so desperate that we could not control the situation. Then as to a remedy, I believe one must be provided, the matter is getting so serious. I have made a proposition to several of our connections looking toward some rule in regard to diversion, to experiment with. For instance, I made a proposition to three large systems that I would enter into an agreement with them under which I would have the right to prohibit the delivery of our cars to five connections, considering that five just for an experiment, and they would have the right to prohibit delivery of their cars to five connections, under penalty of $1 per day until that car was returned either to home road or to our line. We wanted to see just how that would work out. We put a maximum penalty on the car of $10. These roads are looking into it. I am open to an agreement with anyone who wants to take up the proposition. We have gone further. We have investigated and I have to-day a list of roads that are not misusing our cars, and I have the promise of the management that those roads will be respected, and their cars will not be diverted.

Mr. Beecham (Chicago, Milwaukee & St. Paul).—I think it might be a good idea to try and obtain some reliable statistics in regard to diversions. I have no doubt at all but that as many cars are diverted in this day as ever, but I do not believe that there are any more. It seems to me that the results are about the same as they used to be. For example, we have cars that have been wandering aimlessly about the south for more than a year, and I had occasion not long since to appeal to a gentleman who presides over the destination of one of the southern lines, asking him to try and send home a certain furniture car. He promised that he would, but he said that it was a very difficult matter to get such a car as that north of the Ohio river, because it was constructed of Georgia pine, and the tendency was to stay in that section of the country. In like manner he said, he had a car west of the Rocky Mountains that was constructed of Oregon fir, and it was impossible to get it out of that climate. I have watched statistics in my office for some time, and I have found that the average of cars away from home from 60 days to 14 months, runs just about as it did eight or ten years ago. I have those statements on file and I occasionally look them over, and they vary but little. It has been said that people were diverting cars in order to avoid penalty. That may be true on some roads but I cannot see any necessity for it. The trouble is that none of us have absolute control over equipment. If we had, it must be plain that when we have a N. C. & St. L. car in our possession and have a load of freight going to Nashville or Atlanta or some other point down there, we would take that car and place it where that load could be put into it, instead of putting that car in local service in the direction in which it is to go, and placing one of our own cars for the Atlanta load. It requires the movement of an empty car here and another one there and a great deal of shifting around to get them where they ought to be placed. It would be a good thing if we could accomplish it, but we have no means of knowing where all the cars are, nor do we know where all the business is. And so, while we do not want our own cars to leave our line, they are constantly leaving it, and we are constantly getting other roads' cars on our line. In general we are trying to load foreign cars in the direction of home, and while I hear a great deal about putting merchandise shipments into them in order to switch them over to some other railroad for the purpose of avoiding the dollar a day, I do not think there is very much to that. I know that there is not much of it on our line. If we have a foreign car on our line and it is under penalty, we try to get it somewhere where we can load it in the direction in which it should go.

Mr. Drew (W. C.).—The point on diversion is not simply avoiding penalty. What we object to and what we suffer from is, we get our cars away down east, and we labor with the eastern lines to get those cars started west. We get them up to Chicago and we begin to feel happy. They get to Chicago, but we never see them. They are shot back to the eastern states again on the road that brought the cars in. That is an abuse it seems to me that ought not to be allowed, and any road which does that I think is certainly treating its neighbors unfairly. And yet such diversions are constantly being made. I have 65 instances in which cars of ours were loaded at freight houses with merchandise inside of three weeks, all over this country, and by almost every road that runs into Chicago.

Mr. Liggett (St. Louis Southwestern).—This subject under consideration comes very close home to us. As the matter now stands we have 60 per cent. of our equipment away from home and can get but a very small proportion of it back. We have three times as many of our cars away from home as we have foreign cars on the line, and the result is that our local business is seriously crippled. We have used every honorable means to induce connections to return our equipment, but with poor success. I question very much if, in times like this, when industries are suffering and the roads have not equipment to do the business, a penalty for

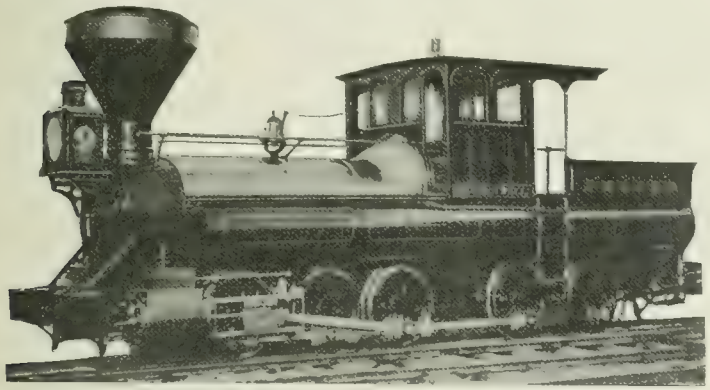
*Extracts from the report of the proceedings of the Association of Transportation and Car Accounting Officers, at St. Louis, Nov. 21 to 22, 1905.

diversion or an increase in the per diem rate, would contribute to bring cars home.

Mr. Wrenne (Nashville, Chattanooga & St. Louis).—When people say that cars cannot be worked home it is not fair. They can be worked home if the people pay any attention to it. But if the superintendents of transportation will wink at such matters, it will continue. There is already a car service rule that cars shall not be diverted. There is no attention whatever paid to it, not a particle, and if the officers and members of this Association will go before the American Railway Association, I think some attention will be paid to it. The members of the American Railway Association understand the importance of this as well as we do. If people who own cars can have their cars brought home, they can do their business. If not, they cannot.

A Historic Locomotive for Purdue University.

By the courtesy of the Pennsylvania Lines, and especially as a result of interest shown by Mr. D. F. Crawford, General Superintendent Motive Power, Purdue University has been able to add a machine of more than passing interest to its collection of historic locomotives. This latest acquisition, which is the sixth locomotive to take its place in the Purdue museum, is the "Reuben Wells," which was built in 1866 by what was then the Jeffersonville, Madison & Indianapolis Railway Company, for use on the "Madison incline." Its appearance when new is shown by the photograph accompanying. Somewhat recently it was remodeled, the rear end of the frame having been cut off, the number of axles



Tank Locomotive, Built for Jeff., Mad. & Ind. R. R., 1868.

reduced from five to four, and a saddle tank placed over the boiler. The engine as it now appears is shown by photograph, Fig. 2.

The scene of this engine's activity was in the immediate vicinity of the city of Madison, Indiana, a place of considerable commercial activity rather early in the last century. Located upon the Ohio river and surrounded on the east, west and north by hills rising to a height of over 400 ft., Madison was easily accessible from the water, but the steep hills on all of the roads leading away from the town made it difficult to distribute merchandize to the interior. After a long process of agitation the construction of a railroad, afterward known as the Jeffersonville, Madison & Indianapolis, was undertaken. The initial portion of this road was finished in 1841. The portion then completed consisted of a mile and a quarter of track rising almost uniformly at the rate of 310 ft. to the mile, or with a grade of 5.89 per cent. This incline was designed and for many years was operated as a rack and pinion road, the first locomotive having been built by the Baldwin Locomotive Works and delivered from Philadelphia to Madison by water. Some years later when Mr. Reuben Wells had become Master Mechanic of the J. M. & I. Railroad Co. he became convinced that by the use of a properly designed locomotive, the rack and pinion might be dispensed with. As a result of his conviction he designed and built the locomotive which has now been presented to Purdue University. This engine when put to work performing a service with plain wheels which had previously involved the use of gears, was justly regarded as a machine of remarkable capacity. It was, in fact, a most excellent adaptation of the means to an end, the significance of which becomes greater when it is remembered that it was put in service in 1868, or nearly 40 years ago.

The successor of Prince Khilkov as Russian Minister of Transportation is K. S. Nemyeshayev, who was General Manager of the Southwestern Railroads, where Count Witte made his reputation as an administrator. The new Minister has made a statement of the causes of the periodical car famines in Russia which has attracted much attention, and modifies the common judgment that it is chiefly due to incapacity and negligence. Some of these causes are due to the character of the country and the circumstances of the grain growers. The latter are mostly very poor and cannot provide granaries for storing their crops, and they therefore hasten to haul their grain to the stations in the few weeks between harvest and the time when the fall rains make the Russian roads impassable. If they could wait till winter, they could haul with sleighs till spring. Then the outlets for grain on the frontier are comparatively few in number, and their elevators are soon filled, and shipments cannot be made as fast as grain arrives, so that even with a greatly larger number of cars, shipments from interior stations cannot be made. No Russian grain port is ice-free all winter, though the harbor of Odessa is usually closed but a few days; and this, of course, greatly limits exports in winter. Before the late railroad strike there were about 170,000 car loads of grain waiting to be forwarded at interior stations. We may imagine that things have not mended since.

Washington Correspondence.

Washington, Feb. 6.—It cannot be said that the Hepburn railroad rate bill has been strengthened by the House debate. On the contrary, it has been so severely criticised, not only by its opponents, but by its supporters as well, that if it had not been understood that it is to be made over by the Senate there would have been strong pressure for amendment in the House. As was indicated in the report of the House Committee, the bill in its present form is not satisfactory to any one—not even to Representative Hepburn, whose name it bears, or to any other member of the committee from which it was unanimously reported. It will serve the purpose for which it was intended, however, that of giving the advocates of rate legislation in the House something to vote for, and it will then be sent to the Senate where the real bill will be made. Representative Grosvenor, of Ohio, spoke for many of his associates as well as for himself when, after a speech of severe criticism of the bill, he declared that he would vote for it, as he believed it should be sent as speedily as possible to another body where it would not be subject to such iron-bound treatment as in the House. Mr. Grosvenor went further than any other critic of the bill in declaring that the railroad rate issue was a "fake issue."

Much of the serious criticism of the Hepburn bill has been directed against its failure to provide for an effective review by the courts of the orders of the Commission. As the debate has progressed it has been made apparent that those members of the House who have seriously studied the provisions of the bill are satisfied that no order of the Commission changing rates could be reviewed by a court unless it could be alleged that the rate made by the Commission was so low as to be actually confiscatory. It has been contended that it would be impracticable to obtain a review even on the ground that the rate was confiscatory, for the reason that the penalty provided for failure or neglect to observe an order of the Commission would be so heavy as to deter the railroad from going into court unless it were willing to put the Commission-made rate into effect pending the review—a course that the road would be reluctant to adopt on account of the extreme difficulty that would be encountered in restoring a rate that had been lowered for any considerable length of time and to which related rates on the same road and on other roads had been adjusted. The bill seems to contemplate the possibility of a court's enjoining the order of the Commission in some way pending the appeal, but it is contended that this could not be done for the reason that there would be no one against whom the injunction could be effectively directed. It is pointed out that an injunction directed against the Commission would be of no effect, for the reason that the Commission is not required to perform any act to put an order into effect, the order being self-executing and the penalty beginning to apply without any further action by the Commission upon the date fixed for it to take effect. If this construction of the bill is correct it would justify Mr. McCall's declaration that it would give the railroad a chance to apply to the courts on peril of its life. In the case of an order that would put into effect rates which would bankrupt the road, it could take its choice between being put into bankruptcy by obeying the order or taking the risk of being bankrupted by the penalty if the court should chance to sustain the Commission.

These arguments have not been without effect on the opinions of Representatives, but they have not changed votes. All except a small minority of the members of the House have been determined from the beginning to vote for any kind of rate bill that might be endorsed by the committee believing that the bill would in any case be made over to meet the wishes of a majority of the Senators. The Senate Committee is to take up the task of making a bill on Friday of this week and is to continue its sessions from day to day until February 16, when it is to vote on reporting a bill. There is no formal work being done by the committee this week, but a great deal of quiet work is in progress and efforts are being made to change the views of Senators who are members of the committee and those who are not. The principal fight in the committee is to be over the question of whether or not provision

is to be made in the bill to be reported for the determination by a court, at some stage of the proceedings, of the judicial question of whether or not a rate called into question is unreasonable. Senators Elkins, Foraker, Aldrich, Kean and Crane, of the Republicans, will stand out firmly for a provision that will bring this question before the courts in some way. It is possible that they may receive some Democratic support. None of the Democratic members of the committee has yet publicly announced his position on this question, but it is understood that Senators Foster, of Louisiana, and McLaurin, of Mississippi, are disposed to favor giving the courts this power, though they may not go to the extent of helping the majority of the Republicans to report a bill containing this provision. It is still possible that there may be several committee reports without a majority in favor of any one bill.

It is generally expected that Senator Knox, of Pennsylvania, will have as much to do with framing the bill to be passed by the Senate as will any other man, though he is not a member of the Committee on Interstate Commerce. The reason for this is that it will be believed that any proposition he may favor will have the approval of the President. Senator Knox does not seem to be in complete harmony with the President at this time, however, for he has let it be known that he favors provision for an effective review, while the President is disposed to believe that no more right of judicial review should be given than would be afforded by the Hepburn bill. This opinion is not shared by any member of his cabinet, however, except Attorney-General Moody. The members of the Cabinet who do not agree with the President are naturally refraining from expressing their views for publication, but it is understood that some of them differ so widely from the President as to favor the Foraker bill, which proposes to have all questions as to unreasonable rates and other alleged violations of the law dealt with by the courts in the first instance and makes of the Commission little more than an investigating and prosecuting body.

The Effect of Nitrogen on Iron and Steel.

In a brief monograph Dr. Hjalmar Braune recently discussed the effect of minute quantities of nitrogen on iron and steel. For the past 20 years the abnormal brittleness of these metals, especially when produced by the basic process, has attracted especial attention. The author states that he has been engaged in the investigation of this phenomenon for the past six years and has come to the conclusion that this accidental brittleness is occasioned by the presence of the nitrogen that the metal has taken up during the different periods of its manufacture.

This nitrogen is only found combined with pure iron ferrite, forming a nitrate of iron of which the carburets, such as cementite, are entirely free. The nitrate of iron exists in solid solution in the ferrite, whose melting point it lowers and at the same time its dissolving properties for the carburet of iron. In this respect, the nitrogen exerts a marked influence on the quality of the metal, upon soft iron as well as upon hard steel and castings. This has been proven by the following experiment.

Test pieces of the best quality of iron and steel have been heated in ammonia to the temperature of 1,475 deg. F. for varying lengths of time, so as to cause a larger or smaller quantity of nitrogen to combine with the iron. The same test pieces have then been reheated in sand, so as to secure a homogeneous distribution of the combined nitrogen throughout the metal.

In the case of test pieces having the following composition:

Carbon	0.060 per cent.	Sulphur	0.005 per cent.
Silicon	0.010 "	Phosphorus	0.050 "
Manganese	0.060 "		

it was found that the quality of the metal varied as the proportion of nitrogen increased. For proportions ranging from 0.07 to 0.08 per cent. of nitrogen, a break in the continuity of the elongation is observed, which for the higher percentages of nitrogen falls rapidly to nothing. The metal then cracks along the whole surface of the test piece. Such pieces had been charged with nitrogen by heating in ammonia to 1,475 deg. F., but because of the limited time during which they were reheated the surface contained a higher percentage of nitrogen than the interior.

The transformation of the metal, as the proportion of the nitrogen increases, can be readily followed photographically. The metal first used was composed of large grains with a uniform surface. As the amount of nitrogen increases, the interior aspect of the grains is modified and lines like streaks of corrosion appear between them, at the same time the size of the grains decrease. It will also be noticed that while some of the grains retain their original appearance, others are completely changed.

When the quantity of nitrogen has risen to from 0.07 to 0.08 per cent. the grains are very small, scarcely one-tenth their original dimensions; at the same time the cement that fills the joints between them has increased in thickness. As soon as this structure has been developed the metal becomes exceedingly fragile.

When the amount of nitrogen has been still further increased up to 0.20 per cent. the cellular structure disappears entirely, and in its place there are a series of small dark, rectilinear lines which have the appearance of perlite more or less clearly defined. In the passage from the cellular to the eutectic structure the contour of the cells can be seen to become marked, divided and separated into small rectilinear lines or bars.

The conclusion reached from an examination of this cellular structure shows that there is a very clear relationship between it and the elongation of soft iron. The larger the cells the more ductile the metal. The cement forming the joint between the cells contains the impurities of the iron. The amount of nitrogen contained in metal produced under ordinary industrial conditions very rarely amounts to as much as 0.07 per cent., but in very soft metals, especially in Lancashire iron, the lower percentages are quite sufficient to make the metal brittle.

In order to study the influence of nitrogen upon the hard steels, one was taken having the following composition:

Carbon	1.15 per cent.	Sulphur	0.012 per cent
Silicon	0.20 "	Phosphorus	0.025 "
Manganese	0.45 "		

This was treated to increasing quantities of nitrogen by heating in ammonia as before. As in the case of soft iron, the tensile strength increased at first with the increase of nitrogen, at the same time the elongation decreased; until, suddenly, when the amount was between 0.030 and 0.035 per cent. the elongation almost entirely disappeared; and the metal became decidedly brittle.

With a steel of 0.50 carbon, the critical point, corresponding to an entire disappearance of its malleability, was attained when the content of nitrogen was between 0.040 and 0.045 per cent., and finally for steel of 0.20 carbon the same point was reached with from 0.05 to 0.06 per cent. of nitrogen. In every case, the sudden appearance of this brittleness corresponds to a change of structure. Metals as ordinarily produced rarely contain 0.06 per cent. of nitrogen, though those with from 0.03 to 0.04 per cent. are common. It is for this reason that the hard steels become brittle more easily than the soft ones, because their critical content of nitrogen does not vary as much from that which is ordinarily in them.

Nitrogen thus exercises an important influence on tempered steels. The nitrate of iron, in this case, is found in solution in martenite, just as it was in the ferrite of the reheated steels. The influence of the nitrogen upon the electric and magnetic properties of steel is also considerable. In soft iron especially the coercive force and hysteresis is increased.

Pig Iron and Rail Production in 1905.

The Bulletin of the American Iron and Steel Association prints the following statistics of pig iron and rail production in the United States during 1905. The collection of unsold pig iron stock statistics has been abandoned.

The total production of pig iron was 22,992,380 gross tons, against 16,497,033 tons in 1904, 18,009,252 tons in 1903, and 17,821,307 tons in 1902. The following table gives the half-yearly production in the last four years in gross tons.

Periods.	1902.	1903.	1904.	1905.
First half	8,808,574	9,707,367	8,173,438	11,163,175
Second half	9,012,733	8,301,885	8,323,595	11,829,205
Total	17,821,307	18,009,252	16,497,033	22,992,380

The production of 1905 was not only much the largest in our history but it exceeded that of 1904 by 6,495,347 tons, or over 39 per cent. The year of next largest production was 1903, when 18,009,252 tons were made. The increase in production in 1905 over 1903 was 4,983,128 tons, or over 27 per cent. The production in the second half of 1905 was 666,030 tons more than that of the first half. The total production by states is shown in the subjoined table.

Total Production of Pig Iron by States.

States	Blast furnaces—In blast Jun. 30, 1905.	Blast furnaces—Dec 31, 1905. In.	Out.	Tot'l.	Production, gross tons of 2,240 lbs. (including spiegeleisen.) First Half 1905.	Second Half 1905.	Total for 1905.
Massachusetts	1	1	1	2	7,636	8,351	15,987
Connecticut	2	3	0	3			
New York	13	14	9	23	550,208	647,860	1,198,068
New Jersey	6	5	6	11	165,991	145,048	311,039
Pennsylvania	124	126	27	153	5,226,691	5,352,436	10,579,127
Maryland	3	4	2	6	156,334	175,762	332,096
Virginia	15	14	12	26	240,672	269,538	510,210
North Carolina	0	0	1	1			
Georgia	1	3	1	4	25,752	12,947	38,699
Texas	1	0	4	4			
Alabama	29	30	19	49	743,547	860,515	1,604,062
West Virginia	2	4	0	4	149,016	149,163	298,179
Kentucky	2	3	5	8	32,793	30,942	63,735
Tennessee	15	12	8	20	195,757	176,935	372,692
Ohio	42	55	7	62	2,181,058	2,405,052	4,586,110
Illinois	19	17	4	21	979,157	1,055,326	2,034,483
Michigan	9	9	2	11	147,953	140,751	288,704
Wisconsin	6	6	0	6	184,234	167,181	351,415
Minnesota	0	1	0	1			
Missouri	1	2	0	2			
Colorado	3	4	1	5	176,376	231,398	407,774
Oregon	0	0	1	1			
Washington	0	0	1	1			
Total 1905	294	313	111	424	11,163,175	11,829,205	22,992,380
Total, 1904	216	261	168	429	8,173,438	8,323,595	16,497,033

The production of Bessemer and low-phosphorus pig iron in

1905 was 12,407,116 tons, against 9,098,659 tons in 1904, an increase of 3,308,457 tons, or over 36 per cent. The production of basic pig iron in 1905, not including charcoal of basic quality, was 4,105,179 tons, against 2,483,104 tons in 1904, an increase of 1,622,075 tons, or over 65 per cent. The production of charcoal pig iron was 352,928 tons, against 337,529 tons in 1904, 504,757 tons in 1903, and 378,504 tons in 1902. The production in 1905 was 15,399 tons more than in 1904, but it was 151,829 tons less than in 1903 and 25,576 tons less than in 1902. The production of spiegeleisen and ferro-manganese was 289,983 tons against 219,446 tons in 1904, an increase of 70,537 tons. The production of ferro-manganese alone was 62,186 tons, against 57,076 tons in 1904. One company produced 1,243 tons of ferro-phosphorus in 1905, against a similar production of 946 tons in 1904. Another company reported a production of 2,750 tons of ferro-Bessemer in 1905, but did not report any iron of this grade in 1904. These figures are not included in the spiegeleisen and ferro-manganese reported above.

The whole number of furnaces in blast on Dec. 31, 1905, was 313, against 294 on June 30, 1905, and 261 on Dec. 31, 1904. The number of furnaces in blast at the end of 1905 was larger than at the close of any year since 1891, when exactly the same number of furnaces were active.

The production of all kinds of rails in the United States in 1905 was 3,372,257 gross tons, against 2,284,711 tons in 1904, an increase of 1,087,546 tons, or 48 per cent. This is the maximum production in any year. The year of next largest production was 1903, when 2,992,477 tons were made. The increase in 1905 over 1903 amounted to 379,780 tons, or over 12 per cent. Rails rolled from purchased blooms, crop ends, "seconds," and rerolled, or renewed, rails are included. Renewed rails are rails that have been in use and after reheating are rolled down to smaller sections.

The following table gives the production of all kinds of rails in 1905 according to the weight of the rails per yard. Street rails are included.

Kind of rails.	Rails—Bessemer.	Rails—Open-h'rth.	Iron.	Total.
Under 45 lbs.	209,853	16,409	318	226,580
45 lbs. and less than 85	1,468,123	131,501	0	1,599,624
85 lbs. and over	1,510,699	35,354	0	1,546,053
Total, gross tons	3,188,675	183,264	318	3,372,257

In the following table the production of all kinds of rails in 1905 is given by states.

States.	Rails—Bessemer.	Rails—Open-h'rth.	Iron.	Total.
Pennsylvania	1,095,154	18,687	...	1,113,841
Other States	2,093,521	164,577	318	2,258,416
Total, gross tons	3,188,675	183,264	318	3,372,257

Twenty-four plants in 12 states rolled or re-rolled rails in 1905, as follows: New York, 1; Pennsylvania, 5; Maryland, 3; West Virginia, 1; Georgia, 1; Alabama, 3; Ohio, 4; Illinois, 2; Wisconsin, 1; Colorado, 1; Washington, 1, and California, 1.

The production of Bessemer steel rails amounted to 3,188,675 gross tons, against 2,137,957 tons in 1904, an increase of 1,050,718 tons, or 49 per cent. In the following table the production of Bessemer steel rails is given by states from 1902 to 1905.

	1902.	1903.	1904.	1905.
Pennsylvania	1,148,425	1,186,284	801,657	1,095,154
Other States	1,786,967	1,760,472	1,336,300	2,093,521
Total gross tons	2,935,392	2,946,756	2,137,957	3,188,675

In addition to Pennsylvania the states which made Bessemer rails in 1905 were New York, Maryland, West Virginia, Georgia, Ohio, Illinois, Wisconsin, Colorado, and Washington.

The total production of open-hearth steel rails in 1905 was 183,264 tons, against 145,883 tons in 1904, 45,054 tons in 1903, 6,029 tons in 1902, 2,093 tons in 1901, and 1,333 tons in 1900. The maximum production of open-hearth rails was reached in 1905; the year of next highest production was 1904. Alabama rolled almost all the open-hearth rails that were rolled in 1905 and 1904, Pennsylvania rolling the remainder in 1905 and Pennsylvania and Colorado in 1904.

The production of iron rails in 1905 was 318 tons, all rolled in Alabama, Ohio, and California, and all weighing less than 15 lbs. to the yard. In 1904 the production was 871 tons.

The demand by shippers for cars on the Prussian State Railways last December was 28 per cent. greater than the year before. In November 197,633 carloads of beet roots alone were forwarded, which is 32 per cent. more than the year before. These are usually hauled but short distances.

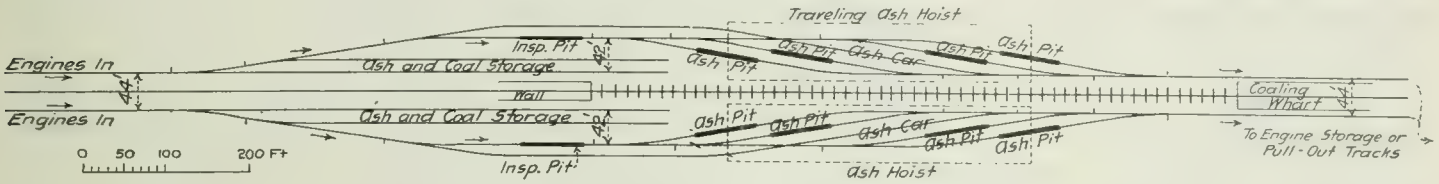
Locomotive Handling at Terminals.

BY W. A. MAC CART.

In times of freight blockades, such as have occurred in recent years, the energies of all transportation officials are bent to ascertain and remove, so far as can be done, all causes tending to congestion, and to improve the service in all directions. Prompt handling of motive power is a first essential in moving congested freight, so that the engines may be cleaned, coaled and turned and made ready for service without delay. This means providing not only good facilities for each of these purposes, but it means having them so located as to be readily accessible.

The writer has known of instances where, during these strenuous times, engines have made a return trip over divisions of the road running backward because if permitted to try to reach a turntable they would be so hemmed in by other movements and the cramped surroundings that there was no assurance when they could be gotten back to the main tracks ready for a trip. These delays sometimes amount to three and four hours, when one hour should have been sufficient for the required purposes; and the facilities themselves are usually to blame. With this in mind, a plan is submitted which it is believed will, without requiring a large amount of room, tend to expedite at least the cleaning and handling of the engines at the coaling wharf.

The plan needs no explanation, being a series of parallel ash pits holding one engine each. This will permit of any particular engine that may be specially needed receiving prompt attention and returning to its service instead of having to wait behind a string of three or four already on a single track ash pit. The space required is very little more than would be needed for the usual design of two parallel ash pit tracks of the same standing room with an ash car track between them. With a track layout of this design, so located that it would be easily accessible by engines coming from or going to trains, any locomotive should be made ready for a return trip in a minimum of time.



Ash Pit Arrangement for a Terminal Yard.

Industrial Railroads and Car Service.*

The subject of industrial railroads and their relation to car service and per diem charges was taken up. The following are extracts from the discussion:

Mr. Daly (Illinois Central).—The question has been discussed by several Chicago railroads as to what the difference is between a non-per diem road and an industrial road. For example, we have connection with the Pullman Railroad at Chicago and with the Illinois Northern Railroad. If the New York Central loads a car to either of these railroads, or if it comes to Chicago and we reconsign it to either of these railroads, we pay the per diem while that car is on the Illinois Northern or the Pullman Railroad, simply because we class them as industrial railroads. Now take a smaller road located at New Orleans or Louisville or Atlanta or San Francisco, under exactly the same conditions: They are classed by the roads in that territory as non-per diem roads. Hence if we load a car to them, we have got to stand the per diem on it. Now should there be any difference between an industrial road at Chicago and an industrial road at Atlanta, or a logging road that is not eligible to per diem and cannot get in. Still, because we connect with these railroads at Chicago and they are termed industrial roads by the Chicago railroads themselves, it obligates the road that delivers to them (not the road that loads the freight) to pay the per diem on the car, whereas if we did not class them as industrial roads we would save the per diem we are now paying. I believe if one section of the country bears the per diem on cars, the other section of the country ought to do likewise. I should like to ask if the Chicago, Milwaukee & St. Paul considers it fair that when we deliver them an Illinois Central car going to the South Dakota Central and they assume the per diem on that car while it is on the South Dakota Central tracks and pay it to us, and then the next week they give us one of their cars going to the Georgia Central, which is an identical railroad to the South Dakota Central in every sense but which we have not seen fit to classify as an industrial railroad, is it fair that we should collect per diem from them on our car and refuse to pay them per diem while their car is on our tracks?"

Mr. Prall (Pittsburg Car Service Association).—I have been

*Extracts from the proceedings of the Association of Transportation and Car Accounting Officers, at St. Louis, Nov. 21 to 22, 1905.

very much interested in hearing the discussion on industrial and non-per diem roads. An understanding of the industrial and the non-per diem road to me is absolutely necessary in conducting car service. A car service rule applied as an industrial rule is per diem pure and simple, with free time allowed and $1 charge, instead of no time allowed and 20 cents a day charge. The industrial rule is applied during the entire movement of the car—the loaded car in, the detention of the car while on the track of the industry, and the return of the empty car. It has to be applied to an industry exactly in the same way as the per diem regulation to a connecting line, using the same report. No matter what the industry may do with that car while in its possession, that car is charged for after the free time expires, at the rate of $1 per car per day. If the car is held 60 days it gets the free time, which is the regular time allowed to everybody for the unloading of the car, or the regular time allowed for the loading of the car, and one day for the switching of the loaded car, and one day for the return of the empty. It is the acknowledgment of the same principle that has been granted in switching service by the American Railway Association; four days reclaim. Four days besides the day of the offering and the delivery of the car. Now you can take the industrial rule and apply it to what they call non-per diem roads, because non-per diem roads are nothing in the world but industrial roads, and if the non-per diem road is long enough and it requires two days for the load and two days for the return of the empty, you have the right to allow it to them under the car service rules. That is, the regular time and the necessary time for switching the load and for the return of the empty. There is no difficulty in understanding the industrial rule, and that the non-per diem road is an industrial road. If it is not, why is it not admitted into the American Railway Association? In handling the business of the United States Steel Corporation, the corporation, and all its plants (and I have 27 in my territory), are all handled under the industrial rule. I have a form called 520 which is nothing but an interchange report put in book form. Every car is recorded on Form 520, and the carbon is turned over to the representative of the plant, and every one of those plants makes the same report on my form and turns the carbon over to the agent when they return the car. It is absolute per diem. In handling those industries we have another form which we call 510, which is an offering form. We offer all cars we cannot place on interchange tracks, giving the car number and initials, and all those cars are again recorded on the interchange report, Form 510, and every car received in the Pittsburg territory is recorded from time of actual receipt. Not an imaginary receipt. We follow that up with Form 510, recording actual detention, from actual receipt to actual placement on interchange and actual return of the car to the rails of the railroad. I do not mean to say in making that statement that in the report of the railroad detention in switching service, we report the time consumed in the return of the empty car. That is never done and cannot be done under car service rules and regulations on any car. If you stop and think you will see that the car service regulations and records only show records to the time of unloading of the cars. Consequently in applying the industrial rule to the plant, the detention is only reported to the time of unloading the car, but if the car is not returned after unloading within one day there is a charge of $1, and no detention is shown for that empty car movement. You must remember, in order to understand my statement, that in determining the length of time for handling a car in switching service you must multiply the railroad detention by two. In some districts by three, where you move your empty cars when you get ready. Under the industrial rule, if the empty car is not taken from the track where it is unloaded by the engines in the service of the industrial company automatically, the industrial road is charged for the failure to promptly move the car back to interchange, and in that way the industrial rule as a car service rule is far in advance of any other car service rule that is applied in any Association. It is per diem pure and simple.

Mr. Johnson (Chicago, Rock Island & Pacific).—Are we to understand that Mr. Prall advocates having only two methods of handling the per diem question? I judge he believes he can include all railroads not signers of the per diem agreement under his industrial rule.

Mr. Prall (P. C. S. A.).—Yes, I desire to make that a positive statement. For instance, there is one road in the Pittsburg territory that delivers to another road. The first road is 10 miles long, the second 15. There will be no difficulty in handling it, the second road having an additional day, the first road being responsible for the maintenance of its record for deliveries to the other road under the industrial rule. Again, the New Haven & Dunbar operating under the industrial rule, makes deliveries to nine different plants connecting with its rails. They run a regular car service record with all their plants and apply the regular rule, called by us "1 A," allowing 48 hours for the loading or unloading of cars, and collecting car service themselves. They pay under the industrial rule for the detention of any car, either on their own rails or on the rails of the industries they serve, they accepting all responsibility for their service. Where the industrial rule has been introduced, delays have been reduced 90 per cent. In this connection there is one thing I should like to point out. Every railroad is perfectly willing under per diem, to have the switching road return its cars in two days even if it is a four-day reclaim, and make 10 cents on the movement, the idea being that the return of the car quickly is well worth the 10 cents. It is the same way under the industrial rule. If a car is placed to-day at any time it is recorded as to-morrow. We give them to-morrow. We do not count the first day. If they can place that car the day they receive it they will charge for it. If it is detained on an industry track for three days, they collect a dollar and they can bring the car back and give it to the railroad and they do not owe the railroad anything. It is an inducement to move the cars just as fast as they can and they do it. The free time is one day in addition for the load, and up to 4 o'clock of the day after the recorded release of the car for the return of the empty. Four o'clock means the railroad has a right to begin checking at 4 instead of 6 o'clock. It means a day. If you deliver a car on Monday under per diem and they bring it back that day there is no charge. If they bring it back Tuesday, there is a charge. If you place a car on Monday under ordinary car service rules, the time begins at 7 a.m. Tuesday. If you give the industrial road the car on Monday I record it as placed at 8 a.m. Tuesday. We calculate from the next 7 a.m., so we calculate from 7 a.m. Wednesday, giving them Wednesday and Thursday. If the car is returned on Friday by 4 o'clock we record it as released the previous night at 6 o'clock. That is to keep down the car service charge and makes plain that we cannot calculate the time for the return of the empty. If we did, we should have a complication. We have to remember always the free time as it expires under the direct rule, which is the rule allowing 48 hours. If you go over it again you will see that it is the reclaim allowance. You give a car to a connection in switching service. You allow them four days reclaim. Under the industrial rule practice as we apply it we allow thing you simply undertake to do, but the other party doesn't carry out his part.

Mr. Elliott (Illinois & Iowa Car Service Association).—The industrial rule ought not to be difficult to understand. Its purpose is simply to give time enough to do the work, in addition to the regular car service time allowed free. The distinction between per diem rules and the industrial rule, is that the per diem rules are a matter of agreement between you, which you agree to abide by, while the industrial rule is something you put upon someone, who may or may not carry it out. In regard to the Illinois Northern case that Mr. Daly spoke of, it would be a very simple matter for the railroads to say, "You may have that car so long; after that you will pay $1 a day for it." That is simple enough, but getting the dollar is another matter. You bump up against traffic arrangements and the other departments. There are lots of industrial rules that are applied and you are able to enforce the collection. There are other industrial rules that you may want to apply, or may apply without getting any money. There is a great distinction there between the agreements on per diem, which are agreements among you, and the industrial rule, which is something you simply undertake to do, but the other doesn't carry out his part.

Mr. Prall.—The per diem rule has a most distinct advantage, in that it is a matter of agreement—signed agreement. It is a contract between railroads that must be lived up to. That car service, whether it is an industrial rule or any other rule, is a question of law. It is a question of the understanding of the railroads of their own interests, and where the railroads have such a record that they can and do proceed to the end of collecting their just demands, there is no distinction between the charge of $1 a car per day as charged to an industrial road, and as charged to any corporation or individual. The difficulty is invariably in the application of a car service rule that we may have to sustain our contentions in the courts. We must sustain our position as being always equitable, applying reasonable rules and regulations, so that it can be proven, not that those rules are expedient, but that they are of mutual advantage to the community and the railroads. We have to apply those rules which give the least annoyance to the consignee and in such a way that they are not only applied to the consignee but to the railroad in its service, so that through the application of the rules the railroad improves the service to the satisfaction of the consignee, which ends in the co-operation of the consignee with the railroads.

Mr. Daly (Ill. Cent.).—I should like to ask Mr. Prall if he has any industrial lines that have refused to pay him car service according to his car service rules.

Mr. Prall.—Yes, in the past, but now the rule has been agreed upon.

Mr. Daly.—Has the average number of days been knocked out?

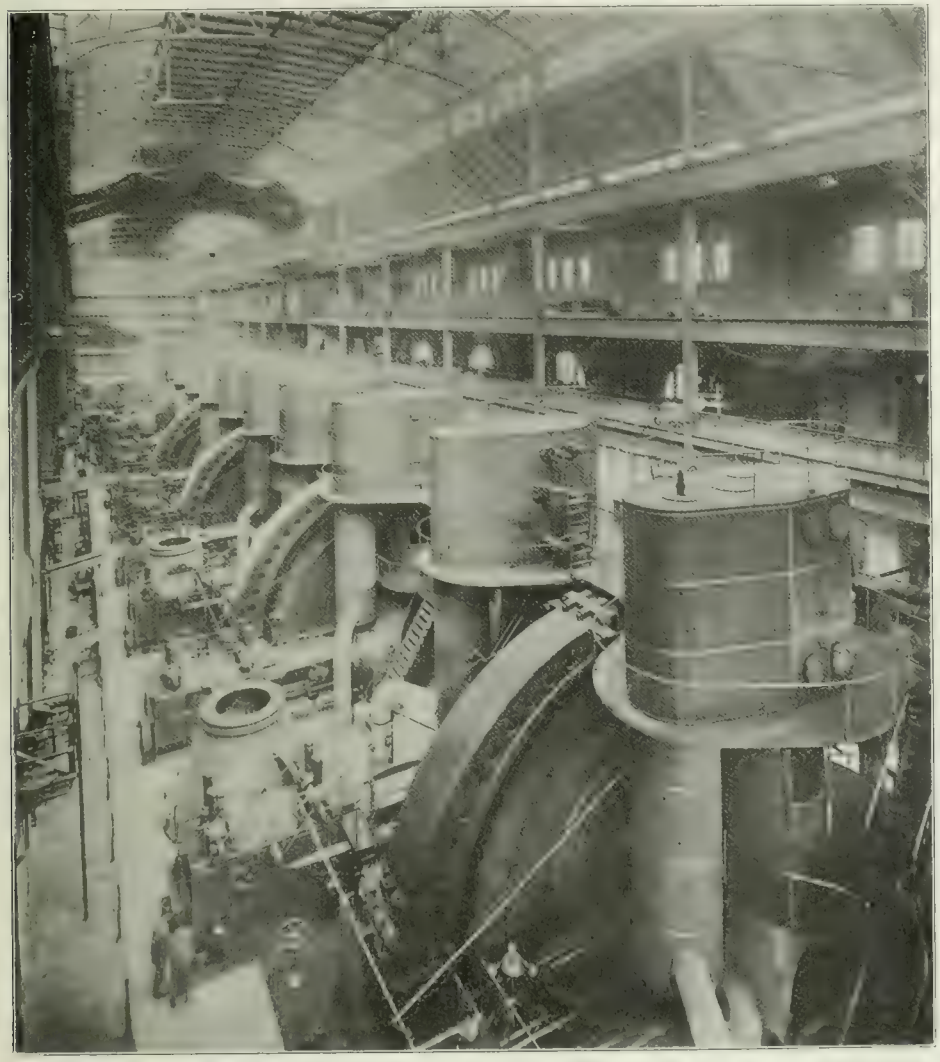
Mr. Prall.—I knocked the average time out in the very first notice that I promulgated as car service commissioner. The biggest

kind of a row was raised, but now there is not an industry that wants to go back to the average time. The actual time and the average time of the United States Steel corporation has been reduced in consequence from between five and six days to less than two.

Engine Failures.

Mr. M. K. Barnum, Assistant to the Second Vice-President of the Chicago, Burlington & Quincy, addressed the engineering students of Purdue University on this subject January 29. The importance of the subject was emphasized by a statement to the effect that the proportion of engine failures to mileage is to some extent an indication of good or poor management, though the possibility of an epidemic of failure under the best of management was admitted. "Practice," he said in defining failures, "varies greatly." A broad definition counts as failures all delays of any account whatever chargeable to engines. Another and a much narrower one is, a delay of more than five minutes to a passenger train or of more than ten minutes to a freight train at any one point due to broken, defective, or lost parts of machinery, hot bearings or leaky boilers. A generally accepted definition which lies between these limits makes a failure any defect in an engine or its mechanical operation which causes it to lose time or make stops which would otherwise be unnecessary. The speaker discussed the effect of engine failures upon the cost of operation, loss of business and the movement of traffic; he then analyzed the causes leading to such failures and described the manner in which failures are reported and the methods by which the higher officials handle the statistics of them. Attention was called to the importance of shopping engines at proper intervals. Large engines in freight service require to be shopped after running from 45,000 to 60,000 miles, while smaller engines in lighter service will frequently run for 75,000 to 125,000 miles between shopping. A careful study of the requirements of different classes of engines with reference to shopping will greatly assist in reducing failures on the road.

In his discussion of details it was shown that technical failures of engines were often failures of men, the apparatus being in satisfactory condition but delays occurring through inattention or faults on the part of the crew. He said also that the reverse conditions sometimes existed, that through prompt and wise action on the part of the engineer, a technical failure may be actually avoided. Failure of the first class occurred when an engineer brought his engine back to the roundhouse because of an alleged failure of injectors, whereas in fact the injectors were in working order but were not properly handled. This, he said, while recorded as an engine failure, was really the failure of a man. As an illustration of the manner in which a technical failure may sometimes be avoided, a case was cited where an engine within four miles of a terminal broke its piston rod; the cylinder head, piston and rod all being blown clear of the engine. The engineer knowing that all harm had been done which could be done, held his throttle open and got into the terminal on time, thus avoiding a technical failure, notwithstanding the fact that there was actual and serious breakage of parts. In conclusion, attention was called to the extremely satisfactory records which many roads are now enjoying with reference to engine failures. The speaker considered a good record to be one which permits a mileage of 10,000 miles per failure, yet some roads are to-day operating with less than one failure to 15,000 miles.



Six of the Nine 1,200-h.p. Allis-Chalmers Engines—Fifty-Ninth Street Power Station of the Interborough Rapid Transit Company, New York.

Interborough Rapid Transit Company Test of Subway Engines.

An interesting official 15-hour test of one of the nine twin vertical-horizontal Reynolds Corliss engines, cylinders 42 in. and 86 in. x 60 in., which are in operation at the 59th street station of the Interborough Rapid Transit Company, New York, was concluded December 15th. The tests were conducted by the Interborough Rapid Transit Company and representatives of the Allis-Chalmers Company as a final determination of the fulfillment of the builder's guarantee and formally provided for in the original contracts.

How well the tests of engine No. 8, which was selected as representing all the engines installed, fulfilled the claims made for it, may be readily ascertained from the following data giving a synopsis of the completed tests. As per agreement, on account of the impossibility of keeping a constant load, the power was determined by the readings of tested integrating wattmeters. These readings were reduced to I.H.P. by running the generator as a synchronous motor; adding the electrical input to the switchboard readings when developing power, to obtain the power exerted by the engine. The result of the test so made, under conditions approximating the contract requirements of 7,500 h.p., 75 r.p.m., 175 lbs. steam pressure and 26-in. vacuum, was a consumption of 11.96 lbs. of dry saturated steam per I.H.P. hr., or well within the guarantee of 12.25 lbs. The steam consumption per k.w. hr at the switchboard was 17.34 lbs. The details of the test are given in the following table:

Duration	15 hrs
Load	5,079.2 K. W.
Friction and generator losses	417.3 K. W. 559.14 H. P.
Total load	5,496.5 K. W.
I. H. P.	7,365.3 H. P.
Revs. per minute	75.02
Steam pressure	175.18 lbs.
R. H. receiver	19.1 "
L. H. receiver	19.27 "
Vacuum	Actually 26.02 "
Temperature, injection water	42.36 deg.
Temperature, R. H. discharge	74.05 "
Temperature L. H. discharge	77.38 "
Barometer	30.50 lbs.
Water per hour	89,906 "
Drips per hour	512 "
Leakage per hour (boiler)	1,470
Boiler level correction	60
Net water per hour	87,964
Quality of steam	100.38
Dry steam per hour	88,119.3
Dry steam per K. W. hour	17.34
Dry steam per I. H. P.	11.96

The final results allow for boiler leakage which was determined by a separate test of 24 hr duration. The steam was very slightly superheated during the test as being easier to make allowance for than wet steam, and a correction was made to reduce the superheated steam to equivalent dry saturated steam.

The vacuum was carried at 26.02 in., or as near the contract requirement as possible, but the barometer stood at 30.50 in.

The vacuum was, therefore, equivalent to only 25.52 in. referred to 30 in. barometer; no correction was made, however, as none was provided for in the contract. Other tests at varying vacua show that if the vacuum had been carried enough higher to correspond to 26 in. vacuum when referred to 30 in. barometer, the steam consumption would have been about 0.09 lbs. better, or 11.87 lbs. per i.h.p. hr., instead of the official figure of 11.96 lbs.

General Electric Straight-Air Brake Equipment.

The General Electric Company has recently placed upon the market a complete line of air-brake equipments for all classes of electric railway service. The apparatus now offered is the result of a long experience and careful study of the requirements of electric traction service. It combines the essential features of positive control, simplicity and ease of manipulation, and is adapted for motor cars, operating singly or occasionally hauling one or two trailers. The General Electric standard straight-air-brake equipment consists of the following: Motor compressor, suspension cradle, air compressor governor, motorman's valves with removable handles, brake cylinder, reservoir with hangers and drain cocks, safety valve, gages and exhaust mufflers.

The compressor is compact and self-contained and the motor is made in accordance with the standard practice of the General Electric Company in railroad motor construction. The four-pole cast-steel magnet frame extends in both directions to form a complete box shaped covering for the armature and field coils. All bearings are supplied with dust-proof doors providing perfect protection from dust, and at the same time rendering all parts accessible for inspection. Herring-bone gearing with a removable protecting case is provided, assuring comparatively noiseless operation and long wear. The wearing qualities of the compressor are further assured by straining all entering air through curled-hair filters, thus excluding dust and other foreign substances. All parts of the motors and compressors of the same size are interchangeable. Careful provision has been made for the lubrication of bearings, and the enclosed construction affords protection from water and dust. The compressor is supported in a cradle in any convenient place beneath the car. Several sizes of compressors are made to meet any requirements.

To govern the intermittent action of this motor compressor, a compact and reliable governor is furnished. This may be located in any convenient place beneath the car or within the car itself, as it is dust, snow and waterproof and is also of small size. This governor consists of a flexible diaphragm and plunger which operates a pair of contact fingers through a double system of levers. These open and close the circuit in response to the variation in pressure upon the diaphragm. The double series of levers renders the action of the fingers quick-break and positive, and a strong magnetic blow-out effectually extinguishes the arc formed on opening the circuit. All parts of this governor, subject to wear, are easily renewable, and the construction, together with the absence of valves of any sort, insures reliability of action.

To control the admission of air into the brake cylinder an improved form of motorman's valve is employed. These valves have been specially designed to meet the requirements of the hard service and rough usage to which they are put. Two forms are made, known as Type S and Type SS, the latter differing in construction from the first only in that it has an auxiliary valve for admitting air to pneumatic sanders. This auxiliary valve is operated by a press-button located in the handle so that the operator can apply the sand during breaking or running without removing his hand from the handle. As these valves, from the nature of their service, are subjected to wear, special attention has been paid to the wearing surfaces which are designed to keep in proper alinement and to facilitate even wear, and also to permit regrinding them when that becomes necessary. These motorman's valves are furnished either of the slide valve or rotary type.

The brake cylinders supplied with these equipments have been designed with a view of incorporating such features as have been found to be most satisfactory in the past. The cylinders are fitted with tubular piston rods, which surround the push rods to which the brake levers are connected. These push rods are so arranged as to move within the hollow piston rods when the brakes are applied by hand. The reservoirs are made of a special grade of steel, and are so constructed as to give maximum strength with minimum weight. A ½-in. drain cock of substantial construction is furnished with each reservoir; this is fitted with a lever handle. Mufflers are provided to deaden the noise of the exhaust when brakes are released. These do not interfere in any way with the free release of the brakes.

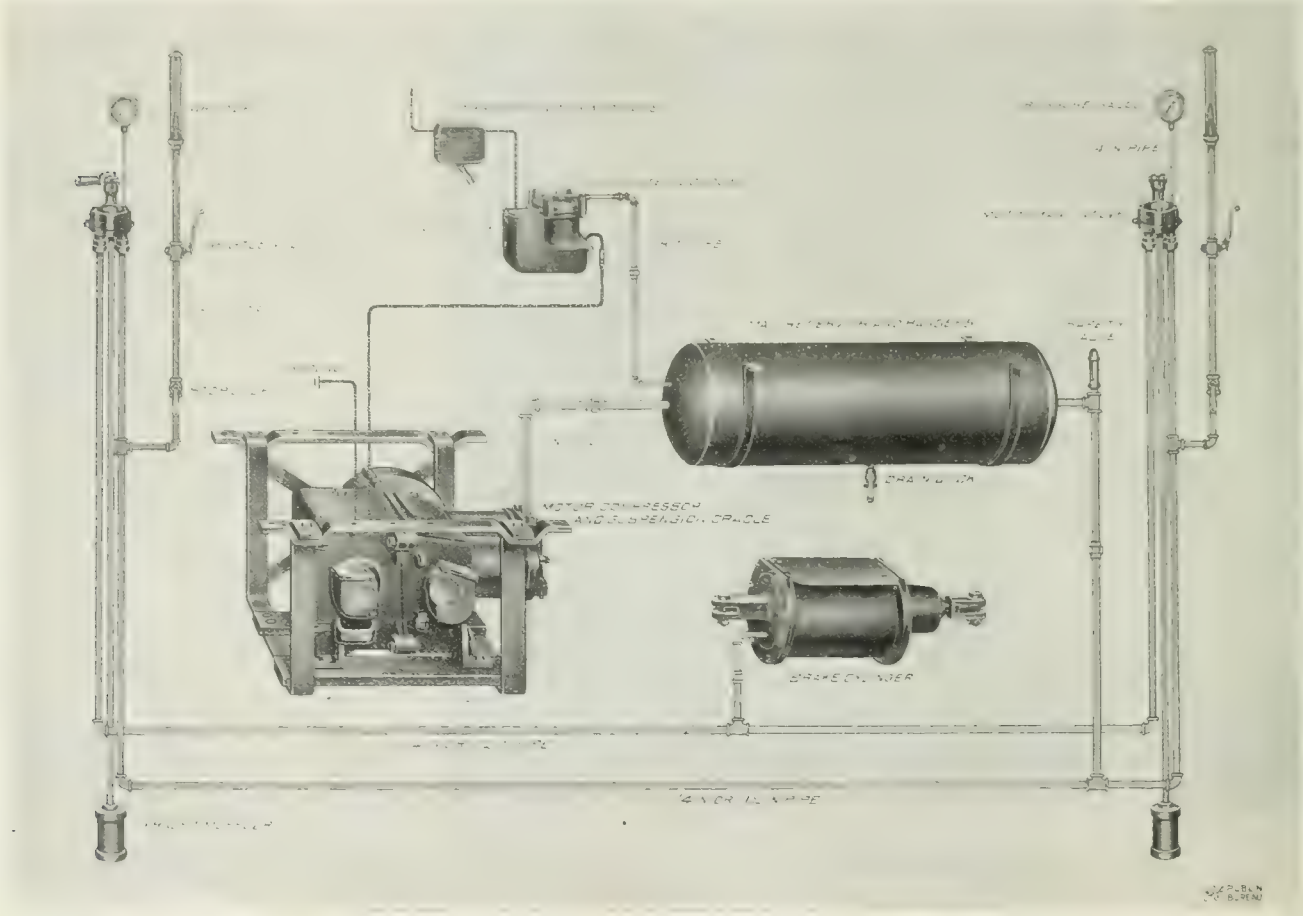


Diagram of General Electric Straight-Air Brake Equipments.

In addition to the parts mentioned, when two or more motor cars are equipped with the straight-air brake equipment, couplings for reservoir lines between cars are provided, as well as special governors for simultaneous starting and stopping of the car compressors. These retain the same desirable features as the governor described.

The General Electric Company also furnishes automatic equipments and combined straight and automatic air-brake equipment to meet the requirements of all classes of service.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Speech of Senator Lodge on Rate Legislation 145
- Ohio Passenger Fares 145
- Card Index Systems in the Motive Power Department. 146
- Trainmen's Working Hours on the Great Western Railway of England..... 146
- Further Rock Island Retrenchment..... 146
- Two Object Lessons in Railroad History. 147
- Trade Catalogues 148

ILLUSTRATED:
- The Detroit River Tunnel of the Michigan Central 149
- Operation of Electric Locomotive During a Snowstorm. 152
- The Warren & Jamestown Single Phase Railway 157
- Construction of a Subway Tunnel Under the River Seine in Paris. 164
- The Standard Wieland Pipe Threading and Cutting Machine 168

CONTRIBUTIONS:
- The Real Issue 148
- Wheeling & Lake Erie Earnings. 148

MISCELLANEOUS:
- Washington Correspondence 154
- Required Reduction of Passenger Fares in Ohio. 154
- Railway Education 160
- Detention of Cars in Yards..... 163
- January Decisions in Railroad Law..... 164
- The Division Engineer 166
- How to be a Good Station Agent..... 166
- An Early "American Special" 167
- How a Station Agent Should Handle Freight Cars 167
- Foreign Railroad Notes 168
  - Hours in Prussian Shops
  - Passes in Austria
  - Italian Ministry

GENERAL NEWS SECTION:
- Notes 49
- Obituary 51
- Meetings and Announcements 51
- Elections and Appointments. 51
- Locomotive Building 53
- Car Building 53
- Bridge Building 53
- Railroad Construction 54
- Railroad Corporation News 56

VOL. XL., No. 7. FRIDAY, FEBRUARY 16, 1906.

On February 12, in the United States Senate, Senator Lodge delivered a remarkable speech on rate regulation. It was remarkable because it wasted no time in doubtful economics of highly debatable points, but viewed the suggested regulative measures solely with the purpose of finding out what they would accomplish. "What is really the matter, and what can we really do about it?" might have been the text of this speech, to which we will give fuller space in a subsequent issue. The following quotations are straight to the point:

"In nine cases out of ten when I have talked with any one who was very eager for general railroad legislation, and especially for Government rate making, I have found that the special grievance complained of was a personal and not a place discrimination."

"Government rate making is not, and cannot furnish, any remedy by and of itself for personal discrimination or rebates."

"To sum what we may learn from English experience, we find that the provision against increasing rates has prevented the reduction of rates, that undue preferences or rebates have been successfully stopped, that discrimination between localities exists and that the long and short haul discriminations are not interfered with. It therefore appears that in England the rate making by Government, so far as it has gone and so far as it affects discriminations between localities, has had either no result or has prevented rate reductions."

"The experience of all other countries, taken as a whole, shows us that it is entirely possible to abolish all discriminations between persons * * * * that Government rate making has not lowered rates, but has made them not only higher but inelastic * * * * that Government rate making has not stopped discriminations between localities in the slightest degree."

"Two dangers seem to me to menace this legislation. The first is that in the desire to have rates fixed in some form by an executive commission, exercising powers delegated to it by Congress, we shall fail to give an effective remedy for the worst evil which has arisen, that known as 'personal discriminations.' Whatever else governmental rate making can do, it cannot, by the mere fact of its existence, do away with an offense which consists in the evasion of an established rate. * * * * The second danger is that rate making by the Government, which can only affect excessive rates and place discriminations, will go too far, and will bring on evils far more serious than those it is designed to cure."

We devote this week an unusual amount of space to the thorough and interesting document prepared by Mr. James McCrea to show why passenger fares should not be arbitrarily reduced to two cents per mile in the State of Ohio. The paper discusses at length many points that are thoroughly familiar already to readers of the *Railroad Gazette*, but it does no harm once in a while to round up a subject and view it broadly, from a standpoint somewhat remote from the nearness of daily practice. The arguments made by Mr. McCrea, which should at once strike the technical and the non-technical reader as being most effective in the advance of his cause are, first of all, that the profit of passenger business depends wholly on passenger density. The writer is forced in making his argument to apportion costs between freight and passenger traffic, else he could find no way of determining whether or not a service was profitable. It is, of course, impossible to say accurately that any one kind of a traffic on a railroad costs a certain amount or a certain proportion of the entire amount of expenses to handle, but we are disposed to agree with Mr. McCrea that it is fair enough in a broad comparison to pro rate expenses on a train mile basis. When this is done it is perfectly clear why Eastern lines can make a profit out of their passenger business when Western lines cannot, for a road must be maintained and fixed charges must be paid whether a train a day or two hundred trains a day are run over the track. It may be objected that on lines doing an abnormally heavy freight business and an abnormally light passenger business it would be impossible to make the passenger business pay for itself, that a rate which would actually bear the requisite proportion of expenses would drive away traffic. There are cases, undoubtedly, where this is true, and here the railroad must make a voluntary sacrifice, either to build for the future or to comply merely with its charter requirements. Mr. McCrea did not go into this, and he did not need to. What he set out to do was to prove to the

Legislature of Ohio that his passenger charges were clearly not exorbitant and not unduly profitable to the company. He showed this convincingly by proving that much of the passenger traffic on the lines in which he is interested is done at a figure which returns no profit at all to the company. His second main point rested on this proved assumption that a reduction of passenger fares in Ohio is a tax, and that the taxes paid by Ohio lines are already abnormally high in proportion to the gross earnings of the roads. The issue is thus presented squarely. If the Ohio legislature wishes to tax the roads further let it do so under true colors.

In the discussion by the Western Railway Club last month of the uses and advantages of card index systems in motive power departments, Mr. Parish, of the Lake Shore, referred to the superiority of industrial concerns, and particularly the large corporations or trusts, over the railroads in the matter of knowing accurately their shop costs. The conditions are not similar, of course, and the greater difficulty of keeping, or arriving at, costs in a locomotive shop are well known. To keep the costs of manufacturing only would be comparatively easy, but the proportion of pure manufacturing in the majority of shops is small. Repairs constitute the principal output, and repair costs are difficult; in fact, next to impossible, to determine accurately under the methods which obtain generally, taken in conjunction with features which are to a greater or less extent unavoidable in railroad practice. A typical instance will suffice to illustrate this point. The average round house is very deficient in facilities for making repairs to locomotives, therefore any machine work, for instance, that may be necessary has to be done in the "back shop." A machinist at work on an engine in the roundhouse brings to the shop a piece to be machined at once. The foreman orders a man on a lathe, say, to lay aside the piece on which he is engaged for the roundhouse job, which takes an hour or two, perhaps; the repairer meantime having to wait—or he probably does wait, whether he has to or not. Or if the emergency requires it, a piece is taken from an engine of similar class in the shop, just ready to go out, maybe, and its departure delayed until another can be made. This sort of thing, these emergency happenings, are occurring continually and in a variety of which only the man who has experienced them has any conception. The difficulty of any attempt to keep an accurate record of repair costs under such conditions is obvious, especially in shops where the methods which constitute present general practice prevail. Piecework shops, however, having the individual operation system, find themselves able to ascertain these costs with much greater accuracy than was formerly possible, especially, as Mr. Parish says, after the system has been in force long enough for every one to have a thorough appreciation of the importance of getting at costs correctly. He adds that the use of a card system is a great help in this connection.

If we take the railroad commissioners' report and the grand jury's report and read them together, we shall be pretty likely to conclude that the engineman who failed at Baker Bridge, Mass., in November, had actually worked 16 hours a day for five successive days, in the week preceding that collision—which gives a very practical aspect to the commissioners' dictum that working hour limits should be "rigidly" enforced, by a rule to which exception shall be made only in cases where no risk of life is involved. As any little mistake made by an engineman may endanger lives, the only possible interpretation of this recommendation is that the rule for enginemen's hours shall recognize no exceptions whatever. This is a hard saying; who can hear it? Yet it is perfectly logical. Think of the glowing terms which are used in describing the skill, alertness, fidelity and courage of the ideal engineman; do they not always imply a man in the full possession of every faculty, with body and mind in perfect health? And is any railroad officer ready to "stand for" the assignment of any but an ideal runner to a fast express train on a busy railroad? Of course not, in theory. But how shall we reform our practice? One way is to stop trying to work so close to the limit. The Great Western Railway of England, in replying recently to a question from the Board of Trade concerning overwork, said:

> "The company have made elaborate and detailed arrangements for the relief of guards and enginemen whose trains are delayed on the road, and who are therefore prevented from reaching their destination stations within the booked hours of duty. For example: A goods train has suffered such serious delay as to make it probable that it will not reach its destination under, say, two hours after the booked time. In such a case the men are relieved before arriving at the destination station and are allowed to proceed home as passengers, having of course no duties either actual or theoretical, to all intents and purposes resting. Moreover, in order that the men shall not be prejudiced in any way by the late arrival of their trains they are paid wages at the usual rate for the time occupied in leaving from the point at which they are relieved to their destination station."

Whether or not this regulation was forced upon the company by an arrogant labor union or was the voluntary action of a cautious superintendent, we do not know, but it is an excellent rule. It must be somewhat costly in money and it must often seem wasteful and unnecessary. Moreover, the putting of fresh men on a train will not always prevent mistakes. But who can devise any other way of avoiding a share of the responsibility for the errors and negligence of men who are kept too long on duty? In contrast to this English practice we heard recently of a collision on a prominent road in this country where the engineman at fault had been on duty 27 hours. He had been detained by a landslide. Quite likely he had slept a part of the time while waiting. It may even be true that the delay was not the real chief cause of his mistake. Nevertheless, the only way for the superintendent to wash his hands of responsibility in such a case is to provide the best possible arrangements for relieving men some hours before they are exhausted, and for providing this relief wherever it may be needed—not at the "terminal," which may be 150 miles away. American legislation has been very lenient in allowing all sorts of dangerous practice on railroads in emergencies. Emergencies are just the time when all safeguards are important. We cannot adopt safeguards without increasing expense, but the increase would be far more rational than many increases that have been approved in the past. Why should not you, on your road, have a larger list of spare enginemen, and a higher grade of men on that list? Possibly a satisfactory condition may be attainable only by returning to the traditions of the fathers, and having a small force of men paid by the month, regardless of the number of days worked.

FURTHER ROCK ISLAND RETRENCHMENT.

For the last eight years the St. Louis & San Francisco Railroad has paid a dividend on its second preferred stock; for four years regularly at the rate of 4 per cent. During the last financial year a great deal of refunding and readjustment of securities came due, all of which was sucessfully accomplished. On Friday of last week, with gross earnings for the half year, June 30 to January 1, about $1,000,000 greater than for the corresponding period a year ago, the directors announced that the quarterly dividend on the $16,000,000 second preferred stock would not be paid. Ordinarily it would be surprising to find a railroad after having so successfully weathered large new capital requirements and with earnings so distinctly on the increase, passing a dividend paid almost continuously since reorganization ten years earlier. Last fall, however, a new plan of action was adopted in the management of the Rock Island properties. The 4 per cent. dividend on the preferred stock of the controlling Rock Island Company early in January was passed and there was announced an extensive campaign of improvements on the lines of the Rock Island System. Operating conditions on the Frisco System were similar—a high operating ratio and in particular an unduly large proportion of gross earnings used for conducting transportation. It is therefore natural to find a parallel policy under way on the Frisco lines. Particularly does it seem, as did the passing of the Rock Island dividend, conspicuous only in its lateness, when it is realized that immediate needs for additions, improvements and new terminal facilities now calling for attention, aside from similar expenditures already authorized, will cost the St. Louis & San Francisco about $3,000,000. The $640,000 second preferred annual dividend requirement will cover only a part of this, but its application toward improved operating efficiency, following similar action on the Rock Island, is another step in the right direction. Every such move makes clearer the purpose of the principal owners of these allied railroad groups to run their properties as railroads rather than as credit factories. In this particular instance not only is the Frisco System itself directly benefited, but the financial position of all the companies will ultimately be strengthened. The New Jersey holding company's payments depend entirely on dividends received from the two groups of railroads. The more money that is spent out of "Frisco" earning on the line instead of being paid out in dividends,

the sooner will come the time when earnings will justify a declaration on St. L. & S. F. common stock, in which the Rock Island Company's funds are invested.

TWO OBJECT LESSONS IN RAILROAD HISTORY.

The New York, New Haven & Hartford Railroad Company has just sent out a circular which must be taken as an announcement of the official extinction of the aged and venerable Naugatuck Railroad of Connecticut. The Naugatuck road itself, prosperous and expanding, will, of course, remain vigorous and vitalized. But its entity, its outlines and perspectives and, with them its traditions, will pass away, merged and obscured in the larger New Haven system by which for years it has been held under a 10 per cent. lease. The final *coup de grâce* is in the form of a notice which shows that the New Haven, having acquired more than three-quarters of the Naugatuck shares, has, in effect, sold the road to itself at $300 a share duly mailed by check to shareholders, willing or unwilling, who still outstand. It is Connecticut law and the price paid is high though the form of procedure seems a bit unique; is, indeed, we believe the first proceeding of the kind under a Connecticut statute enacted recently. But we are not here discussing railroad ethics or law in the case or the merits or demerits of the proposition. Much more interesting are two object lessons in railroad history which the last chapter in the life story of the Naugatuck Railroad—in connection and contrast with a sister line, the Housatonic—calls to mind.

Two large valleys, the Housatonic and the Naugatuck, cut western Connecticut north and south. In a rough and general way the two valleys are thus parallel. The Housatonic valley, much the broader and longer, reaches well up into the Berkshire region of Massachusetts. The Naugatuck Valley shuts in several miles south of the Connecticut northern state line. Seventy years ago (1836) the Housatonic Railroad was chartered—with layout through the valley of the same name—and four years later it was opened. Sixty years ago (1845) the Naugatuck Railroad was chartered and four years later it was opened. Both roads had their southern terminal at Bridgeport on the sound with steamboat connections. The Housatonic line was 74 miles long, the Naugatuck, 56. Both roads were among the earliest three or four railroad lines opened in Connecticut and are to be classed in the "pioneer" group of New England local railroads. They were opened at a period when far more than now—at least in New England—the coming of the railroad was supposed to spell prosperity for the beneficiary region; and that fact, together with similarity of location and identity of the chief terminal, made their prognosis one of exceptional interest.

That prognosis, from the comparative viewpoint, was all in favor of the Housatonic. In operation it was the older road by nine years. At an epoch when water power was the unit of factory industry it skirted a large swift river abounding in narrows and falls and not seriously affected by summer drouth; while the Naugatuck was a much smaller stream occasionally running low in long hot spells. At its northern terminal the Housatonic tapped the Boston & Albany, a trunk line east and west, and later acquired a shorter cut toward Albany; the Naugatuck for two decades ended northward in a small factory village (Winsted) and the later east and west connection—the Connecticut Western, now the Central New England—was unimportant as a feeder. Finally the Housatonic was the longer line by 18 miles; and, as to original industries native to the soil, it cut a region of active iron mining and large secondary iron industry which at that time the Naugatuck had not. Nothing was wanting to make the relative forecast of the two lines one-sided with all the stars of the railroad horoscope blinking in the Housatonic's favor; and that horoscope seems now, in the back look of the larger fraction of a century, as one sided as it appeared then.

Paradox has been aptly defined as the truth walking backwards; and, in the case of the Housatonic and Naugatuck railroads, the anomalous definition stands. The strange outcome was just what could not have been predicted. The Housatonic led a staggering existence. It paid for awhile a dividend on its preferred stock, but on its common stock, if our memory does not go astray, trifling dividends or none; and it was finally taken into the New Haven system not on any basis of intrinsic prosperity but for what President C. P. Clark used to call a "nuisance" value. *Per contra* the life story of the Naugatuck has run on lines just the reverse. After a comparatively short period of the hardship not uncommon in early railroading it reached a period of payment of dividends rising to 10 per cent. and was leased many years ago at that rate to the New Haven company, which now capitalizes the guaranteed dividend at $300 a share. Its essentially local business, due almost entirely to factory traffic, has been developed enormously. The Naugatuck valley proper is hardly more than 40 miles in length. But it may be questioned whether any valley of the same extent in the world registers a larger factory product in quality and volume; certainly none in the pace of its growth.

Returning to a comparison of the two valleys and their respective railroad lines and using the census returns for population in Connecticut towns tapped by the two lines as the test, the annexed tables are compiled—blanks in the first column of figures indicating townships set off from others and incorporated since the earlier census dates:

Housatonic Railroad

Connecticut townships.	Population— 1840.	1900
Trumbull	1,204	1,587
Monroe	1,351	1,043
Newtown	3,189	3,276
Brookfield	1,255	1,046
New Milford	3,974	4,804
Kent	1,759	1,220
Cornwall	1,703	1,175
Canaan	2,166	820
North Canaan	....	1,803
Total	16,601	16,774

Naugatuck Railroad.

Connecticut townships.	Population— 1850.	1900.
Stratford	2,040	3,657
Milford	2,465	3,783
Derby	3,824	7,930
Ansonia	.....	12,681
Seymour	1,677	3,541
Beacon Falls	.....	623
Naugatuck	1,720	10,451
Waterbury	5,137	51,139
Plymouth	2,568	2,823
Thomaston	.....	3,300
Litchfield	3,953	3,214
Torrington	1,916	12,453
Winchester	2,179	7,763
Total	27,479	113,358

It will be seen that while the nine Connecticut towns served by the Housatonic road have remained practically stationary during sixty years the thirteen townships served by the Naugatuck have increased to more than four fold—about 312 per cent.—during a half century; and the disparity would be still more marked could the changes of population during the past five years be included. There are striking specific cases as well as the broad generalization. Thus, for an example, on the Housatonic line there is the station of Hawleyville in the township of Newtown. For more than a third of a century it has been a junction point where the Highland division of the New Haven system—formerly the New York & New England road—the Housatonic, the Litchfield branch and lines to Norwalk and thence to New York city, intersect. By every rule and precedent Hawleyville should have had its "boom"; yet it has remained all but stagnant and little more than a mere station. By way of contrast may be cited Torrington on the Naugatuck line some 45 miles from tide water. That township had in 1880 a population of 3,327, rising to 6,048 in 1890 and more than doubling to 12,453 during the last census decade—a growth western in speed while eastern in the solidity and permanence of industrial character.

When we turn to the more interesting subject of the causes of the disparity in the life stories of the two old railroad lines originally congenate and endeavor to interpret facts into forces, the problem somewhat deepens. Not a few of the elemental reasons reach back to subtle influences based on local tendencies, situation and character. Of the more patent historical causes there are ancient tales but somewhat explicit that tell of early old fogyism in Housatonic management and passenger fares and freight rates so high as to be deadly to progress. Much more definite as a ground plan of Naugatuck railroad prosperity was probably the good fortune which happened to locate in the valley great pioneers in the brass and copper industries introducing us to such names as Scovill, Phelps and Coe. From their large and successful enterprises, with not a few factories loading their tens of carloads each day, other and varied metallic industries have been offshoots. What we may call the "trunk" factories have branched out into others and prosperity and success generated a great brood of side products. In its broad aspect the object lesson of the history of the two old railroads, therefore, teaches the wisdom of liberal policy in the genesis of traffic and the vastness of the results of individual energy and enterprise. These two factors conspicuous among others that are

obscure, have their special value and suggestiveness in railroad policy when one studies the almost fantastic contrasts of Housatonic-Naugatuck annals.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾ In. by 6⅛ In.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8½ " by 10¾ "

"The Road of a Thousand Wonders."—A veritable gem of the advertiser's art is being distributed by the passenger department of the Southern Pacific bearing the above title, the road in question being the Coast Line and Shasta Route of the Southern Pacific extending from Los Angeles through San Francisco to Portland, over 1,300 miles. To quote the title page, "these pages picture and tell of this region and its wonders, of the varied charms of sea and sky, of mountain and valley, field and forest, and of climatic features which mean summer all the year; of numberless resorts attractive for health-seeking idling enjoyment and all out-of-door recreation." The story is told in most alluring fashion, both in type and by numerous colored half-tones of surpassing beauty, all made from photographs. The book of 72 pages is magazine size, printed on plate paper with an embossed cover in green gold and blue. Its beauty and artistic excellence entitle it to special commendation aside from its merit as a most creditable piece of advertising.

Compound Lever Track and Automatic Lowering Jacks.—A number of interesting illustrations and detailed descriptions of Buckeye jacks are given in a 28-page pamphlet published by the Buckeye Jack Mfg. Co., Louisville, Ohio. Among the illustrations are included a one-ton automobile jack, a 10-ton track or trip jack, and a number of automatic lowering jacks ranging in capacity from five tons to 15 tons. The last few pages of the pamphlet contain a number of highly complimentary testimonial letters from users of the Buckeye jacks.

High-Pressure Blowers.—This is the title of Bulletin No. 127, just issued by the B. F. Sturtevant Co., Boston, Mass. In condensed form it presents the essential features of this type of rotary or so-called positive blower, tabulates the proper sizes required for different capacities of foundry cupolas, gives the principal dimensions of horizontal and vertical types and illustrates methods of driving by direct-connected Sturtevant motors and engines. A detailed description of this machine was printed in the *Railroad Gazette* of Feb. 2, 1906.

Pneumatic Sanders.—The Watters A. B. C. pneumatic track sander, made by J. H. Watters, Asst. M. M., Georgia R. R., Augusta, Ga., is described and illustrated in a 12-page pamphlet just issued. Line and half-tone engravings illustrate the details of the mechanism and its application and operation. A large number of favorable testimonial letters from motive power department officers also are printed. E. G. Fisher & Co., Fisher Building, Chicago, are general western agents.

Locomotive Lubricators.—The No. 21 Detroit locomotive lubricator is described in a pamphlet just issued by the Detroit Lubricator Co., Detroit, Mich. The pamphlet also contains a large amount of helpful hints and other information which will prove interesting and instructive to locomotive enginemen, roundhouse foremen, and lubricator repairmen.

CONTRIBUTIONS

The Real Issue.

New York, Feb. 14, 1906.

To the Editor of the Railroad Gazette:

In the wilderness of words which have been printed concerning the need of regulating the railroads of the country by legislation or judicial action, the main facts seem to have been most of the time obscured, and the average reader rises from the perusal of an editorial, or Congressional report or debate, with anything but clear ideas of the problem which he is trying to grasp, or of the remedy which should be applied to the evils from which he suffers. This being so, I call your attention to a letter from the Governor of West Virginia which was read in the Senate last week by Senator Tillman, of South Carolina, telling of the difficulty of enforcing the laws in West Virginia. The Governor's complaint had to do with alleged discrimination by the Baltimore & Ohio towards small coal shippers and said:

It may be that the Pennsylvania Railroad Company does not legally own a controlling part of the Baltimore & Ohio or the Chesapeake & Ohio or the Norfolk & Western, but I have no doubt that an investigation will show that the Pennsylvania practically controls these three great trunk lines which traverse West Virginia and which are the only means whereby the products of this state including coal, can be shipped either to the lakes in the West or other markets in the East. Hence it is a fact that West Virginia to-day is in the grasp of a railroad trust which practically says what part of the state shall be developed and what shall not be developed, how much coal shall be shipped out of the state to what points or ports it shall be shipped and when it shall be shipped. Of course it makes its own rates and we are helpless. The Pennsylvania Railroad is very largely interested in the production of shipment of bituminous coal, it will naturally look after its own interest and the interest of the people along its lines in Pennsylvania and elsewhere first of all, and therefore the interests of West Virginia are subordinated to the interests of these others and our railroads upon which we are dependent are controlled by an iron corporation practically in competition with us."

Two editorial comments were made on this letter. Senator Elkins, Senator from the same state in which the complaint arises, said that the shipper had an adequate remedy in the mandamus but that there was a disinclination to employ this remedy, and Senator Foraker, of Ohio, said that the Governor's complaint "went to the heart of the railroad trouble all over the country;" a remedy for the evil complained of would do more than anything else to solve the railroad problem.

Senator Foraker is right; this is the heart of the trouble. Look at the facts. A citizen of Philadelphia, being a director in the Pennsylvania railroad and also in the B. & O.—Mr. John P. Green, for instance—votes as a director on the boards of both companies. He votes we may presume, in a way to promote the interests of each company. Neither by himself, nor with his associates, does he control the policy of the B. & O., for he and all his Pennsylvania friends together, including the railroad company, own less than a majority of the stock. Moreover, it is readily imaginable that his course as a director of the B. & O. would not in the slightest degree be changed if he should divest himself of all interest in the Pennsylvania Railroad. In other words, the most unselfish and public spirited director of either company would act just the same if the roads were in active competition with each other.

In such a situation, what can the law do? If anything, it must come out squarely and say just what is meant: that it is against public policy for one group of men to own large blocks of stock in two separate and competing railroads. Have not these public officials learned, from the Northern Securities case, and from contemporary history, that the American people have never gone to this extent in trying to regulate the acts of the individual? If West Virginia wishes to regulate the Baltimore & Ohio railroad let her do it in the direct and obvious way by legislative action concerning rates, and by taxation. It is tiresome to hear Senators and others talk so mysteriously about "problems" that are so simple when frankly dealt with.

G. M. P.

Wheeling & Lake Erie Earnings.

Pittsburg, Feb. 12, 1906.

To the Editor of the Railroad Gazette:

I notice on page 48 of your edition of February 9th you print the following information:

"Wheeling & Lake Erie. The gross earnings for the six months ending January 31 were $2,900,293, an increase of $578,245; net earnings $829,981, an increase of $28,810."

I beg to correct this information by appending the true figures hereunder:

Comparative Statement of Earnings and Expenses, Six Months Ending December 31st, 1905 and 1904.

	Six months, ending Dec. 31, 1905.	Dec. 31, 1904	Percentage inc. or dec.
Gross earnings	$2,899,200.59	$2,321,048.47	+25.0
Operating expenses	2,076,396.42	1,820,876.58	14.0
Per ct. operating exp. to earnings	71.62%	78.45%	6.83
Net earnings	$822,804.17	500,171.89	+64.50
Deduct, fixed charges, interest and rentals	700,202.56	545,480.16	+28.36
Surplus	$122,601.61	$45,308.27	Deficit.
Better off six months ending Dec. 31, 1905, than six months ending Dec. 31, 1904			$167,909.88
If we had received the same average revenue per ton mile for the six months ending Dec. 31, 1905, as we did for the six months ending Dec. 31, 1904 our gross earnings would have increased			$34,442.10
Or, 35.95 per cent, instead of			$578,152.12
And the ratio of operating expenses to earnings would have decreased from			71.62 to 65.8 per cent.

B. A. Worthington.

The Detroit River Tunnel of the Michigan Central.

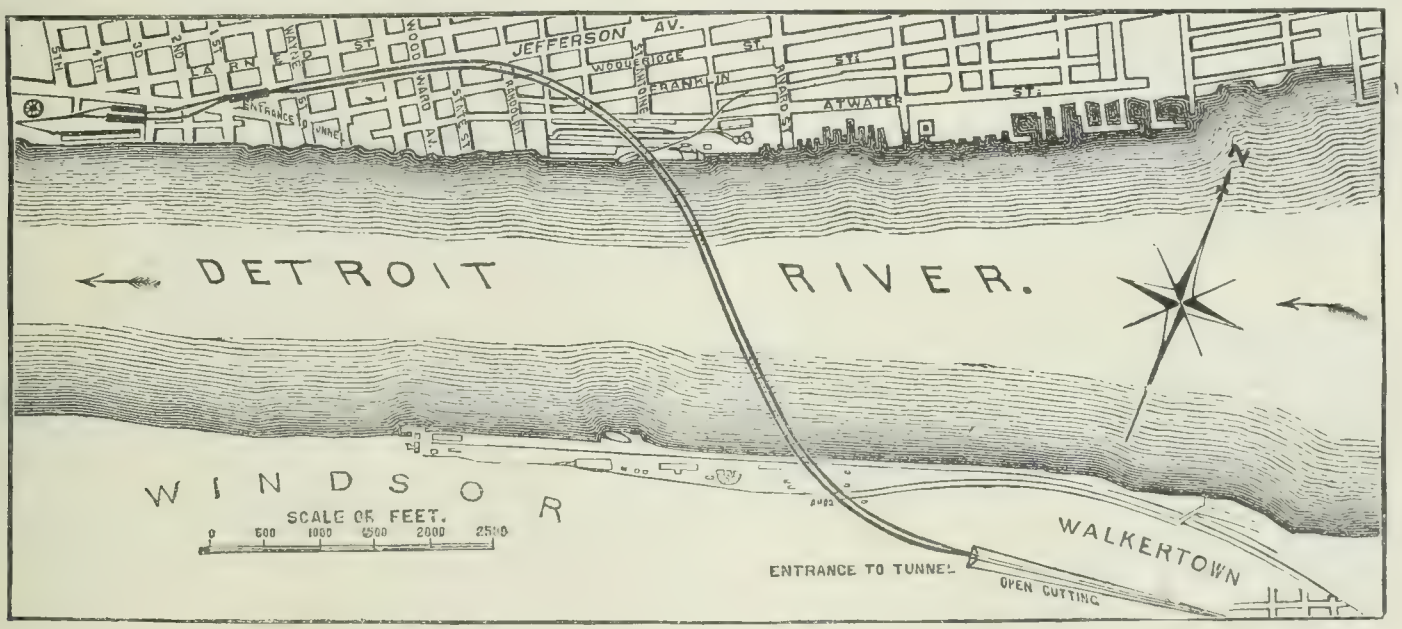
After vainly trying for a number of years to reach an agreement with the Grand Trunk for the building of a joint bridge or tunnel entrance into Detroit from Canada, the Michigan Central has finally decided to build a double-track tunnel under the river for its own use. Several years ago the Grand Trunk built a single-track tunnel under the St. Clair river at Port Huron, Mich., 55 miles north of Detroit through which through trains are run, but at Detroit all the through traffic of the Michigan Central, Grand Trunk and the Pere Marquette is ferried over the river to Windsor, Ont. The accompanying map shows the general railroad situation at Detroit and Windsor. The main line of the Michigan Central enters Detroit from the west and curving slightly after crossing the L. S. & M. S. at West Detroit continues on to the Third Street Station at the foot of Third street next to the river. The Toledo and Bay City divisions come in from the south and north respectively and join the main line at West Detroit Junction. The Wabash, Pere Marquette, and the Detroit, Toledo & Ironton come in from the south along the river bank over the Detroit Union Railroad Depot & Station Co. tracks to the Union Depot, just west of the Michigan Central Station on Third street. This station is also used by the Canadian Pacific for trains ferried over the river at the foot of 18th street. The Lake Shore enters from the south and swings almost entirely around the north end of the city to a connection with the Grand Trunk tracks running down to the river. The Lake Shore and the Grand Trunk use the Brush Street Station, about three-quarters of a mile above the Michigan Central Station.

On the Canada side, the Michigan Central terminal is a little below the Third Street Station on the Detroit side; the Canadian Pacific terminal is almost opposite the Third Street Station; and the Grand Trunk, Wabash and Pere Marquette are still farther up the river opposite Brush Street Station. All of the passenger stations are head end terminals and movements of trains from the stations to the ferry slips are in the reverse direction. The Wabash, Pere Marquette and Canadian Pacific ferry slips on the Detroit side are more than a mile and a half from the Union Station, the Michigan Central slips are over half a mile away and the Grand Trunk slips are about the same distance from the station.

It will be seen from the map how difficult it would have been to locate a bridge or tunnel anywhere along the river front which would give satisfactory facilities to both the Grand Trunk and the Michigan Central. Any compromise situation would have involved the abandonment of valuable terminal property by one or both roads and neither would consent to such an arrangement. The fact that all the railroad terminals are situated on the river front complicated the problem of building a joint terminal because of the length of the approaches required for either a tunnel or a bridge.

The history of the tunnel project is interesting. In the late sixties the Michigan Central and the Great Western, now the Grand Trunk, came to an agreement to build a joint tunnel under the Detroit river and the Detroit River Transit Company was incorporated to own and operate it. The legislature of Michigan passed a bill authorizing the construction of the tunnel and the Dominion Government likewise passed a bill for the same purpose. Mr. J. F. Joy, President of the Michigan Central, was also president of the Tunnel Co., and he employed Mr. E. S. Chesbrough, then City Engineer of Chicago, to prepare plans. Mr. Chesbrough had only recently completed the waterworks tunnel, two miles out, under Lake Michigan, at Chicago, and also a roadway tunnel under the Chicago river. He made borings and drew up the plans for two parallel tubes, each to contain a single track. The accompanying map, reproduced from the *Railroad Gazette*, April 2, 1870, shows the route of the tunnels as proposed. The estimated cost of the entire improvement was $2,650,000. No work on the tunnel was ever done, however. Years went by with the tunnel project being revived periodically. In 1904 the two railroad companies again tried to agree on some scheme for crossing the river. A bridge was talked of, and Boller & Hodge, the engineers for the Wabash bridge at Pittsburg, were asked to prepare estimates and plans for a suitable overhead structure. While their plans were never made public it is understood that they were prepared to recommend a through steel truss bridge, with 600-ft. spans and 150 ft. under clearance, reached by elevated approaches through Detroit, involving an entire rearrangement of the yards and terminals of both roads.

Having failed to make joint arrangements with the Grand Trunk, the Michigan Central decided to abandon the bridge project and to build a tunnel for its own use at the most convenient point under the river. An advisory board of engineers was created last year to draw up plans for a double tunnel to be operated with electric locomotives. This board consists of Mr. W. J. Wilgus, Vice-President of the New York Central; Mr. H. A. Carson, Chief Engineer of the Boston Rapid Transit Subway, and who has recently completed the East Boston tunnel under Boston harbor, and Mr. W. S. Kinnear, Assistant General Manager of the Michigan Central who was formerly Chief Engineer of that road and who will act as Chief Engineer of the tunnel company after the contract is awarded. The Detroit River Tunnel Company has been incorporated in Michigan and Canada to build the tunnel. Bids on the work have been asked for by March 8, and as soon as the contract is awarded work will be begun. The tunnel company has practically completed excavation for the Windsor shaft and has commenced excavation for the Detroit shaft.



Proposed Tunnel under the Detroit River.

(Reproduced from The Railroad Gazette, April 2, 1870.)

After a careful study of all the topographical and traffic conditions on both sides of the river the Advisory Board of Engineers decided on the location shown on the map. The approach grade on the Detroit side begins at about the intersection of 15th and Baker streets. The tracks leading to the Third Street Station will be deflected to each side of the open approach cut and brought together again over the approach tunnel about 1,000 ft. beyond the portal. The open approach section will be 1,400 ft. long beginning with a 1 per cent. descending grade which increases to 2 per cent. before reaching the portal. This grade is continued through the approach tunnel and for the first 600 ft. of the subaqueous tunnel from which point it changes on a vertical curve to level. About 700 ft. from the Windsor end of the subaqueous tunnel the grade again changes to 1.1 per cent. ascending, increasing to 1.5 per cent. which is continued to the eastern summit. The Detroit approach is a tangent to station 150. A 5 deg. curve changes the alignment to station 161 where the river tangent begins. On the Windsor side the 2 deg. approach curve begins at station 181 and connects with the approach tangent at station 198. The river tangent is located at a slight angle to the center line of the river

at the crossing. The entire length of the tunnel and approaches is 12,800 ft., of the tunnel 7,860 ft., and of the subaqueous section 2,625 ft. for the west-bound track, and slightly less for the east-bound track.

Subaqueous Tunnel Section.

The width of the Detroit river at the point of crossing is about 2,600 ft. The minimum depth is 19.7 ft., and the maximum depth of the channel in the center of the river is 47.2 ft. A complete series of test bores was made on both sides of the center line of the tunnel from portal to portal. Most of the holes were drilled 30 or 40 ft. below the level of the bottom of the tunnel, and the core samples obtained showed favorable ground. The river bed is underlaid with stiff blue clay, containing some gravel and occasional sand pockets of small size. Bed rock is from 20 to 40 ft. below the bottom of the tunnel and the clay on top contains few boulders of any size. The maximum velocity of current in the river was found to be 2.31 miles an hour, the maximum velocity at the bottom 1.56 miles an hour, and the minimum velocity at the bottom 0.8 miles an hour; these currents are not swift enough to produce much erosion of the hard clay bottom.

It was necessary to fix the location of the portals of the approach tunnels, as shown on the plan and profile, because of the yard and terminal arrangements required on both sides of the river; and to keep the grades in the tunnels within reasonable limits, the top of the tubes must be kept very close to the bottom of the river. Under these conditions, driving the tunnels with the common shield method would involve filling a mat of clay or other material over the places where the roof is near the bottom of the river in order to hold the compressed air in front of the shield. To overcome this difficulty Mr. W. J. Wilgus, one of the members of the Advisory Board of Engineers, has devised a method of building the tunnels designated as Design A, which is entirely original and as yet untried, but which apparently has many advantages over any previous method in use for similar work. The specifications have been drawn to give the bidders the option of selecting any or all of four methods proposed or of submitting alternative plans of their own for doing the work in some other way. The three other methods included in the specifications are:

Design B: Trench method suggested by Mr. H. A. Carson, member of the Advisory Board of Engineers, but differing essentially from Design A.

Design C: Trench method, being a modification of Design A.

Design D: The common shield method using compressed air, the same as is being employed in the tunnels under the Hudson and East rivers, New York.

Design A may be briefly described as a method by which the pervious material underlying the river is replaced by an imperfectly water-tight mass of concrete placed under water, through which, without the use of shields, the inner tubes or tunnels proper may be constructed to secure water-tightness, continuity of strength and good workmanship, the whole work being done without the use of high air pressure or cofferdams. The following is an outline of the progressive stages of building the tunnels by this method:

A trench will be dredged in the bottom of the river, which is principally silt and firm clay, without rock or boulders, to the approximate dimensions shown on the drawings. It has been assumed that the slope of ½ to 1 will be sufficient for the purpose, but it may be necessary to use flatter slopes or put in sheet piling to maintain the approximate cross-section. "Two-men" stone will then be deposited over the bottom of the trench to a depth of 18 in. to form a blanket between the underlying clay or sand and the mass of concrete. On top of the loose stones 1:3:6 concrete will be laid to a thickness of 2 ft. The concrete will be machine mixed on barges or floating platforms, which will be moved progressively across the river as the work is completed. The tremie bucket or bag method of depositing concrete under water, will be used for this work. After the concrete has set saddles supported on blocking and wedges will be laid on the concrete by divers to receive the tunnel forms. An alternative method will be to drive piles in the bottom of the trench and cut them off at the right elevation to receive the saddles, thus dispensing with the blocking and wedges.

The forms, built either of timber or steel, will be built on shore in convenient lengths of from 50 to 500 ft., floated into position, and sunk in their proper place on the saddles before described. When they are placed, the remainder of the concrete will be deposited entirely surrounding the forms and filling the excavated trench to the level of the river bottom. The adjacent sections of the forms will either be joined under water so as to make water-tight connections or an open space will be left between them to be filled with concrete forming a solid bulkhead to be cut out later when the tunnel lining is put in.

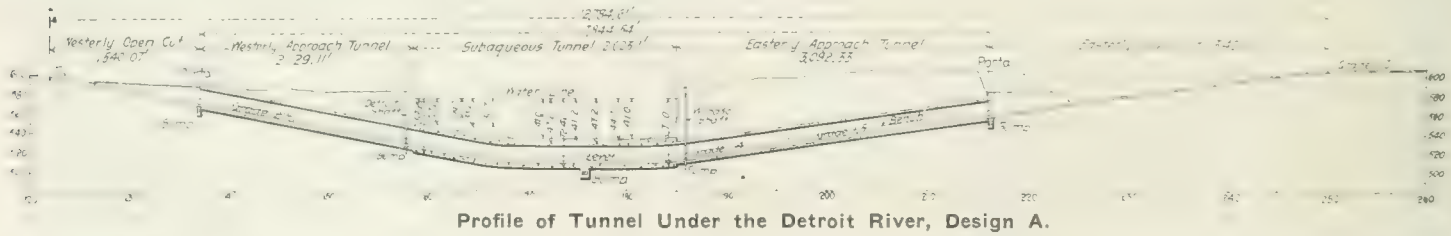
After the concrete surrounding the forms has thoroughly set the water will be pumped out of the first section and if the leakage is excessive sufficient air pressure will be put on to enable the forms to be removed, the waterproofing applied and the inner tube or tunnel lining to be put in place. If the forms are made of rolled steel they will be built with water-tight joints and left in the work to act as additional waterproofing on the outside of the inner tubes. If the forms are made of wood, waterproofing will be laid on the exterior and allowed to remain on the inside of the concrete shell when the forms are removed. This will require high air pressure to prevent hydrostatic pressure from distorting the waterproofing. When each section has been made water-tight the inner lining of reinforced concrete will be put in and the tunnel and tracks completed.

The specifications give the contractor the option of using steel or wooden forms for the tunnels. If steel forms are used they will have to be strongly braced internally to prevent distortion in floating to place and after the water has been pumped out preparatory to putting in the inner tubes. When sinking them in place pumps can be used to equalize the water pressure inside and out, and it is expected that lengths up to 500 and 600 ft. can be successfully floated and sunk. Convenience in handling, however, may make it desirable to use shorter lengths. Provision has been made in designing the inner tubes for a variation of 3-in. in the aline-

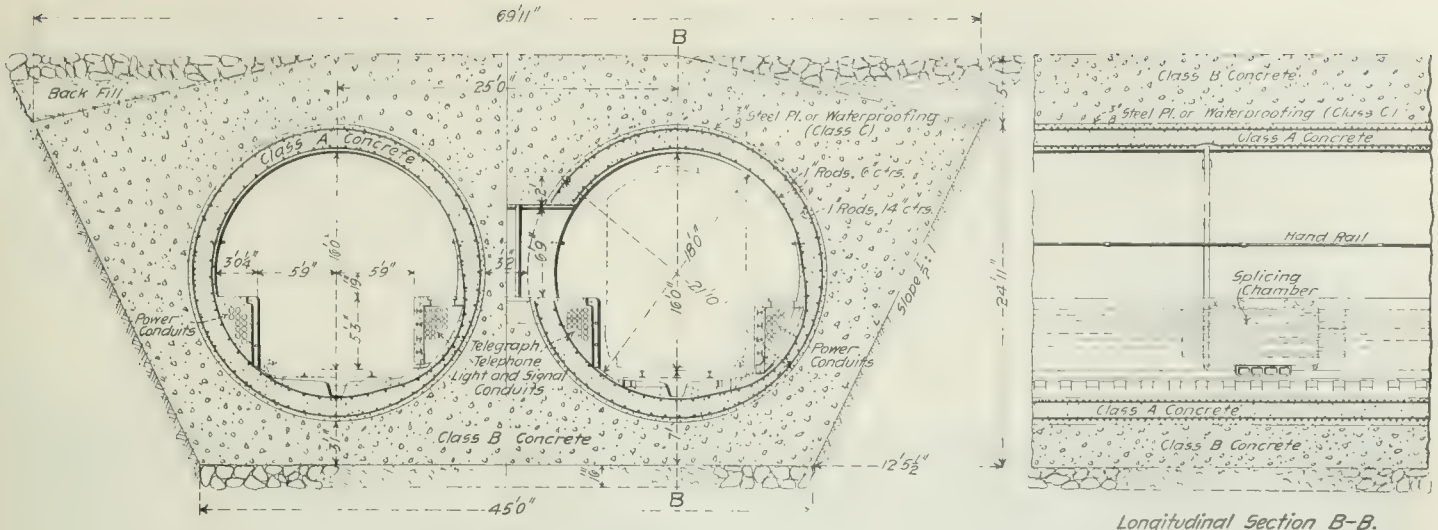


Sketch Map of Railroad Terminals in Detroit and Windsor.

1. *Michigan Central, Third Street Depot.*
2. *Union Depot, Wabash, Pere Marquette, Detroit, Toledo, & Ironton, Canadian Pacific.*
3. *Brush Street Depot, Grand Trunk, Lake Shore & Michigan Southern.*
4. *Windsor Depot, Canadian Pacific.*
5. *Windsor Depot, Grand Trunk, Wabash.*
6. *Windsor Depot, Pere Marquette.*
7. *West Detroit Junction.*
8. *Windsor Depot, Michigan Central.*

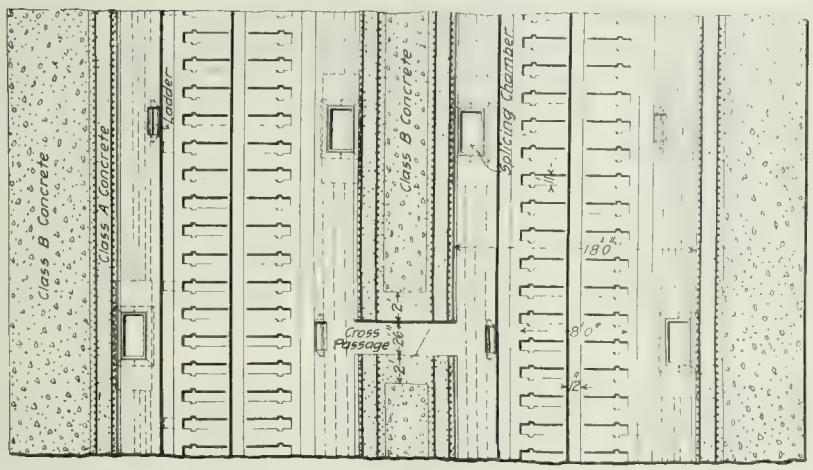


Profile of Tunnel Under the Detroit River, Design A.



Typical Section of Tunnel.

Longitudinal Section B-B.



Plan.

Details of Tunnel Construction, Design A.

ment of the sections in case the cradles are not accurately set. The forms are to be provided with grouting holes and screw plugs at frequent intervals to permit filling any voids in the concrete surrounding the tubes. If concrete bulkheads are not used temporary steel bulkheads will be put in the forms before they are sunk to prevent flooding when the water is pumped out by reason of defects in the forms or joints of adjacent sections.

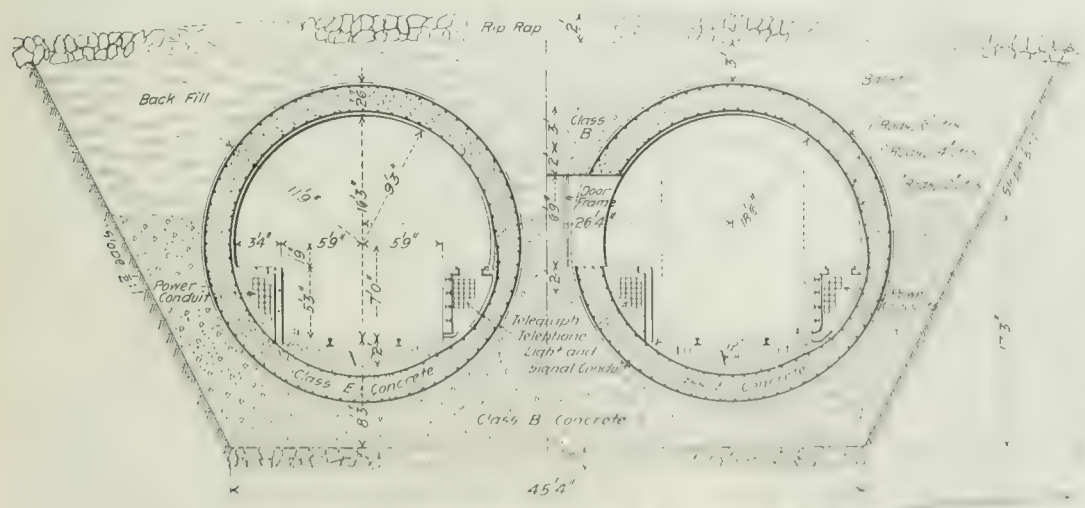
The interior lining will be 23 in. thick of 1:2:4 concrete reinforced with longitudinal and circumferential rods, 1 in. in diameter. The longitudinal rods will be spaced 14 in. center entirely around the tube being placed just inside the two rings of circumferential rods. These latter will be spaced 6 in. center to center, and 3 in. in from the inner and outer faces of the tubes. The inside diameter of the tubes will be 18 ft., with 16 ft. clear height from top of rail. A bench 3 ft. 1½ in. wide and 5 ft. 3 in. above the top of rail will be formed on each side of the tubes, and the power, telegraph, telephone, signal and lighting wires will be laid in conduits built into those benches. The vertical faces of the benches will be reinforced with old rails, laid longitudinally. A clearance of 11 ft. 6 in. is provided for between the benches, which is well outside the maximum equipment clearance line.

The track construction is designed to give perfect drainage and to prevent creeping of the rails. The floor of the tunnel has a gutter 1 ft. 3 in. deep and 2 ft. wide in the center which slopes to the sump near the middle of the river. Recesses are formed in the floor to receive the cross-ties on which the rails rest. The New York Central standard type of under-running third-rail will be used in the tunnel. Other details of the design are clearly shown on the drawing.

Design B differs from Design A in that the inner tubes are made in sections complete, on the shore, floated into position, sunk on the cradles previously laid on the concrete bed and then joined with strong and water-tight joints before the surrounding mass of concrete is deposited. Backfilling will then be deposited over the tubes and around the mass of concrete and the top of the filled-in trench covered with rip-rap. Design C differs from Design A only in the details of the steel forms to be used and the steel reinforcement in the inner lining.

Dredging the tunnel trench will be carried on day and night to complete the work as soon as possible. Part of the dredged material is to be retained for backfilling on top of the concrete before the rip-rap is placed. The remainder will be loaded on scows and dumped either opposite Belle Isle in the main channel near the Michigan shore, or inside a new bulkhead at the foot of 12th street, where a tract of land along the river bank is to be reclaimed.

The advantages claimed for the trench method over the shield method are: Reduction in lift of traffic owing to the higher level at which the tunnel can be built; saving in time of construction; minimizing risks; and large saving in first cost. The reduction in lift of traffic amounts to more than 8 ft., although a tunnel built with the shield method would have no heavier grades than one built by the trench method. The grade would simply be continued farther into the tunnel. Because of the thin layer of mud over the shield, driving the tunnel by that method would involve considerable risk of blowing out and flooding which would endanger life and might greatly delay the work. The very favorable nature of the river bottom insures little difficulty in dredging the trench and as the concrete work can be put down in large masses uninterruptedly the work should progress rapidly when once under way.



Cross-Section Through Tunnels, Design B.

The enormous traffic on the river would not be greatly interfered with by the dredging and concreting barges. There is every reason to believe that the tunnel can be built by this method safely, quickly and cheaply.

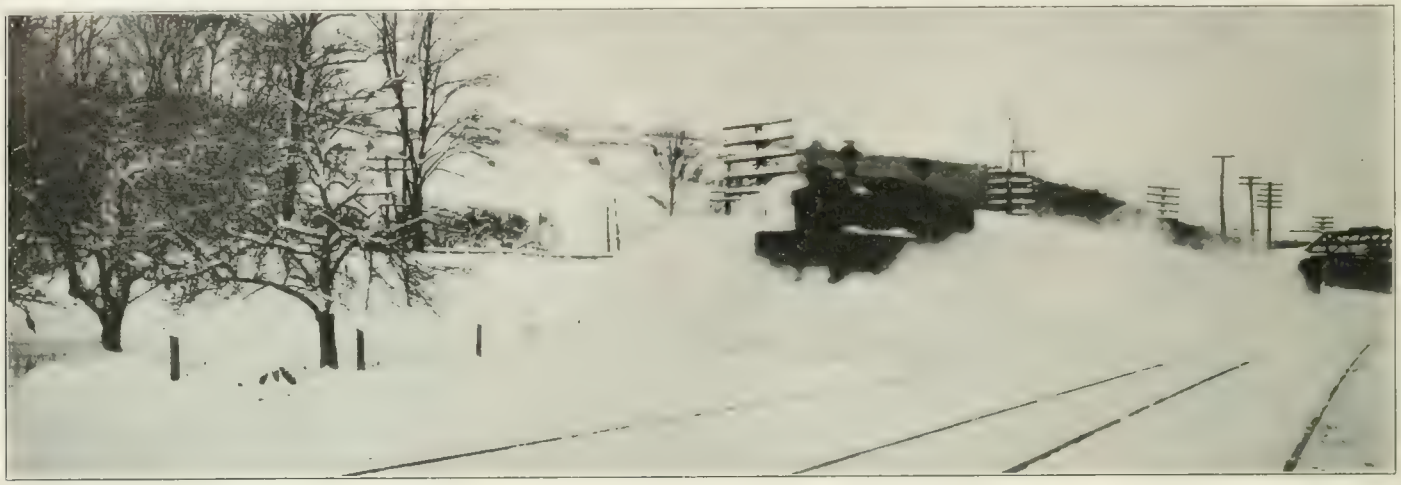
(To be continued.)

Operation of Electric Locomotive During a Snowstorm.

On February 9 a very unusual and interesting test of one of the New York Central's electric locomotives was made near Schenectady, N. Y., during a severe snowstorm. At the time the locomotive went on the track there was about 13 inches of snow between the rails. The protected and unprotected over-running rails were both completely covered, and in some places there was from four to six inches of snow on top of the protection boards. The flanger plow used to clean the snow out from between the track rails did not throw it clear of the third rail, and it was found that from the standpoint of third-rail operation much better service on the over-running rail would have been got without the plow.

The report which follows is arranged by paragraphs, topically, with reference both to the results obtained from the locomotive and from each of five types of third-rail protection (including also the unprotected type). These third-rail protection devices are shown herewith, and the stippled part of the drawing around the rail shows where the snow located and made the most trouble. One thing was demonstrated clearly—that a third-rail entirely unprotected is a good deal less troublesome in a snowstorm than a third rail protected in such a way that snow is encouraged to accumulate.

Over-Running Rail, Unprotected.—Very little flashing, or trouble, was experienced on the first trip of the locomotive. On the following trips conditions grew worse, due to the fact that ice had formed



Snow Test of New York Central Electric Locomotive.

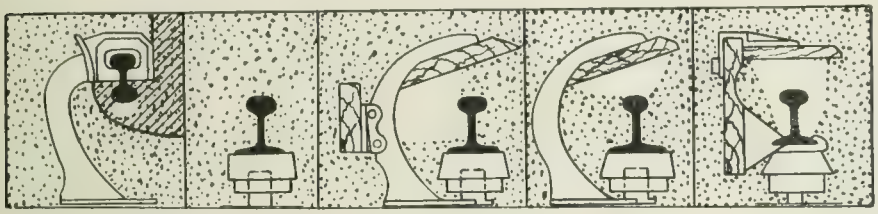


Elevation of Locomotive, Showing Flangers.

and the snow had become ironed out by the shoes. The unprotected over-running rail finally became so bad that it was almost impossible to run over it.

Over-Running Rails, Protected.—The service of these rails was not much better than the bare rail; in fact, in some cases it was probably worse. The wings of the snowplow would throw about enough snow to keep the top of the rail covered.

Under-Running Rail.—The locomotive left the barn at 10:30 a. m., as stated, and at 2 p. m. it began operation on the long stretch of under-running rail. Except in a single instance, there was practically no trouble. This exception occurred at the west end of the line, where there are two short lengths of this rail installed. The long stretch between the under-running rail at the Fonda, Johnstown & Gloversville station and the West Crossing gives the shoe a chance to fill up with snow and ice, so that when the top contact surface of the under-running shoe strikes the rail there is a chance of the circuit being broken. After the locomotive had made one trip over the under-running rail, the snow was scooped from under the contact surface for 2½ or 3 inches; and, unlike the over-running rail, each passage of the locomotive would tend to clean off the surface of contact.

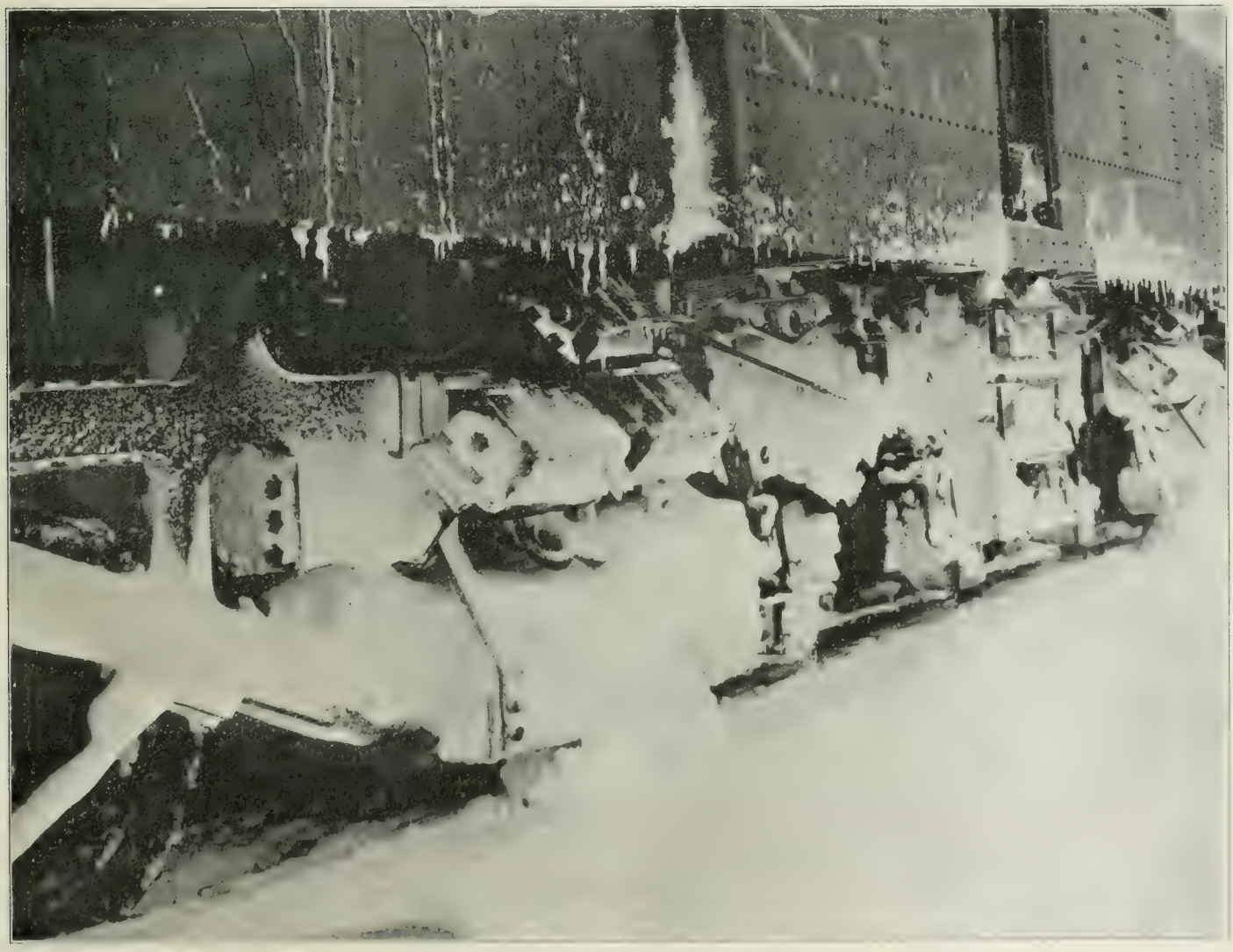


Condition of Five Types of Third Rail After Passage of Flanger.

After an inspection lasting all the afternoon, it was agreed that the conditions under which the locomotive was operating were more severe than in regular service because no flangers were being run over the line; also, that the snowplow at present used on the locomotive can be improved; that the operation of the shoe on the under contact rail is much more satisfactory than on the other types, and that the rail is much easier to keep clean. The under-running rail, to which reference is made, is the one which we have previously shown in the *Railroad Gazette*, which was designed and patented by Mr. Wilgus and Mr. Sprague, and was further developed by Mr. Katte.

The report as presented on general conditions shows that the snow began falling February 9 at 1:30 a. m., and stopped at 2 p. m.; that its character was medium heavy, average depth 17 inches; drifting, none; flanger over road on tracks Nos. 1 and 3 at 12.30 p. m. Effect of flanger on under-running third rail: flanger on track 3 packed the snow hard against the rail, but after the first passage of the locomotive the snow was cleared away for a distance of 2½ or 3 inches beneath the rail, as shown by the heavy line in the drawing. On the unprotected rail of the over-running type the effect of the flanger was minimized, since the rail was on the far side of the track so that the flanger on track 3 made little difference. The first trip of the locomotive over the unprotected rail caused less trouble than succeeding trips, for the reason that the arcing of the first passage melted the snow and formed ice, which made conditions much worse on subsequent trips. The over-running third rail of the New York Central type, protected top and side (Fig. 3), suffered no ill effect from the flanger, since it was too far away; but after the passage of the locomotive the effect was the same as with the bare rail; that is to say, there was a tendency to iron down the snow on top of the rail and to form a layer of ice. Fig. 4 shows the New York Central third rail of the top protected type. This suffered no bad effect from the operation of the flanger, but it was almost impossible to run over the rail after a few trips. The type of the snowplow used on the locomotive was chiefly responsible for this. The rail of the inner running type, shown in Fig. 5, was packed about more tightly with snow by the flanger than were the others. The shoe on the locomotive arced badly in running over it, but not as badly as on the New York Central over-running protected types.

When the locomotive was laid up again at 6 p. m., after having



View of Frame and Motors After the Test.

been on the road for eight hours, the snow was packed around the commutator and brush holder, but there was very little on the armature. About 10 inches of snow clung to the bottom side of the armature and commutator screws. There was no sign of motor trouble which could be attributed to the snow.

Operation of Shoes. The enclosed third-rail shoe stops took care of the snow very well. There was no indication of trouble occasioned by the snow preventing the shoes from turning on their axles. This was one of the sources of trouble in the experiments made last winter. The shoes, however, arced badly, both on the protected and on the unprotected over-running rail. The arcing on the under-running rail was very much less.

While the trials were being made, the snow fell, during the morning, at an average rate of three inches per hour.

Washington Correspondence.

WASHINGTON, Feb. 13. Rapid progress is being made by the Senate Committee on Interstate Commerce with the preparation of the railroad rate bill to be reported to the Senate. The speech delivered on Monday by Senator Lodge, of Massachusetts, has done much to clear the air. While Mr. Lodge did not assume to speak for the President, and it is clear that his views as to the unwisdom of any provision for fixing transportation charges by governmental authority are certainly not concurred in by the President, there is no doubt in the minds of Senators that in the part of his speech dealing with the question of judicial review, Mr. Lodge expressed the views of Mr. Roosevelt. It is significant, therefore, that Mr. Lodge declared that the President's message recommending that the Commission be given authority to fix rates "subject to review by the courts" contemplated that the courts should be empowered "to determine, not merely whether the rate established by the Commission is confiscatory, but whether it is lawful, just and reasonable."

As a result of conferences with Senators, after Mr. Lodge had made his speech, Senator Elkins, chairman of the Committee on Interstate Commerce, introduced his revised bill to-day and will ask the committee to consider it to-morrow. He has expressed confidence that it can be reported from the committee and be passed by the Senate, but, in the opinion of other Senators this is hardly possible. It is known that the President is anxious to have the Hepburn bill made the basis of the action of the Senate, and there is little doubt that this will be done, but when it is reported from the committee it will be very unlike the Hepburn bill that passed the House. The present plan is to retain the language providing for the fixing of a rate by the commission, but to insert a provision for a judicial review that will give the courts jurisdiction, not only of the question of whether or not the rate made by the commission is reasonable and just, but to go back of the order of the commission and pass upon the question of the reasonableness and justice of the rate that had been complained of. There will be no express provision authorizing the court to suspend the order pending review nor any provision attempting to interfere with such suspension.

In the opinion of some of the lawyers of the Senate it will be very difficult to frame such a review provision that will be constitutional, their theory being that an order of the commission fixing a future rate is a legislative act and that the courts can neither review it after it has been made nor inquire into the grounds on which the commission—as a part of the legislative branch of the government—based its action in making the order. In order to narrow, as much as possible any adverse court decision on any constitutional question, it is proposed to include in the bill a provision that if any one feature of the act shall be found to be unconstitutional it shall not be held to invalidate the entire act.

It is held, however, by Senator Foraker and some of the other members of the Committee on Interstate Commerce that the Hepburn bill is unconstitutional fundamentally, and that no such provision can save its most essential features. The ground of this contention is that it proposes an unconstitutional blending of legislative, executive and judicial functions in the hands of one set of officials. It is obvious that if this contention is correct it would make no matter whether the provisions for judicial review might be constitutional or not, the whole rate-making power would fall to the ground. Even this would not destroy the law, however, if the present plan is carried out, for it is proposed to incorporate in the Hepburn bill the third section of the Foraker bill. This is the section that provides for the bringing of proceedings in the United States Circuit Courts in the first instance and that authorizes a court, finding that any rate is unreasonable or unjust or is unjustly discriminatory and therefore illegal, to issue an injunction restraining the railroad from continuing the illegal charge in excess of the lawful reasonable rate or restraining the continuance of the illegal discrimination, the injunction to remain in force during such period as the same or substantially the same conditions may continue as are established by the evidence in the case. It is proposed to give complainants the right to elect whether their complaints shall be passed upon by the commission or taken before the courts in the first instance. In addition to affording this alternative method of procedure it is expected that the incorporation of this provision from the Foraker bill will make it certain that the courts will leave some kind of effective legislation on the statute books and will not destroy the whole act. There seems to be no doubt now as to the bill being reported by a majority of the committee, for, even if Senator Dolliver and Senator Clapp should refuse to unite with their Republican associates it is understood that at least two Democrats—Senator McLaurin and Senator Foster—will vote for the amended bill. The revised Elkins bill also includes the third section of the Foraker bill, so that whatever may be done by the committee, it is practically certain that the bill reported will contain a provision for an alternative procedure before the courts.

A general investigation by the Interstate Commerce Commission into the relations between the railroads and the bituminous coal industry seems to be assured by the unanimous adoption by the Senate of the Tillman joint resolution directing such an investigation. The resolution is now before the House Committee on Interstate and Foreign Commerce, and there is little doubt that it will be reported and adopted by the House. It calls for complete information as to the interests of railroads and railroad officers in the mining of bituminous coal, as to whether there is a combination, in the form of a trust or otherwise, in the bituminous coal industry, as to how the relations of the railroads and their officers, and any combination that may exist, operate on independent producers, and as to whether there is discrimination against independent producers in the matter of car supply or in any other way. The Commission is required to report any remedy that it can suggest for any of the enumerated evils that may be found to exist, and also to report any facts or conclusions that it may think pertinent to the inquiry. J. C. W.

Required Reduction of Passenger Fares in Ohio.

Mr. James McCrea, First Vice-President of the Pennsylvania Lines West of Pittsburg, has submitted to the Ohio Committee on Railroads and Telegraphs a full discussion of the passenger business done by his company, as an argument against the enactment of any law fixing the maximum rate which railroads may charge for transporting passengers within the State of Ohio at two cents a mile. A portion of this document follows:

Exhibit "A" shows the earnings per passenger per mile and per passenger train mile for each of the different roads embraced in the Pennsylvania System West of Pittsburg for the year 1904; and I beg to call your attention to the fact that twenty out of the thirty-two roads show a loss upon every passenger carried. The passenger train earnings include the earnings from mail, express and baggage; and yet eleven out of thirty-two lines show an actual average loss on every passenger train hauled.

Exhibit "B"* shows the passenger mileage, earnings, expenses, and averages on passenger business from 1871 to 1904, inclusive, on Pennsylvania Company lines (Northwest System), and from 1890 to 1904 on The Pittsburg, Cincinnati, Chicago & St. Louis Railway Company lines (Southwest System). The rate received has decreased from a maximum of 2.83 cents on the Pennsylvania Company lines in 1873, to 2.02 cents in 1904, while the expenses have increased from 1.89 cents in 1873 to 2.13 cents. On the P., C. C. & St. L. Ry. the rate received has decreased from 2.30 cents in 1890 to 1.94 cents per passenger per mile, while the expenses per passenger per mile have decreased from 2.13 cents to 1.93 cents, leaving a margin in the year 1904 of only one-tenth of one mill per passenger per mile. The difference in the cost on the Northwest System, 2.13 cents per passenger per mile, and that on the Southwest System, 1.93 cents per mile, is wholly explained by the difference in the number of limited express trains with expensive equipment and high speed. On the Fort Wayne road there are six daily trains of this character, while on the P., C., C. & St. L. Ry. there are only two per day.

At this point it seems proper to me to give an explanation as to how the expenses in connection with the transportation of passengers are arrived at. Briefly—

A—All known items relating exclusively to passenger business are charged to passenger expenses.

B—General expenses, such as cost of maintaining road and roadbed, superintendence, taxes, et cetera, are divided between passenger and freight on each division, in the proportion which passenger train mileage bears to total passenger and freight train mileage.

Of course, this is arbitrary, but the rule is almost universal, and I know of no other basis that has so many arguments in its favor and which seems so absolutely reasonable. Should there be any imperfections in this method of dividing these expenses, it must have been a constant one, and therefore there can be no doubt as to the correctness of the ratio showing the increased cost as between 1873 and 1904, inclusive.

Later on I will go a little more into detail as to the reasons why earnings per mile have been reduced and expenses per mile increased, but it seems right to say here, in a general way, that the earnings have been reduced by competition and the increase in the use of mileage, commutation and excursion tickets, while the expenses have

*Not shown in this abstract.—EDITOR

been increased because of higher standards for track and equipment and greater weight and speed of trains.

Exhibit "C" shows the passenger statistics for all Pennsylvania Lines for the state of Ohio, as well as for the Pennsylvania Company, P., C., C. & St. L. Ry., the Vandalia Railroad, and the G. R. & I. Ry. Cos. Columns 13, 14 and 15 show the earnings and operating cost, with profit or loss on all passenger trains, and the earnings include the earnings of passenger, mail, express and baggage. I prefer to treat the subject from this standpoint rather than from that of the earnings, expenses and profits per passenger per mile, as shown in columns 9, 10 and 11, because the criticism has been made that by showing only the earnings from passenger fares an attempt has been made to deceive the public. I think a little consideration will make plain to anyone not only the difficulty but the illogical results that would be produced by attempting to apportion the mail and express earnings on the basis of the passengers carried one mile.

In the earnings of passenger trains is included $498,787, on account of mail and a large proportion of the earnings from express covering traffic that was carried on exclusive mail and express trains and upon which no passengers were handled. Had the operations of these trains been excluded, the average earnings per passenger train mile would have been considerably reduced and the net result affected accordingly.

I would draw particular attention to column 16 of this statement, in which you will find the passenger train proportion of fixed charges and dividends on capital stock, per passenger train mile. I presume no one will dispute the propriety of the passenger traffic (including mail and express) bearing its fair and proper share of the fixed charges and reasonable dividends to the stockholders for the capital invested in the property. When these charges are provided for, the Pennsylvania Company lines in the state of Ohio show a loss of nearly 16 cents per passenger train mile, the P., C., C. & St. L. a loss of over 3 cents per passenger train mile, the Little Miami over 15 cents, and all Pennsylvania Lines in the state of Ohio a loss of almost 11 cents per passenger train mile, while the results on all of our lines, including those outside of the state of Ohio, are as follows:

Pennsylvania Company	.03402 cents	loss
P., C., C. & St. L. Ry.	.03867 "	profit
Vandalia Railroad	.19071 "	"
G. R. & I. Ry.	.03450 "	"

In studying the results shown in column 17, please take into consideration the information which I will give you later in regard to the average number of passengers carried per train mile in the state of New York as compared with the state of Ohio. In the former state they average 61 passengers per train mile, while in Ohio the average is 48, or a difference of 13 passengers, which at 2 cents per mile would have added to the net profits of operation 26 cents per train mile, or enough to have eliminated the deficit and left a surplus of over 15 cents per passenger train mile on all Pennsylvania Lines in the state of Ohio. Of course, I know that the advocates of the measure under consideration by your committee will charge that these unprofitable results are partly due to over-capitalization on the part of the railroads. Some of you are no doubt aware that the leases under which the Pennsylvania Company operates the P., F. W. & C. Ry.; the C. & P. R. R., and other properties, were made thirty years or more ago, at a time when the rate of interest was much higher than at present, and it therefore pays a rental of 7 per cent. on the stock of most of these companies. The actual capitalization per mile is not high, but at the time at which the leases were made, what was a fair rate of interest has become in some instances burdensome. So far as the Pennsylvania Company stockholders are concerned, with an investment of $40,000,000, they received in 1904 a return of 5 per cent., but in many previous years they received nothing whatever, because the income was devoted to capital expenditures without any increase in capital.

The stockholders of the P., C., C. & St. L. Ry., with a capital stock of $52,000,000, received in dividends during the year 1904, $1,841,511.50, or less than 4 per cent. Outside of this small return to the people who invested so much money in these properties, and the interest on the bonded debt, every dollar expended has gone back to the public in payment either of wages to employees or for materials for the operation and improvement of the road; and right here I desire to say that for every dollar represented in the capitalization of the Pennsylvania Lines in the state of Ohio, an actual dollar has been invested; that the property cannot be reproduced for the same capitalization, and that the return on the capital so invested is less than for any other character of business; and as proof of this assertion I would refer you to the statistics of the Interstate Commerce Commission, from which the following statement is made up; the figures covering the railroads are taken from the report for 1903, while those in regard to manufactures and agriculture are from the census reports of 1900:

In making up the figures for manufactures 60 per cent. of the revenue is set aside for interest and dividends and 40 per cent. for surplus to cover depreciation, etc. In agriculture the taxes are estimated at 1 per cent. on the valuation. It will be seen from these figures that if a man had $1,000 which he desired to invest in three industries in the United States—steam railroads, manufacturing and agriculture—in the same ratio as investments in such have up to the present time been made he would place in:

Railroad stocks and bonds	$276
Manufacturing	235
Agriculture	489

The gross earnings from these investments, according to returns of Interstate Commerce Commission reports for 1903 and census reports of 1900, would be from:

		Per cent.
Railroads	$46.00	16.8
Manufacturing	310.00	132.1
Agriculture	106.00	21.8
Totals	$462.00	46.2

Of the above gross earnings there would be expended on account of cost of operation, including labor, material, taxes and incidentals:

		Per cent.
Railroads	$33.00	12.2
Manufacturing	265.00	112.8
Agriculture	37.00	7.6
Totals	$335.00	33.5

There would remain for interest and dividends:

		Per cent
Railroads	$10.70	3.75
Manufacturing	26.90	11.62
Agriculture	58.40	12.05
Totals	$96.00	9.60

Amount to be carried to surplus for renewals and depreciation:

		Per cent
Railroads	$2.55	0.85
Manufacturing	18.10	7.65
Agriculture	10.55	2.16
Totals	$31.00	3.10

If he had invested all of the $1,000 in railroad stock and bonds his net returns would have been: From interest and dividends, $37.50; surplus, $8.50; total, $46. If all had been invested in manufacturing his returns would have been: From interest and dividends, $116.20; surplus, $76.50; total, $192.70. If he had invested all in agriculture his profits would have been $120.50; surplus, $21.60; total, $142.10.

In other words, it is shown that if a man invests in manufacturing he will, on an average, receive $4^{2}/_{10}$ times as great a return and if he invests in agriculture he will receive $3^{1}/_{10}$ times as great a return as if he had made his investment in railroads.

Here let me speak of a very important feature in connection with the transportation problem, which is seldom referred to in the public prints and which I do not believe is generally thought of, although the truth of it, I think, will easily be recognized when your attention is called to the matter; and that is, that to serve the public well and as they have a right to demand, transportation companies must expend large sums of money in increasing their facilities. The only way in which this capital can be obtained is by

A. Taking it out of the income from operations;
B. The sale of stock; or
C. The sale of bonds.

There are always expenditures to be made which cannot be expected to yield a return equivalent to the interest on their cost, as for example the separation of the grade between railroads and highways, and many other improvements that add to comfort, convenience and safety, and a large part of these expenditures must be taken from income, and unless the transportation companies can show a surplus so invested over and above that which is necessary to pay interest on its debt and a fair dividend on its capital stock, the public will not buy additional stock or bonds that may be offered in the market, in order to provide additional facilities necessitated by growth of business; therefore it is necessary that the net profits of a railroad shall show a sufficient surplus over dividends to be convincing evidence to investors that the company will be able to pay its interest and dividends on such new obligations as are offered for sale.

The statement has been made by one of the advocates of the bill, that the average miles traveled by each passenger is: In France 21; in Germany 15, in Russia 65, in Austria 20, in Italy 28 etc., and that the rates for second class are: In France 2.32 cents Germany 2.28 cents, Austria 2.34 cents, Russia 0.82 of a cent, etc., and this, together with the statement that the New York, New Haven & Hartford R. R., and some of the railroads within the state of New York were carrying passengers profitably at a rate of two cents per mile, was claimed to have proved the argument of the

	Amounts invested capital or value.	Per cent	Gross Income from operation annual amount	Per cent on capital invested	Cost of operation including taxes	Per cent	Interest and dividends	Per cent	Carried to surplus for depreciation, etc.	Per cent
Railroads	$11,582,289,186	27.62	$1,950,743,638	16.84	$1,116,509,047	11.21	$[illegible]	[illegible]	$[illegible]	[illegible]
Manufactures	9,835,086,900	23.46	13,011,287,498	132.12	11,109,101,891	113.85	[illegible]	[illegible]	[illegible]	[illegible]
Agriculture	20,514,001,838	48.92	4,471,019,160	21.81	1,556,530,621	7.60	2,471,[illegible]	12.05	[illegible]	[illegible]
Totals	$41,931,377,933	100.00	$19,436,050,294	46.20	$14,082,141,532	33.50	$4,049,433,036	9.60	$1,304,475,126	3.10

speaker, that a cheap fare means a longer ride, and therefore more money to the railroads. A careful examination of Exhibits "D" and "E" will, I think, thoroughly demonstrate that the conclusions reached are erroneous. It is not the cheap fare and the long haul that produces a net exercise to the railroad company, but *a full* train. It costs just as much for fuel, wages, repairs to and maintenance of equipment and track, taxes, interest, etc., to haul a train of six cars with twenty people in it, as it does to haul the same train with one hundred people. The New York, New Haven & Hartford R. R. received but 1.7 cents per passenger per mile last year, but it handles the largest number of passengers per mile of road (351,163) and per passenger train mile (471) of any road in the country, while its average haul per passenger was very low, being 18.5 miles.

In Exhibit "E" Group 1, you will note the average number of passengers per mile of road in New England was 15,794, average haul 18.5 miles and the average rate 1.79. Group 2 includes the Middle States, and the average passengers per mile of road dropped to 10,651, while the rate increased from 1.79 cents to 1.89 cents, and the average haul per passenger from 17.5 to 22.5 miles, while in Group 3, which includes Ohio, Michigan, Indiana, Illinois and Wisconsin, the average number of passengers per mile of road dropped to 2,385, the rate increased from 1.89 to 2.16 per mile, and the average haul increased from 22.5 to 38.4 miles.

By following the statements down through the different groups you will find that the average rate received, and the average haul per passenger, increases almost uniformly as the average number of passengers per mile of road (or as we call it the "passenger density") decreases; when you reach Group 8, the passenger density increases and the rate and average haul drops. This is nothing more or less than a demonstration of the same law that governs all business transactions. A merchant may be forced by competition to sell 100 barrels of sugar at such a small margin, that when charged with its proportion of the general expenses, such as rent, wages, heat, lighting etc., the operation will result in a loss, but he might sell 1,000 barrels at the same margin, and, by a wider distribution of the fixed charges, leave himself with a small profit instead of a loss.

You will note in Exhibit "D" that I have selected some of the principal roads in the different states. In New England the average number of passengers per train mile is 63; on the N. Y., N. H. & H. Railroad, which was selected as a Connecticut road, the average is 77 passengers per train mile; on the roads in the state of New York the average is 61 passengers per train mile; in Ohio the average is 48; Indiana, 54; Illinois, 49; Michigan, 42; the average for Ohio, Indiana and Illinois in the year 1904 being abnormally swelled by the travel to the World's Fair at St. Louis.

I might elaborate this question of the effect of densely populated districts upon the profits in the transportation of passengers, but I think it is sufficient to refer you to Exhibits "D" and "E" and say that when the density of travel in Ohio equals that of New York and Connecticut I think you will find that the railroads will no longer oppose a similar service at a similar price.

While the average rate received per passenger has, by reason of the increase in commutation travel, excursion business, the use of mileage tickets, reduced rates to conventions, clergymen, etc., been decreasing, every element that enters into the cost of doing the work, both with respect to labor and materials, has been increasing. Locomotives which ten years ago cost $9,000, to-day cost $18,000; passenger coaches which could then have been purchased at $6,000, now cost over $9,000. Both wages and the price of fuel (two very important items) have advanced; competition has resulted in the introduction of dining cars, cafe cars, observation cars, and fast schedules, while the steady growth in the number of people to be cared for has necessitated the construction of expensive terminal stations; and last, but not least, has been the increase in taxation, all of which have added greatly to the cost of handling the business, and I venture the assertion, based upon practical experience in this country and upon personal observation abroad, that no railroads in the world give better or cheaper service, conditions considered, than is given by the lines which traverse the state of Ohio.

According to the speaker who addressed your committee last Wednesday evening, the first-class fares in Great Britain are 2.94 cents, in France 3.4 cents, in Germany a fraction over 3 cents; the second-class fares in Great Britain 2.46 cents, in France 2.32 cents, and in Germany 2.28 cents; and third-class fares in Great Britain 2 cents, in France 1.5 cents, and in Germany 1.5 cents. The rate received on the P., C., C. & St. L. Railway for the year 1904 was 1.95 cents, and on the P., F. W. & C. Railway 1.96 cents; in both cases less than the third-class fare in Great Britain, and but little more than the third-class fare in France and Germany.

The gentleman referred to says that he does not know the character of equipment furnished with third-class tickets, but I am not only familiar with it but have no hesitation in saying that we would not be permitted to use on the Ohio roads cars equipped like the third-class cars in European countries.

It is impossible for anyone to form a correct judgment of any business proposition without a thorough knowledge of all the facts in connection with it, and therefore it follows that it is impossible for the average citizen to form an intelligent or just opinion as to what is an equitable charge for transportation because they cannot

Pennsylvania Lines West of Pittsburg.
Average Passenger Earnings, Expenses and Net Earnings Per Mile and Per Train Mile, Year Ending Dec. 31, 1904.

	Per passenger—per mile			Per passenger train—per mile		
	1. Earnings. cts.	2. Expenses. cts.	3. Net. cts.	4. Earnings. cts.	5. Expenses. cts.	6. Net. cts.
Pitts., Ft. Wayne & Chic. Ry.	1.98	2.06	0.08*	112.9	85.0	27.9
Massillon & Cleveland R. R.	0.91	0.38	0.53			
New Castle & Beaver Valley R. R.	2.64	1.32	1.32	141.8	63.2	81.6
Pitts., Youngstown & Ashtabula	2.37	3.35	0.98*	76.3	77.7	*1.4
Lake & Pittsburg R. R.	2.31	2.62	0.31*	84.4	83.9	0.5
New Castle Branch W. N. Y. & P.	2.57	2.60	0.03*	82.9	77.6	5.3
Cleveland & Pittsburg R. R.	2.08	2.13	0.05*	127.4	108.7	18.9
Pitts., Ohio Val. & Cincinnati R. R.	2.75	7.82	5.07*	105.3	242.7	*137.4
Toledo, Walhonding Val. & Ohio	1.68	2.16	0.48*	75.8	79.1	*3.3
South Chicago & South Atl. R. R.	1.22	3.32	2.10*	82.3	80.5	*48.2
Cleveland & Marietta R. R.	2.33	2.25	0.08	107.0	90.4	16.6
All lines operated directly in Pennsylvania Company	2.01	2.13	0.12*	109.0	87.1	21.9
Pitts., Cin., Chic. & St. Louis Ry.	1.96	1.94	0.02	124.4	90.3	34.1
Toledo, Mich. & Ft. R. R.	1.76	2.01	0.25*	102.9	89.0	13.9
Cleveland, Lorain & Wheeling R. Way	1.99	1.45	0.54	154.2	101.6	52.6
Pitts., Wheeling & Kentucky R. R.	2.41	2.05	0.36	140.8	104.9	35.9
Long Island R. R.	2.34	2.06	0.28	100.1	76.0	24.1
All lines operated directly by P., C., C. & St. L. Ry. Co.	1.95	1.94	0.01	124.4	90.1	34.3
Grand Rapids & Indiana Ry.	2.07	1.80	0.27	111.1	85.1	26.0
Michigan Central & Grand Rapids & Ind.	1.43	1.43	0.00*	114.7	100.0	14.7
Traverse City R. R.	2.36	2.88	0.52*	68.0	67.3	0.7
Cin., R. & Ft. Wayne R. R.	2.41	2.46	0.05*	113.1	98.0	15.1
Cin. & Muskingum Valley R. R.	2.47	2.92	0.45*	58.6	59.4	*0.8
Wayne Junction & Westchester R. R.	2.78	2.59	0.19	115.0	91.9	23.1
Cairo, Carrollton & Yazoo Railway	2.26	3.90	1.64*	28.9	45.1	*16.2
Cleveland, Akron & Columbus Ry.	1.72	1.76	0.04*	92.6	79.0	13.6
Cincinnati, Lebanon & Northern	1.21	2.81	1.60*	39.1	75.3	*36.2
Toledo, Peoria & Western Ry.	2.14	2.26	0.18	100.9	81.3	19.6
Central Indiana Ry.	2.68	6.00	3.32*	32.2	53.3	*21.1
Terre Haute & Indianapolis R. R.	1.68	1.37	0.31	153.1	95.5	57.6
St. Louis, Vandalia & Terre Haute	1.83	1.29	0.54	154.4	82.7	71.7
Terre Haute & Logansport Ry.	2.00	2.19	0.19*	75.1	73.1	2.0
Logansport & Toledo Ry.	2.14	2.96	0.82*	64.0	74.3	*10.3
Terre Haute & Peoria R. R.	2.40	3.78	1.38*	69.7	82.7	*22.0
All lines operated under their own organizations	1.94	1.77	0.17	108.6	81.5	27.1

*Loss.

29 roads show net loss per passenger per mile, 12 roads show net earnings per passenger per mile. Note.—The reason that in some cases a loss is shown per passenger per mile and a profit per passenger train mile is because the earnings per passenger per mile include mail and express.

Passenger Statistics of Pennsylvania Lines.

		In the State of Ohio, June 30, 1904. Grand Totals.	Pennsylvania Lines West of Pittsburg, Year ending Dec. 31, 1904. Pitts., Ft. Wayne & Chic. Ry. Lines.	P., C., C. & St. L. Ry.	Vandalia Railroad.	Grand Rap. & I. Ry.
1	Miles of road—Total	3,019.34	1,526.29	1,422.50	687.77	573.39
2	In Ohio	1,857.95				
3	Gross earnings from passengers	$9,271,138.04	$3,051,551.44	$6,033,244.34	$2,417,333.23	$1,378,653.36
4	Number of passengers	10,502,528	10,292,765	16,415,946	2,879,071	2,051,703
5	Number of passengers carried 1 mile	251,300,942	151,141,008	315,569,429	131,452,564	66,408,713
6	Number of passengers per mile of road	6,904	6,644	7,317	4,187	3,578
7	Number of passengers carried 1 mile per train mile	156,194	184,249	240,208	191,129	115,818
8	Number of passengers per passenger train mile	45	41	47	54	46
9	Per passenger per mile—Earnings, cents	1.946	2.021	1.840	1.839	2.076
10	Expenses, cents	2.166	2.128	1.935	1.536	1.878
11	Profit or loss, cents	L. 0.220	L. 0.107	P. 0.095	P. 0.283	P. 0.198
12.	Passenger train mileage	7,587,071	6,896,674	7,307,522	2,448,584	1,435,515
	Passenger train earnings—Per train mile, exp. and baggage					
13.	Earnings, per train mile	$1.09784	$1.08681	$1.21016	$1.25845	$1.09853
14.	Expenses, per train mile	0.95413	0.86765	0.90528	0.83536	0.86808
15	Net earnings, per train mile	0.14371	0.21916	0.30488	0.42309	0.22955
16	Proportion of fixed charges and div. per pass. train mile	0.24256	0.25318	0.20621	0.23238	0.19561
17	Net loss per passenger train mile	0.10078	0.03402	P. 0.03867	P. 0.19071*	P. 0.03440

*The profit on the Vandalia Railroad is due to the World's Fair traffic in 1904; the results for 1903 show that the average number of passengers per train mile was 36, as against 54 in 1904, and the loss per passenger train mile was 10.42 cents.

Note.—In the earnings of passenger trains is included $18,787, on account of mail and a large proportion of the earnings from express covering traffic that was carried in exclusive express trains and upon which no passengers were handled. Had the operations of these trains been excluded the average miles per passenger train would have been considerably reduced and the net result affected accordingly.

know all the facts concerning it; and the same reasoning holds good with respect to all the subjects of legislation; therefore, in a government of the people by the people, the people have selected representatives whose duty it is to meet together and carefully consider the questions involved when new laws or modifications of old laws are demanded, and consequently it is your duty as representatives of the people, before legislating on a subject of this magnitude, to make every effort to ascertain the whole facts of the case, and be guided in your recommendation and vote by such facts and conditions.

As one of the representatives of the largest taxpaying interests, the largest employers of labor, and the largest purchasers of materials, I have felt it my duty to appear before you and present the facts submitted, and ask that before coming to any conclusion you carefully consider them; have the statements checked by representatives selected by yourselves, with the sworn statements furnished under the requirements of the law and filed in the office of the Commissioner of Railroads and Telegraphs at Columbus, Ohio, and in the office of the Interstate Commerce Commission at Washington. Disinterested experts can always be found, and when legislation involving so much is before you for consideration, it seems to me that it is the duty of the representatives of the people to take the time and spend the money, if necessary, to enable them to obtain such information as will place them in a position to decide what is fair and equitable to all interests. If it is determined that a change is necessary, an effort should be made to see what adjustment can be reached between what is demanded and what the transportation companies feel they can fairly be asked to yield, and then prepare the law in such form as will make it bear with as little hardship as possible on the interests affected.

I have not undertaken to criticise in detail the bill that is now before you for consideration, because I am merely representing one of the transportation companies which serve the people of the state of Ohio, and because I sincerely trust that the effect of what I have said will be a careful study by your committee of this bill, through consultation with the experts of the other railroads, and other experts that you deem it proper to employ, to check and verify arguments presented, so that in the end both the public and the railroads will feel that they have been properly treated. This is a course that has always been followed by Congress, members of state legislatures here and elsewhere, and by the representative bodies of countries with whose rates ours have been compared, so that the practice has almost become an unwritten law; and surely it seems to me not only fair to the railroads, whose interests are so largely affected, but the public as well, should be assured of equal justice, as we all know that government by the people, to be a success, must be just.

You cannot enact a law that will injure or cripple any industry in the state without its reacting on every citizen in the state. The taxes paid by the Pennsylvania Lines in the state of Ohio in 1904 amounted to $1,249,033, or 3.72 per cent. of our gross earnings, which is surely in excess of that paid by any other industry in the state; and, while we have sometimes complained, yet we have paid them without dispute so long as they bore a reasonable comparison with the taxes assessed against other citizens; and we still stand ready and willing to pay our full share of any tax that is assessed uniformly and fairly upon all citizens of the state, but we ask in return that our rights shall be given that fair and reasonable consideration that you would give to any other subject upon which you were called to legislate.

If the investigations which I am urging you to make shall prove, as I believe they will, that a rate of two cents per passenger mile is not remunerative to the railroads, then it follows as a simple matter of justice that the existing law should not be changed and that to do so would work serious injury, both to the railroads and to the interests of the state of Ohio as a whole.

Statement Showing "Passenger Density" (which is an Index of the Population) Tributary to Some of the Principal Lines in Connecticut, New York, Ohio, Indiana, Illinois and Michigan.

Name of road.	Miles of road	No. passengers carried — One mile per mile of road.	Per mile of road.	Per passenger train mile.	Average haul per passenger
Connecticut:					
N. Y., N. H. & Hartford	2,032	579,562	31,163	77	18.56
New York:					
N. Y., C. & H. R. R. R.	3,490	384,570	12,036	59	31.95
Erie R. R.	2,151	264,335	9,654	63	27.38
D., L. & W. R. R.	770	477,235	23,310	68	20.48
Lehigh Valley R. R.	1,394	145,364	3,263	52	44.55
N. Y., O. & W. Ry.	548	102,348	2,990	56	34.73
Average, New York		303,614	10,401	61	30.35
Ohio: L. S. & M. S. Ry.	1,454	240,270	9,255	52	56.40
Big Four Ry.	1,891	174,259	3,236	54	53.85
Balt. & Ohio R. R.	4,026	175,235	3,855	51	45.46
Hocking Valley Ry.	347	111,285	5,705	49	19.50
Cin., Ham. & Dayton	1,015	109,550	3,778	41	28.94
W. & Lake Erie R. R.	442	46,668	2,013	27	24.18
Lake Erie & Western	880	55,219	1,876	31	29.42
Penn. Lines, N. W. Sys	1,526	184,219	6,744	41	27.32
Penn. Lines, S.W. Sys.	1,423	240,208	7,317	47	32.83
N. Y., C. & St. Louis	523	160,566	1,712	69	93.76
N. & W. Ry.	1,833	77,136	1,929	42	39.98
Average for Ohio.		159,631	3,992	48	39.99
Indiana:					
T., St. L. & K. C. Ry.	450	92,677	1,719	45	53.89
Wabash R. R.	2,517	212,110	2,625	56	80.80
Monon Route	591	103,943	2,438	47	42.63
Average for Indiana.		179,205	2,481	54	72.23
Illinois:					
Vandalia R. R.	688	191,129	4,187	54	45.65
Illinois Central R.R.	4,374	133,520	9,953	51	26.96
Chic. & East. Ill. R. R.	758	82,615	2,915	38	28.39
Chicago & Alton Ry.	919	262,967	3,573	73	73.60
C., R. I. & P. Ry.	7,205	76,792	1,675	43	45.82
Average for Illinois.		112,777	3,019	49	37.36
Michigan:					
Grand Rapids & Ind.	573	115,818	3,578	46	32.37
Michigan Central R. R.	1,653	139,269	2,216	40	62.83
Ann Arbor R. R.	292	67,328	2,065	45	32.59
Average, Michigan.		125,442	2,506	42	50.04

Passenger Statistics for the Year Ending Dec. 31, 1904, by Groups, as Shown in Poor's Manual for 1905.

	Miles.	Rate received per pas'ger, cents.	Earnings per passenger train mile, cents.	Average — Per mile of road — Receipts.	No. passengers.	Passengers per pass. tr. mile.	Haul per passenger.
Group 1.	7,807	1.79	113.19	$4,939	15,704	63.0	17.5
Group 2.	26,468	1.89	101.50	1,383	10,651	55.5	22.9
Group 3.	66,839	2.16	98.61	1,949	2,385	46.0	38.4
Group 4.	25,431	2.33	86.45	1,320	1,384	36.1	39.8
Group 5.	11,417	2.46	103.89	1,589	1,581	42.1	40.8
Group 6.	38,135	2.28	99.37	1,364	954	44.1	63.4
Group 7.	23,448	2.28	119.65	1,634	945	52.3	75.9
Group 8.	12,800	1.99	147.11	2,299	3,262	75.9	35.4

Group 1 includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut.

Group 2, New York, New Jersey, Pennsylvania, Delaware and Maryland.

Group 3, Ohio, Michigan, Indiana, Illinois and Wisconsin.

Group 4, Virginia, West Virginia, North Carolina, South Carolina, Florida and Georgia.

Group 5, Alabama, Mississippi, Tennessee, Kentucky and Louisiana.

Group 6, Missouri, Arkansas, Texas, Kansas, Colorado, New Mexico, Oklahoma and Indian Territory.

Group 7, Iowa, Minnesota, Nebraska, North Dakota, South Dakota, Wyoming, and Montana.

Group 8, Washington, Oregon, California, Nevada, Idaho, Arizona, and Utah.

The Warren & Jamestown Single-Phase Railway.

The electric line which has recently been opened between Warren, Pa., and Jamestown, N. Y., traverses the valley of the Conewango creek, and connects the rich "Tiona" oil fields of Pennsylvania with the southern shore of the Lake Chautauqua. Warren, the southern terminal of the line, is located in the heart of the oil fields and the natural gas belt of the western portion of the state. It contains some 15,000 inhabitants, while its surrounding territory has a population of 10,000 more within easy access of the new road. Jamestown, at the other end, is a prosperous manufacturing city of 29,000 inhabitants, and is connected by steam and electric roads with the resorts of the Chautauqua region, whose summer population is estimated at 50,000. The New York towns of Falconer, Frewsburg and Fentonville, and Ackley, Russell and Glade, Pa., bring the total permanent population of the territory adjacent to the new road up to more than 65,000 inhabitants.

The equipment of the road is thoroughly modern, comprising horizontal gas engines as prime sources of driving power, and the single-phase alternating-current system of the Westinghouse Electric & Manufacturing Company. This is the first instance of a single-phase electric railway, operated by gas engines. The current is generated in a power house without a boiler plant, transmitted at a potential of 22,000 volts over bare copper wires to transformer stations operated without attendants, fed to the central trolley section at 3,300 volts, to the terminal sections within the city limits at 550 volts.

The track is laid with 70 lb. rails on oak and chestnut ties and ballasted with gravel. The rails are connected by soldered bonds made by the Ohio Brass Company, and are cross bonded at frequent intervals. The line follows the winding course of the Conewango and has many curves. The grades are heavy, one is three-quarters of a mile long with an average of 3½ per cent. and a short stretch of 7 per cent. The sharpest curve has a radius of 65 ft. Four turnouts are now in use, but this number will soon be increased to five. The car barns are at Warren, Pa., and Frewsburg, N. Y., with the repair shop at Warren.

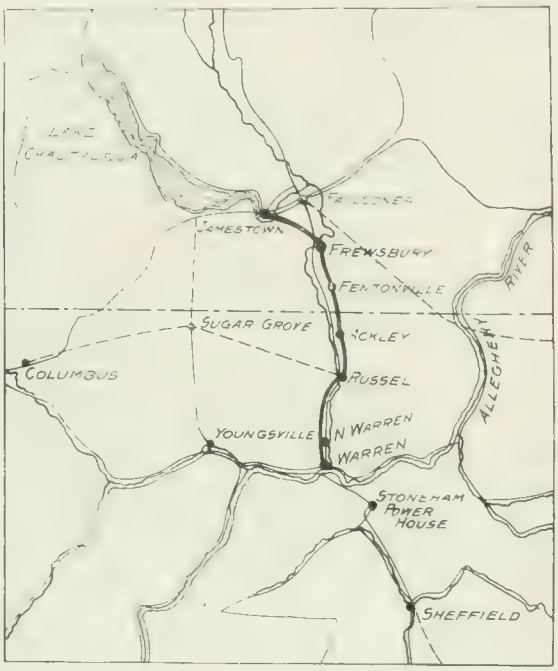
The power house is located at Stoneham, five miles south of Warren, that site having been selected by reason of its proximity to the natural gas pipe lines from which its fuel supply is obtained. The equipment includes two 260 k.w., 380 volt, 25-cycle, alternating current generators of the revolving field type, which are direct connected to horizontal gas engines operating at a speed of 150 r.p.m. The two units are connected in parallel and run together with remarkable smoothness. The engines were built and erected by the Westinghouse Machine Company and the electrical machinery was furnished and installed by the Westinghouse Electric & Manufacturing Company.

The new type of horizontal double acting gas engine bears a close resemblance to approved steam engine practice. Symmetrical design has been adopted wherever possible, notably in the cylinder casting with its symmetrical valve chambers and in the pistons. A relay governing system has been devised which has proven en-

tirely adequate in respect to both regulation and parallel working, and which places this type of gas engine upon the same plane with large Corliss steam engine practice. To make all parts accessible the engine has been elevated to such a height that all parts are above the floor level. Inspection and cleaning, especially of cylinders, is possible without dismantling the engine.

Injury from neglect has been avoided by providing automatic auxiliaries, both of jacket cooling water being delivered under gravity head cylinder oil, by positive pressure and compressed air for starting from storage reservoirs. The starting arrangement has proven particularly efficient, as with only two operations, opening up of gas and air valves, the engine automatically starts and comes up to speed under its own ignition without further attention. Less than a minute is required to bring the engine up to speed. A duplicate system of igniters is employed with four different combinations in each combustion chamber. Any igniters may be replaced while the engine is in service and in case of necessity any cylinder may be isolated for repairs during operation.

There are two main generating units of 260 k.w., 500 nominal h.p. capacity at present installed at Warren, with space for a third of equal size. Single-crank, tandem units were employed in place of twin tandem units in order to give greater flexibility of operation, the former representing the standard adopted by the builders. The units have solid couplings between engine and generator and operate in parallel on the station load in the same manner as an ordinary steam driven unit. The four-stroke cycle is used, which, with



Map of the Warren & Jamestown Single-Phase Electric Railway.

the tandem arrangement, gives a power impulse with each successive stroke of the engine. The cylinders are 21 in. in diameter by 30 in. stroke. The unit runs at a nominal speed of 150 r.p.m. For this particular service the engine is rated at 470 b.h.p., with a maximum of 520 b.h.p., giving a 35 per cent. overload capacity on the generator.

The cylinders are symmetrical about both axes and supported free from the foundations by front, center and rear housings. The front housing is anchored but the remainder of the engine is free to adjust itself to temperature changes. The jacket walls are cast free. The interior of the cylinders is accessible from above and below through valve openings without removing the heads. Solid forged steel crank shafts are used with positive pressure oiling at the pins.

The bearings are of segmental construction with wedge adjustment and water-cooled shells. The crossheads are of cast-steel with bored guides and adjustable slippers. The pistons are in one piece, cast symmetrical about both axes without internal ribs. They are mounted permanently on the rods and are water-cooled, being floated free from the cylinder walls. Nickel steel is used for the piston rods which are made with a bored water duct. The rods are made in two parts to facilitate handling and are united at the center crosshead. The rear piston may be disconnected. The packing is of the segmental metallic type, floating about the rods and internally lubricated. All the valves are of the poppet type, spring seated in the direction of pressure and removable in one piece with bonnet.

One inlet valve for each cylinder end combines the functions of mixing, governing and admission. Each valve is under direct governor control. The exhaust valves are raised by a multiplying lever system giving heavy force at the start, followed by rapid opening. The valves are water-cooled and are always full of water.

The balanced system of governing is employed in which an



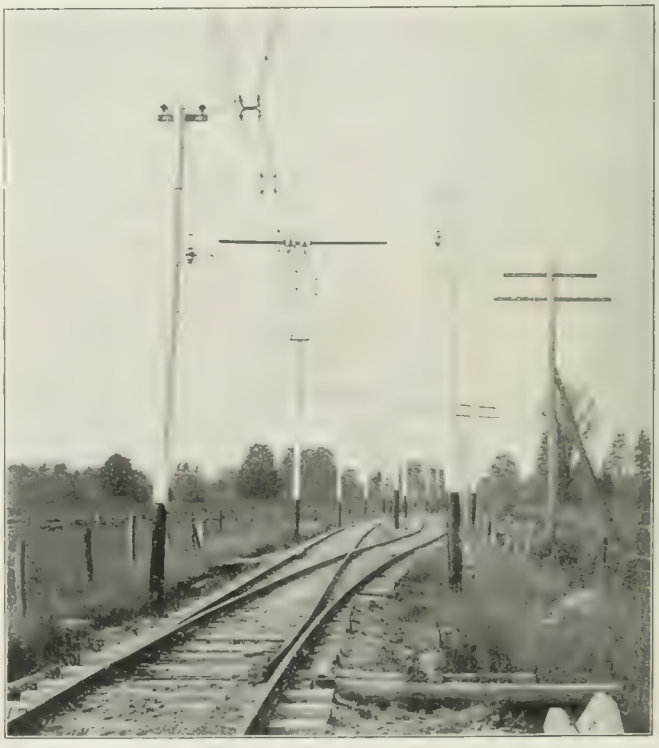
Transformer Sub-Station.

auxiliary oil cylinder does all the work of actuating the main valve. The sensitive centrifugal regulator is positively driven, as is the auxiliary oil pump supplying the relay system. Manual synchronizing adjustment for alternating-current working is also supplied.

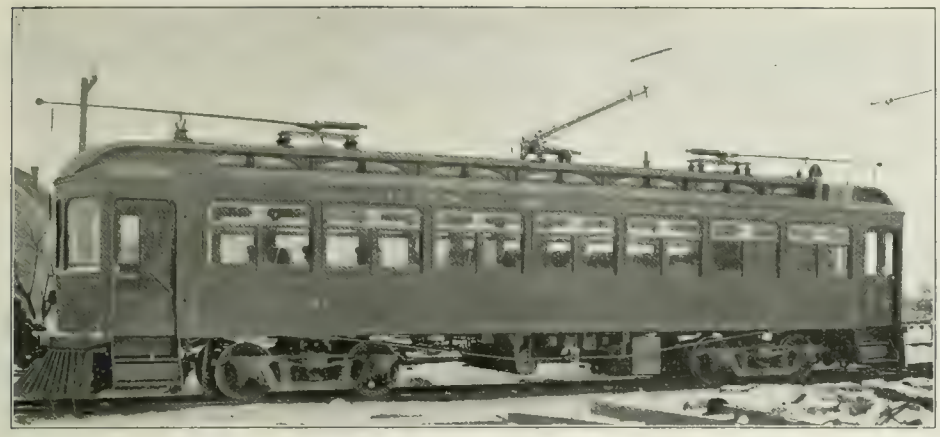
The ignition is of the hammer-break type, in duplicate, with two independent sources of current. The point of ignition is changeable and the igniter plugs are removable while the engine is running. An automatic safety stop is interposed in the igniter circuits. Separate water circuits are supplied for each important part with open funnel discharge. The pistons are maintained at an even temperature by a double-ended plunger pump attached to the center crosshead. A gravity water supply for the entire engine is used with an automatic motor-driven pump for maintaining a constant head.

The oiling is done with a gravity flush system for the engine oil with a filter and a positive-driven return pump. For the cylinder oil positive-timed injection from sight-feed pumps driven by engine is employed.

The Warren plant was started on Oct. 19, 1905, and has since been in continuous service, averaging 17½ to 18 hours a day without developing any trouble of a serious nature. The only prolonged shut-down was made after a two-months' run for the purpose of examining the condition of the interior of the first unit started.



Pole Line Construction at Turn-out, Showing Catenary Suspension.



Single-Phase Passenger Car on the Warren & Jamestown.

Every part was found to be in perfect working order without evidences of deterioration from wear or excessive strains.

Daily observations of the gas consumption of the plant furnish an indication of its high economy. During the month of December, 1905, the cost of gas consumed by the interurban system averaged less than 50 cents per hour, or about 16 cents per car hour for 35-ton interurban single-phase cars. At present the large gas engines operate both interurban and city systems totaling 10 cars. During the week ending January 12 the cost of gas averaged less than 75 cents per hour, or 7½ cents per car hour, for three interurban and seven city cars. With this combined operation there has been realized a saving of approximately 20 per cent. in cost of gas over the independent operation of the interurban and urban plants, the former by the new horizontal and the latter by vertical type engines.

Fuel gas is available from several different points and is clean and uniform in quality, averaging from 1,000 to 1,100 b.t.u. total per cu. ft. Gas is obtained at a straight rate of 15 cents per 1,000 cu. ft., which places the cost of power so far below the usual figure that any other source of motive power is out of the question.

From the generators the current passes through a switchboard of blue Vermont marble panels completely equipped with apparatus and controlling devices to raising transformers of the Westinghouse oil-immersed, self-cooling type, which transform the potential from 380 to 22,000 volts. The two feeders which leave the station are protected by circuit breakers of the fuse type, disconnecting switches, low-equivalent lightning arresters and choke coils.

The high-potential lines of No. 6 bare copper wire are carried on porcelain insulators of the Ohio Brass Company, known by the trade name of Locke No. 406, which are supported on chestnut poles. Each feeder connects with a transforming station, one of which is located 1¼ miles from the Warren terminal and the other 1½ miles from the end of the line in Jamestown.

The transformer stations are made of concrete blocks and are of suitable size to permit a good arrangement of the apparatus. They are similarly equipped, each containing two 150-k.w., 22,000-3,300-volt, lowering transformers of the oil-immersed self-cooling type, which are controlled and protected by fuse type circuit breakers and disconnecting switches in the high-potential circuits and by oil switches and enclosed fuses in the secondary lines, one of which taps the 3,300-volt trolley section while the other feeds the city section of the trolley line through auto-transformers along the track which reduce the potential from 3,300 to 550 volts. Both high and low-potential feeder circuits are protected by choke coils and low-equivalent lightning arresters which are mounted in the transforming stations. The apparatus is symmetrically arranged, that mounted on one side of the station being exactly duplicated on the other. The two transformers are connected in parallel. Each has sufficient capacity to carry the entire normal load and either may be readily cut out of service.

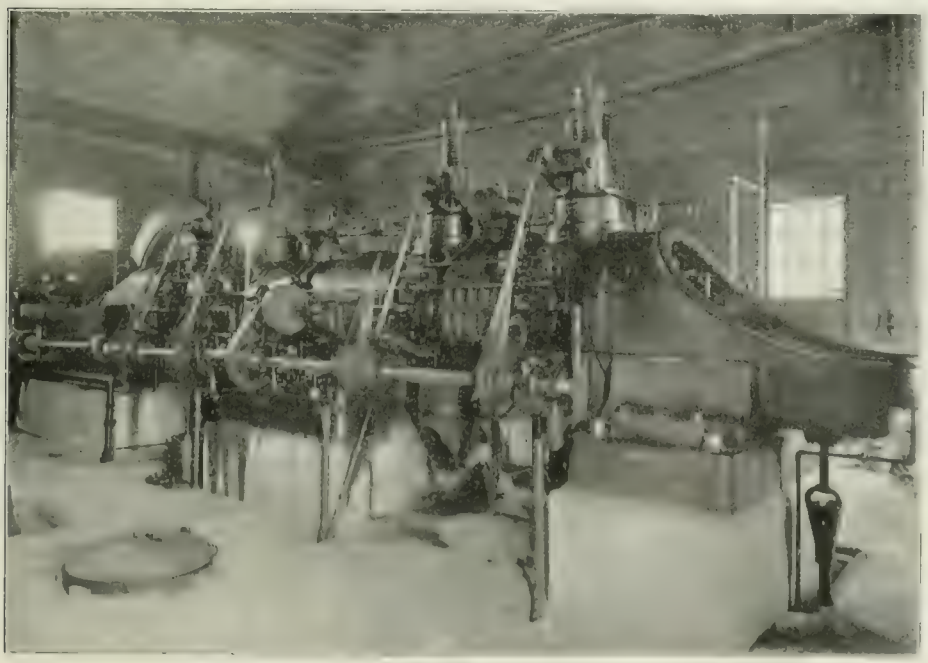


Single-Phase Baggage and Express Car, Warren & Jamestown.

The transformer stations are operated entirely without attendants and require only occasional inspection. The building is fireproof. It contains no moving machinery or apparatus and has adequate automatic protection, so that there is no likelihood of trouble other than the opening of a circuit breaker because of excessive load. The high-potential feeders enter the transformer houses through protected openings under the roof. The high-voltage feeder leading to the Jamestown transformer station is carried upon the pole line which supports the overhead construction.

The trolley line is divided into a central and two terminal sections. The central section is connected direct to the transformer stations receiving alternating current at 3,300 volts. A No. 000 grooved trolley wire is swung by catenary suspension from a ⅜ in. messenger cable which is carried on heavy porcelain insulators mounted on angle-iron brackets supported on the chestnut poles. The poles are 7 in. in diameter at the top and are 35 ft. high. They are painted white and black and present an attractive appearance. The white upper portions serve as useful guides to the line of track at night.

The overhead construction is particularly interesting. A detail shown in the illustration is the slight raising of one trolley wire at switch turnouts, so that the bow trolley easily passes from one wire to the other without impairment of contact. At frequent intervals the messenger cable is anchored and steady-strain brackets are used at curves and turnouts. A few of the curves are constructed with pull-outs. The catenary over-



Interior of Power House, Showing One of the Two Gas Engine Units.

head line construction is substantial, and has not given any trouble since erection. With such a line 3,300 volts is as easily handled as low potential direct current with the usual overhead construction.

The central high-voltage trolley line is separated from the terminal sections by section insulators. Within the limits of the terminal towns the trolley lines are supplied with alternating current at the low potential of 550 volts. A feeder from each transformer station leads to three 75-k.w. auto-transformers which are located along the track and connected to a No. 0000 secondary feeder which supplies the trolley. The auto-transformers reduce the potential from 3,300 to 550 volts. They are swung between pairs of poles.

The low-potential trolley is supported from span wires by insulating hangers, in accordance with the standard practice for direct current work. In Warren the cars run over the tracks of the Warren Street Railway Company, which is equipped with the direct current system. The two trolley wires, alternating-current and direct-current, are suspended side by side from the same spans without appreciably complicating the structure or in any way impairing the service of either system.

The passenger cars are of the double-end, vestibuled, double-truck type, with 33-in. wheels and 5½-in. axles. They measure 52 ft. over all by 9 ft. in width, and seat 59 people on cross seats, which have high backs and are upholstered in green plush. The cars are supplied with baggage racks, signal circuits and many other modern features. A smoking compartment is provided at one end and on the side. They are finished in mahogany and are decorated in excellent taste.

The operating company has at present five passenger cars and one baggage car, all of which were furnished by the St. Louis Car Company. Each is equipped with four Westinghouse No. 108, 50-h.p. motors of the single-phase, alternating-current, compensating, series type, mounted one on each axle and connected by single-reduction gears. The motors are connected permanently in multiple and are operated by the hand control system by means of taps from an auto-transformer which supplies a varying e.m.f. at the motor terminals. The controllers are of the drum type and closely resemble those of direct-current practice, though they occupy somewhat less space. They are mounted upon the platform at each end, so that the car may be operated in either direction. A feature of this installation is its simplicity and the small space required by the electrical apparatus. It consists only of one bow trolley, two standard wheel trolleys, two controllers, two canopy switches, one auto-transformer, two preventive coils with resistance, two fuse boxes, one change-over switch, and the necessary connecting cables.

The bow trolley is used on the 3,300-volt section and the wheel trolleys on the terminal sections of the line. The change-over switch is arranged to cut out the bow trolley and transfer the connections of the wheel trolleys from the low to the high-voltage service taps of the auto-transformer, so that, in case of accident to the bow trolley, the wheel trolleys, which are mounted on heavy insulators, may be used on the 3,300-volt section of the line. The bow trolley is pneumatically operated, the controlling valve being mounted on the platform within easy reach of the motorman. The wheel trolleys are handled in the ordinary way with ropes in which suitable insulators have been inserted to guard against the possibility of ground when used on a high-voltage circuit. The preventive coils and resistances eliminate arcing at the controller contacts when passing from one transformer connection to another.

The cars are equipped with Westinghouse straight air-brakes operated by means of an air compressor which is driven by a single-phase, series-wound motor of a construction similar to that employed for the main driving motors. Hand brakes are also supplied. The car, complete with equipment but without load, weighs approximately 66,000 lbs.

The motorman has the car under complete control at all times. It accelerates rapidly and without the slightest jar. It runs smoothly, and the alternating-current equipment responds readily to emergency demands, it being found possible to stop the car in a very short distance by simply throwing the reverse switch. As the controller handles are interlocking the operating drum must first be thrown to the off position.

The winter schedule requires two passenger and one baggage car. Commencing at 6 o'clock in the morning cars leave either end of the line every hour and a half; this service continues until 11.30 p.m. The run of 22½ miles is made in one hour and ten minutes, each car laying over about 20 minutes between trips. There are 53 stations along the line at which stops may be made; the average run each way includes about 15 stops. The two cars pass at a switch near Ackley, about the center of the line. Commencing at the Warren terminal, the schedule is as follows:

Warren to North Warren	10 mins.
North Warren to Ackley Switch	25 "
Ackley Switch to Frewsburg	20 "
Frewsburg to Jamestown Terminal	15 "
Total run, one way	1 hr. and 10 mins.

The maximum running speed is 50 miles per hour. The complete run from terminal to terminal without stops has been made in 47 minutes.

The change from the high to the low-voltage trolley is easily accomplished. As the car approaches the terminal section the motorman releases an air valve, thereby lowering the bow trolley which automatically closes down and locks in place. After passing the section insulator the conductor places the wheel trolley on the line in the ordinary way. The change-over may be made without stopping.

Under present arrangements the car is run two days with a mileage of 246, and is then brought in for inspection. The bow trolley shoes are found to give a life of approximately 10,000 miles. So far there has been no indication of undue wear of the trolley wire, nor has there been any trouble with the overhead structure.

The baggage car makes three trips per day on regular schedule, leaving Warren at 7.25 a.m., 11.40 a.m. and 4.15 p.m., and leaving Jamestown at 9.50 a.m., 2.30 p.m. and 7 p.m.

The present service of the Warren & Jamestown Street Railway Company requires a total of but eight employees, outside the general offices and car crews. It is made up of four men in the car barns, three power house attendants and one line-man. An additional line-man is occasionally borrowed from the Warren Street Railway Company. There are no attendants in the transformer stations.

The officers of the railway company are Mr. D. H. Siggins, President; Mr. H. M. Preston, Vice-President; Mr. S. Q. Smith, Secretary. Mr. Siggins is assisted in the management of the property by his son, Mr. H. A. Siggins, a director of the company and general manager of the Warren Street Railway.

Railway Education.*

The daily activities of mankind have long since become too important to be neglected in the educational world, and it is now realized that the universities may shape their curricula with direct reference to these and yet lose little, if any, of the mental development so long considered a monopoly of the humanistic studies. The four years devoted to professional preparation for medicine or for the law are not commonly supposed to have any particularly injurious or warping effect upon the mind of the student; in fact, are conceived to be mentally stimulating and invigorating. Equally harmless and equally beneficial is the mental preparation for other practical pursuits of life; in either case, the chief essential in the arrangement of the educational pabulum is that the various studies shall be handled in a broad and scientific way, compelling, on the part of the student, both analytical and synthetical modes of thought. Thus, in existing universities, we find not only the traditional schools of law, medicine and theology, but also the modern schools of engineering, architecture, education, journalism, commerce and the like. In turn, the engineering school divides out into its civil, mechanical, and electrical branches, and, so right along the line, is to be seen greater and greater indication of the influence of the spirit of specialization, which, after all, is but a response to the demand that education shall adapt itself to the necessities of life.

The number of persons engaged in engineering, in architecture, or in educational work falls far below the number at work in the transportation industry, and yet there has been but little effort to provide technical training for the latter. As a part result of this, the railways are finding themselves to-day in lack of a sufficient number of men qualified to occupy, with dignity and success, the positions of initial responsibility, men who know how to do the right thing at the right time, who show initiative and originality when thrown back upon their own resources, who possess not merely physical or brute obstinacy but especially that inflexible mental determination and persistency arising from the realization of the trained mind as to the relation of the individual worker to the collective working. It may be that careful professional training will be of considerable benefit to those destined to attain to the seats of power in the transportation industry; I am inclined to think that it will. The conducting of modern transportation is becoming constantly more and more complex; the day of happy-go-lucky, rule of thumb railroading, while not entirely gone, will soon be but a shadow of the past. There is no industry at the moment which demands keener intellect, shrewder wit, and better trained comprehension; no industry in which the failure of these qualities in its officers and, to no small extent, in its men, would be more disastrous to the general interests of the country. The necessity for, and demand for, an adequate supply of these qualities is increasing with the extension of the industry. In sheer self-defense, even from a dividend point of view, the railways of this country will have to pay more attention than they have ever done before to the improvement of the quality of the men they take into their employment. For their own interests, they must stimulate a steady flow of the brightest minds of each rising generation into their service, so that they may have ample choice of selection in filling up the lieutenancies and corporalships, some of those appointed to which, in turn, will qualify for responsibility as captains

*Extracts from a paper presented at the January meeting of the St. Louis Railway Club.

†Of the University of Chicago.

and colonels, and, maybe, even as generals of the railway army. There are all varieties of transportation problems, but, without doubt, the most difficult one of all is that of securing competent and trustworthy service.

Let us now address ourselves to the consideration of a remedy for the situation. It seems to me that two kinds of work need to be carried on, the first and the one of primary importance being the development of facilities for technical training in transportation, granting to the various studies included in the same all the dignity of university teaching and making the transportation school as direct and natural an opening into transportation as the medical and law schools into medicine and law. The second is the more systematic provision of technical education for the men already in the service, the great majority of whom, for many years to come, must necessarily be without the initial training referred to in the earlier part of this paragraph. Much may be said in praise of the work accomplished for employees through the railway clubs and the educational branches of the railroad Y. M. C. A. and in other ways, but more needs to be done, with greater system, and with more pronounced educational results.

My proposal is that the railways should directly encourage the extension of transportation teaching at all of the larger universities. Even in our engineering schools, the attention given to the special equipment of the civil and mechanical engineer intending to enter railroad work has been but limited, and, so far as the commercial and operating sides of railroading have been concerned, their portion has been utter neglect. The courses in railway transportation, offered by so many of the universities, have been mere academic exercises, frequently taught by men without any living interest in or understanding of the railway organism, in no way affording the requisite technical preparation for a railway career. Such places as New York, St. Louis, San Francisco, New Orleans and many other university towns ought to have their own schemes, but the development should be greater in Chicago than elsewhere on account of the unique facilities it affords as the foremost railway center of the country.

The railway companies, as a first and great step, should cooperate in founding, in that city, a railway college. The task of establishing the college should not be leift to the railways centering on Chicago. The companies of the North, East, South and West will secure no less benefit from the realization of the project than the first named. I believe that the college should be placed in academic relation with the University of Chicago because the broadening influence of a great university would be a good thing to have environing its students. A mind running in narrow grooves is the worst possession a practical man can have, for it prevents him from appreciating the scope of his own duties.

One distinctive feature of this college should be the arrangement of the work of its members. The students should follow their classes from the beginning of October until the middle of June, and from that time until the middle of September should be placed out on the railroads at a small salary to learn the practical details of the business. They could be used to fill in the odd vacancies (which occur during every part of the year), and, even if they did not accomplish much, they would probably earn the small salary assigned. The combination, in each year of college life, of the theory of the class with the practice of the road would be beneficial both mentally and morally to the student. Any inclination to the "swelled head," acquired in the class room, would be knocked out of him most effectually by his associates in employment. During the whole period of the three months he would be required to submit weekly reports as to the work he was doing, with descriptions of and observations upon the same.

Admission to the college should be granted only to youths who have already proved the possession of a certain amount of ability and perseverance by graduating from the four years' course of a high-school. Nowadays, with the spread of educational facilities, there is no reason why this requirement should not be enforced. I know of at least one town with barely 1,500 population that possesses a high-school offering as strong a four years' course as many places of twenty times the population. In the high-school is, or should be, laid the foundation of a broad culture upon which the superstructure of railway technology could be raised with confidence. Though not necessary in some branches of the service, it might yet be advisable to add to the educational admission requirements a physical test, which should cover eyesight, hearing and general condition. Through these requirements there would be some assurance of obtaining the sound mind in sound body, so essential to the production of the highest results.

The courses of the railway college should provide training on five different sides: mechanical engineering, civil engineering, electrical engineering, commercial and operating, all with distinct reference, of course, to railroad work. To effect this, the college should be in close touch with the engineering department of the university, so that courses common to railroad and general engineering should not need to be handled in the railway college, only those courses coming under its direct charge which bear a distinctly railroad aspect, for instance, railway construction, maintenance of way, locomotive construction, locomotive tests, and so forth. The independent establishment of a railway college would necessitate the provision of an entire engineering equipment, and this enormous expense would be largely saved by the co-operation suggested. The students of the engineering side of the railway college would not only obtain a more comprehensive preparation for this special work of their future employment than would be given in any ordinary school of engineering, but they would also secure a knowledge of general railway organization and operation through the non-engineering courses, a certain number of these being included in their curricula, which would enable the novice railroad engineers to understand better than they often do, under the present systems of training, the relationships of their respective departments to the general work of the railway. The mechanical man would have some knowledge of track—a necessity, not an accomplishment, in these days, when the problem of high speed and weight of motive power and car equipment is so interlinked with that of track capacity; he would have some knowledge of accounting, sufficient at any rate to realize the relation borne by the expenses of his department to those of the whole railway; a thorough understanding of the working necessities of the operating department would form part of his mental equipment; and many other matters, that, aside from his work though they may appear to be, would nevertheless be of real advantage to him in the performance of his daily duties.

It has also been suggested that it would be an advantage if railway students, not specializing in engineering, were required to take a certain amount of work in this branch. In fact, the Canadian railways, in the transportation department which they have provided at McGill University, Montreal, have arranged for something of this kind to be done. Personally, I am inclined to agree with this policy, provided it be carried out in moderation, because (1) the training may be of practical value to the future railroad man, and (2) it insures that each student shall have the benefit of the accurate and scientific training arising out of the study of engineering and correlated subjects.

Turning now to the subjects of the curriculum, I shall confine my attention chiefly to the railway subjects proper. What railway subjects should be taught in the suggested college? The following technical courses could and should be given: Railway Construction, Maintenance of Way, Economic Theory of Railway Location, Railway Terminals, Plans and Specifications of Railway Structures of all kinds, Railway Accounting, Station Returns, the Construction and Use of Railway Statistics, Organization, Handling of Traffic—Freight and Passengers—Signaling and Train Service, Motive Power Equipment, Car Equipment, Rate-Making, Government Control of Railways, Passenger Department, Freight Department, Railway Finance, Telegraphy, Corporation Law in its Relation to Railways, Railway Liabilities, Law of Carriers.

The names of the subjects will largely indicate to railway men what would be the work of the classes held therein. For instance, the Handling of Traffic course, on its freight side, would deal with the methods of disposing of freight in the "out" and "in" freight houses and at transfer stations, the work of the yards, way-billing and expensing, supervision of fast freight, car service, per diem, and so forth, in each section of the work starting with a general type, then proceeding to description of other methods in use both in this country and abroad, and finally winding up with such critical work as may be desirable. Accompanying the class-room work, would be the actual observation of working methods on railways at points within reach of class visits.

Under the head of Freight Department would be handled the organization of the department, duties of officers, solicitation of freight, the industrial agent or commissioner, freight claims, clearing systems, and so forth, the whole course giving a compact survey of the actual work of the department, with due regard to differences of organization, policy and methods. Classification and rates, it may be added, would be handled in the course of Rate-Making. In a similarly practical manner, each of the other railway subjects would be treated, and, in the hands of competent professional instructors, would both inform and train the minds of the students.

Associated with these railway subjects would be the more general ones of mathematics, surveying, mechanical drawing, shop work, chemistry, physics, economics and English in all full courses, leading to the Bachelor of Science in Transportation. Students specializing in one branch or other of railway engineering would not be able to take all of the subjects named in the preceding paragraphs, but such selection would be made as seemed practicable and desirable.

Throughout the whole four years every effort would be made to exclude the incompetent and the idle. What would be the position at the end of the fourth and succeeding years from the foundation of the college? Each year there would be issuing from the college at the service of the railways a picked body of young men, sound in body and in mind, not lacking in either culture or practical knowledge directly in line with their future work, young men possessing already, by reason of several summer seasons of actual rail

roading, a useful acquaintance with their future duties, men capable of thinking and working, men ready to bring to their duties the accuracy and swiftness of scientific methods and the discretion and wisdom of the accumulated experience of railroads of past and present, of both East and West.

My remarks have so far referred to students of the railway college able to put in the regular four years' undergraduate period. Though it is to be hoped that these would form by far the largest constituency of the college, there are others to be provided for, who possess equal mental qualifications, but, for various reasons, must limit their education to one or two years from the date of graduation at high school. For these the college should present a special arrangement of courses, emphasizing the railroad subjects, and yet giving some general training, so that a youth compelled to leave at the end of one or two years' work would be competent to discharge with success the duties of, say, a station agent, a branch of the service in which the railways are particularly weak at present, or any other suitable position. There are a great many young men drifting into the mind-restraining curricula of the shorthand and business school who, with the opportunity of a much more broadening kind of education before them, offering a direct opening into the branches of a profession where men, and not machines, are the great need, would be glad to take a one or two years' course in the suggested college. If there were associated with the college a department of correspondence tuition, these short course men could continue their technical education after they had entered the service, with advantage to themselves and profit to their employing companies. The ambitious boy with plenty of determination but little money in his pocket could probably find many opportunities of temporary employment—the close relationship existing between the institution and the railways would doubtless secure not a few advantages for such students.

The railway college, financed by the railways, would place at the disposal of the roads a number of scholarships. It is not difficult to see how the companies might well use these scholarships as one factor in cementing to their service the loyalty of the better class of their employees. Such scholarships could be offered in open competition to the sons of employees fulfilling the necessary educational and physical requirements for admission.

The companies would benefit by the leavening influence exerted by the steady influx of able and broad-minded young men, whose training would enable them to see far above and beyond the petty aims and strifes of unregulated unionism, and who would become natural leaders of thought among their associates. Their influence would strengthen good discipline, encourage amiable relations between men and officers, because there would be better understanding of one another's duties and responsibilities. The work of the school would have a direct bearing upon the labor problem as it faces the railway companies to-day.

A further thought presents itself, namely, that the specialized education of the railway college would induce in the mind of the future railway man a greater appreciation of his work, a stronger desire to remain in an employment in which his training would be more likely to bring ultimate success than in any other. The greater reliance with which railway officials could depend upon the service of the members of their various departments would be entirely beneficial to the companies. To some railway men, particularly unfortunate in the unsettled temperament of their subordinates, the change would seem almost Utopian.

Turning to the second kind of work which needs to be carried on under the head of railway training, namely, as previously stated, the more systematic provision of technical education for the men already in the service, the organization of this side of railway education must fall under three heads: (a) evening schools, (b) correspondence tuition, and (c) traveling teachers.

Our evening railway classes at Chicago, which are now in their second year, have had considerable success. A number of railways with interests in that city have met the expenses between them, in return, sending employees to the school on free scholarships. Our initial difficulties lie to quite an extent in getting hold of the right kind of material. A considerable portion of the men sent to us reveal no sign of any real desire to better themselves by hard work. Lacking in energy, determination and foresight, they are soon found among the backsliders. This class of men we do not want; they are not of the kind out of which real *railroad* men are to be made, though no doubt they ape the title. As experience lends wisdom to the administration of this work, we are hoping to be able to devise some method of selection which will enable the companies to fill up the classes with workers and "stickers." Of course, the conditions to which railway employees are subject render regular attendance at evening classes, with the due performance of home work in connection therewith, a task of difficulty and demanding great perseverance. Company's service, sickness or other unavoidable cause may compel a man's absence for two or three nights. He loses the connection, his back work has accumulated considerably, and unless he is gritty, he is apt to become discouraged. But it is the gritty men we want to train and not the weak-backed ones, so that if out of every two or three men sent us, under present conditions, we discover one worth while, the result is encouraging. Our school affords also a temporary abiding place for another type of man, not without grit or brain capacity, but yet an unreliable student. I refer to the man who measures his education on a strictly cash basis, poorly calculated at that; he does not want to waste his valuable time over any of the broader problems of railway management and policy, is indifferent to the manner in which the company's business is carried on outside of his own immediate work; with a metaphorical pistol at your head, he (i. e., his attitude, not his words) demands that you prove to him the possession of goods that can be transferred to him in the minimum time and at the maximum advantage of dollars per month to himself. He can see $10 per month increase in salary at the end of three months with a very appreciative eye, but is absolutely blind to a hundred per month increase three years hence. Here is a man that wilfully narrows his capacity, and, until something happens to reveal to himself what a fool he is, neither school nor company can hope to do anything with him.

In conducting the evening classes, our plan has been so far to compel every man in his first year to take similar work—traffic man, accounting man, operating man, motive power man, roadway man, all alike have had to pass through the same course, which gives a general survey of the more important features of the whole organization, work and policy of the railways.

[Notes regarding, and outlines of, these evening courses of the University of Chicago have already been given in these columns.—Editor.]

Of course, the treatment of each subject has to be more or less brief, but we have arranged our syllabus so that upon this class a number of more specialized courses can be built. However, it is probable that after the current year, our evening syllabus will be modified by dividing up this general course into its component parts, and treating both the elementary and more advanced stages of each part in one continuous class. This will probably induce the men, who are not willing to devote their time to the study of departments of the road other than their own, to put in solid work with the classes, and we are hoping that a year's experience, in classes relating to their particular departments, will have so broadened them and have so whet their appetites for more that they will desire to enter classes dealing with other parts of the railway organization. At least, if this does not happen, the conclusion will then have to be reached that such persons are educationally incorrigible.

* * * * * * *

Another side of the Chicago railway education scheme, so far as it affects present employees, is that of correspondence tuition, a department which will probably open next October. This will give the opportunity of the higher training in railway transportation to the young man located, it may be, a hundred miles from "anywhere," and so improve the chance of bettering his position. It is the intention to reproduce some or all of the courses previously named as closely as possible in this correspondence department. The sentimental and material advantages to the correspondence student of membership in and work with a university of international standing are obvious.

At certain points where classes of forty or fifty employees can be formed, we are hoping to be able to handle some of the courses by the direct instruction of a traveling lecturer. Such a lecturer would have several centers established within accessible distance of one another, and would hold "school" at each one night a week during, say, six months of the year. He would thus be able to handle ten or twelve centers during the year. With half a dozen energetic and capable young men, of trained ability and with specialized knowledge of their subjects, a wide field could be effectively covered in this way.

In addition to this work of instruction, the railway college should become a world-famous center of research work. As its testing plants, appliances and libraries develop, its faculty and advanced students, in association with practical railway men, could be constantly devoting attention to the consideration of the improvement of railway facilities in all departments. I should like to see its libraries associated with a bureau of information, which should collect, classify and make readily accessible the results of the investigations of all countries and all investigators on railway subjects. Thus, if a railroad wished to have at its disposal a complete record of past and present experiments and experiences of other railroads in the matter of treated ties, it would be able to have drawn up for it by the bureau a succinct account of the same, or could send its representative to the bureau to investigate on the spot, with the help of the officers of the bureau and of the college specialists in that field. Or if a railroad wished to review the methods of handling l.c.l. freight in various parts of the country or abroad, similar facilities would be at its disposal, and so on. The value of the bureau, as administered by a scientific college in this way, and situated in the most accessible city in America, would be immense.

I should like to say much more in explanation of the undertaking which the railways centering in Chicago and the University of Chicago are endeavoring to carry out. There are some difficulties

in the way. The least serious one is that of finance. The work proposed to be done is so entirely in the interests of the railroad companies and will contribute so much to their more economical working, that there can be little doubt of their willingness to extend their financial aid to whatever amount is necessary. The annual income required is not really very large, probably never exceeding $100,000 per annum. At present we need but a fifth of that income. In fact, it should not be a difficult task within the next five years to secure a permanent endowment for the institution and its work that would provide adequate buildings and equipment, as well as a sufficient annual income for current expenses, thus relieving the companies from annual contributions. But even if the latter were to continue, the co-operation of twenty-five to thirty roads would reduce the quota of each to the insignificant sum of $3,000 to $4,000 a year. With hundreds of trained men graduating each year from the college, with thousands of railroad employees enjoying the benefits through evening classes, divisional schools and correspondence tuition, with the further advantages available in the Bureau of Information and in the experiments of its various plants, each road could depend upon getting good value for its money, even if its individual appropriation were twenty times as much.

A difficulty of more importance than the financial one, though still but temporary, is that of securing suitable instructors. We need men of the highest and broadest mental training, keen in investigation, sympathetic in teaching, men who possess the most desirable academic qualities and qualifications, and at the same time have the practical instinct. We see no other opportunity but to train our own instructors, and this we are proposing to do by taking able university graduates of suitable preparation, placing them for twelve months or so out on the road, a month here, three months there and so on, engaging in the practical side of the subjects in which they are specializing, studying the different methods in use and their relative values, consulting with and being advised by railway men of all grades and all opinions. Furthermore, not only will they do this before engaging in teaching, but, as instructors of the college, they will be expected to keep in touch with movements in their respective departments on the railroads, making investigation trips on all possible occasions. It has been suggested that the railway college should be largely staffed by railroad men. Where suitable men of actual road or office experience, efficient teachers and capable of real research work, in short, likely to do credit to the college, could be obtained, such could be made good use of. But the ex-railroad man who has "resigned" because of incapacity, we do not want; the ex-railroad man who has been worked out, we do not want; the ex-railroad man who is looking for a kind of retiring allowance in the shape of a nice easy job, we do not want. The railroad man of trained mind, high capacity and wide experience, possessing undoubted powers of discipline and exposition, associated with a strong personality, we do want, but we could not get him, for the railroads need this type of man for their own service, and are able to pay him anywhere from three to ten times as much salary as we could give him. A careful study of the question has convinced me that the policy of training our own instructors, securing them before they have the opportunity of making high salaries, men who combine the practical instinct with power of exposition, who possess love for research and are disposed toward teaching, is not merely the only feasible plan, but, except in special instances, the most desirable one.

Detention of Cars in Yards.*

The committee on conducting transportation presented the following statement from the Pennsylvania Railroad bearing upon experimental work undertaken with the object of facilitating the movement of cars through yards. This was followed by a discussion, part of which is included herewith:

You all know that there is need for better transportation. We have put a lot of money into railroad improvements, cars have been increased in their capacity, larger locomotives put on the road, and now comes the question of better and quicker transportation. We are endeavoring to formulate some methods by which car movement can be given closer supervision, and to establish such records and methods as will make it possible for us to keep in touch with yard delays, train and car movement, terminal delays and delays at sidings and point of shipments where freight originates. We have been keeping certain records during the past year, and find that our greatest trouble is to get cars through yards and released at terminal points. After we decide exactly what we are going to do as to keeping records and establishing better supervision in yards and at terminals, we then expect to take up and establish an audit (analysis of delays) at all stations, sidings, coal tipples, etc. I hope by the next time the Association meets that I may be able to give you something more definite on this subject.

Mr. Drew (Wisconsin Central). If this is an important question to the Pennsylvania and the Baltimore & Ohio and all the other big roads, what do you think it is to the great majority of small single track roads such as we have in the West? We all know that in the west the yardmaster is an autocrat. He does just about as he pleases, and we have to let him do pretty much as he pleases, and if we can devise any scheme by which we can assist him in doing his work of getting his trains out and saving that long detention that we all know about, we shall have accomplished a great deal. We have a method now of obtaining information as to movements in yards. When I was a telegraph operator, I used to sit at the key and hear the despatcher: "When is No. 222 going to get out?" "Oh, I don't know; it is up in the yard." It would be waiting on a single track road in the yard to get out. Now we have our yards all connected by telephones, and when the despatcher asks the operator, he cries to a man in the other end of the yard and obtains the information promptly.

Mr. Aylesbury (Terminal Railroad Association of St. Louis).—Judging by number of cars handled we should be having one of the worst congestions we ever had in the St. Louis terminals, at the present time. We came to the conclusion that something must be done to eliminate the delay to cars in our yards, especially the movement of empty cars. We found out that one reason for delay was on account of being unable to give the yardmaster prompt information as to what disposition should be made of empty cars. When a freight drag comes into the terminal yards it has to be switched immediately or put on the hold track. If we put very many cars on the hold track we are congested. We asked the different superintendents if they would instruct their agents and yardmaster to card all loaded cars delivered to the terminal lines. A little card about 1½ in. square is used. When the Illinois Central brings a car into St. Louis, their agent at East St. Louis tacks this card onto the needle beam, showing they brought this car and delivered it to the Wiggins Ferry Company for the Iron Mountain. When this car comes back from the Iron Mountain it is delivered to the Wiggins Ferry and instead of calling up my office for disposition of that car, all the yardmaster has to do is to look at the little card on the needle beam and he knows that the car belongs to the Illinois Central. No one knows, unless he has seen this practice, what it means to the large terminals in disposing of these empty cars. The lines entering St. Louis are all vitally interested in the movement of cars through this gateway, and while they are putting these cards on the cars for our benefit, they realize the effort is returned one hundredfold in the return of cars to them without any delay or congestion in the terminals.

Mr. Seale (Southern Railway).—After the last meeting the Southern took in hand this matter of delay. I am sorry to say we had never thought of it before. We have made a betterment in the yard delays. We take, for instance, conductors' reports out of a certain terminal for 24 hours—from midnight to midnight—which shows the time that trains left there. Then I go back through my records and find the time that each one of those cars arrived by the conductors' reports, show the delay to each car, and then make an average; I do not know that I can tell you just what our delays were, but on the average about 18 hours. We reduced the average to 13. I understand the Pennsylvania says that five hours is considered too much. Really, it is too much. If we were to eliminate our carded train that goes right through a terminal, and take into consideration only the delays to slow freight, our delays would be something like 20, 22 or 24 hours. That seems unreasonable, but as a matter of fact it is true. We have bettered it, and are going to make a much greater improvement. I have now some blanks which we are just putting in the big yards to show what the delay is chargeable to—whether waiting for engines, waiting for the train to be made up, or waiting for other trains. Delay is chargeable to one of three things—waiting for an engine, for train to be made up, or waiting for passenger trains. Take a road like our main line for instance, from Washington to Greenville, Miss. There are seven relay points. Now take a load of slow freight with 13 hours delay at each of those points. Just see what it would amount to. It would be exceptional for the same load to meet with such delay at every one of these seven relay points. We have told our superintendents that it is all well and good for each of them at times to hold a train for tonnage, but if all of them were to hold the same train or the same bunch of cars, what would the result be? So now, none of our trains wait at terminal points. When you have a whole lot of traffic you cannot at all times do it, but we have arranged now so that we take care of each freight train as it comes in. We have company coal or something to fill in with that train to give it its tonnage.

Mr. Beecham (Chicago, Milwaukee & St. Paul).—And any one who has investigated the movement of cars on railroads will be impressed with the fact that they move very slowly. I am reminded of that by an experience I had not long since in tracing a carload of lumber that started from Chicago to Los Angeles. It was 60 days on the way, and we not only could not get any information about it, but we could get no answers to any inquiries made about it. And there are many such cases as that coming

*Extracts from the proceedings of the Association of Transportation and Car Accounting Officers, at St. Louis, Nov. 21 to 22, 1905.

up in railroad affairs every day. Many of these gentlemen have stated that freight moves with reasonable despatch on their railroads, but I want to put myself on record as saying that freight does not move with necessary despatch on any railroad. When it comes to handling less than carload freight, from all that I have been able to learn about the railroads in Europe, the railroads of this country are not in it, and you know perfectly well when you come to figure out the mileage that your cars make, that it is very low. One gentleman said here to-day that they move about four miles an hour. I can walk faster than that, and I am a poor walker, too. It is not a question of getting a load into a car. The man who wants to load the car will take care of that. It is not a question of getting a load out of a car. The man who wants the contents of the car will take it out if you give him an opportunity. But it is up to the railroads to move that car from where it is loaded to where it is to be unloaded, and they have not as yet solved that problem.

January Decisions in Railroad Law.

The following cases were decided in the United States Supreme Court and the other Federal courts during the month of January, on railroad matters:

Presumption of Negligence in Grade Crossing Accident.—The mere fact that a person is found dead beneath a railroad engine at a grade crossing does not of itself alone raise a presumption of negligent operation of the locomotive, and it is the duty of the representative of the deceased suing for his death to establish that fact. In such a case, a right to recovery will be defeated where the evidence shows that the deceased was familiar with the crossing and the operation of trains at the particular time in question, and that the accident could only have occurred by reason of his own carelessness in venturing upon the track at the time he did. St. Louis & San Francisco Railroad Co. v. Chapman, 140 Fed. Rep. 129.

Mail Carrying Contracts.—The condition in mail carrying contracts whereby the contractor is required to perform all services that may become necessary under the contract without additional pay, is construed by the Supreme Court to intend only those services reasonably within the contemplation of the parties at the time bids are advertised. The advertisements for these bids usually specify the amount of extra service likely to be exacted. In the case in question this amount of extra service was stated and the bids were made upon that basis, but Congress afterwards made provision for an enormous increase of the service and the Government contended that this should be performed without extra compensation. The service was clearly not contemplated at the time the bids were solicited, and the Supreme Court upheld the extra compensation allowed by the Court of Claims. United States v. Utah, Nevada & California Stage Co., 26 Supreme Ct. Rep. 69.

Hackmen at Station.—A railroad company having contracted with a transfer company for furnishing vehicles for incoming passengers, and the provision in this regard being ample, may legally exclude from its grounds all other hackmen and cabmen seeking entrance thereto for the purpose of soliciting for themselves the custom or patronage of passengers, and this right of the railroad company may be enforced by injunction. This rule of law, however, does not operate to prevent licensed hackmen from soliciting patronage from the public sidewalk at the main entrance of the station, provided the ingress and egress of passengers and employees is not interfered with. Donovan v. Pennsylvania Company, 26 Supreme Ct. Rep. 91.

The Swedish State Railroads have regulated the maximum permissible speed of trains by the weight of the rails. On tracks the rails of which weigh 81 lbs. per yard, 56 miles an hour is permitted; on 66-lb. rails, 50 miles; on 62½-lb. rails, 47 miles; on 50-lb. rails, 37 miles. But no train may run more than 37 miles an hour unless it is equipped with continuous brakes.

Construction of a Subway Tunnel Under the River Seine in Paris.

BY L. OMMELANGE.

The "Transversale Nord-Sud" line, or line No. 4, of the Paris Metropolitan subway system, is projected to pass the Seine at two different points. This passage, which is 358 ft. long and includes two underground stations, furnishes one of the greatest difficulties which are met with in the whole construction. Its cost is estimated at $3,100,000. The Prefecture of the Seine brought forward a proposal to use two twin tunnels of small circular section with a metallic lining for the Seine crossing. Instead, however, of adopting this plan, the proposal of one of the most successful Parisian engineers—Monsieur L. Chagnaud—was adopted. His plan provides for a single tube double track tunnel of the same dimensions as in the other sections of the Metropolitan. The project of the Prefecture was unsatisfactory, largely because it required a four per cent. grade on the approach to the edge of the river. Also the Seine was to be crossed on a level grade 46 ft. below the surface of the water. M. Chagnaud's proposal makes the crossing possible at 36 ft. 7 in. below the surface of the Seine, which is almost 10 ft. higher than in the other proposal, this change, of course, doing away with the necessity for so steep a grade on the approaches. Incidentally, it is interesting to observe that on the entire length of line No. 4 there are but three four per cent. grades, which is the maximum allowed on the Metropolitan's lines. These are, where it



Fig. 1—The First Caisson on the Mounting Stage.

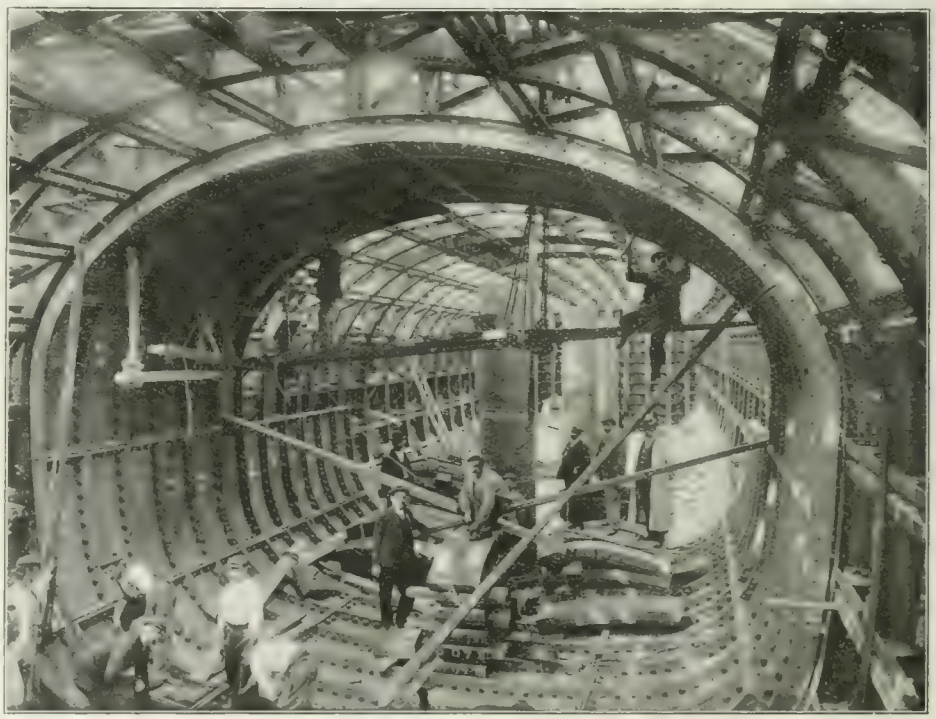


Fig. 2—Putting in Place the Cast-Iron Lining of the Caisson.

crosses under line No. 1, under the Orleans Railway, and under the Bierre sewer collector.

The type of tunnel used throughout the subway, except at the Seine crossings, has an interior section very little different from the common masonry type. In its construction a special type of shield is being used. The walls are formed by a cast-iron lining made up of rings 2 inches thick, which are themselves divided into arches having such curvature as will most effectively strengthen them to resist the pressure supported by the tunnel in the position which they are in each instance to occupy. To make the walls weather- and waterproof, creosoted planks of wood are placed in the bolted joints, and injections of cement made through and over



Fig. 3—The Caisson After Being Launched.

the lining so as to fill up any vacant spaces that might remain between the outside curve of the arch and the earth surrounding it. Inside, the metallic lining is covered with a layer of asphalt 4¾ in. thick; that is, corresponding to the height of the ribs. This, in its turn, is coated with Portland cement $1^{3}/_{16}$ in. thick.

In the parts of the tunnel under the Seine, on the other hand, there will be some striking differences from this type of construction. The metal tubes forming the shell of the tunnel will be made in the same way as throughout the rest of the line, but will be surrounded by the metal caisson used in placing them in position. The whole of the space between the walls of the caisson and the tunnel proper will be filled with cement and concrete in which the angle irons, or ties, of the iron framing will be imbedded. This will make, outside the metallic lining of the tunnel, a lining of strongly resistant and practically indestructible masonry.

The construction of the first of the caissons to be built and its placing in position in the Seine are shown in the accompanying

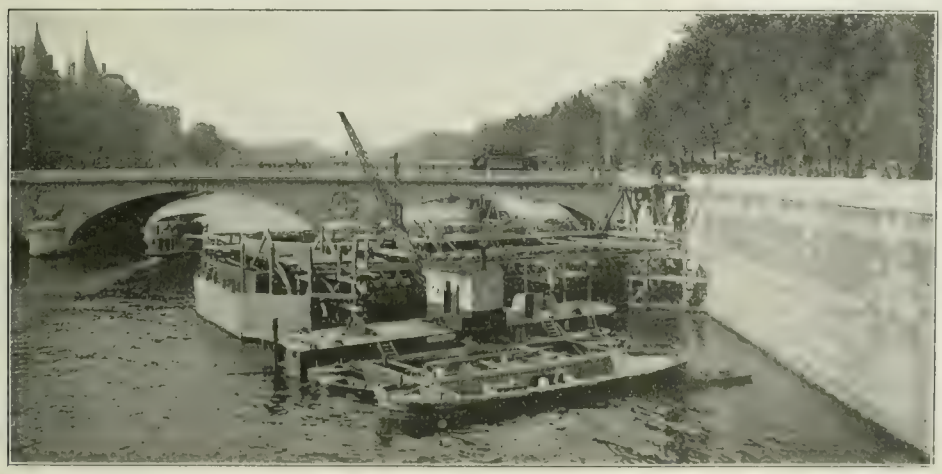


Fig. 4—The Caisson Ready to be Sunk.

photographs. Fig. 1 shows the construction of the caisson on the mounting stage, arranged for it on the Quai des Tuileries. This illustrates clearly the ribbed construction, first placed in position, and later, as shown in Fig. 2, supporting the interior cast-iron lining, which is in that photograph being mounted. In Fig. 3 the caisson has been launched parallel to the river bank. Fig. 4 shows the same caisson completed, placed on the temporary mounting stage in the river and ready to be sunk. The caisson weighs 280 tons.

There will be three such caissons used in carrying the tunnel under the main arm of the Seine, and two more in the crossing of the smaller arm of the river. Those used in the main arm will be 118 ft. 1 in., 191 ft. 7 in., and 121 ft. 9 in. long, respectively. The caissons to be used under the smaller arm of the river will each be 65 ft. long. All the caissons are made to conform to the circumference of a curve of 1,148 ft. radius. At their extremities they will be temporarily closed by means of metal bulkheads, which are to be removed when connection is made between the different sections of the tunnel. In order to make this possible, a space 5 ft. long will be left open between them; the connection being made by means of movable caissons. Two of these short movable caissons lowered vertically will make possible the construction of two masonry walls, which will form a joint with the abutments or jambs of the two extremities of the large caissons. These walls will be raised up to the plane of a horizontal supporting surface built at the ends of each two adjoining caissons. On this supporting surface it will then be possible to place the final short caisson, under cover of which the joint between the two longer ones can be finished and the panels forming the temporary extremities of the long caissons removed.

The construction of the various Seine crossings will include the use of three different processes. The compressed air shield method will be used for building a three-section tunnel; a compressed air caisson will be used for the tunnel of line No. 4 and for the two stations included in the Seine crossing; and the freezing process will be used at the crossing under the line of the Orleans Railway, because the working of this line must not be interfered with by underground construction work. Of these three methods of construction, the sinking of caissons by compressed air is the only one yet in complete operation.

The first caisson for the large arm of the Seine, nearest the right bank, (shown in the illustrations) has been sunk to its final level. In its construction, rapid progress was made by the use of automatic riveting machinery and pneumatic hammers. After it had been mounted and the iron plates which make it water-tight riveted on the outside, it was launched, as already shown in Fig. 3. This was made easier because it was first raised 7 ft. 3¾ in. above the surface of the river. The caisson was then towed to the point at which it was to be sunk. The position at the bottom of the river to be occupied by it was first dredged at a level of 16 ft. 4⅞ in. below the surface of the water, so as to enable the caisson to rest, when sunk, upon an even bed. Up-stream from this point guide piles were sunk, against which the caisson bears. These protect the caisson and also support a large platform. After the caisson was sunk and settled in position, the next piece of work taken in hand was placing the cast-iron plating on the tunnel. After this was finished concrete was introduced between the cast-iron lining and the outside jacket, until the caisson was thoroughly well supported upon the bed of the river. The shafts for access to the working chamber were then put in position, as well as the air chambers, which cap the whole. Sinking to the deeper level was then begun by means of compressed air. After the desired level was reached, the working chamber was asphalted. The tunnel, which had been filled with water to cushion the caisson and facilitate the sinking process, as soon as the caisson was in position, was emptied, the shafts for access to the working chamber removed, and the openings left in the plating carefully closed up. Telephone connection was made between the working chamber of the caisson and the buildings on the quay.

The two new tunnel stations to be built on the section where line No. 4 crosses the Seine will, in their interior arrangement, be quite different from the other stations of the Metropolitan lines. The actual envelope or jacket of the station will be formed by a section of asphalt injected around the lining. The metal lining is composed of iron plates $^{5}/_{16}$ in. thick, riveted to the outer transverse ribs, which, as in the tunnel caissons, are spaced 4 ft. apart. The arch will be fully centered and of 20 ft. 5 in. radius, the plane of the spandrels being 1 ft. 4 in. above the platform, which are only 10 ft. 5 in. wide, instead of 13 ft. 5½ in. wide, as in the other Metropolitan stations. On the inside—a feature common to all the Metropolitan stations—the metal lining will be covered with a thin layer of concrete, held in position by metal armoring, upon which there will be a lining of glazed tiles. Each station will be made up of three caissons, together 387 ft. long.

The center caisson is 223 ft. long, containing the station proper, and at each end there is an elliptic shaft connecting the station with the tunnel and containing the staircases and lifts which form the access to the station. The caissons for the stations will be mounted on

be ground. They will be 41 ft. high, 54 ft. wide and 190 ft. long.

For the accompanying illustrations of the construction and sinking of the first caisson for the Seine crossing we are indebted to Monsieur Bienvenue, Engineer in Chief of the Paris Subway.

The Division Engineer.

II

In carrying on the work you do, never delegate to any one that supervision which as Division Engineer, you are supposed to give. For example, the Roadmasters and Master Carpenters report to you, and you should not arrange that they report to your Assistant Engineer or to your Chief Clerk. You shirk your duty when this is done. You are not doing what you are paid to do. Again, you are having men report to an inferior in rank, as a Roadmaster or a Master Carpenter outranks an Assistant Engineer or a Chief Clerk. Finally, you are asking this younger engineer and this clerk to do work for which they are not paid. Have you a right to order a man continually to do work beyond his grade? Can you hold him then responsible for his mistakes? Nothing so takes the heart out of a Roadmaster as getting orders over the signature of his Division Engineer, which can mean one of two things, viz., that the Division Engineer never wrote the message, or that he has gone crazy. How do we feel when we get such a message or letter from the Chief Engineer's office? Surely, it will distress us less than our similar communication will worry a roadmaster. Then stop it before you well begin it. If your Chief Clerk needs to write letters about other things than accounts and bills, have him sign his initial after your name. If he sends a wire, have him sign only your initials or his own name to it, while you have it understood that messages you send will have more of your name than the initials. If an Assistant Engineer needs to wire or write, let him use his own name, and have an understanding with all about it. Or, when you are away, let him say, "In the absence of the Division Engineer you are directed," then sign the name of the Assistant Engineer. Remember, that a man on the spot has the best point of view, and that a good extra gang foreman on the spot ought to be as good, at least, as a Division Engineer 100 miles away. If you have the idea that your office as such can run your field work in your absence you have not the right view. "Railroads are burdened by bureaus and departments not properly balanced, which give a chief clerk in an office more authority than a higher-priced official on the spot."

The Division Engineer must not allow his own office force to annoy or to domineer over roadmasters and master carpenters. But this is not enough. From the Chief Engineer's office, from the Superintendent's office and elsewhere, he will receive foolish queries and aggravating letters. Never, under any circumstances, pass these things on to roadmasters and others. Take these troubles on your own shoulders. You can carry them better than they can. You should be the better drilled railroad man. It is mean to shift burdens to shoulders less broad than your own. Stand between your men and criticism, and they will stand between you and failure.

Never try to trick men under you. Be sure your Roadmaster will find you out. If the fact that trickery is wrong will not deter you, just bear in mind that you will get caught. "Honesty is the best policy, and I ought to know, for I have tried both," a fellow once said to me, who was just out of the penitentiary for horse stealing. I have never yet heard of a really successful Division Engineer on railroad work whose word was not as good as his bond among his men as elsewhere.

Regarding the relations of the Division Engineer with associated officials, the Superintendent, Master Mechanic, Division Freight Agent, etc. As railroads are generally organized he stands on what may be called the firing line. Here the work of maintenance touches that of transportation, motive power and traffic, and, sad to say, on some roads the clashing here is so great that a stranger would think it the warring of foreign powers instead of the working of parts of the same interest. It is expensive. Will it end? How often the end sought is not harmony, but destruction! One department tries to eat up another? Then dividends cease. The management changes; and the road, at its new birth, has then a saner existence. While human nature is as it is, harmony must be earnestly sought for. It will not come through gravitation. We have so many officials now who were telegraph operators or clerks yesterday that breadth of vision and trained tempers cannot be reasonably expected. These growing pains of American railroads must be lived through. Those of us with a little white in our beards sometimes wonder that roads ever earn a dividend at all. In spite of ourselves we waste ten times our salaries each year, and cannot help it, and carry out ill-advised work and practices. If we all worked for the company and quit working for promotion for its own sake, things would be better. Why do some of us want most to do that which we are least able to do? It is natural in youth and inexperience, but some never outgrow it. Why do some men always feel that the way to have certain work well done is to have that work placed in their hands and then they forget to look after it at all? There was once a Traffic Vice-President of a granger road who absolutely refused to express any opinion on track and always denied any knowledge of it. He minded his own (traffic) business. He now draws the highest salary of any railroad man in America. Other men can work with him.

The attitude of the Division Engineer to the Superintendent of that part of the line should be that of helpfulness, and a firm resolve to do all in his power to make the administration of that Superintendent a success. Whether or not the engineer reports to the Superintendent the principle holds the same. The division officials should do good team work. Star performance is costly and not in the interests of the stockholders. No effort should be spared to agree at once or else reach an understanding. If such cannot be had, then refer the difference in opinion or in understanding to the proper general officials, whose decision must be final. Never fight it out on the division. It will get into the lower ranks of the service and become a most deplorable conflict, causing endless friction and loss. If your Chief Engineer does not or cannot settle it, then he cannot carry his load, and the Division Engineer had better quit now while he is yet in no ill repute. Avoid quarrels.

But stress of circumstances or some mistake may place on a division a Superintendent whose hand is against every man. Then fight. The division is a hell. Though the sins of my life be many, I never expect to be punished hereafter as I have already been punished with such superintendents. But you need not be lonesome. The motive power and the traffic division officials are in equal distress. Never lose your temper. Do your work above criticism. Give that Superintendent plenty of "swing," and then, when he has clearly done you wrong and you can prove it, let him down hard. Show your knowledge of railroading. After a while he will learn to respect you, at least. After a while longer the company will remove him, and you will float up on a wave of reform. On an average, a Division Engineer has quite as long a railroad experience to draw from as a Superintendent, and should be more than a civil engineer—a railroad civil engineer. I once went to a division as its Division Engineer when I was a stranger there. I have told that Superintendent I never quarreled, but would fight in self-defense. We had no trouble, ever. He was a broad-gage man, and I went there in an emergency. Such a *modus vivendi* would not always do. I went to a division of another road where the Superintendent was at war with the head of the Engineering Department, and looked daggers at me as we met. In six months he was my firm friend, and remained so. At the same time I retained the good esteem of my superior—the head of the department. It was sailing pretty close to the wind. But never quarrel and never fear. I most dread a weak or inexperienced Superintendent. He does not know good work from poor work, and he meddles more. But if a Superintendent was writing this article he would no doubt express a corresponding fear about his division engineer.

RAILROADER.

How to be a Good Station Agent.*

I am very much gratified at being able to meet with you to-day, for personal as well as business reasons. I know from experience that we can do business together better if we are acquainted, and it is important that we should all understand the various instructions emanating from my office in the same way; then we will all be pulling together. Then again, I do not know it all. I have been benefited by meeting the agents on the various divisions, and have received suggestions that have resulted in improving the service. This is a strenuous age in railroading, as in every other line of business. Service that satisfied our patrons five years ago will not answer to-day. Then a shipper ordered a car, giving a reasonable length of time in which to furnish it; the shipment was made, and that ended the transaction. To-day a car of a certain dimension and capacity must be provided immediately it is ordered. A large percentage of shipments must be traced to destination. Nearly every large point on our line is reached by some other line, and it requires constant and persistent effort on our part to avoid loss of traffic through failure to provide the right kind of equipment just at the time it is required. . . . Conceit may puff a man up, but can never prop him up. A man should never be ashamed to own that he has been in the wrong. Our history contains the name of no man worth remembering who led a life of ease. Beware of a sudden rise in the world. The chap does not belong at the top of the ladder who didn't climb it honestly, round by round. Do the thing nearest to you, and do it well. No successful man lives without jostling and being jostled. He has to elbow his way through the world, giving and receiving offense. His life is a daily battle, but persistent, long continued and well directed effort will always win in the end. All things come to those who wait and hustle while they wait. Keep an even temper no matter what happens. This is a prime element of success. Never let the sun go down on duties undone. The best a man ever did

*Extracts from an address to agents by E. E. Betts, Car Service Agent of the Chicago & North-Western.

should not be his standard for the rest of his life. He should strive to do better.

Have a fixed purpose in life and work to that purpose. Don't quit your job because of some fancied grievance, and then be sorry for it the rest of your life. It is a serious matter for a man to change his occupation, particularly in middle life. Be sure you are thoroughly acquainted with yourself before you make a move. Clothes don't make the man, but they often go a long way towards securing a job, or, having a job, in securing promotion. "Cleanliness is next to Godliness." We cannot all be handsome, like your superintendent, but we can at least keep our clothes clean; our shoes shined; wear a clean collar; change shirts once a week and shave often enough so that we shall not resemble the Wild Man of Borneo. Recently a general freight agent wanted a traveling man and called in an agent who was promising material, but he was turned down solely on account of his personal appearance.

"Honesty is the best policy" always and ever. If something has gone wrong at your station, and you are taken to task, don't lie about it. Give the facts. If there are any extenuating circumstances state them. More men are dismissed for lying than because of the act lied about. If you are in the wrong, and you know it, don't argue the matter; acknowledge the fact; say you are sorry and that it won't occur again, and see that it don't. There is a time for all things. The time to tell your superintendent about the poor condition of your stock yards is before some business is lost, instead of after the other fellow got it and the matter has been reported to Chicago.

No booze fighter ever achieved lasting success. Whiskey will get the best of any man. It is an unequal struggle. "Cut it out." Keep things in order around the station. You will find you can accomplish about twice as much in a given time by having things in their right place, and there is nothing so annoying to a superintendent as to find the station office and other premises littered up and in an unbusiness-like condition.

An Early "American Special."

BY W. B. PALEY.

One of the earliest fast runs recorded in British railroad history took place in connection with what is now termed an "American special." On Jan. 15, 1840, the sailing packet ship "Siddons" anchored outside the Mersey about noon, having made the run across in the fine time of 17 days. She brought New York papers to December 28 and President Van Buren's message to Congress. This was awaited with considerable interest, a good deal of friction having arisen between the two governments over the Canadian insurrection, then very recently suppressed. It was impossible to get the papers and despatches to Liverpool in time to catch the 12.15 p.m. train on the Grand Junction Railway, which, though it seems almost incredible, was the latest train by which London could be reached the same day. About an hour after it had gone, however, Messrs. Willmer and Smith, news agents, obtained a light engine and overtook it at Stafford. The directors had a meeting that day and were not a little surprised at another request for a special, coming from a rival agent who had got wind of the other firm's enterprising effort. It was difficult to refuse it in common fairness, as he had not been officially informed of his rival's energy. Captain Cleather, the manager of the line, personally took the agent up through the tunnel from Lime street station (then worked by a stationary engine and ropes) to Edge Hill, telling him that it was doubtful if an engine would be found ready to go. By good luck one that could be spared had steam up and at 2.20 p.m. the messenger started on his journey of 96 miles. Not even a single coach was provided, the man in charge of the papers, and a boy who accompanied him, having to find room where they could on a four-wheeled tender so small that it only carried about 700 gallons of water and half a ton of coke. It was a bitterly cold day, not the smallest screen or weather-board of any kind was fitted to the engine, yet the messenger, with extraordinary pluck, said he should like to try the 60 miles an hour of the Great Western!

The original intention had been to catch the 6 p.m. train out of Birmingham, but as the little engine rushed along it became obviously possible to get there in time for the 5 o'clock. This train not only got to Euston half an hour before the 6, but was the one which the other agent had overtaken at Stafford. If it was caught therefore neither would have an advantage over the other as to the possibility of landing his "copy" in London in time for next morning's papers. Precisely at three minutes past five the engine slowed into the station at Curzon street, Birmingham, and to the great relief of the agent the 5 o'clock train had not left. The rivals proceeded to Euston by it, the first man in blissful ignorance of the second's arrival, and next morning the President's long-winded message occupied the whole of a large six column page of *The Times*.

The route of the special would be over the Liverpool & Manchester Railway for about 11 miles from Lime street, turning off then by a curve down to the Grand Junction Railway at Newton Junction, then by Crewe, Stafford & Wolverhampton to a terminus, now a goods station, on the east side of Birmingham. From the time given, namely, 2 hours and 43 minutes, it is expressly stated that 23 minutes have to be deducted for stops for water and an obstruction outside Birmingham. This leaves 140 minutes for 96 miles, equal to 41.14 miles per hour. So many as six stops are said to have been made in all, and the average running speed was probably not far short of 60 miles an hour. The Grand Junction passenger engines were six-wheelers, with single drivers, in some cases only 5 ft., in others 5 ft. 6 in. in diameter, with carrying wheels 3 ft. 6 in. They had inside cylinders, variously 12½ and 13 x 18, massive outside frames of wood and iron bolted together, and carried a dome near the funnel. The line was one of the three allies which in 1846 united to form the London & North-Western, which has perpetuated the names of many of the original Grand Junction engines in its own locomotive stock.

How a Station Agent Should Handle Freight Cars.*

We have cars of different capacities—some 40,000, some 50,000, some 60,000, and some 80,000 lbs. capacity. It costs money to haul an empty car, and it costs more to haul an 80,000 capacity empty than it does a 40,000 capacity empty, because it weighs more. Therefore, it is obvious that we do not want to furnish a 40-ton car to move 20 tons of freight if it can be avoided. A car order should state the capacity of the car wanted, in order that the despatcher may, if it is practicable and economical to do so, furnish you with a proper sized car—but remember this, the first consideration is to secure the business. Never permit a car of freight to get away from you on account of waiting for a car of the proper capacity. We would prefer that you use any kind of a car rather than absolutely lose a shipment of freight.

The loading of cars to their maximum capacity has a marked bearing on economical transportation. Our average revenue tonnage per car is about 12 tons. This is too low. It has not been increased for three years, notwithstanding that during that time we have largely added to our heavy capacity equipment and destroyed a large amount of small equipment. We ought to increase this at least 10 per cent. Such an increase would reduce our empty mileage to just that extent and add to our revenue train tonnage. The rate on grain from Missouri Valley to Chicago, locally is 14 cents. An 80,000 capacity car loaded to 10 per cent. above capacity, which is our standard maximum loading, at this rate would earn $123.20. The same car loaded with 60,000 lbs. would earn $84.20. By failure to secure full utility we, therefore, lose $39 of the earning capacity of this car, or approximately 32 per cent.

Again, an 80,000 capacity car weighs approximately 17 tons. Loading it to 10 per cent. above capacity, for every ton of dead weight of car hauled, we earn $7.25 revenue on the load. Assuming that we use an 80,000 capacity car to handle a load of 60,000 lbs., we receive for the load $84. For the 17 tons deadweight of this same 80,000 capacity car we earn from the load therein $4.94 per ton. It is, therefore, apparent that we lose $2.31 per ton on this car from Missouri Valley to Chicago. Experience teaches us the approximate cost per mile for handling empty cars is 2 cents. This indicates that it would be economy to have moved a 60,000 capacity car empty 1,960 miles to care for this load, provided we utilized the 80,000 capacity car to the full percentage of utility at the same or some nearby point.

We secure on grain between 85 per cent. and 90 per cent. of the capacity of the car, while our standard load is 110 per cent. From this you will observe that we lose between 20 per cent. and 25 per cent. of the utility of each car, or for every four car loads of actual freight to be handled we are using five cars to handle the commodity. This is equivalent to hauling one car empty from Missouri Valley to Chicago, because all of the commodities handled in the five cars could have been handled in four.

Further, we frequently move cars empty from Chicago to Missouri Valley. The conclusion, therefore, is that we have hauled one car from Chicago to Missouri Valley and return empty without revenue earnings. The distance from Chicago to Missouri Valley is 467 miles, or 934 miles for the round trip. It costs us 2 cents per mile to handle an empty car. We have, therefore, expended $19.68 of the company's money with no return. Why? Because the local representative on the ground either failed to secure the proper car for the shipment to be moved or failed to insist on the shipper loading the car to its full capacity, because it would be a little extra expense to the shipper to get into the car and shovel the grain back to enable him to get a sufficient amount in the car to bring it up to our rating.

When a heavy traffic is moving and equipment is at a premium, the most important thing on this railroad is the prompt unloading of cars and their movement to points where wanted. The mileage of our cars has steadily decreased during the past three years. We want to correct this and start the ball rolling in the other

*Extracts from an address to a class by E. E. Russell, Car Service Agent of the Chicago & North Western.

direction. There is no such thing as a surplus of equipment now on this system at any time of the year. Foreign cars arriving at your station should be given preference in the matter of unloading, securing disposition before the car is ready to move, and seeing that it is moved after it is ready. No foreign car should be delayed at any station a minute through failure to have disposition in your possession.

If a foreign car is loaded it should be so loaded as will take it off the line, if possible, or loaded in direction of the junction point. In operating under per diem and penalty we cannot ignore the proper home routing of cars, or at least in loading them to some point that will take them off our rails and avoid the penalty charge. If, for instance, you had an empty Erie car at your station and had a load for New York City, routed via the Lake Shore, it is no crime to load the Erie car because we are loading it into home territory and other lines are using our equipment in a similar manner. Of course, it is desirable to load a car via the home line, if possible, but some latitude is allowed in matters of this kind.

Form 55—a home route card—was gotten up to provide agents and everybody having to do with the handling of foreign cars, necessary information to insure that cars are economically handled. One of the essential features of this form is the date the car is received from a connection, as 30 days from that date, if the car still remains on our line, this company is obliged to pay one dollar a day for its use. We have had considerable trouble on account of agents at junction points failing to give all of the information required on this blank, particularly the date of receipt and the date the car will become "penalty." Many agents simply fill in the car numbers and initials. This defeats the purpose of the form—it is of no use whatever. If a foreign car arrives at your station with a Form 55-A improperly filled out it is up to you to secure the necessary information through your chief train despatcher and then properly make out a card. Because somebody at the other end fails to do his duty is no reason why you should allow the car to leave your station without a full and correct home route card.

If you have a foreign car billed and not moved, report it to the train despatcher at once. If you are holding foreign cars for prospective business report them on the 46 report. Keep the despatcher advised of your wants in this line. It may be more economical to hold a car if you can use it in three or four days. At the same time, that is a matter for the despatcher to decide. He has in mind the needs of the entire division.

Do not load any foreign cars to non-per diem roads. If you haven't a list of these non-per diem roads it can be obtained through my office. If at a junction point you have any foreign cars for delivery to a foreign road see that delivery is effected before midnight. That will cut off 20 cents on every car. There is a difference of 20 cents between the delivery of a car to a connection at 11.59 p.m. and 12.01 a.m.

Don't educate shippers to think because we have a few new series 40-ft. furniture cars that they can be furnished on every order that is placed for this class of equipment. These cars were built for a special purpose. We have orders for more of them than we can furnish. If we are short of cars, don't advertise it to shippers and cuss the despatcher. Put the best side out; put on a little more steam yourself and get a faster move on unloading your cars. Keep in touch with shippers; get information as to the future business, and keep us advised. Don't hold cars around your station, thinking perhaps you are going to require them in a day or two, when the man at the next station may be turning away freight for want of cars. This matter must be looked at from a whole road standpoint.

Foreign Railroad Notes.

The hours for a day's work in the shops of the Prussian State Railroads have been reduced to nine.

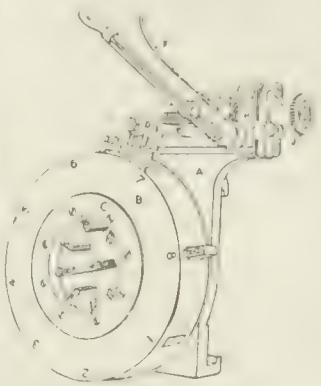
The Austrian State Railroads have agreed to give a limited number of free passes yearly to retired and pensioned employees and to certain members of their families.

The Italian Ministry under which the operation of the railroads by the State began has been dissolved, after a life of only nine months. The management of the railroads was not in question. The new Minister of Public Works is Signore Tedesco, who has held the place before, and is said to be *persona non grata* to the railroad companies, with whom important questions are still pending.

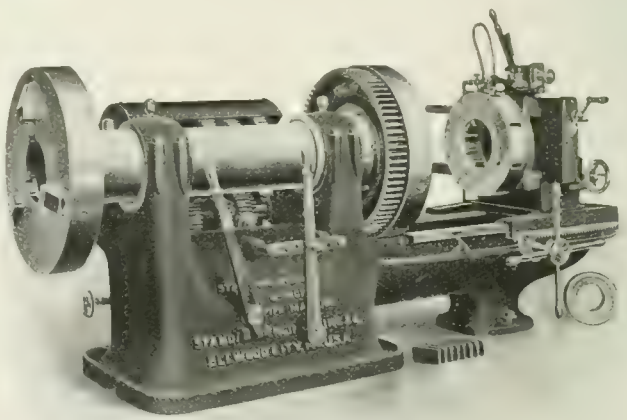
The new President of the Swiss Confederation, Dr. Ludwig Forrer, is a railroad man; at least, he has for two years been Manager of the International Railroad Freight Law Bureau, and at the same time Honorary Professor of Railroad Transportation Law in the Berne University. For 26 years he has been a member of the Swiss National Council. He is best known as the author of a proposed law concerning insurance against illness and accidents, which has been much praised by adherents of State Socialism in and out of Switzerland, but which has been defeated in Switzerland by the opposition of the country people.

The Standard Wieland Pipe Threading and Cutting Machine.

The accompanying illustration shows a 6-in. standard Wieland pipe threading and cutting machine made by the Standard Engineering Co., Ellwood City, Pa. The bed of this machine as shown, including the journal-boxes, is cast in one piece. It is provided with a trough for catching the oil which is delivered to the die head and cutting-off tool by means of a rotary pump. The die operating mechanism is independent of the adjusting screw, as is shown in the line drawing. The adjusting screw H passes through the fulcrum nut or block G, which is provided with a clamp gib to lock the adjustment. Moving the fulcrum block G to the left by turning the hand-wheel J contracts the chasers radially, and by moving the block to the right the chasers are expanded. The lever F has an arc-shaped fin which rides on its rest and automatically centers the lever and connecting link E in a straight line at all points of adjustment. The finished threads are prevented from being gouged or damaged inasmuch as the chasers are withdrawn from the pipe the moment the lever is raised. The cam ring B has an opening opposite each chaser which allows the passage way to be cleaned without removing the ring. The lower chasers marked 1, 2, 3 and 4 have a groove and are put into place from the inside of the die head in the order named. The upper chasers, 5, 6, 7 and 8, have projecting pins and are inserted from the outside through holes in the periphery of the cam ring. They are firmly held in position so that they will not drop out. The chasers are unusually deep, and will cut a full thread at one cut. Those for 6-in. pipe will, when new, cut a perfect thread or screw 2⅛ in. long. This enables the cutting of a full taper thread for heavy fittings tapped deeper than standard, and it also allows the entrance of the chasers to be ground when necessary and still leave enough depth for a standard thread. Chips are prevented from passing into the cam ring by means of the face ring C, which is secured to the die-head by screws. The die-head A is arranged on a slide so that it can be slid aside before cutting off the pipe or removing it from the machine, thereby preventing the ruining of the bottom chasers by dragging the pipe across them. The cutting-off slide has a tool post so that the burr may be bored out of the pipe by placing the cutting-off tool at an angle.



Details of Die Operating Mechanisms.



The Standard Wieland Six-Inch Pipe Threading and Cutting Machine.

The steady slides are universal and have removable steel V-jaws. The chuck jaws are independent and are provided with renewable steel teeth. The jaws of both the front and the rear chuck project beyond the face of the chuck shells; this makes it possible to grip short nipples in the front chuck and to screw flanges to pipe by power by holding them in the rear chuck jaws. Six spindle speeds are attainable by shifting gears driven by a single speed pulley. The change-gears are shifted by means of levers placed at the operator's side. The countershaft has two friction clutch pulleys, 16 in. in diameter, for 5-in. double belts, and should be driven at 200 r.p.m. The floor space required for this machine is about 4 ft. by 10 ft., and its net weight is about 5,500 lbs. These machines are made in several sizes, and are used in a number of railroad shops, including the Pennsylvania, the New York Central & Hudson River, and the Erie. When desired they can be fitted for motor drive.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Two-Cent Fares on the New Haven..... 169
- Another Rail Motor Car 169
- A New Point in Interstate Commerce Act 170
- Collecting Tickets and Cash Fares..... 170
- January Accidents 171
- Russia's Undeveloped Resources..... 172
- German Rates on Passengers and on Pig Iron. 172
- Trade Catalogues 172

ILLUSTRATED:
- New Bismarck Bridge of Northern Pacific 174
- Horseback Inspection of the Philippine Railroad Projects 178
- The Detroit River Tunnel. 184
- Private Cars and the Fruit Industry.... 186
- The Strang Gasolene-Electric Rail Motor Car. 188
- The Whitney Self-Adjusting Chill. 190

CONTRIBUTIONS:
- Weak Cars in Passenger Trains. 172

MISCELLANEOUS:
- Functions of a Good Draft Gear..... 173
- Large Electric and Steam Locomotives... 175
- Senator Lodge on Rate Regulation.... 180
- The Panama Canal 182
- Government Railroad Monopoly in Italy. 185
- Injuries to Employees. 187
- Technical Considerations in Electric Railway Engineering 189
- High Speed Experiments in Prussia.... 191
- Train Accidents in the U. S. in January 191
- Foreign Railroad Notes: Workmen's Free Trips in Bavaria... / Forest Fires from Railroad Sparks.. / Enforced Temperance in Prussia..... 192

GENERAL NEWS SECTION:
- Notes 57
- Meetings and Announcements..... 59
- Elections and Appointments..... 59
- Locomotive Building 59
- Car Building 59
- Bridge Building 60
- Railroad Construction 60
- Railroad Corporation News..... 62

VOL. XL., No. 8. FRIDAY, FEBRUARY 23, 1906.

In support of the proposition in Ohio and other states to reduce by law passenger rates to 2 cents—or less—per mile, the "voluntary" decision of the New York, New Haven & Hartford fixing the two-cent rate has over and over again been cited. The facts, historical and present, may therefore fitly be stated with their proper qualifications. In the year 1886 the New Haven directorate, when President Watrous was head of the corporation, voted to reduce the regular fare to 2 cents a mile on the main line between New York and Springfield, Mass., and to 2½ cents a mile on the Shore Line and Air Line divisions, then under lease. Last Saturday the directors of the company voted to reduce the regular rate of 2½ cents a mile on the Berkshire division to 2 cents a mile and to consider later a similar reduction on the Naugatuck and Northampton divisions. There has thus been an interval of almost twenty years during which the *regular* rate, as we understand it, has remained satisfactorily unchanged, notwithstanding the immense growth of the system and of the volume of passenger traffic and the definition of the New Haven's "trunk" line under the Connecticut statute as including 114 miles of double track between New Haven and Providence in addition to the old "main" line between New York and Springfield. In fact, the company now charges on its through system for the 232 miles between New York and Boston $5, or 2.15 cents a mile; and it will be noticed that last Saturday's action of the directors does not affect its Eastern business. We do not, of course, overlook the fact that during the twenty-year period referred to the company has fixed a general 2-cent rate by mileage books—1,000 miles on the whole system and 500 miles in Connecticut—but this has not been the "regular" rate, nor is it now. We have not the slightest doubt that the New Haven has found the reductions both wise and profitable, and that continued reductions will be in the end remunerative. But the facts remain writ large that reductions of the regular rate have tarried long, that they have not been general and are not so now, and that they have been, in the main, differentiated according to density of passenger traffic on the various parts of a railroad system which is far and away ahead of all others of the country in the size of its average passenger trainload. It is a very different case from the sweeping and indiscriminate imposition of the 2-cent rate as a maximum on railroad lines of all kinds in a large state with, relatively speaking, very low passenger density. Instead of being arguments for such a proposition, the whole history and policy of the New Haven Company strike in a line diametrically opposite.

ANOTHER RAIL MOTOR CAR

Another design of gasolene-electric rail motor car is described in another column, and it is quite similar to the car designed by the General Electric Company for the Delaware & Hudson, illustrated in the *Railroad Gazette*, February 9. These two cars, of the same general type, represent one effort in the direction of producing a satisfactory rail auto-car; the Union Pacific gasolene motor car represents another, and the steam motor cars, now in extensive use in England, but as yet untried in this country, represent still a third method. The gasolene motor cars on the North Eastern Railway and all those built in this country are still some little way removed from unqualified success. They are interesting experiments but as yet of little practical value for actual service. The gasolene engine has made wonderful progress within the last few years, due largely to the development of the automobile, and it is not surprising that the results obtained with road vehicles of moderate power have attracted and held the attention and efforts of many of those who have been trying to work out the more difficult problem of railroad motor cars. If the gasolene cars have one common fault, it is that they are underpowered. It is a difficult matter to build an engine of sufficient power to drive a car continuously at a speed of 30 or 40 miles an hour over a road of average grades and to keep the size and weight down to reasonable limits. Automobiles of 200 h. p. are talked about, but they are myths. Increasing the size and multiplying the number of cylinders will not increase the power of the engine in direct proportion unless the adjustment of the valves and ignition is perfect. And it must be remembered that the power of the prime mover does not by any means represent the power delivered at the wheels. The engine in the Delaware & Hudson car runs at 450 r. p. m., and has six 9 in. x 10 in. cylinders. It is said to be the most powerful unit of its kind built, but it develops only 160 brake horse-power, which means about 130 horse-power delivered at the wheels when every part of the apparatus is in perfect working order. On fairly level track and in

the absence of strong head winds the car maintained an average speed of 35 miles an hour and a maximum speed of 40 miles an hour. A gas engine cannot be forced beyond its full capacity as can a steam boiler, and as it has no reserve power, the slightest unfavorable circumstance means a considerable falling off in the speed. The gasolene-electric combination gives smooth and easy control, and in connection with storage batteries some reserve power for accelerating or climbing grades, but at the expense of added weight and first cost of the apparatus. The Union Pacific cars have not yet had a fair trial to test the wearing qualities of the direct transmission gear employed. If it proves entirely successful, the introduction of a generator and motors on the axles to transmit the power from the engine to the wheels would seem to be a useless complication which has few advantages to offset its additional weight and cost. It seems strange, in view of the interest which is manifested in rail motor cars in this country, that no road has as yet made serious experiments with steam cars using a flash boiler. The prevalent—almost universal type of car with which experiments have been made in England during the last two years does not differ in any material particular from a little locomotive with an upright boiler, and a car built around it. It is safe to say that these cars are not a success, and the Great Western (England), which was foremost in its experiments, has now discontinued building them. The reasons for this are plain: the upright-boiler locomotive has no advantage over any other small locomotive, except, perhaps, in minute fuel economy; there is no economy in train crew, and a locomotive temporarily out of commission means a car out of commission also, as Mr. Forney used to point out in these columns. The North-Eastern is now experimenting with light locomotives coupled to a single car with a device which permits driving from either end. This saves new first cost and gives separate units, but introduces no special working economies.

Meantime, the automobile makers are contributing every day to the practical designing of gas engines and flash-boiler steam engines. It seems reasonable to suppose that it will be only a question of time—and no very long time at that—before they can produce a car capable of picking up its load at the start.

A NEW POINT IN THE INTERSTATE COMMERCE ACT.*

The Supreme Court of the United States on February 19, with an undivided bench, handed down a decision which looks as if it might be important and far reaching in its interpretation of the Interstate Commerce Law. The case arose in a suit instituted in the United States Circuit Court of the District of West Virginia by the Interstate Commerce Commission to enjoin the carrying out of a contract under which the Chesapeake & Ohio Railway Company agreed to deliver at New Haven 60,000 tons of New River coal for the New York, New Haven & Hartford at $2.75 per ton. The price of coal at the mines, plus the cost of transportation from Newport News to New Haven, was $2.47 per ton, while the published rate from the mine to Newport News was $1.45 per ton, and the bill was based on the claim that this was in effect a discrimination in that the company carried the coal for less than the usual rates. The company denied this and alleged that it was a loss it sustained on the price of the coal, and that it took these means to reimburse the New Haven road for something over $100,000 which the New Haven had lost through the inability of the Cheasapeake & Ohio to fill a previous contract, owing to a strike of miners.

The Circuit Court held that there was no violation of the rebate provision of the Interstate Commerce Act, but held that the contract between the two roads was illegal and enjoined its enforcement. Both railroads and the Commission appealed. In the course of a long decision Justice White says: "We find it impossible to conclude from the proof that the Chesapeake & Ohio could have made a contract for so large an amount of coal to be delivered over so long a period without taking into view the existing prices, and the cost necessarily to be occasioned by the delivery of the coal if the full published freight rates were to be realized. Indeed, the proof leaves no doubt upon our minds that in making the contract the Chesapeake & Ohio sought to accomplish results which it deemed beneficial by means which it considered effectual, even although resort to such means was prohibited by the Interstate Commerce Act. * * * We think it is shown that the mode of delivery adopted was simply the result of a disregard by the Chesapeake & Ohio of the economic conceptions upon which the Interstate Commerce Law rests, and a substitution in their stead of the conceptions of the Chesapeake & Ohio as to what was best for itself and for the public. Further, as the prohibition of the Interstate Commerce Act is ever operative, even if the facts established that at the particular time the contract was made, considering the then cost of coal and other proper items, the net published tariff of rates would have been realized by the Chesapeake & Ohio from the contract, which is not the case, it is apparent that the deliveries under contract came under the prohibition of the statute whenever for any cause, such as the increased cost of the coal at the mines, an increase in the cost of the ocean carriage, etc., the gross sum realized was not sufficient to net the Chesapeake & Ohio its published tariff of rates. * * * As the court below did not decide that the second and sixth sections of the Act relating to the maintenance of rates had been violated, the injunction by it issued was not made as directly responsive to the comments of the statute on that subject as we think it should have been. We therefore conclude that the injunction below should be modified and enlarged by perpetually enjoining the Chesapeake & Ohio from taking less than the rates fixed in its published tariff of freight rates by means of dealing in the purchase and sale of coal, and as thus modified the decree below is affirmed."

In the earlier part of the decision the court expands the principle expressed in the last paragraph, and it brings out very clearly the point that if, by the mere fact of purchasing and selling merchandise to be transported a carrier is endowed with the power of disregarding the published rate, the carrier then possesses the right to treat the owners of like commodities by entirely different rules, selecting the favored persons from whom it would buy and the favored persons to whom it would sell, thus giving such persons an advantage over every other and leading to a monopolization in the hands of such persons of all the productions in which the carrier chose to deal.

To the non-legal mind this seems a perfectly sound exposition of the principles laid down in the Interstate Commerce Act, and it has for a long time been pretty certain that some of the suits pending would develop this situation, or something like it, although the actual breadth and scope of the decision which the court handed down is said to have surprised even the attorneys who argued the case. It remains to determine what the effect of the decision will be on coal railroads which haul their own coal and upon private car lines, if these are declared common carriers by congressional act, as it now seems quite likely that they will be. A number of critics have said that this decision will prevent coal roads from owning coal mines and beef packers from owning refrigerator cars. We do not believe that this is so. If it is, it is not so by virtue of the present decision, for the matter at issue deals only with the entire rate for product plus transportation. If this rate is such that any one can buy the product at the market price and deliver it to a customer, after paying the rail rate, as cheaply as the railroads or car lines themselves can do so, then the principle laid down by the court is apparently not violated. This is as it should be.

But right here comes in a very interesting and perplexing question, which shows what the law has to contend with when it concerns itself with the very broad principles of the Interstate Commerce Act in extension. Suppose a coal company, which has no apparent connection with a railroad, makes a wholesale rate very much lower than its retail rate provided a sufficiently large quantity of its commodity is bought at one time. We believe that this would not conflict with any existing statute. Suppose, then, that only one customer is so situated that it can take advantage of that rate, that customer being a railroad. What is to prevent the coal company from making a "midnight tariff" for the railroad whenever it seems expedient—and, if it does so, how will the result be any different from the present situation? We do not know whether it would be or not. We merely suggest this as one of the interesting possibilities which this novel and very far reaching case appears to bring up.

*The decision of the United States Circuit Court on this case (which is now affirmed) was reported in the *Railroad Gazette*, of Feb. 5, 1904, page 102.

COLLECTING TICKETS AND CASH FARES.

It was announced in Houston, Tex., the other day that one of the railroads entering that city which for a year or so had had on its passenger trains collectors, who had been put on to relieve the conductors and leave them free to attend to the safe and prompt movement of their trains, had taken them off; and, at the same time, it was announced that one of the other railroads had just decided to put a large number of collectors on. This epitomizes a

considerable number of news items that have appeared in the newspapers during the past dozen years; collectors are put on and taken off, and put on again, and no one seems to have a settled opinion whether it is or is not profitable to employ them. What is the reason for this? Do we not yet understand the essential conditions of the business of collecting tickets and fares?

Let us admit at the outset that there is no great weight in the argument that we ought to partly relieve the conductors to prevent collisions. Collectors are put on to stop or reduce stealing. A level headed conductor has no trouble in attending to safety first and cash and tickets second. Relieving him of work is more likely to entail the same difficulty as putting a third man on the engine, the difficulty of holding him to the infrequent duties that still rest on him. Conductors who by neglect cause collisions seldom convince anybody that overwork in other things was the real cause of the trouble; and the true remedy for collisions does not lie in this direction at all; it is to be found in connection with the signaling and the lookout on the engine.

We must also admit that on heavy trains doing local business the best conductor or collector in the world will miss some fares. As long as there are dishonest passengers this will be a penalty of our slipshod way of admitting people to the trains without collecting their tickets when they enter. Again, we must recognize that we cannot make all conductors or collectors honest; and if a superintendent were to begin with a force of honest conductors he would have a duty not to unnecessarily tempt them to become dishonest.

So much concerning what we should not or cannot do. What we should do is reasonably simple, if we take time enough and spend money enough. Many a superintendent west of the Mississippi has said that he could not do as well in this matter as his eastern friends, because of the smaller number of men from which to select efficient and reliable conductors. While this point cannot be ignored, it is proper to suggest that bank cashiers seem to be as reliable in Idaho and Arizona as in Ohio or Maine. But whether one does or does not have the time and money necessary to accomplish ideal conditions there are a few simple principles that would seem to be generally applicable whether dealing with a railroad in the wilderness or one in New York or Chicago.

For practical purposes the prevention of stealing and the prevention of mistakes may be treated as one and the same thing. The bank examiners deal with an honest cashier the same as with one suspected of dishonesty. If a railroad superintendent is not ready to expend the necessary care and money to deal strictly with all his conductors he need not feel disappointed if he has friction in trying to discipline a part of them. To prevent mistakes, in a business where some mistakes are inevitable, it is necessary to enforce as many habitual safeguards as possible; habitual as against occasional. Tickets as well as cash should be closely watched. Tickets turned in to the accounting office by conductors should be examined without delay. Tickets which can be profitably handled by scalpers or traded in by passengers should be limited to as few days as practicable; so that when 100 tickets of a certain form have been sold on a given day it will be possible to find out quickly whether or not all of them have been promptly used and turned in. To so arrange tickets that the passenger will have the least possible temptation to misuse them and the conductor the least possible temptation to do anything but promptly turn them in helps to promote honest habits; and habits help to govern action. Habits of accuracy tend to promote habits of honesty. One of the disadvantages of the coupon mileage ticket is that it is easy to make mistakes with it. Accidental mistakes often lead to voluntary "mistakes."

In collecting cash fares the duplex receipt and the 10 cent rebate are generally regarded as essential. Beyond this there is no check except such as may be effected by requiring the practice of habits of accuracy to the utmost possible extent. All those exceptional situations in which it is necessary to allow conductors to collect the net fare, or omit the receipt, should be the subject of constant watchfulness and care.

In surprise checking the main thing is to get reliable checkers, which is by no means easy. One trustworthy "spotter" is better than a dozen who think that their main duty is to discover something wrong. Surprise checking is necessary, if it does not discover more than one thief in ten years, for prevention, not cure, is the desideratum. It must be admitted that—so loose is our system—all of the precautions mentioned in the foregoing paragraphs are insufficient without surprise checking.

While thus constantly watching for thievery, we must try to secure men whose self-respect and desire to be reputable citizens will keep them above stealing. It is important so to explain the ethics of surprise checking that these men will understand that it casts no aspersion upon them. The only systematic way to detect misconduct in any conductor is to watch the conduct, good and bad, of all conductors.

To train a man in habits of accuracy—which, as we have said, is an important element in training for honesty—it is necessary to begin when he is young; long before he is fit to entrust with a passenger train. A clerkship in a station or the general offices is a much more favorable place for thus training a young man than is a freight train. Native honesty may be as strong, or even stronger, in the brakemen; but the training which confirms the mental and moral traits must be found in fiduciary practice. It may as well be admitted, also, that politeness, another important element in a passenger man's training, can be cultivated on a freight train only under decided disadvantages. These considerations afford a strong argument in favor of having special collectors to take tickets and fares. If we desire to have the freight man for a passenger conductor because of his experience, we must, as a rule, put up with a man somewhat less qualified to deal with passengers than would be a man from an office. In view of the very small number of brakemen that we see on many passenger trains nowadays, we are not going to argue against the employment of collectors; there is too much evidence of the need of more men on trains, for the purpose of attending to the wants of passengers; we will content ourselves with the observation that whatever number of men is employed, and of whatever grade, every one of them should be made useful in promoting the comfort of passengers. One prominent eastern road has given up the attempt to make polished gentlemen out of freight conductors, and recruits its passenger train forces—beginning with passenger brakemen—from other classes. The difference between freight cabooses and "varnished cars" is frankly recognized. The policy is made acceptable to the freight conductors by arranging their work so that they earn about as much pay as do the passenger men. Assuming, as we must assume, that the men who are put in charge of passenger trains are properly trained for all of their duties, this policy disposes of one of the obstacles to securing satisfactory men to collect fares and tickets. If we eliminate the long period of freight-train service there should be time to train men in accuracy, honesty and train-management before they are too old to be put in charge of passenger trains. When the block system is in use everywhere the training of an office man to take charge of a train will be a less tedious task than it is at present.

If the views which we have here expressed are correct, we may fairly sum up by saying that the man to collect fares should have the two essential qualifications of honesty and politeness: and that as a means of securing these the superintendent should take an interest in a third qualification, civic pride—if we may use so ambitious a term. It is necessary to seek men who not only have some moral character but who intend to cultivate the moral virtues. If men with these qualities cannot be trained up in the freight train service we must train them in some other way. If we must have two men on a train where we should prefer to get along with one, we can use the two to give passengers more efficient and pleasing personal attention. However high the character of the men, constant discipline in accuracy is proper and necessary. Discipline in accuracy is as near as we can get to discipline in honesty

January Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of January, printed in another column, contains accounts of 29 collisions, 23 derailments and one other accident. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	Place	Killed	Injured
3d	Chicago, Ill.	0	10
5th	Palisade, Nev.	1	11
6th	Corry, Pa.	3	8
11th	St. Louis	0	9
13th	Lawrenceburg, Ky.	1	4
23d	Glendora, Cal.	0	15
24th	Ore Hill, Conn.	2	0
29th	Edelstein, Ill.	1	0
30th	Columbia, S. C.	1	3

Two of these accidents, Glendora and Edelstein, are reported as having been due to failures in block working. The derailment at St. Louis affords an interesting instance for comparison with the disastrous derailment on the Elevated road in New York City a few

months ago. The cases are alike, in that in both of them a passenger car fell, about 15 ft. from the track to the pavement of the street; but they are unlike in that in the St. Louis case no person was killed. This favorable outcome may be partly due to the negative fact that only a few people were in the car; but it is pleasanter to dwell on the positive fact that the great strength of the car framing was undoubtedly an essential element in the saving of these 13 passengers' lives.

The first item, Chicago, emphasizes the fact that the occurrence of injuries to passengers does not always imply something wrong in our provision for the safety of passengers; for these 10 men (drovers, no doubt) were in a freight caboose. The Interstate Commerce Commission has lately introduced in its accident bulletins a change that will produce instructive results on this point: men riding on a train to take charge of freight, together with mail clerks, express messengers and other classes who are lawfully on a train but are neither employees nor regular passengers, are put in a separate class, distinct from regular passengers in passenger trains. If regular passengers riding in freight cabooses were also segregated in the Government reports we should see a still further diminution of the totals in the first column of the casualty tables. A railroad is bound, of course, to see to the safety of all persons lawfully riding on its trains, including employees; and the separating of persons into different classes in the tabulations is not advocated by any one with the idea of showing more or less blame or responsibility in any given case. But with casualty reports as ordinarily made, in which the reader is likely to assume that all of the "passengers" were riding in passenger cars on regular passenger trains, most people are likely to jump at the conclusion that the deaths and injuries—whether the number be small or great—have occurred in spite of the exercise of the highest care of which the railroad is capable. Such a conclusion is in some degree erroneous; for, irrespective of the care taken by the trainmen or the intelligence of the provisions for safety made by the company, the dangers of travel are inevitably somewhat greater on freight trains than on passenger.

The second accident, Palisades, illustrates another phase of passenger travel which has lately become prominent—the fact that a large number of persons may suffer in a passenger train collision or a derailment, while yet no passenger is injured.

The number of electric car accidents reported in the newspapers of the United States in the month of January was nine, in which four persons were killed and 56 injured.

After sinking some 300 million dollars in the Siberian Railroad, Russia, if recent reports are true, is likely to gain more wealth than from all Siberia from its extreme northeastern European government, now unavailable for the lack of three or four hundred miles of railroad. There, in the valley of the Pechora, and especially on its little tributary the Uchta, north of the 63d parallel, about 300 miles south of the Arctic, as far northeast of the navigable Dwina river, and 400 miles east by south from Archangel, in an uninhabited wilderness, have been found (so Russian newspapers say) stores of petroleum which promise to exceed in quantity the fields on the Caspian, while much superior in quality. The Caspian petroleum, by the way, is heavy, and yields per barrel only about half as much illuminating oil as the American crude oil. But this is not all: the same country is full of copper mines, from which millions of tons of ore may be extracted. We are not accustomed in this country to find petroleum and copper in juxtaposition; but this is in Russia, and on the edge of the Arctic zone. Unfortunately it is impossible to draw on these treasures at present; for they are almost inaccessible, and there is no one in the country to do the work. A pipe line to the Dwina would give outlet for the oil to the port of Archangel, which has a considerable and increasing trade, chiefly with England; but it would not bring men and supplies in. About 400 miles of railroad will be necessary for this, connecting with a new line from St. Petersburg eastward. This the state is asked to build. It pretends that it has something else to do just at present. A company with a capital of less than $3,000,000 has been organized to develop these treasures, but at latest news had not had all its stock subscribed. This story may seem like a romance manufactured to bear Standard Oil and Amalgamated Copper stock; but it is probable that it is founded, at least in part, on fact. Baku petroleum specialists are reported to have examined the country and to be enthusiastic over the prospects.

The German iron-masters do not favor any general cheapening of passenger fares, arguing that these are already so low that they hardly exceed the bare cost, and that a reduction in freight rates, which would permit a greater growth of manufacturing industries, would be of much more value to the laboring population than any reduction in the cost of travel. One man has been to the trouble to separate passenger and freight expenses, as nearly as possible, on the basis adopted in this country; and has found that passenger expenses absorb 92 per cent. of the passenger earnings of the Prussian State Railroads, while 49 per cent. of the freight earnings are net. At a meeting of representatives of German blast furnaces Dec. 3, one of the speakers affirmed that on the average 23 to 24 per cent. of the cost of producing pig iron in Germany went for railroad freight charges, which have been reduced comparatively little in course of years; while in America, where in 1876 Sir Lowthian Bell found that the cost of transportation for materials for a ton of pig were $8.33 at Pittsburg it has been reduced to $2.34. This speaker drew the conclusion that in dull times America will make the prices of pig iron for the whole world, and unless the German iron-masters can secure lower freights, they will be driven out of the market at such times.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.	
Postal-card circulars	3⅝ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

The General Railway Signal Co., Buffalo, N. Y., has issued the second section of its catalogue and price list—the section which deals with mechanical interlocking. This is a book of 480 pages, 6 in. x 9 in., and both the letter press and the drawings are large and plain, affording the maximum of convenience to the reader. This company, with the large and well equipped shops which fell to it when it absorbed the Pneumatic Signal Company, is well prepared to make everything in the mechanical interlocking line; and this catalogue describes interlocking machines, both with vertical and with horizontal locking; all kinds of leadout and ground connections, switch-and-lock movements in ample variety, bridge locks and everything that is in demand. Self-contained electric motor signals are recommended for distant signals with mechanical plants, and everything in connection with these signals and with electric locking is shown. The lists of articles, always on the page opposite the drawings of the same articles, are printed in large type, and every descriptive clause which is not short has the principal words printed in full faced capitals, making a convenient "short title" for use in ordering. Besides the regular index, there is an index to pattern numbers, enabling the reader quickly to find the order number of any casting of which he knows the number.

Steam Engines.—"Allis-Chalmers Engines—At Home and Abroad," is the title of a 68 page bulletin about to be issued by the Allis-Chalmers Co., Milwaukee, Wis. The title page illustration represents four engines, capable of furnishing 35,000 h.p., installed in the power-house of the Twin City Rapid Transit Co., Minneapolis. A number of other large railway power-stations in which Allis-Chalmers engines are used are also illustrated. Illustrations of its pumping and blowing engines, as well as of air compressors and hoisting engines which are installed in some of the largest municipal and industrial plants in this country, are also given.

Water Filtration.—Four interesting pamphlets bearing the following titles are published by the Pittsburg Filter Mfg. Co., Pittsburg, Pa. "Mechanical Filtration," "Efficiency of Mechanical Filters," "The Purification of Water from a Sanitary Standpoint," and "Water Filtration and its Relation to Municipal Health and Prosperity, with some Statistics of Typhoid Fever Epidemics."

Tents and Awnings.—The United States Tent & Awning Co., Chicago, sends its 40-page pamphlet catalogue, describing and illustrating its large line of tents and awnings. A full list of sizes and prices for different qualities of materials is given. The list also includes cots, paulins, flags, horse covers, etc.

CONTRIBUTIONS

Weak Cars in Passenger Trains.

Worcester, Mass., Feb. 17, 1906.

To the Editor of the Railroad Gazette:

Gentlemen:—I was a passenger on the Pacific express (Boston & Albany Railroad) which entered into collision on Thursday evening last, in the Boston yard. The cause of the collision will probably be cleared up as another case of inevitable human fallibility. But the cause of the loss of life and limb cannot be so disposed of. That was plainly due, in my opinion, to the improper use of old and

weaker cars in the middle of a modern heavy train. The train consisted of two modern baggage and express cars immediately behind the locomotive; then followed two cars of the 1860 pattern filled with emigrants; then followed two modern day coaches, one of them vestibuled, and two or three sleepers. The collision was an insignificant bump. The train had just pulled out of Trinity Place station and had acquired but little headway (the locomotive and forward cars only had passed Huntington avenue), and the brakes had been on hard for several seconds before the crash came. The locomotive and two forward cars were practically unharmed, but the baggage car was telescoped into the forward emigrant car.

It is my opinion that had the train been composed either of all modern cars or of all old cars, no loss of life would have occurred. In the former case probably nothing would have smashed; or if it did, it would have been one of the baggage cars. In the latter case the inertia would have been so much less that probably nothing would have crumpled; or if it did, it would have been the baggage cars again.

SIDNEY A. REEVE.

Functions of a Good Draft Gear.

BY A. STUCKI.

Ask the man on the repair track, "What part have you to repair the most?" and he will answer, "The draft rigging." Is it a wonder, if we consider that this detail has to be yielding; that all the heavy blows and shocks are concentrated at that point and are from there transmitted to the car?

These blows get heavier every year. The trainmen know that the steel cars can stand more punishment than their wooden predecessors, and have a decided tendency to handle them accordingly. The switchmen in yards seem to be somewhat of the same opinion, judging from a recent expression from one railroad officer, "that sleeping within a mile and a half radius from a switching yard is out of the question." The locomotives are constantly increasing in weight; so are the cars. The number of cars in a train is double that of a few years ago and trains run at a higher speed. Is it any wonder that the old style draft gears fail under the new conditions of service? Even designs of recent date have failed quite frequently, and it may not be amiss to see what really does take place when two cars come together.

For convenience sake, let us first define the expressions most used hereafter:

Capacity = Pressure at the point the gear becomes solid.
Recoil = Pressure at the point the gear starts to recede.
Whole work = Energy temporarily absorbed during the stroke.
Work given off = Energy given off during the return stroke.
Work absorbed = Energy permanently absorbed.
Impact = Maximum pressure due to energy left unabsorbed by the whole work done.

It will be noticed that this leaves the usual meaning of "capacity" and "recoil" intact.

In a general way the functions of a draft gear are to absorb energy and to transmit part of the excess energy safely to the car. In order to permanently absorb as much work or energy as possible, it is necessary to have a high capacity, a long stroke, and a low recoil. Until comparatively a few years ago one standard spring of 19,000 lbs. capacity was all that was required. As the cars got heavier, two such springs were found to be necessary, either side by side or in tandem, and both types are extensively used today. However, some of the railroads, desirous of protecting their rolling stock as much as possible, did not stop there; some tried triple and others quadruple springs to suit the changed condition of the service, but this made at the best only 4 x 19,000 or 76,000 lbs. elastic resistance, which was still considered insufficient, and objectionable in other respects. At this period, for the first time, the friction draft gear made its appearance and at once attracted the attention of railroad men because among other advantages it made it possible to obtain a capacity of 150,000 lbs. and more.

Since that time, friction has been made use of in innumerable different ways and constructions, thereby using the different mechanical elements, such as the wedge, the cam, key, eccentric, lever, torsion, leaf springs, coil springs, dampened or otherwise, plain pressure or plain or grooved surfaces, the inclined plane, etc., etc., but in an article of this sort it would lead too far to describe in detail the construction of these respective gears.

The longer the stroke the greater is the whole work done, everything else being equal. With the standard 6¼-in. x 8-in. spring the stroke is 1¾ in., ¼ in. initial compression being allowed; and the stroke naturally remains unchanged, even if the springs are arranged side by side or in tandem. When the friction draft gear was introduced, this motion was increased and the majority of gears of that type adhere to 2⅝ in. This dimension has not been exceeded as yet, and the reason why it cannot very well be done is the fact that the overhang of the coupler, already great, would become excessive, especially when under tension. We have already gone pretty far in allowing the coupler head, weighing possibly 200 lbs., to overhang a foot or more beyond the center of the carry iron. This overhang is more serious if we consider that the connection between the coupler and the yoke is not always secure, which has a tendency to throw more weight on the carry iron. Often only four bolts in tension (none in shear) are used to fasten the carry iron to take the weight of the couplers and the vertical chafing between two adjoining cars. It is self-evident that the motion of the draft rigging could be increased beyond 2⅝ in., provided a more substantial support or suspension of the coupler is devised. This increase in stroke would increase the whole work done by the draft gear.

The recoil in the different gears varies even more than the capacity, at least in proportion. Roughly speaking, it should be small, so as not to re-act on the car as soon as the latter is through taking the impact. On the other hand, a certain amount should always be present to insure the proper return of the gear into its normal condition, else lost motion will take place between the followers and the yoke, with results far more serious than those of a recoil too large. This point should be watched very carefully, especially so since some friction gears in service may change their bearing surfaces, which affects the friction and causes the sliding parts to stick.

Let us now take up a specific case in order to see what really does take place during the time the cars come together. Suppose that a loaded train runs into a loaded car standing still. Speeds of 13 and even 15 miles an hour have sometimes been assumed in this connection, but let us assume a speed of eight miles an hour, which is usually made the basis of tests in this field.

The weight per car being taken as 40,000 lbs., and the load as 100,000 lbs., the total weight (w) is 140,000 lbs. The velocity (v), eight miles an hour, is very close to 12 ft. a second. This gives an energy stored up in one moving car equal to

$$\frac{wv^2}{2g} \text{ or } \frac{140{,}000 \times 12^2}{2 \times 32.16} \text{ or } 313{,}450 \text{ foot pounds.}$$

g = acceleration of gravity, being taken as 32.16.

Let us further consider that the cars in turn are equipped with four types of gears which were tested for the Master Car Builders' Association at Purdue University in 1902, the first three being of the friction type; the last one being a spring gear. At the moment the respective gears became solid, i.e., have reached their capacity, the whole work done by two gears and the work left to be done by the car is as follows:

	Gear A.	Gear B.	Gear C.	Gear D.
Whole work done in ft. lbs. by two gears.	36,800	28,200	27,600	12,150
Work left to be transmitted to standing car in ft.-lbs.	138,825	142,625	142,925	150,650
Per cent. of work done by the draft gear	23.5	18.1	17.6	7.8

The figures for the work done are derived from the tests above mentioned, and the work left to be transmitted is obtained by subtracting the whole work done from the whole energy, i.e., 313,450 foot pounds, divided by two, inasmuch as only half of the energy need be transmitted to the standing car to result in a uniform speed for the two colliding cars.

The impact now depends upon the rigidity and stiffness of the car, and it is natural that the less the latter yields the harder the blow will be. If the cars, or even only one of them is a wooden one, the dynamometer car will not register as high as with a rigid steel frame.

After the impact has taken place, the draft gear is free to expand to its usual condition, and in so doing will give off a certain part of the work in the return stroke. Taking the same gears as above, we find the following:

	Gear A	Gear B	Gear C.	Gear D.
Work given off in ft. lbs.	3,466	4,400	4,800	10,400
Work absorbed in ft. lbs.	33,332	23,800	22,800	1,750
Absorption in per cent. of total energy	21.3	15.2	14.5	1.2

The movement of the standing car during the closing of the two gears has not been taken into consideration. It is, however, very small. A draft gear with a capacity of 150,000 lbs., uniformly increasing from zero and with a stroke of 2⅝ in. will have a movement of about $\frac{1}{100}$ in., which is entirely negligible. This is due to the enormous speed of the moving car and the absence of any motion with the standing car. These conditions will naturally change when the difference of speed of two approaching cars is smaller. Then a considerable movement of the slower car takes place between the time the couplers meet and the moment the draft gears become solid. This movement assists the draft gears.

From what has been said, it will be seen that the second function of the draft gear is an important one and in providing for the transmission of this excess energy to the car we should always consider the most severe cases allowable in service. Unfortunately there is no stipulation or standard in this respect as yet, and we often hear of impacts registering from 300,000 to 600,000 lbs. At any rate it is well to make the draft gear as strong as the coupler, and the car stronger than either of the two.

The springs of a draft gear should not be exposed to the impact but should be protected from the time the gear reaches its

capacity. Otherwise these heavy blows are transmitted through surfaces of small area and a decided tendency exists to crush the material or to cause the coils to slip relative to each other. All other weak parts should be thrown out of action and the final blow should always be transmitted through the strong and solid parts. The writer has seen many serious mistakes made in this direction, and in every case subjecting the gear to actual service showed them up very quickly. It is interesting to point out that in figures quoted above the total work done by the draft rigging is in every case small, in comparison with what is left for the cars to take care of.

If it were possible to get as high a capacity in gear D as in the cases of the other types of gears, the impact would be the same and the car would absorb the same amount of energy. However, the work given off by the spring gear is nearly as great as the work done, hence in returning to its normal condition it would transmit another blow to the car, setting up a series of oscillations and jerks which would tend to shorten the life of the car and all its parts. Unfortunately service data cannot be obtained in this respect inasmuch as the inaccessible gears of two adjoining cars are always working together. In other words, it is one of your own and one of your neighbor's gears that protect your car, and unless cars are kept on special runs it is almost impossible to obtain accurate data in this respect.

There is another condition, in itself almost the reverse from that just mentioned, but the result is just as hard on the car, and has a tendency to rack it to pieces. This is always the case when the first portion of the stroke is too stiff, which means that the small waves constantly existing in a moving train are not taken care of by the draft gear but are transmitted to the car just the same as if the draft gear had been a solid block, and the gear cannot do its duty until the shocks are large enough to overcome the initial resistance.

A draft gear should be self-contained, i.e., it should not exert any side or other component pressure on the car frame, except in the direction of the center sills. By this no allusion is made to trifles, such as the weight of the gear itself. Whenever friction is used to augment the capacity of a draft gear, the bearing surfaces should be made large. By doing this the friction is not increased (for the amount of friction is independent of the size of bearing surface), but it is necessary to reduce the wear and increase the life of the gear. This point should be watched closely, especially in designs where large surfaces are hard to work in, as for example, in spring dampeners, where sometimes only one point bears and in cam motions where only a line is touching at one time.

It has already been mentioned that wear sometimes changes the shape of the friction elements, such as cams and keys, thereby affecting the original motion and either making the gear too stiff or too flexible. The natural suggestion would be to make the friction surfaces of such contours so that the wear, no matter how much there is, will not affect the shape and its subsequent working.

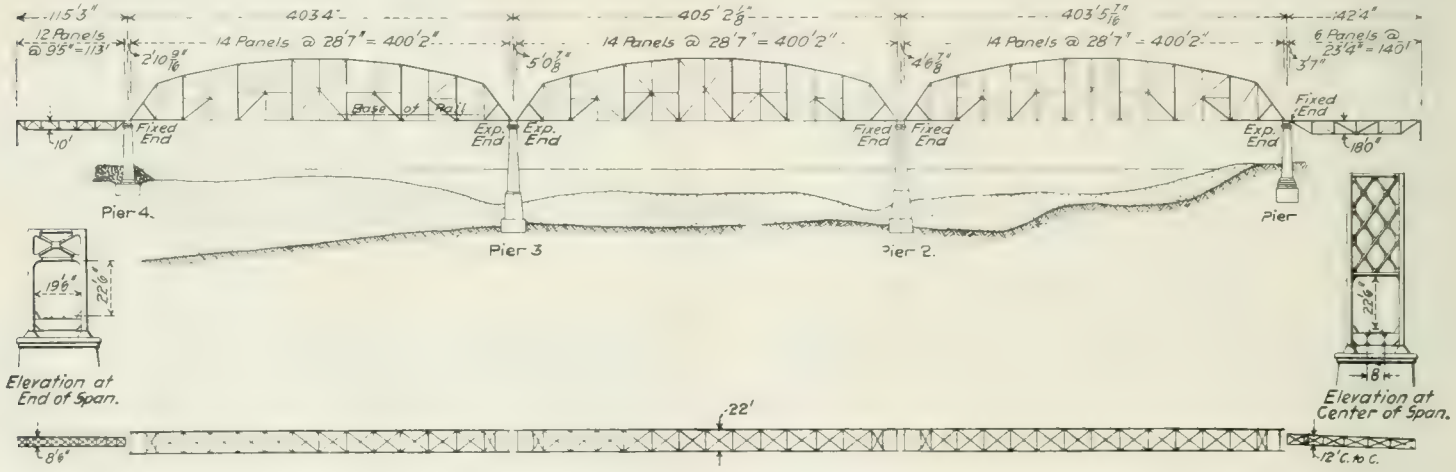
The Master Car Builders' Association has made the interchange of arcs possible or at least practicable, and through its efforts the whole question of rolling stock has immensely been simplified, not only for the railroads but for the car builder as well. Why not then assist these efforts and use such details as have been made standard or recommended practice; for instance, the yoke, followers, fillers, and springs? By doing this it will not be necessary for the railroads to carry so many different parts in stock. It will facilitate repair, and undoubtedly save a good deal of time.

Simplicity of construction is the fundamental principle in car building, and it applies to draft gears more than anything else. As between a draft gear containing 20 pieces and one doing exactly the same thing, but containing 10 pieces, there is only one choice. We may look at it from any side as to its life, first cost, method of manufacture, ease of repair, and find every advantage in favor of the simple device. For the same reason the different parts in themselves should not be of an intricate or delicate nature; they should be governed by the same rules as any other car casting.

New Bismarck Bridge of the Northern Pacific.

The Bismarck bridge of the Northern Pacific crosses the Missouri river just west of Bismarck, N. Dak. It is a single-track structure, carrying the main line of the railroad. The original bridge was built in 1882, and was designed for a train load of two 75-ton engines followed by a uniform load of 2,000 lbs. per foot. As it had become too light for present traffic, it was decided to replace it with a new structure during the summer of 1905. This work has just been completed.

The previous bridge consisted of three 400-ft. double intersection through pin spans, supported on four granite masonry piers across the main channel of the river, with one 113-ft. deck approach span at each end. It was built by the Detroit Bridge & Iron Works. As the masonry piers were in good condition, it was decided to use them for the new bridge, making such changes as were necessary for the changed bearings. The main spans, therefore, are the same length as before, but the east approach span, 113 ft. long, has been replaced with a new span 140 ft. long on account of the bank formation, which has a tendency to slide toward the river. The west approach span has been replaced with a new span of the same length as before. The new structure is designed for the Northern Pacific Railway standard loading of two 188½-ton engines followed by a uniform train load of 5,000 lbs. per foot of track. The main channel spans are designed with curved top chords, as seen by the illustrations, giving a much more pleasing effect than the older design. The approach spans are deck-riveted lattice spans. The contract for the fabrication of the new structure was let to the American Bridge Company, and the greater part of the work was done at its new Ambridge plant. The track stringers were made at the Detroit works.



Plan and Elevation of New Bismarck Bridge, Northern Pacific.

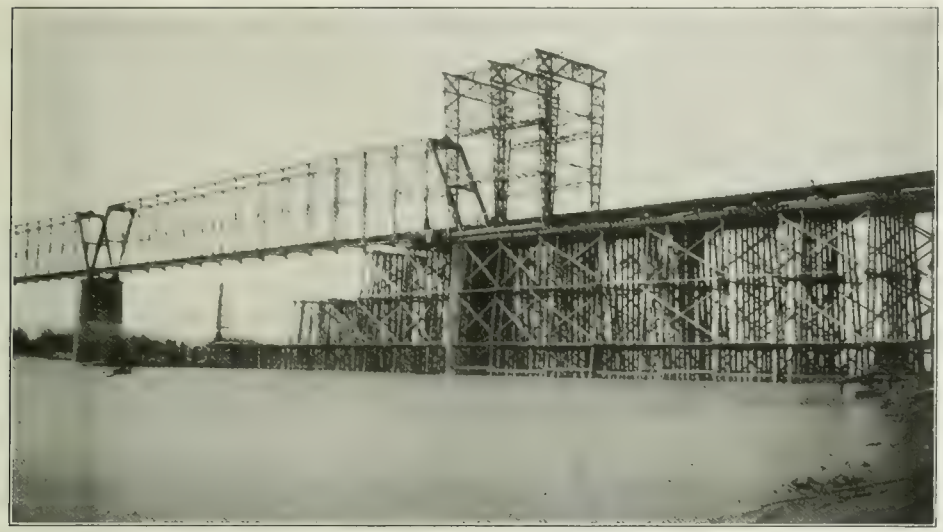
As it was necessary to maintain traffic across the bridge during construction, and as the traffic was expected to be unusually heavy on account of the exposition at Portland, Ore., it was decided that the railroad company itself would do the work of removing the old bridge and erecting the new one in its place, as it was believed they could do it with less probability of delay to traffic than if the work should be done by a contractor.

The bottom of the Missouri river, as is well known, is of a very unstable character, and sudden changes in the channel are to be expected. For this reason the original bridge had been erected on Howe trusses supported on intermediate temporary piers, as it was thought that ordinary falsework could not be maintained. In the erection of the new structure, however, it was decided to use the ordinary method of falsework supported on piles; and although the requirements of maintaining traffic and the erection of a heavier structure made it more difficult, it was successfully accomplished. The high-water stage of the river at Bismarck does not end until about the 10th of July, so no attempt was made to push the work before then; but after that date there is a steady decline in the high water of the river and force of the current. The force which had been previously organized was then largely increased, and the work was pushed vigorously until the last span was erected.

The 400-ft. spans were connected up and swung while under traffic. The approach spans were assembled on falsework alongside their permanent position and riveted up complete, and then moved into position between trains. The entire work of riveting the old

spans and erection of the new spans in their places was accomplished without accident and without materially interfering with traffic. The last span was moved into place December 25 last, the rapidity of erection under the conditions described being one of the notable points in connection with the bridge.

The tendency of the east bank to slide toward the river has been referred to. A short distance back from the river this bank rises to a height of about 100 ft. above the tracks. Some years ago this sliding tendency, in conjunction with the resultant earth pressure on its back, started the east pier to moving toward the river. Mr. George S. Morison undertook to restore it to its original position. First excavating back of it, he built under it a foundation of concrete, and interposed rollers between pier and foundation. When power was applied to the pier it moved back so rapidly that workmen in the excavation at its back barely had time to get out of its way.



Falsework and Traveler Used in Rebuilding the Bismarck Bridge.

Although the tendency of the pier to move bodily toward the river had been corrected, the sliding of the bank once more imposed a pressure on its back, which started it to tipping. To relieve it, an excavation was once more made at its back and is being maintained permanently. Special provisions have also been made to drain the high bank suitably to minimize the tendency to slide.

The general character of the new structure is shown by the accompanying illustrations. The work was done under the general direction of Mr. E. J. Pearson, then Chief Engineer of the Northern Pacific, by Mr. Ralph Modjeski, Consulting Engineer, Chicago, who designed the new structure, organized the forces in the field and had direct charge of the work. Mr. Ernest Nickerson was Resident Engineer at Bismarck, and Mr. James Saguin Superintendent of Erection.



First and Second Spans Erected and Falsework Under Old Third Span.

A press despatch from Tokio says that the Japanese Government has introduced in the Legislature a bill providing for the purchase by the state of 15 private railroads, which have an aggregate capital of $225,000,000.

Large Electric and Steam Locomotives.

At the February meeting of the New York Railroad Club, Mr. J. E. Muhlfeld, Superintendent of Motive Power of the Baltimore & Ohio, presented a paper on the subject of large locomotives. He gave a brief review of the work of the heavy electric engines used on the road. This consists, to a large extent, of helping on grades of from one to one and a half per cent. and over curves of from five to eleven degrees, with the mileage of 5,042 miles per month, about evenly divided between light and loaded service.

Considering $1.25 per net ton as a base cost for fuel delivered at the power plant, the average total operating and maintenance expenses during the year for generating the current; the labor and material for the locomotive electrical and mechanical repairs; the engineer's wages; wiping, hostlering, inspecting, oiling and despatching; lubricating and miscellaneous supplies, was approximately $34.50 per 100 miles run per locomotive. Of this amount the average cost of labor and material applied to each locomotive for the running and shop repairs, would be $3.20, or 52 per cent. for the electrical, and $2.90, or 48 per cent. for the mechanical, making a total average cost of $6.10 per 100 miles run for both the electrical and mechanical repairs.

The above figures do not take into consideration interest, depreciation, taxes nor insurance on the investment, nor do they include the expenses incident to the maintenance of such equipment as battery, feeders, third rail, bonding wires, insulation, safety cut-out switches, extra motors, etc., which is not required for steam locomotive operation. The wages for the conductor, or second man on the locomotive, have also been omitted.

During their service considerable difficulty has been experienced with the shoes used for collecting the current from the surface third rail; the loosening, wear and breakage of pinions used to transmit the power from the motors to the gears on the driver wheel axles; the lubrication, heating and wear at the armature bearings; the flange and tread wear of driver wheel tire; derailments; stalling and breaking in two of freight trains due to slipping of driver wheel, more especially with wet rail or when tire of drivers connected in series are not of exact diameters, and in miscellaneous renewals and shop repairs.

The driver wheel tires which when new were 2⅞ in. thick, are now 1¾ in. thick, showing only 7,500 miles run per $^1/_{16}$ in. metal removed at tread, and will have to be renewed within a few months.

The large steam locomotive dealt with was the Mallet compound, illustrated in the *Railroad Gazette* for September 4, 1903, and May 27, 1904. This engine was put in service on the Connellsville Division on January 6, 1905, and in the year that it has been at work it has developed that this subdivision of the power has resulted in less strain on all parts and reduced the liability to breakage; and also that while the wearing and total parts per locomotive are increased, they are greatly reduced when compared with the development of the same power by tandem locomotives, and the reduction in concentrated stresses and weight insures a more satisfactory and economical maintenance of those details most susceptible to depreciation.

The power of the engine is practically equal to that of two consolidation locomotives like those used on the division in question. The combined drawbar pull of the former is 79,100 lbs., while that of the Mallet compound No. 2400 is about 74,000 lbs. when working compound, and 81,000 lbs. when working simple. The weight of train that can be taken up the mountain by two of the consolidation locomotives is about 2,025 tons contained in loaded steel cars of 100,000 lbs. capacity. The weight of train that the 2,400 and one of the consolidation locomotives can take up the grade is about 3,210 tons, contained in similar cars. The above figures are based on the locomotives operating at a speed of 10 miles per hour under fair coal and weather conditions, and with the 2,400 working in compound gear.

The total elevation from Connellsville to Rockwood is 931 ft.

the ruling grade between Confluence and Fort Hill being 1 per cent., and the total distance 43.4 miles.

In through freight service, from Connellsville to Rockwood, the 2,400, singly, has moved, in 36 steel cars, 1,668 tons of loading, and 702 tons of cars, or a total of 2,370 tons in the cars. Adding the weight in working order of the locomotive and averaging the weight of the tender loaded with coal and water at 225 tons, it would make the total weight of the train, including locomotive and tender, 2,594 tons, about 64.3 per cent. of which was paying load.

The actual running time was four hours, making an average speed of 10½ miles per hour. When handling this tonnage over the hardest pulls and around 8 degrees 30 minutes curvature, as high a rate of speed was maintained as with through freight trains of 1,200 tons total, when handled by consolidation locomotives.

Had this same train of cars been hauled by the standard consolidation type locomotive, it would have required the maximum hauling capacity of two locomotives to have handled it at the same rate of speed, and the average weight of the motive power would have been 304 tons, making the total tonnage of the train 2,674 tons, and about 62.4 per cent. of which would have been paying load.

When helping trains consisting of consolidation type pulling locomotive having tractive power of 39,700 lbs., with 40 cars consisting of about 2,400 tons, weight of lading and cars, the 2400 has pulled 36 of the 40 cars in the train on 3 and 4 degrees curvature, and 1 per cent. grade, making an average speed of about 4½ miles per hour, and has pushed the entire train and pulling locomotive, weighing about 2,550 tons, when the pulling locomotive was shut off, at a speed of 2 miles per hour, and maintained the working steam pressure and the normal water level for a distance of one-half mile on the same curvature and grade, and which performance could have been continued.

During the year the engine had made 44,976 miles at a total cost of labor and material per 100 miles run of $3.16. During the last six months it has been out of service eleven days for washing, staybolt testing and repairs, or about 6 per cent. of the time.

When working at Rockwood the locomotive remains in service for two or more weeks' period, and is then taken to Connellsville for a washout, staybolt test and the necessary inspection and running repair work.

Allowing for firebox and boiler tube renewals, heavy machinery repairs, etc., it is estimated from the last year's performance that at the end of ten years the shop charges for working repairs will have averaged not to exceed 9 cents per mile run.

When operating over combination, level and mountain divisions, No. 2400 will consume less coal per ton per mile than the various types of simple consolidation locomotives now in the service, and when operated on a comparatively level line it consumed materially less coal per ton-mile. On the mountainous part of the division, the fuel consumption per ton-mile is more favorable than for the simple consolidation locomotives, but not to such a great extent as when working on the more level portions of the division.

In this mountain helper service, where the engine is kept at work for long periods between fire cleanings, it has been able to meet all rquirements, and still use ordinary run-of-mine coal, containing 20 to 40 per cent. of volatile matter.

The general condition of the boiler and machinery after 12 months of service was as follows:

Treads of tire show even wear amounting to $^{3}/_{16}$ in., or about $^{1}/_{64}$ in. per month; tires calipered uniform in diameter.

High and low-pressure cylinders were in good condition, being worn smooth and not oblong or bell-mouth.

The high-pressure piston and low-pressure side valves were in good condition. Piston valves have had the packing rings renewed once and the slide valves have received no repairs.

The engine frames, splice bolts, keys, pedestal caps, braces, etc., have given no trouble, and there have been no renewals nor repairs.

All driver bearings were in good condition, and while there have been two warm journals, due to lack of lubrication, since the locomotive has been in service, none of the frictional surfaces were injured.

The driver boxes were in good condition, crown brasses have given no evidence of becoming loose in the boxes, and are of sufficient thickness to continue in service for twelve months before renewals need be considered.

The driver wheels are fitted up when new with $^{1}/_{16}$-in. end play between each hub and box, which has been increased to from $^{3}/_{32}$ in. to ⅛ in.; the front and rear driver wheels on both high and low-pressure engines having the greater amount.

All parts of the Walschaert gear were in good condition, and the total lost motion between the main driver wheel axles and the piston and slide valves, as measured at the valve stems, with the reverse bar in full forward position, averaged $^{3}/_{64}$ in. for the low pressure and slightly less for the high-pressure engines, and for all engines in full back-up gear.

The boiler, which carries a working pressure of 235 lbs. indicated, was in good condition, and there has been no evidence of weakness or any trouble due to staying, leaky steams, leaky or broken staybolts or leaky rivets. The staybolts are of the ordinary straight type 1 in. in diameter, spaced 3¾ in., with tell-tale holes drilled at the outer end.

The firebox was in good condition, and there has been no indication of leakage, except at the furnace door ring, where two defective rivets were deplaced by countersunk head patch bolts.

The boiler tubes were good for another month's service, and there was but one flue plugged, which was due to its collapsing about eight feet from the front tube sheet.

This locomotive will remain in service until the latter part of January, 1906, when it will be removed on account of the tire wear having reached the limit allowable of ¼ in. at the tread; it will then have the driver wheel tires reset, boiler tubes removed, boiler cleaned out, boiler tubes replaced and reset, and whatever repairs that may be necessary given to the machinery and repainted. It is estimated that the cost to make these repairs and put the locomotive in condition for another year's service, or 40,000 miles' run, will be about $750 for labor and $250 for material, or a total of $1,000.

From the performance up to the present date it has been found that the following features embodied in the design of this locomotive have given entirely satifactory results, with respect to design, maintenance and operation:

The flexible joints to the high and low-pressure cylinder, receiver and exhaust pipes. Articulated frame. Intercepting, reducing and emergency valve and intermediate chamber system of compounding and simpling. Combination hand and power reversing gear. Walschaert motion gear. High-pressure piston and low-pressure double ported slide valves. High and low-pressure cylinder packing. Method of securing high-pressure cylinders to boiler. Single disc main throttle valve. Driver, crank pin and other bearings. Injectors and water works. Lubrication of valves, cylinders and bearings. Tracking and riding qualities, going forward or backward around maximum curvature, and when pushing, pulling or braking trains or running light.

There has been no trouble on account of priming, and the results accomplished through the distribution of the work over four instead of two main crank pins and auxiliary parts have been markedly satisfactory.

In consideration of the boiler having 72.2 sq. ft. of grate area, 220.0 sq. ft. of firebox heating surface, 5,380.0 sq. ft. tube heating surface, and flat and radial sheet staybolts of the ordinary solid type, the performance of the boiler, firebox, boiler tubes and stays, with 235 lbs. indicated working pressure, has demonstrated that it is economical and entirely practicable to operate well-designed and constructed locomotive types of boiler under severe weather, water, fuel and handling conditions, with from 200 to 250 lbs. boiler pressure.

While the boiler tubes are 2¼ in. in diameter and 21 ft. long, there has, with ordinary attention, been practically no difficulty on account of leaky or stopped-up boiler tubes, and the steaming has been at all times free, and such as would enable the locomotive to develop the maximum tractive power under the most severe operating conditions.

There was initially some irregular wear of the flange to the left front driver wheel tire of the forward engine, on account of the cross-equalizer of the spring gear not being sufficiently strong to carry the weight, but after a new equalizer was applied this trouble was eliminated. Several of the driver springs also broke, and the grate gear was redesigned to provide larger drop grate openings.

It also required some experimenting to make a suitable flexible connection between the oil delivery pipe and the low-pressure cylinder steam chest, which, however, has resulted satisfactorily.

While it has been noted that quite a number of changes in minor details would be desirable, should other locomotives of this type be constructed, still, when taken as a whole, the design, construction and operation in general can be considered as efficient and economical.

From a transportation standpoint, locomotive No. 2400 has been performing the service of two standard consolidation locomotives, when used as a helper, and when handling through freight trains.

This results in a saving of delay which would produce overtime in many cases, whereas the 2400 takes the place of the second helper and moves the train promptly.

In starting trains it has been frequently noticed that during unfavorable freezing weather conditions, with ice on the rails, the 2400 would push the train and take the slack between the tender and engine of the pulling locomotive, before the latter had moved its driver wheels. It has also demonstrated that it has as good a hauling capacity when backing up as when going ahead; and for the reason that it has seemingly not been stalled since in regular service, it may not be out of place to mention here that it has been nicknamed "Maud," in comparison with the renowned mule that moves anything it goes up against.

Among the advantages accruing from the use of this engine there stands prominently forth the capacity to develop a high tractive power for starting and moving heavy trains, which is at

the maximum because the whole of the 334,500 lbs. of weight are distributed over the 12 drivers. This involves a tonnage and speed per train that will provide for the least number of locomotives and crews. The result then of this year's service indicates that for slow freight service, where a greater tractive power is desired than what can be obtained from a properly designed consolidation type locomotive, is that it would appear that the use of the Mallet articulated design, as already described, would result in the movement of the greatest tonnage per hour over a single piece of level or mountainous track, with a proper degree of safety, efficiency and economy.

NEW YORK RAILROAD CLUB DISCUSSION.

At the conclusion of the reading of his paper, Mr. Muhlfeld added a few words in which he emphasized his belief that the steam locomotive was by far the most desirable, flexible and economical for the handling of heavy traffic. In short, he definitely threw down the gauntlet to the advocates of the electric machine.

The discussion which followed totally ignored the desirability or the practical operation of heavy locomotives in themselves, but swung around the relative merits of the two types as set forth in the paper. It naturally followed that there were differences of opinion as to the details of opinions expressed, though no position taken by the writer was seriously attacked. The first speaker, Mr. Gaines, for example, doubted the advisability of using high steam pressures. He said that while it was perfectly possible to build boilers that could carry a 250-lb. steam pressure, experience had shown that these high loads tended to a rapid deterioration of the boiler, and that as a matter of fact the life of the firebox was about in an inverse proportion to the pressure it was called upon to carry. A further peculiarity of this is also to be found in the fact, that while, with the lower pressures the deterioration of the firebox is gradual, when the higher is used the box simply goes all at once.

The reply to this argument was that while there had been some trouble with leaky tubes, due to the wide variations of duty that the boiler had been called upon to perform, and to the carelessness of the fireman in running with dirty fires or fires with holes burned through, they had been comparatively insignificant, and when the engine was brought into the shop but two broken staybolts had been found.

Attention was also called to the use of inclined planes of the Central Railroad of New Jersey for handling the heavy coal traffic up to the summit of the divide between the Wyoming and Delaware valleys as presenting a possible comparison in cost of operation with that of electric locomotives that require a special power plant for their propulsion.

Evidently the steam locomotive, especially the Mallet compound, was in the hands of its friends, for there seemed to be no word of adverse criticism in regard to it. It appears that it is an exceedingly easy riding engine, and that it is no more effort to handle it than it is the ordinary engines of the road. There has been no complaint on the part of the fireman as to the amount of labor involved in the shoveling of the coal, and the maintenance of the steam pressure. This may possibly be due, as one speaker expressed it, to the fact that it was designed on easy lines. That is to say, there was a liberal allowance for all of the parts that enter into its construction, and advantage was not taken of every possibility to save in weight and space. As for its development of power, it was estimated that, at 4½ miles per hour, it developed about 860 horse-power, which was increased to about 1,860 when the speed rose to 10 miles per hour. The general average of the power that was used was placed at about 1,500 horse-power. As for the work of the engineman, he seemed to have less trouble with the reverse lever; that is to say, it took less exertion to move it than with the ordinary consolidation locomotive.

It was generally agreed, however, that the matter of the cost of repairs of this engine had not yet been definitely or finally settled. The engine was new and the cost of the first year must necessarily be less than those of the years to come, and it is expected that the rate that has prevailed up to this time will be increased from year to year, for six or seven years, after which it will settle down to an average that will be maintained through the balance of the life of the engine. Attention was called to the fact that the repair cost of different engines varies almost in direct proportion to their first cost, or, to express it differently, in proportion to their tractive power. This is merely another way of saying that it varies as the weight of the engine.

In Mr. Muhlfeld's paper comparisons were made of the cost of operating steam and electric locomotives that were in favor of the former. These were criticised on the ground that the electric plant and locomotives of the Baltimore & Ohio had been designed ten or twelve years ago, and that they were obsolete and old-fashioned, so that it could not be expected that they would be fully up to modern, present-day requirements and able to make the showing that was obtained with a locomotive of the latest design. The reply to this was that, as a matter of fact, the older electric locomotives of the Baltimore & Ohio were doing better service and doing it more economically than the new ones, and that the Mallet engine must be considered in the light of an experimental machine as well. As for the power plant, it was acknowledged that it was somewhat out of date, but still it was claimed that it was working with good economy, and though it was the intention to rebuild it, the company was well satisfied with its present performances. It provided power for the shops where about one hundred motors were at work, besides charging the storage batteries, so that, in spite of the fact that the requirements of the road service were apt to vary, the load on the power house was practically constant.

It seemed to be a curious coincidence that the specifications for an electric locomotive as laid down by Mr. Muhlfeld, comprising fourteen points (omitted from our report of the paper), were almost all covered in the latest type of electric locomotive. It was urged also that it is possible to combine more power in an electric locomotive under the control of a single man than would be possible with any steam engine. The use of several units that could be combined and worked as a single machine offered advantages that no ordinary locomotive possessed. It was claimed and conceded that the accelerating power of the electric machine far exceeded that of the steam, and the case of the New York Central engine was cited as an instance.

A discussion had arisen on the point that developed a kind of sporting proposition, in which it was suggested that the two types of engines be placed alongside and with the same weights of trains, race from a standing start for the length of the electric line at Schenectady. This was done, a Prairie type of engine with about the same weight on the drivers being used as the competitor. In spite of every effort, the electric locomotive won in each of the four trials that were made, by about a quarter of a mile. During the acceleration the engine developed about 2,500 horse-power at the wheels. This was made possible because the present control of three engines is such that the drawbar pull is maintained constant during the whole period of acceleration.

The Mallet and other steam locomotives had been criticised because they had been able to develop but 10 horse-power per ton of weight, though it was claimed to be possible to exceed this. The New York Central engine had developed 22 horse-power per ton under normal workings, while as much as 30 horse-power had been obtained at times.

One other advantage of the electric locomotive is that it is in perfect relative balance, which is not the case with the steam engine. It is in the details of the electric engine that improvements must be made. As one speaker expressed it, the paper of the evening seemed to be a plea for the further development of the electric locomotive.

Motor cars were kept pretty well out of the discussion, though they were alluded to, and it was urged that, as they had been worked up to a state of practical perfection and the cost of maintainance had been reduced to a minimum, it was fair to use these figures as the basis for estimating the value of the electric locomotive along the same lines. This was not conceded, however, as the conditions of operation were so different and the requirements of the service of the latter so severe that it was claimed that comparisons along these lines were impossible. One item of the details of these cars was mentioned that is of interest. The gearing between the armature shaft and the axles has been found to be wanting. Starting with the rawhide pinion and steel gear, the railroads had then taken up the cast-steel gears and now, with the heavy motors that are used, these had been found to be too weak. There is a shearing stress on the teeth that they cannot withstand, and it has been found to be impossible to secure castings of sufficient strength and homogeneity to stand up to the work. It has therefore been found to be necessary to resort to forged ring gears in which the teeth are cut in a forged ring like the tire of a wheel.

As between the direct and alternating current machines, there seemed to be a tendency to favor the latter, though the greater part of the discussion referred directly to the former. The advantage claimed for the latter was that the motors could always be used in parallel so that there was less danger of slipping than in the case of the direct current machine; in fact, this slipping of one pair of drivers was one of the principal drawbacks that was acknowledged to exist in the present electric locomotive.

In closing the discussion, Mr. Muhlfeld emphasized his earlier statement that the boiler of the Mallet engine had given no trouble at all, and that the occurrence of leaky tubes had been insignificant, in spite of the high pressures and the fact that these tubes are 21 ft. long, the longest that have ever been applied to any locomotive in this country. He felt that the electric locomotive was laboring under the difficulty of lying between the use of the overhead trolley and the third rail. The overhead trolley was impractical with the direct current, while the disadvantages of the third rail were to be found in the increased first cost, increased complexity of mechanism, the increased danger of personal injury to workmen and others and the fact that it is not adapted to working with voltages greater than 600. It was suggested that the single-phase alternating engine with the mechanical details worked out along the lines that had been

followed on the Valtellina road in Italy offered a solution that should be carefully considered.

The claims that the electric locomotive had won out where it had been placed in competition with the steam engine was met with a contradiction and a counter-claim that it had been introduced where the conditions of the traffic were such that the steam engine could not be used. The case of the Baltimore tunnel is in point, and the same holds true of the work that is now being done in New York. It is simply a question of the inability of the steam engine to meet the requirements, and has no relation to its tractive capacity.

In reviewing the discussion as a whole, it appears that the consensus of opinion was that electric locomotives, like those that are driven by steam, must be designed for the special service that they are intended to perform, and that no one type can be taken as universally applicable, while in the matter of heavy freight service the time does not seem to have yet come when it can compete in economy of operation and maintainance with the steam machine.

Horseback Inspection of the Philippine Railroad Projects.

BY L. E. BENNETT.*

On May 19, 1905, I started from Iloilo, the seaport of the Island of Panay, on an inspection of the railroad projects for which bids had been asked by the Government. The first route to be covered was the proposed line from Iloilo north through Pototan, Passi, Dumarao, and Dao to Capiz, 78 miles, with a branch line 22 miles long to Batan in northern Panay, which is a flourishing port on the coast. Our party consisted of a native cook, who also acted as interpreter, one native soldier and myself. Food, bedding, cooking utensils, dishes and other supplies were carried on a pack pony and each of the party was mounted on another native pony. With this outfit we could make about 20 miles a day over the trails, sleeping at night in the most convenient settlement along the way, usually as the guests of some native village official.



Escort of Native Soldiers.



Cocoanut Rafts on the Pagsanjan River.

From Iloilo to Passi the proposed line passes through a country much like that to be seen in eastern Nebraska, ranging from absolutely flat to low undulating hills. Everywhere, of course, is heavy tropical vegetation. The route is through an almost continuous line of small villages from Iloilo out to Pototan, 20 miles. The public highway is lined with houses for the entire distance. Long lines of pedestrians can be seen on the highway from dawn to dark carrying packs of farm produce on their backs into the larger towns. These native farmers will carry from 50 to 75 lbs. of farm produce, fruits and even grass and forage on their backs in this manner and trot along the dusty roads for miles to sell their load and return with the equivalent in the necessities of life which they cannot get from the soil. Carts and farm animals are scarce and during the rainy season the roads become so muddy and at times are completely flooded so that they are impassable even for men on foot to say nothing of carts. Under these circumstances it is not to be wondered at that there is little prosperity and progress.

The population reached by this first 20 miles of the line must exceed 350 per square mile, or about six times the average rural population in the United States. For the remaining distance up to Passi, 35 miles from Iloilo, the population is over 200 per square mile. The country beyond Pototan is more undulating but easy building for a railroad with light grades and curves. It would involve comparatively light construction work with the exception of the numerous bridges and flood openings.

I carried a letter of introduction from the Governor of the Islands to all native officials in the towns which secured for us every attention and assistance. The Filipinos are naturally a hospitable people and will almost always share what they have with a traveler and decline to accept payment for food or lodging. After a two-days' journey we arrived at Passi on Saturday night, and having been invited by the Presidente, or local mayor, to spend Sunday as his guests, we accepted. He welcomed us heartily when he learned my mission.

Passi is a large town with several thousand inhabitants, located in the center of an extremely fertile district. In the surrounding lowlands rice and sugar cane are grown, and in the hills hemp, coffee, cocoa, grass fibers for making fine grass cloth, and a fair quality of tobacco are grown. Only a small part of the land is under cultivation as it costs at present from $30 to $40 a ton to carry the produce down to the



Country Road in the Philippines.

*Mr. Bennett, who has been actively engaged in pioneer railroad surveys and construction, in many parts of the world, was employed by J. G. White & Co., who intended to submit bids for the construction of a number of railroad lines in the Philippine Islands, which were authorized by the United States Government, to make a reconnoissance of the country through which it was proposed to build. Early in 1905 he began his trip through the Islands and on his return to the United States made a favorable report which served as a basis for compiling the bids made by J. G. White & Co. These bids for an aggregate of nearly 300 miles, have been accepted by the Government. Some of Mr. Bennett's experiences are told by him in this interesting extract from his diary.



Rice Fields Near Iloilo, Panay.

market at Iloilo, and only during the dry season can anything be transported. The opening of a railroad through this country will develop it rapidly as thousands of families are only awaiting trans portation facilities to move in and cultivate the rich soil.

On Sunday afternoon the Presidente took us to see the cock-fights in the municipal cock-pit. Cock-fighting is the national sport of the natives, and men, women and children attend the Sunday mains which are the event of the week. Early Monday morning we started on the next stage of the journey to Dumerao.

Between Passi and Dumerao a range of low hills forms a divide about 300 ft. high and 11 miles across. This divide is sparsely settled but presents no great engineering difficulties in the way of railroad building. The north side of the divide slopes down gradually into a beautiful and fertile valley which extends to the coast and the port of Capiz. The principal town between Passi and Capiz is Dao, which stands at the junction of two small rivers in the midst of the rich rice fields. Dao shows evidences of great loss by the war. The remains of many wood and masonry houses indicate that it was a flourishing settlement before the war broke out. Dao is 19 miles inland from Capiz and the country lying between is rich and under extensive cultivation. A succession of small villages extend all the way down to Capiz, which is a substantial and flourishing sea port doing a large business and having good stores, large warehouses and a number of comfortable residences.

Arriving Capiz I found that a coasting steamer was leaving next day for Iloilo, and thinking that the return trip would be made quicker and with more comfort by boat, the ponies and pack outfit were sent back empty to Iloilo over the trail we had followed. The boat, a small coasting steamer of 100 tons register and called the "General Blanco," did a general trading business along the coast, dealing chiefly in fish of various stages of decomposition. In all my travels I have never encountered such a vile odor as we were compelled to endure for the next two days, not even excepting a steamer loaded with garlic on which I made a trip from Alexandria to Brindisi. Fish never seem too badly decomposed for human consumption in the Orient. When we arrived at Iloilo I was compelled to throw away what few clothes I had taken with me as the smell had permeated everything.

Another interesting inspection trip was through the island of Negros over the route of the proposed railroad. I left Iloilo in a steam launch on July 12, 1905, making for Himamaylan on the southwestern coast of Negroes. It was a beautiful trip down the narrow strait between Panay and Negros and we landed in the evening at the town which is at the mouth of the tidal estuary called the Himamaylan river. This estuary is used in a small way as a port for shipping sugar.



River at the Port of Iloilo, the Terminus of the Railroad.

We slept over night at the house of a half-breed Spanish planter who was the son of a Spanish priest and a native woman. His father had long been the virtual ruler of the town before the war. The next day the planter provided us with horses and a two-wheeled cart and accompanied us as far inland as San Juan de Ilog. The whole country between Himamaylan and San Juan de Ilog is practically one continuous sugar plantation, the soil being a rich alluvial loam. The plantations have many substantial buildings on them and in many ways this is the most prosperous looking district in the islands. The land holdings on Negros are nearly all in large tracts of 200 to 2,000 acres. On the other islands the holdings are smaller, most of the farms being about two acres, which supports an entire family.

On the second day we started from San Juan de Ilog to visit a large volcano about 7,000 ft. high situated some distance inland. We went on horseback as far as Isabela, passing through a rich country planted with sugar cane and corn. The mayor of the town supplied us with chickens, eggs and rice and with the supplies of canned milk, butter and other necessities not to be had in the interior towns but which we carried with us, we prepared a plentiful noon meal. After lunch the mayor, dressed in immaculate white, accompanied me to a small hill back of the town where we could overlook the valley and get some photographs of the village and the surrounding sugar plantations. He had a great contempt for his countrymen who labored and soiled their hands and he would not think of appearing in public unless neatly dressed. His young nephew



The National Sport of the Filipinos.

whom I met before we left, told me he had been attending college at Iloilo and had been studying theology and philosophy. His father had borrowed the money to send him by giving his farm as security and paying a high rate of interest. They had very little to eat in the house but the young Filipino was very much disgusted when I suggested that he would have made better use of his time by studying improved methods of cultivating sugar and rice. Unfortunately this is too frequently the effect of a little education on the average young Filipino. It only gives him the idea that it is dishonorable and degrading to labor with his hands.

Leaving Isabela early in the afternoon we arrived that night at the foot of the volcano where we spent the night with an unusually intelligent native lieutenant of the Constabulary in command of a detail stationed there to catch some cattle thieves who had been operating in the neighborhood. He had been to the St. Louis Exposition and had just returned from the United States. When I told him about the young student of Isabela he laughed and his comment was that many foolish young Filipino students preferred philosophy and an empty stomach to the study of sugar cane culture with plenty to eat.

The next morning he accompanied our party to several sugar plantations and from a small hill near one of them a planter showed me the whole surrounding valley which was a magnificent sight. We could see about 20,000 acres of rich sugar land still uncultivated for want of good roads and transportation facilities. The gently sloping sides of the nearby volcano showed another 20,000 acres suitable for growing coffee, cocoa, rubber, gutta percha and manila hemp. One enterprising native planter had started a plantation on the volcano slope and had demonstrated that it was possible to cultivate all of these products successfully, but he was unable to make the venture pay for want of communication with the markets.

Leaving this valley we crossed a low range of foothills about five miles across which were uncultivated and sparsely inhabited. On the other side was another valley of sugar plantations and for seven hours we passed through a continuous line of plantations, arriving at La Carlota about 10 o'clock in a drenching rain. We tried to get a night's lodging at the house of the Mayor but he and his chief-of-police had gone out to spend the night with some planters and to have a game of "monte." A frightened policeman whom we encountered finally took us to the house of an American school-teacher who put us up for the night.

The next day being Sunday we rested and in the evening our pedagogue host took us to the Planters' Club, where we met some of the leading native planters. The club house was well furnished and they kept on tap several of the best-known brands of American and Scotch whiskey. The members played poker and several of them could swear fluently in English, demonstrating in various ways that the village of La Carlota is fast attaining a high state of civilization.

Early Monday morning we started on our way to Murcia, where we arrived at night, having passed through extensive and fertile sugar plantations, corn fields and much wild land uncultivated for want of roads. From Murcia we went down to the sea to the port of Silay. Here we spent the night very comfortably at the residence of Senor Domingo Hernaiz, a rich native planter. On the following day our host accompanied us about 20 miles on our journey along the coast to Manapla. This is a town which does a considerable business in native timber, the logs being floated downstream with bamboo floats from the forests several miles back in the interior. These forests extend inland to the summit of the volcano and there are thousands of acres of rich timber land awaiting the coming of the railroad to be opened up. It will pay well to build logging lines from the main line into the forest.

From Manapla we continued on to Cadiz the next day where we were entertained by the Mayor and the American school teacher. An impromptu dance was arranged for us which was not altogether enjoyed after a long day's ride on horseback. The teacher told me of having established a young ladies school for teaching improved methods of cultivating the soil but at first his pupils, who belonged to the leading families, brought servants along with them to the gardens to do the work. When they finally were made to understand that they, and not the servants were to be taught, they willingly undertook to do the work and were then making good progress.

Leaving Cadiz in the morning we arrived at night at Escalante, the port of Danao, at the mouth of the Danao river. This river is 700 ft. wide and 50 ft. deep and affords good anchorage for eight or ten steamships. There is a bar at the mouth of the river which must be dredged out first, however. We lodged with constabulary officers and were well received by the natives. After resting a day we telegraphed for a steam launch to meet us at Victoria on the northern end of Negros to take us across the rough channel to Panay and then back to Iloilo. We took passage on a sailing lighter to Victoria, traveling as guests of the owner, a Chinese merchant who traded along the coast. Head winds and the strong tide delayed us and just when we were within sight of Victoria, the steam launch sent over for us turned and steamed back to Iloilo, having waited in vain for our coming. One of two things was left for us to do, return to Silay on horseback or risk crossing the rough channel in a small fisherman's boat. The wind was blowing hard and the waves were high but we decided to risk the small boat and in two hours time had navigated the 20 miles across the channel. The little boat was only 30 ft. long, but the fishermen were good sailors and guided us skilfully and safely. A few hours later we were in the harbor of Iloilo.

The Island of Negros is capable of producing 400,000 tons of sugar a year when cultivated and developed with modern appliances and provided with transportation facilities. The country is well drained and slopes gradually toward the sea on all sides from the volcano in the center of the island. The soil is volcanic ash and mud thrown out by the eruptions of past ages, and there is no better soil anywhere for the cultivation of sugar cane. Railroad construction will be easy with light grades and curves. The cost of railroad building should not exceed $30,000 a mile, and the road should pay good returns on the investment as the country develops. The railroad will cause a vast acreage to be brought under cultivation which is now wild land.

Senator Lodge on Rate Regulation.

The following highly condensed abstract is taken from the speech on rate regulation delivered by Senator Lodge in the United States Senate, February 12:

The evils complained of in our system of owning and operating railroads may be practically covered under three grievances:

1. Discrimination between persons.
2. Excessive rates.
3. Discrimination between localities.

Mr. Lodge argued that the discriminations known in this country as rebates and in England as "undue preferences" form a large proportion of all the injustices complained of, and nothing is more important than to cure them. "In nine cases out of ten," he said, "where I have talked with any one who was very eager for general railroad legislation and especially for Government rate making, I have found that the special grievance complained of was a personal and not a place discrimination." Arguments for or against Government interference to stop rebates have no application to the questions of excessive rates or of discriminations between localities. We have a stringent law recently passed against rebates. Government rate making is not, and cannot furnish, any remedy by and of itself for personal discrimniations or rebates.

"The evasion of the established rate for the benefit of a favored shipper, which constitutes a discrimination between persons, therefore, must be dealt with not by general legislation as to rates, but by an ample provision for punishing those who violate the law. I regard these discriminations between persons, or rebates, as by far the greatest evil now existent in connection with our railroad systems and as one of the most fruitful in wrong and injustice with which we have to deal. It is upon these personal discriminations that the great trusts whose operations have not only alarmed the people but have made them justly indignant have been built up. To make the law thoroughly efficient we ought to add, in my judgment, three provisions. We should restore the former penalties of the interstate commerce law—which should not have been repealed —and make these secret evasions of the published rates punishable by imprisonment. The men who perpetrate these evasions in defiance of the law suffer but little by a fine, even if it be a heavy one. Their resources are too large to make a money penalty a serious one. For this very reason they are persons who would feel acutely a punishment by imprisonment, and that penalty ought to be provided in any law which we pass.

"A second addition to the present law which we need is a provision to facilitate the procuring of evidence by the law officers of the Government. This defect has been pointed out by the Attorney-General in his report, and I think nothing is more requisite than a clause enabling the proper authorities to examine the books of the railroad companies whenever they have good reason to think rebates are being granted. A third and last addition should be the enactment of suitable provisions in regard to private car lines, switching charges, private sidings and tracks, elevator charges, midnight rates and all the various and ingenious arrangements now employed to cover up the grant of rebates. That the eradication of rebates is not impossible, or in the least impracticable, is proved by the experience of England, where 'undue preferences' are practically unknown and where the railroads are most reliable in the payment of dividends, showing that the abolition of rebates and personal discriminations would be to the railroads a solid benefit instead of a fancied injury.

"It may, I think, be safely asserted that if there was no grievance to be dealt with except excessive rates there would be no need of any legislation whatever. We could safely leave the cure of excessive rates to the law of competition among the railroads themselves, and where there were no competing lines to the competition

of markets, which no consolidation nor combination of roads can do away with."

With regard to England, Mr. Lodge quoted Mr. Acworth's testimony, as follows:

> As to rate making, I have no doubt that the interference of Parliament and courts and the executive has all tended to stereotype and keep rates at an unnecessarily high level. Speaking as an individual student, I have no doubt that leaving the power to make rates generally and primarily to the railroads and to the free play of the business forces is the process that will arrive at the best results for the community, with this exception: that I fully think it is necessary that the community in some way should interfere to protect all customers from unfair treatment.

"In England the result, practically, of the very moderate legislation which they have adopted has been to make the rates almost wholly inelastic. No railroad dares to lower a rate, if it can possibly be avoided, because of the restrictions imposed by law on increasing the rate when it becomes necessary. The result is that rates in England have not, as a rule, declined; and while our rates show a decline of 41.7 per cent. as against a 24.3 per cent. fall in prices, it is apparent that in England prices have fallen faster than rates, owing to the fixed character given to rates by legislation.

"To sum what we may learn from the English experience, we find that the provision against increasing rates has prevented the reduction of rates, that undue preferences or rebates have been successfully stopped, that discriminations between localities exist and that the long and short haul discriminations are not interfered with. It therefore appears that in England the rate making by Government, so far as it has gone and so far as it affects discriminations between localities, has had either no result or has prevented rate reductions."

In France, with nearly all the railroads in private hands, but governmental regulation of rates very stringent, amounting practically to Government rate making, the result has been "to make rates inelastic, to keep them high and to drive business to the waterways. Discriminations between localities exist just as they do here, but are made by the Government in obedience to local financial and political influences, which exert power in proportion to the pressure they can severally bring to bear."

In Germany, where almost all the roads are operated by the Government, and with a complicated system of rate fixing, Mr. Lodge demonstrated that instead of doing away with discriminations Government rate making has resulted in giving discriminations of one sort or another to 80 per cent. of all the freight carried. Rate fixing there "has been carried out with an elaboration and scientific thoroughness unequaled anywhere else. The result has been the abolition, practically of rebates or personal discriminations, and the multiplication of all other discriminations, extending not only to localities, but to industries, character of articles, and the final destination of the freight. The outcome of this system of discrimination has been to sectionalize Germany and to draw tariff barriers around certain regions or districts, and the discriminations have been brought about by the pressure of political, local and industrial interests, have been taken up by political parties, and have played a large part in national politics and in the legislation of the Reichstag. It is also apparent that, although Germany has managed to make a profit on her railroads, the transportation efficiency is low, the railroads are run with great disregard of public convenience and rates are 50 per cent. higher than our own and are inelastic."

Mr. Lodge called attention to substantially the same state of affairs in Austro-Hungary, Italy and the smaller European States. In Russia, where rates are fixed by the Government and are lower than anywhere else except in the United States, the roads are run at a loss, which the taxpayers have to make up. Government rate fixing, apart from the deficit it occasions, has impeded the freight movement in Russia, by oscillating one way and another under pressure of local interests, has sent freight to the waterways and has not removed discriminations, but merely substituted others.

"If now we review the experience of all other countries, taken as a whole, we find a singular uniformity of result so far as general principles are concerned. This examination shows us that it is not only entirely possible to abolish all discriminations between persons—that is, all rebates or undue preferences—but that this has been actually and effectively accomplished in other countries. It is not necessary to differentiate between the methods employed in the several countries, for whether, as, in England, railroad regulation has been effected through the establishment of a railway commission court, or, as in France and Germany, by the simple operation of direct Government control, the conclusion on this point is the same. It is proved beyond a doubt that personal discriminations can be utterly extirpated, and if it has been done in other countries it can be done here by suitable legislation.

"On the second point of excessive rates the experience of other countries demonstrates that whatever good effects Government rate making has had it has not lowered rates, but, on the contrary, has made them not only higher but inelastic. Where, as in Russia, rates are low, although not so low as ours, the railroads are run at a loss, and the loss is made good out of the pockets of the taxpayers. In England, with maximum rates fixed by Parliament in a schedule and the prohibition against raising rates without the consent of the railway commission court, the rates are higher than ours, inelastic, and do not decline in accordance with the fall of prices, or, indeed, in any substantial degree.

"On the Continent of Europe generally rates are 50 per cent. higher than ours and show the same quality of inflexibility and the same lack of adaptation to changing conditions which we find in England. We have the lowest average freight rates in the world, and yet our railroads are run at a profit without, of course, a dollar of expense to the taxpayer. Government rate making in this country—directed as it can only be against place discriminations and excessive rates—therefore, if the experience of all the rest of the world is of any value, and I regard it as conclusive, would either not reduce the rates at all, or, if it did reduce the rates generally, it would destroy the profits of the roads and lower the wages of those employed upon them unless we accepted the other alternative of Government ownership, with the roads run at a loss and the people taxed to carry them on. The idea of many persons who have been urging Government rate making in this country appears to be that Government rate making will lower freight rates. In seeking popular support that is one of the inducements they hold out, and yet it is as clear as anything can possibly be that it will be impossible to reduce rates arbitrarily and suddenly by Government action without destroying the profits of the railroads and lowering the wages of those employed upon them, or else forcing government ownership and placing upon the shoulders of the taxpayers the gigantic burden of running 200,000 miles of railroad at a loss. So far as excessive rates alone are concerned, it seems to me perfectly obvious from the experience of other countries that there should be no legislation, because if legislation is attempted the results will be disastrous in ultimately raising rates and in making them inflexible and will produce a far worse condition than now exists under the play of natural forces.

"The third and last point is that of discrimination between localities. The experience of other nations shows that government rate making has not stopped discriminations in the slightest degree. It has substituted discriminations made by the government for the discriminations which are brought about by economic forces, the competition of markets and the action of business interests. It hardly, I think, needs argument to show that discriminations forced in this way through political action would be peculiarly unfortunate in the United States, and that the combinations of political interests would make discriminations which would be in the long run more oppressive than those which come into existence by the natural competition of business interests and the working of economic forces. That discriminations which arise in what may be called the 'natural' way have in some instances been created to serve the selfish ends of individuals intrusted with the management of railroads is undoubted, but the history of our railroad development shows that these are constantly being reduced in number, and that the laws of competition and the necessity of earning money are certain to cure them in the long run. Moreover, the discriminations which exist in what may be called the 'natural' way have the immense advantage of not leading to those results so apparent in Germany, where the pressure of local and political interests has forced the establishment of rates which have broken the country up into sections and thrown around each section a barrier higher than those which any tariff could create in obedience to the entirely false principle that any given town or city or any given area of country is entitled by its neighborhood to the sole possession of the region and the population immediately surrounding it.

"That discriminations between localities exist under our system which work injustice it would be folly to deny, but it would be a still greater folly to establish a new series of discriminations, working a larger injustice in the hope of curing the original inequalities. To get rid of the inequalities which exist is eminently desirable; but it is much better to submit to those than to create more and worse inequalities by another system which experience has proved to be worse. In this direction, therefore, it seems to me that we ought to proceed with the utmost caution. Whatever attempt to remedy place discriminations we may make we should so guard it as to avoid applying a remedy far worse than the disease. The experience of the world leads me to doubt most seriously whether any government rate making, with a view to curing place discriminations, can be affected without bringing a change for the worse; but if it is to be tried at all it ought not to go beyond the fixing of a maximum rate by the commission, with the most absolute protection against hasty or prejudiced action through provision for an appeal to the courts of the country. This certainly is as far as we can safely go, unless we are prepared to disregard entirely all the teachings of experience and all the wisdom of those who are authorities upon railroad economics.

"In closing this consideration of the lessons of experience in regard to the relation of the railroads to the Government I wish again to insist upon the magnitude of the problem. I am looking at the railroad system simply as one of the greatest forces in our

modern economic life, upon which the prosperity of the country and its trade and commerce are more dependent than upon any other. It is in this way and with this spirit that Congress should approach the discussion of this question. Many of those who are loudest in denunciation of the railroads, and who assume to speak for the people of the United States, confuse their own personal hostilities, and, in some cases, their own desire for revenge, with the public interest, which has no grudges to satisfy and which seeks only to promote the general welfare. Even the shippers who especially cry out for sympathy, it is well to remember, have shared, in some instances at least, in the rebates and personal discriminations which could not have existed without their seeking and collusion, and mistake occasionally the disappointment caused by a failure to secure preferences themselves for a righteous indignation which aims solely to redress a public wrong.

"It must be remembered that the idea so sedulously disseminated that the railroads are merely the property of a few men and run for their selfish interests, is without foundation in fact. The vast capital invested in railroads and distributed in the form of stocks and bonds is held by thousands of persons, many of whom have most moderate means. These securities largely constitute the securities of savings banks, in which are laid up the hard won earnings of the working men and women of the country, and if we injure or destroy these securities we only affect slightly the great capitalists, but we bring misery and misfortune and poverty to thousands of persons whose little all, either in their own names or that of the savings banks and the trust companies, has been placed in the railroads of the country. It is well also not to forget that the high paid men who are at the head of the great lines of road are but a handful in comparison with the great body of people who earn a secure but modest livelihood in the operation of railroads. There are between two million and a half and three million of people whose livelihood is dependent upon railroads. To force by ill considered legislation a reduction in the earnings of this great body of people would be a cruel injustice, but that is just what we shall do if we do not consider well the steps we take.

"I consider it essential that we should have proper legislation in regard to the railroads, that there should be Government supervision and regulation, that we should stop the intolerable abuse of rebates or discriminations between persons, because if we do not we may find ourselves precipitated into that worst of all disasters, government ownership. But it is equally essential that the legislation we undertake should not itself lead to government ownership, the dangerous pitfall we are seeking to avoid. It is vital that this legislation should succeed, but it can only succeed by being effective against the evils which it can cure, while it proceeds with the utmost care in those directions where experience has shown that some of the remedies now proposed have introduced evils far more unbearable and far more injurious than those which it was sought to remedy.

"Two dangers seem to me to menace that legislation. The first is that in the desire to have rates fixed in some form by an executive commission, exercising powers delegated to it by Congress, we shall fail to give an effective remedy for the worst evil which has arisen, that known as 'personal discriminations.' Whatever else governmental rate making can do it cannot by the mere fact of its existence do away with an offense which consists in the evasion of an established rate. A result of a failure to deal with what, to my mind, is the real, and, I am strongly inclined to believe, the only real evil of the present conditions would be to discredit the law, convince the people that it was insincere and thus promote an agitation in favor of that worst of all evils, government ownership. Whatever else is done or left undone, no pains should be spared to render the law effective for the absolute extirpation of personal discriminations or rebates. That which is to be feared as to rebates is that the law will not go far enough and will not be intelligently effective.

"The second danger which is involved in this legislation is that the rate making by the Government, which can only affect excessive rates and place discriminations, will go too far and will bring on evils far more serious than those it is designed to cure. The lessons to be learned from the experience of other nations confirm this view and admonish us to proceed in this direction with the utmost caution. We should not go too far in rate making by Government—surely not beyond conferring the power upon an executive commission to make maximum rates. The commission charged with this great duty, upon the just performance of which the stability of business and of credit, as well as the welfare of thousands of people will so largely depend, should be established and organized with the utmost care. In tenure and salary the office of Commissioner should be made acceptable to men of the highest character and ability, and the chairman of the commission should, as in England, be taken from among the judges of our circuit courts.

"Finally, there should be ample provision for an appeal to—or, more properly, a review by—courts of competent jurisdiction sitting in equity, not only as to whether the rate is confiscatory, but also whether it is just and reasonable, and an arrangement should be made by law for the rapid disposition of all such cases.

"There seems to be now prophets of a new dispensation who wish to depart from the line marked out by the President in his message and accepted in the House bill of last year by removing so far as possible from the proposed law all proper provisions for review by the courts. This seems to me to strike at the very heart of the measure. I am anxious to see this legislation, but I cannot assent to any restriction upon the right of an American citizen to seek redress in the courts of the country. I am not yet prepared to substitute for the courts of the United States an executive commission. A proper solution of this railroad question is of vast importance, but it sinks into nothing compared with the primary duty of preserving to every American—high or low, rich or poor—free access to the courts of the country. I am quite aware that no statute can take away the constitutional right of a citizen to appeal to the courts if an attempt is made to take his property without due process of law. In other words, legislation cannot prevent an appeal to the courts if it is alleged that the rate is confiscatory; but this is a very narrow ground and a very limited right.

"A rate may not be absolutely confiscatory and yet may be in the highest degree unjust and unreasonable, and indeed well-nigh ruinous. I am not sure that it would be possible to deprive a citizen by legislation of the right to appeal to the courts as to the justice and reasonableness of a given rate, which is a purely judicial question. But no attempt ought to be made, either directly or indirectly, by silence or by assertion, to destroy this privilege, or, rather, this right. If delays are feared it is easy to make arrangements by law which will compel the swift disposition of these railroad cases. If it is a question as to maintaining a rate pending an appeal, either by bonds or by paying the money into court, loss to the party successful in the suit can be prevented. None of these objections have any real weight. But the distrust of the courts, the inclination to refuse an explicit statement of the right to such a judicial review of the commission's decision as are now manifested are ominous in the extreme. Nothing could be more alarming to reflecting men than the disposition shown by some persons to transfer to the legislative and executive branches powers pertaining to the judiciary and thereby deprive the citizen of the most fundamental and sacred of rights.

"We are about to pass a great measure from which, I hope, great good may come, but one which, in its operation, will affect the property and interests of millions of our fellow citizens. It should be guarded with scrupulous care, but above all it should provide that no man should be deprived of his opportunity to go to the courts in defence of his rights if he thinks those rights are invaded."

The Panama Canal.

The report of the Board of Consulting Engineers on the Panama Canal, together with the report of the Isthmian Canal Commission and letters by Secretary Taft and Chief Engineer Stevens, were submitted to Congress on Feb. 19 by President Roosevelt, who added the following letter of his own, advocating a lock canal.

To the Senate and House of Representatives: I submit herewith the letter of the Secretary of War, transmitting the report of the Board of Consulting Engineers on the Panama Canal, and the report of the Isthmian Canal Commission thereon, together with a letter written to the chairman of the Isthmian Canal Commission by Chief Engineer Stevens. Both the Board of Consulting Engineers and the Canal Commission divide in their report. The majority of the Board of Consulting Engineers, eight in number including the five foreign engineers, favor a sea-level canal; and one member of the Canal Commission, Admiral Endicott, takes the same position. Five of the American members of the Board of Consulting Engineers and five members of the Isthmian Canal Commission favor the lock canal and so does Chief Engineer Stevens. The Secretary of War recommends a lock canal pursuant to the recommendation of the minority of the Board of Consulting Engineers and of the majority of the Canal Commission. After careful study of the papers submitted and full and exhaustive consideration of the whole subject I concur in the recommendation.

It will be noticed that the American engineers on the Consulting Board, and on the Commission by a more than two to one majority, favor the lock canal, whereas the foreign engineers are a unit against it. I think this is partly to be explained by the fact that the great traffic canal of the old world is the Suez Canal, a sea-level canal, whereas, the great traffic canal of the new world is the Sault Ste. Marie Canal, a lock canal. Although the latter, the Soo, is closed to navigation during the winter months it carries annually three times the traffic of the Suez Canal. In my judgment the very able argument of the majority of the Board of Consulting Engineers is vitiated by their failure to pay proper heed to the lessons taught by the construction and operation of the Soo Canal. It must be borne in mind as the Commission points out, that there is no question of building what has been picturesquely termed "the straits of Panama"; that is, a waterway

through which the largest vessels could go with safety at uninterrupted high speed. Both the sea-level canal and the proposed lock canal would be too narrow and shallow to be called with any truthfulness a strait, or to have any of the properties of a wide, deep water strip. Both of them would be canals, pure and simple.

Each type has certain disadvantages and certain advantages. But in my judgment the disadvantages are fewer, and the advantages very much greater in the case of a lock canal substantially as proposed in these papers forwarded herewith; and I call especial attention to the fact that the chief engineer who would be mainly responsible for the success of this mighty engineering feat, and who has therefore a peculiar personal interest in judging aright, is emphatically and earnestly in favor of the lock canal project and against the sea-level project.

A careful study of the reports seems to establish a strong probability that the following are the facts: The sea-level canal would be slightly less exposed to damage in the event of war; the running expenses, apart from the heavy cost of interest on the amount employed to build it, would be less; and for small ships the time of transit would probably be less. On the other hand, the lock canal at a level of 80 feet or thereabouts would not cost much more than half as much to build, and could be built in about half the time, while there would be very much less risk connected with building it, and for large ships the transit would be quicker; while, taking into account the interest on the amount saved in building the actual cost of maintenance would be less. After being built, it would be easier to enlarge the lock canal than the sea level canal. Moreover, what has been actually demonstrated in making and operating the great lock canal the Soo, a more important artery of traffic than the great sea-level canal, the Suez, goes to support the opinion of the minority of the Consulting Board of Engineers and of the majority of the Isthmian Canal Commission as to the superior safety, feasibility, and desirability of building a lock canal at Panama.

The law now on our statute books seems to contemplate a lock canal. In my judgment a lock canal as herein recommended is advisable. If the Congress directs that a sea-level canal be constructed, its direction will, of course, be carried out. Otherwise the canal will be built on substantially the plan for a lock canal outlined in the accompanying papers, such changes being made, of course, as may be found actually necessary; including possibly the change recommended by the Secretary of War, as to the site of the dam on the Pacific side. THEODORE ROOSEVELT.

The main conclusions of the majority report of the Board of Consulting Engineers, in favor of a sea-level canal, are as follows:

The vastness of the interests to be served by the canal, many of which interests now wait for their development on the construction of the waterway, demands that the canal shall, when opened to traffic, be of the type which will most perfectly fulfill the purposes which the waterway is intended to accomplish.

First and foremost it is essential that the Panama Canal shall present not merely a means of interoceanic navigation—it may be said that any type of canal would enable vessels to pass from ocean to ocean—but a means of safe and uninterrupted navigation, on which no special hazards will be encountered by and no vexatious delays will be occasioned to the vessels which will traverse it. It is therefore evident that the canal ought to be formed in such manner that the course thereof shall be free from all unnecessary obstructions, and that no obstacles should be interposed in that course, whether temporary or permanent, which would by their very nature be an occasion of peril and of detention to passing vessels, and more particularly to vessels of the great size which the Panama Canal is (in accordance with the provisions of the law of Congress) designed to accommodate. The board is of opinion that this consideration should be of determinative force in respect to the type of canal to be adopted, and that it should lead to rejection of all proposed plans in which lift locks, whether few or many, form the principal or dominating features, and consequently to the acceptance of the sea-level plan as the only one giving reasonable assurance of safe and uninterrupted navigation.

It has already been stated as the opinion of the board that the time required for the construction of the Panama Canal with a summit level of 60 feet above mean sea level, will at best be only two years less than required for the construction of the sea-level canal. But as affecting this question of time, it should be observed that accidents during construction leading to an extension of the time required to complete the canal would be more likely to occur in the more numerous structures involved in the building of the lock canal than in the works for the sea-level canal. It has further been shown that the difference in cost between the two plans will not exceed about $71,000,000 in favor of the former, which must be reduced by the capitalized cost of the maintenance and operation of locks and by the cost of the overflowed lands, as before stated. It is seen, therefore, that the lock design has inconsiderable advantage either in time of realization or ultimate cost over the one recommended by the board for adoption by the United States Government, which possesses all the advantages of practically indefinite capacity for traffic, besides a degree of safety and uninterrupted operation which cannot be approached by any lock plan.

It is the belief of the board that the essential and the indispensable features of a convenient and safe ship canal at the American isthmus are now known; that such a canal can be constructed in 12 or 13 years' time; that the cost will be less than $250,000,000; that it will endure for all time.

The board does not believe that a provisional treatment of this great question would yield results which would be satisfactory to the American nation or advantageous to American commerce, or that such treatment would be in consonance with the increase of population, of trade, and of wealth which will surely take place during the next half century in the Western Hemisphere.

THE MINORITY REPORT.

The minority report, signed by Messrs. Noble, Abbot, Stearns, Ripley and Randolph, concurs with much of the majority report, but concludes that a lock canal would be the better one for the United States to construct, for the following reasons:

(1.) Greater capacity for traffic than afforded by the narrow waterway proposed by the board.

(2.) Greater safety for ships and less danger of interruption to traffic by reason of the wider and deeper channels which the lock canal makes possible at small cost.

(3.) Quicker passage across the Isthmus for large ships or a large traffic.

(4.) Materially less time required for construction.

(5.) Materially less cost.

The Isthmian Canal Commission (except for Commissioner Mordecai T. Endicott, dissenting,) concurs in this minority report, and advocates a lock canal for the following reasons:

(1.) It provides greater safety for ships and less danger of interruption to traffic by reason of its wider and deeper channels.

(2.) It provides quicker passage across the Isthmus for large ships or a large traffic.

(3.) It is in much less danger of damage to itself or of delays to ships from the flood waters of the Chagres and other streams.

(4.) Its cost of operation and maintenance, including fixed charges, will be less by some $2,000,000 or more per annum.

(5.) It can be enlarged hereafter much more easily and cheaply than can a sea-level canal.

(6.) Its military defence can be effected with as little or, perhaps, less difficulty than the sea-level canal.

Brief specifications of the plan recommended in the minority report as adopted by the President are as follows:

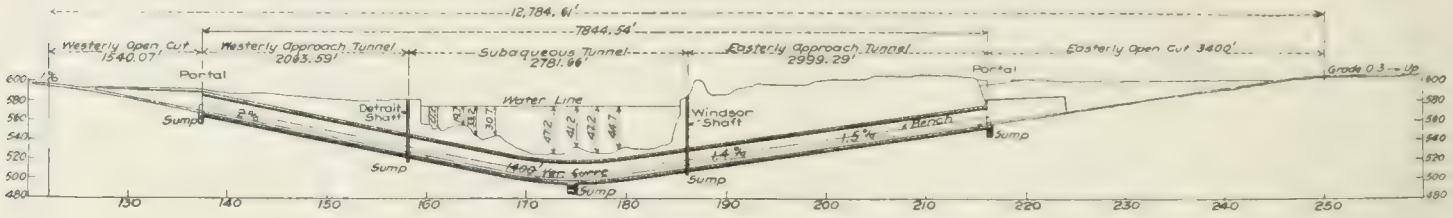
The plan recommended by the minority of the board is a canal with locks, following in general the same location as the other, but with slight variations therefrom in Limon and Panama Bays. Its controlling feature is a dam to close the valley of the Chagres at Gatum, thus creating an artificial lake of which the surface is to be 85 ft. above the sea, and which is to constitute the summit level. The length of this dam will be 7,700 ft., and the height of its crest 135 ft., or 50 ft. above the water surface. It will contain about 21,200,000 cubic yards of material, principally the spoil from the excavation of the canal prism. It is provided with ample spillways and regulating works. A channel 500 ft. wide at sea level leads from Limon Bay to the Gatum dam, where is placed a double flight of three locks, by means of which vessels are lifted into the artificial lake. The lake provides unrestricted navigation for a large part of its length, but becomes more contracted as the Continental Divide is approached until in the Culebra cut the width at bottom is reduced to 200 ft. It finally terminates at Pedro Miguel, where the first lock on the Pacific side is placed, having a lift of 30 ft. By means of this lock vessels are lowered into another artificial lake created by a dam closing the valley of the Rio Grande, and by two other dams closing other depressions, the level of the lake being 55 ft. above the sea. The crests of these dams are 80 ft. above the sea. Communication between the lake and Panama Bay is effected by a double flight of two locks, placed near the shore on the high ground called Sosa Hill. . . . The cost of the canal under this plan is estimated by the minority of the board at $139,705,200, and the time required to build it at nine years.

A correspondent calls attention to the fact that our conclusion on the result of the tests of the New York Central electric locomotive, to the effect that a third rail entirely unprotected is a good deal less troublesome in a storm than a third rail protected in such a way that snow is encouraged to accumulate, is only true as comparing the unprotected third rail with the usual type of protected top-contact rail. He adds that it is a fact that not only during the storm in question, but also during a later drifting snow storm the unprotected top-contact rail was inoperative, due to the collection of snow, ice and sleet causing excessive arcing, whereas, the under-contact protected rail at all times enabled the locomotive to operate without trouble and proved conclusively that the protected under-contact rail is not only safe as regards human life but also guards against the evils of interruption of traffic during snow and sleet storms.

The Detroit River Tunnel.

(*Concluded from page 152.*)

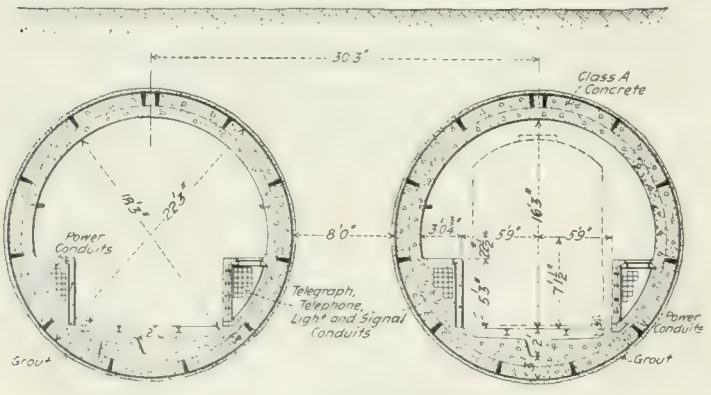
Last week we gave a general outline of the Detroit river tunnel project of the Michigan Central and a description of the three alternative designs for building the tunnel by the trench method. The fourth alternative method, designated as Design D, is the familiar shield method now being used in the tunnels building under the East and North rivers in New York. The shallow depth of the tunnel roof under the river bottom made necessary by the limited approach grades introduces many difficulties in the application of this method, but it is included in the specifications to give bidders an opportunity to submit proposals for a well-tried scheme with which they might be familiar. Were it not for the shallowness of the tunnel the shield method could no doubt be successfully applied in this case as the ground through which the tunnel is to be driven is firm but easily worked in front of the shield without blasting. If the shield is used, thick mats of clay will have to be deposited over the river bottom at the places where the tunnel roof comes dangerously close to the top of the mud to prevent blowing out in front of the shield. The accompanying profile shows the depth of the tunnel under the river and the grades which will be used if Design D is employed.



Profile of Tunnels, Design D.

The cross-section of the twin tunnels, Design D, shows the principal features of the construction which differs but little from that to be used in the Pennsylvania tunnels and the Battery tunnel of the Interborough in New York. The two tubes will be spaced 30 ft. 3 in., center to center, and will be parallel between the shield chambers. They will be lined with segmental cast-iron rings with an outside diameter of 22 ft. 6 in., inside of which will be another shell of 1:2:4 concrete 2 ft. thick. The design of the floor and benches is substantially the same as for Designs A and B. The cast-iron shell will be made up of segmental flanged rings 2 ft. 6 in. wide, and 1½ in. thick. Each ring will be composed of 11 segments and a key segment at the crown. Grout holes are to be provided in each segment for surrounding the outer shell with a thin layer of grout as additional waterproofing.

The specifications cover the method of building with a shield very fully. The shields are to be erected in the shield chambers built out just beyond the shafts, and at least two shields must be used in driving the tunnel to expedite the work. All of the working plant must be built to withstand a pressure of 50 lbs. per sq. in. Bulkheads built of concrete or brick set in cement must be put in at least every 1,000 ft., and when the shield has been forced out 500 ft. from the shield chamber at least two bulkheads must be in use. Each bulkhead must have two working locks 6 ft. x 20 ft. near the bottom for the passage of men and material, a pipe lock 12 in. x 31 ft., and an emergency lock large enough to hold the entire working force at the shield, near the roof. A safety screen must always be in place within 100 ft. of the shield. The working plant above ground must be ample to maintain the necessary pressure in the tunnel, and a spare plant of at least 25 per cent. of the capacity of the normal working plant must always be ready for emergencies. Ventilation in front of the shield is to be provided for with an 8-in. ventilating pipe open to the outside atmosphere and having a suitable pressure regulating valve at the shield.

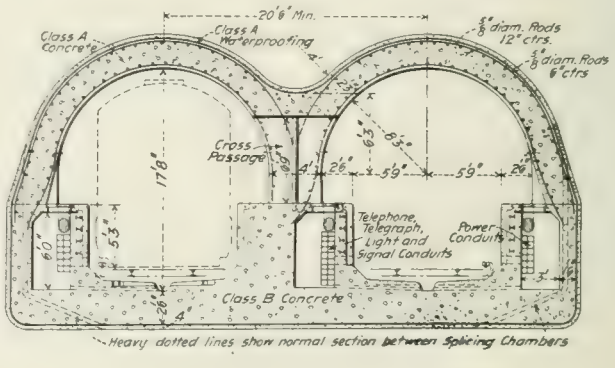


Cross-Section Through Subaqueous Tunnels, Design D.

The approach tunnels at each end leading from the shafts to the portals will be built with timbered open-cuts and back-filled after completion. The cross-section shows the details of construction at a normal section, where the center lines of the two tubes are at a minimum distance from each other of 20 ft. 6 in. Reinforced concrete of a 1:2:4 mixture will be used in the arches above the bench, and a 1:3:6 mixture of concrete, not reinforced for the walls, floor and bench. The tubes will be 2 ft. 7 in. thick at the crown, and will have a full circular arch of 8 ft. 3 in. inside radius. The reinforcement in the crown will be essentially the same as for the subaqueous tunnels, Design A, consisting of annular rings of ⅝-in. rods spaced 6 in. center to center, and longitudinal rods ⅝ in. in diameter, spaced 12 in. center to center, the reinforcement being laid in a mesh 2 in. from the extrados and intrados of the arches. The main body of concrete will be covered with three layers of felt and four alternate layers of pitch, and over this will be laid 4 in. of 1:3:6 concrete to protect the waterproofing. The benches will contain the telephone, power, lighting, telegraph and signal circuits in single-way ducts, as in the subaqueous section. Cross-passages between the two tunnels will be spaced every 200 ft.

The portals will be of 1:3:6 concrete, handsomely decorated and surmounted with a cornice and balustrade. A series of five sumps will be found under each track just outside of the portals, and the two rows of sumps will be separated by a pump chamber. The drawings show pile foundations which will be put in if found necessary when the excavation is made. The retaining walls of the open cut rise to the height of the portal face and continue on out to the end of the cut, reducing in height as the tracks come up to the surface. They are to be stepped on the near face and given a batter of 1 in. to 1 ft. on the front face. Stairs will be built in at both sides leading down from the top of the retaining walls to the level of the bench in the tunnel.

The open approach cut will be built with retaining walls for the first 1,090 ft. from the portal in the Detroit side and for the first 800 ft. on the Windsor side. The walls will have a 4 ft. footing course of 1:4:7½ concrete and a 12-in. coping 3 ft. wide of 1:2:4 concrete, the body of the wall being of 1:3:6 concrete. They will be 29 ft. apart at the top of the footing courses, which allows 13-ft. centers for the tracks. A gas-pipe fence will surmount the coping. The wire ducts will be built into the walls on both sides. The track structure will be 6 in. of quarry spawls laid on the center earth core overlaid with 18 in. of stone ballast in which the ties will be bedded. Sub-drainage is provided for by a line of 6-in. farm tile laid under the paved gutters along each wall. Weep holes or drains through the walls will carry off water collecting behind the walls. Great care will be taken in excavating for the open cuts to prevent caving and damage to adjacent property by draining off water in the soil. Beyond the retaining walls the banks of the cuts will be sodded and given a slope sufficient to hold the sod.

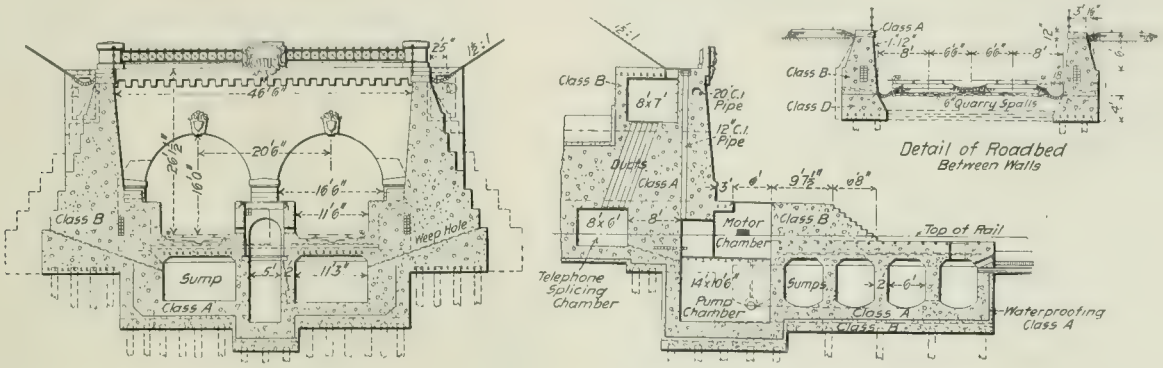


Cross-Section of Approach Tunnels.

The shafts near the river banks at both ends of the tunnels will provide ventilation and an outlet for the drainage pipes from the sumps as well as an exit in case of an accident in the tunnels. They will be built with double wells 12 ft. x 15 ft. 6 in., and the space between the two wells is of sufficient width for a staircase leading up from a cross-passage at the level of the bench in the tunnels. Two sumps will be built under such track at the shafts and

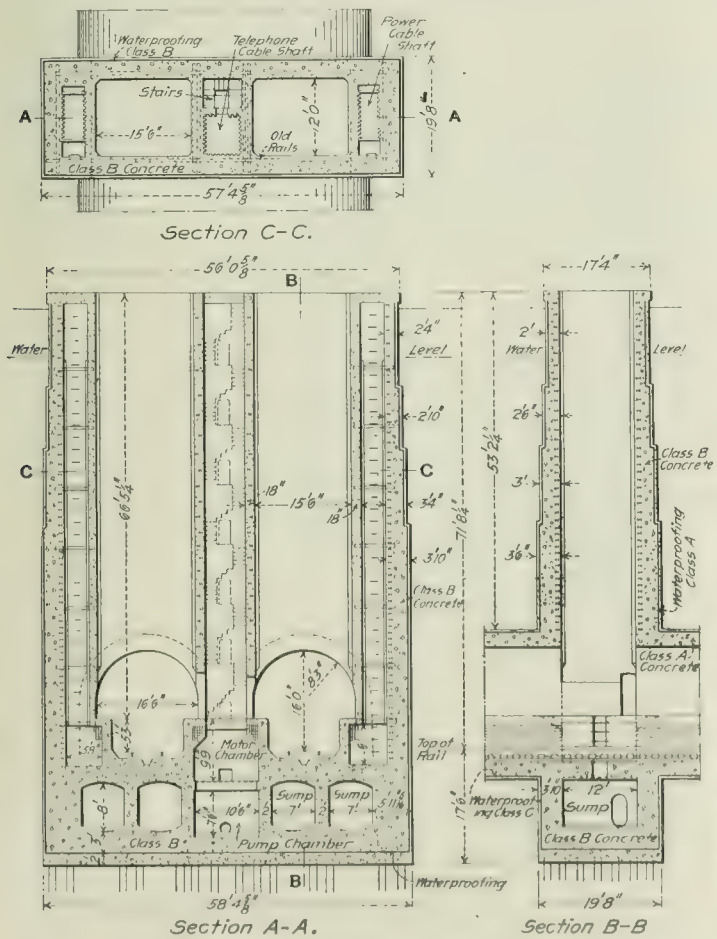
a large pump chamber in between. The sumps will have a combined capacity of 20,000 gallons. Old rails will be used to reinforce the 1:5:6 mixture of concrete, as shown in the drawings. Waterproofing, consisting of 5 layers of felt and 6 alternate layers of pitch, will be laid in the concrete entirely surrounding the shaft and foundations. The excavation for the Windsor shaft is almost completed, this work having been done by the Tunnel Company, which has also begun work on the Detroit shaft.

The specifications for concrete to be used on the work include five classes or mixtures. Class A is a 1:2:4 mixture, using No. 2 broken stone or gravel, which is from 1/16 in. to ¾ in. in its largest diameter. Class B is a 1:3:6 mixture, using No. 1 gravel or stone,



Details of Portals and Cross-Section of Open Approach Cut.

which is from ⅛ in. to 2 in. in its largest diameter. Rubble stones not to exceed 1¼ cu. ft. in volume may be used in this class of work. Class C is a 1:1:2 mixture with No. 2 stone. Class D is a 1:4:7½ mixture of No. 1 stone, and Class E is a 1:1½:3½ mixture using No. 2 stone. Grout is 1 cement:1 sand. Concrete may be laid in freezing weather if salt is used or the sand and water are heated.



Details of Windsor Shaft.

The proportion of salt allowed is 1 lb. to 18 gallons of water. All concrete is to be machine mixed.

The estimated cost of the tunnel is between $7,000,000 and $8,000,000. The actual tunneling work under the river is expected to be completed in less than a year.

We are indebted to Mr. W. J. Wilgus, Vice-President of the New York Central and member of the Advisory Board of Engineers, for the drawings and information.

The Government Railroad Monopoly in Italy.*

I.

Although totally unprepared from the technical, economic, and administrative standpoint, the Italian Government and Parliament have taken it upon themselves to solve the railroad problem. In 1885 contracts were stipulated by which the Italian railroads were divided into three great systems, i.e., the Adriatic, the Mediterranean, and the Sicula roads; the first two in Continental Italy divided the country longitudinally in the Adriatic and Tyrrhenum directions, the third was for Sicily.

The companies paid the Government $53,000,000 as value of the railroad material, and the Government agreed to pay their annual interest charge of $369,730. The chief conditions of the abovementioned contract consisted in fixing a percentage of 27 frs. 50 centimes (5.25 per cent.) on the gross returns, which the railroad companies were to pay the Government annually. This percentage was to be increased if the gross returns exceeded the limits of the initial gross returns, which were fixed at $44,000,000. Ordinary and extraordinary expenses were to be paid by the companies.

Reserve funds were instituted, to which 10 per cent. of the initial gross returns, and 15 per cent. of later returns, were devoted, for the purpose of meeting unavoidable emergencies, for the renewal of railroad metal and other material, and lastly for the improvement of the lines and increase of material. Since a considerable portion of the rails belonged to the Government, the surrender of the railroads to private companies assumed the character of a lease rather than that of a private business. When one adds to this that the condition of the rails was deficient, and that the material was worn and scant, it will easily be understood that the new administration was inaugurated under unfavorable auspices and commenced badly.

A special office of General Railroad Inspectorship was instituted, the object of which was to control the service, and take care that the conditions of the contract were respected. A Board of Tariffs, so-called, was further added, to which delegates of the Government and of the companies were appointed, the object of which was to make such alterations in the tariffs as the economic conditions of the country might render opportune.

But the defective condition of the roads, the mistaken working methods, and the obstacles created by the contract conditions, rendered a rational and proper railroad system impossible, and the companies barely obtained a scant interest, which did not surpass 6 per cent. on the capital paid to the state; and only by the concession of the construction of the new rails, were the companies enabled to continue carrying on the railroads, which in certain years, especially for the Mediterranean line, returned scarcely any profits.

The Government, on its side, while apparently enjoying the stipulated percentage, was in reality obliged to spend a considerably larger sum in aid of the scant reserve fund; and the country had to put up with inadequate service and very high tariffs. As soon as the conditions of the contract were enforced, the results proved to be quite different from what had been expected, and consequently the reserve funds fixed for the improvement of the road and material did not suffice, and the Government was compelled to have recourse to the Treasury so as to make up for this, but always did so tardily and inadequately.

The companies, on their side, with an insufficiently developed property, vainly begged the Government to attend to the matter, and meritorious as the efforts made by the companies were, the railroad service could not prove other than inadequate to the requirements of the country. Not one of the ministers who succeeded one another in the course of 20 years realized that it was his duty to lay the real state of the case before Parliament, all did their best to conceal it, and while the Government allowed the

*The author of this paper, which is the first of a series dealing with the subject, has had intimate connection with the Italian railroad system for many years. On this very account, he prefers to have his name withheld.—EDITOR.

railroad capital to dwindle, the Ministers of Public Works—in order to keep themselves clear of all responsibility—deceived the Parliament by laying all the blame for the bad service and continual unforeseen expenses which the Treasury was compelled to pay, at the companies' charge. For, much as the Government has attempted to avoid the grave responsibilities incurred by its short sightedness, and inadequate as are the present conditions of the Italian railroads to the requirements of the life and commerce of the country, it is none the less a fact that the Government has, during the past 20 years, subscribed $40,000,000, besides the enormous capital spent on new railroads.

Moreover, the Railroad Inspectorship, which the Government created to control the railroad service, to study its defects and suggest remedies therefor, was transformed into a legal office, which wasted its time and energies in fruitless quarrels with the companies, and seconded the Ministers of Public Works in their efforts to deceive the country regarding the real cause of the railroad difficulties, i.e., the inadequate condition of the railroads, the lack of rails, and the conditions imposed on the service. Thus the inspectorship so far lost its technical character that a barrister was appointed as Director.

In like manner, the Board of Tariffs, which might have rendered real service, was paralyzed in its functions, being rarely summoned, and then only to consider matters of secondary importance. In this way the action of the inspectorship was rendered null, on the one side, while on the other, public opinion was misled by the convenient system of laying all the blame on the companies.

This system, while screening those really responsible, created a current of opinion of which the extremist parties availed themselves, and thus Socialists, Radicals and Republicans advanced state monopoly as their program, in their wrath against the companies, which were denounced as those solely responsible for the disgraceful railroad service. In support of this opinion, the many complex questions connected with the grave railroad problem were neither examined nor discussed, while appeal was made to the mob and to the railroad staff.

Public meetings were called, and, totally ignorant of the true state of affairs, passed votes in favor of state monopoly. The railroad staff rebelled, imposing terms and conditions on the Government, and ended by declaring the strike which an inefficient minister was incapable either of foreseeing or tackling. Those acquainted with railroad problems demonstrated that it was a question of substance, not of form, and that the first necessity was to develop the railroads, and complete the lines, thus inaugurating a more logical and rational service. Thus it came about that while the most competent and authoritative statesmen had always declared themselves opposed to state monopoly, they finished by giving in to the weight of public opinion and threats, and only a few isolated men held to their convictions. The Government also went with the tide, and, taking a leap in the dark, proposed the bill for state monopoly, which was hurriedly passed by both branches of Parliament, without any kind of preparation, under the pressure of the railroad strike.

This hurried manner of solving so grave a problem presented one advantage only; it served to conceal the responsibility of those who had brought about the disastrous state of affairs, in which both the Government and private management would have found the Italian railroads in a deplorable condition, and, what is worse, with a working system opposed to all practical and rational notions.

Private Cars and the Fruit Industry.*

The shipment of fruit under refrigeration was not originally Armour's idea. As far back as 1868 fruit had been transported under ventilation or partially iced. Swift transported iced beef with established success in 1880, but it was not until 1888 that any one was daring enough to attempt the costly transportation of carloads of fruit under complete refrigeration from California. In 1888 several men, Hutchins, of Detroit; the Thomases, father and son, of Chicago, and the Hubbard brothers, after experiments with the shipment of iced fruit in Michigan and from the South, demonstrated the practicability of a thorough iced car service from California, and the next year staked everything they had upon their idea, and induced a few growers of cherries and apricots in California to try their new cars.

In spite of every obstacle, Thomas and his associates were successful—unexpectedly so. Upon their almost forgotten efforts, indeed, rests much of the present prosperity of California. They organized the California Fruit Transportation Company, and within three seasons, so amazing was their success, that they owned over six hundred cars—and their profits were really fabulous.

But they quarreled with the Earl Fruit Company, one of the largest fruit shippers of California. Undeniably they themselves became greedy. Earl went to Chicago and tried to make terms with them. When he failed he approached Armour and made arrangements to rent some of his refrigerator cars in the fruit industry. He also got hold of certain patents and organized two refrigerator car lines of his own. Backed by Armour, whose influence with the railroads was supreme, Earl began a fierce contest for the business. He paid rebates for the first time on the California fruit business. In two seasons Thomas was utterly defeated and finally, after disastrous experiments in shipping fruit to Europe, the California Fruit Transportation Company was sold out, name, idea, business and all to Swift & Co.—and Swift & Co., of course, is a part of the "beef trust."

Armour now perceived the brilliant opportunities for profits in the fruit-shipping industry. He developed his business rapidly. For some time he worked on terms of apparent friendliness with the Earl Fruit Company. But Earl was a man of great energy and capacity, and he developed so much aggressiveness and his profits were so glittering that Armour decided to eliminate him. . . . Having crushed his last rival, Armour rapidly broadened his activities, reaching out for more and more of the profitable fruit business of the country. To-day he owns and operates some 14,000 refrigerator cars, worth over $14,000,000; he not only controls most of the fruit transportation of California, and therefore the destiny of the fruit-growers themselves, but he penetrates the peach-growing districts of Michigan and Georgia, and the strawberry fields of North Carolina; he brings tropical fruits from Mobile and New Orleans, melons from Indiana and Illinois, and early vegetables from Arkansas and Missouri.



Fig. 1.

Having crushed his private-car rivals in the fruit industry, Armour now began a new campaign. The railroads themselves had been buying refrigerator cars, and offering them for the shipment of fruit and dairy products. So Armour went to various railroads and proposed or demanded that they make contracts with him for the exclusive use of Armour refrigerator cars. He pays over $200,000 a week in freight at Chicago alone, and vast sums elsewhere. By giving his business to one railroad and taking it from another he could almost make or ruin the profits of the companies concerned. Here was the Pere Marquette Railroad, for example, over which was shipped the bulk of the fruit grown in the rich districts of western Michigan. The Pere Marquette was a weak railroad, hungry for more traffic. Armour went to the eager officers of the Pere Marquette and guaranteed to give them forty cars of meat a week, in return for which the Pere Marquette agreed to use none but Armour's cars for its fruit shipments. The Pere Marquette had a few refrigerator cars of its own with which it had served its customers; but under the new contract it could not supply its own cars to the people along its own line.

It is the theory of the private car that any shipper can own cars and have them shipped over the railroad. Armour says plausibly enough to his rivals who complain:

"Why don't you get your own cars—if you want to do business on an equality with me?"

But these competitors, even if they bought cars, could not ship them over the Pere Marquette Railroad because Armour had prevented the use of any cars but his own anywhere on that railroad. And the Pere Marquette was not the only road affected. No railroad in all the great fruit country of the South was at liberty to use any refrigerator cars except Armour's. About the only fruit-originating railroad of any importance which he did not get was the Santa Fe, which does its duty by its clients by owning its own refrigerating cars, although it charges the same icing rates as Armour and has indulged in the same methods of paying rebates. The Pennsylvania Railroad and the Gould lines also own their own refrigerators and have refused to make exclusive contracts with Armour.

Armour's really valuable service is to roads like the Pere Marquette. They found it a burden to buy and own enough refrigerator cars to handle all the fruit business on their lines, because fruit shipments are crowded into a certain short season. Armour could send his cars to Florida or to California in the winter, and could employ all his cars all the time, which is an economic saving and therefore a service to the people. * * * The very life of these hard-working Michigan farmers depended on railroad service, and they

*Extracts from an article in McClure's Magazine, by R. S. Baker.

were naturally willing to pay almost anything rather than to perish industrially. But can we, after all, excuse Armour on the ground that the railroad did not do its duty?

From Paw Paw, Michigan, to Dubuque, Iowa, the icing charge before Armour's reign was $10 on the average. After Armour got possession it increased to $37.50. To Boston from Grand Rapids, before Armour, icing cost $20 a car; after Armour, $55.

A shipper went to Grand Rapids and tried to reason with Armour's representative there. He explained how unreasonable and unfair such charges were; how, in the end, they would serve to limit the fruit production of Michigan and therefore reduce the business of the Armour car line itself, let alone that of the railroads. When he had finished speaking Armour's man looked up and asked:

"Well, what are you going to do about it?"

The Iowa markets, which had been profitable to Michigan growers, were almost entirely closed after 1902.

But conditions in Michigan, bad as they were, cannot be compared for downright hopelessness with that of the fruit growers of California. The longer the distance shipped, the more dependent the shipper becomes.

J. A. Leverone, of Cincinnati, made two shipments of pineapples, one of fourteen cars from Mobile over the Louisville & Nashville, which had an Armour contract, the other of ten cars from New Orleans by the Illinois Central, which had no Armour contract. The distance from New Orleans to Cincinnati is greater than from Mobile to Cincinnati. On the Armour cars the icing charge was $45 each, on the Illinois Central cars the charge was only $11.37 each—one-fourth as much. At the same time Armour shipped pineapples and sold them at his own branch stores in Cincinnati in competition with his client Leverone. And he sold for $35 a car *cheaper* than Leverone—or just about the profit which he made out of Leverone on ice. What chance could there be for a shipper against Armour under such circumstances?

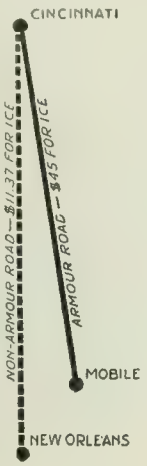


Fig. 2.

Of course, Mr. Leverone objected; his very business existence was threatened. He refused to pay the charges. The officials of the Louisville & Nashville Railroad threatened him, * * * but finally settled with him, refunding the icing charges. Then the Louisville & Nashville issued an order withdrawing the high Armour rates from Mobile to meet the Illinois Central competition at New Orleans. But the poor fruit growers on parts of the Louisville & Nashville, who had no other railroad to help them out, were still wholly at the mercy of the Armour monopoly—and are to-day.

Injuries to Employees.*

We next take up injuries to employees caused by the carelessness of other employees; first, as in the case of passengers, those caused by collisions. From the number of collisions on the main track and in yards one would almost think that the general and fundamental customs and rules on railroads that "In case of doubt always adopt the safe course," and that "Speed must always be sacrificed to safety" were seldom observed; but I do not think that is so. On the contrary I believe it to be the exception and not the rule, else the number of accidents resulting from such failure, though many times in number what they should be (and as long as men are human we will have some accidents), would be so much greater in number that people would be unwilling to travel at all. Yet I have the faith to believe that in the near future the number of such cases will be so greatly reduced that the least thoughtful of us will stand aghast at the record of 1903 and 1904, and that these fundamental rules and the instructions contained in what are known as the "Flag Rules," and "Caution Card," will be so strictly observed and enforced and that blocking of trains by space, not time, intervals will become so general as to practically eliminate this class of accidents, which are caused: By failure to watch for and observe block and other signals; by trains following each other too closely; by trains following at too high a rate of speed; by failure to protect trains stopped on the main track; by cars not being left in to clear at sidings; by switches being left wrong; by lack of caution in time of storm or fog; and by general carelessness and failure to realize the terrible result which is bound to follow any lack of care, failure to comply with the rules and the uncertainty of detection and punishment if such carelessness and failure to comply with rules does not cause an accident.

Every man in the train, engine, and switching service ought to have every requirement of these rules by heart, understand exactly what they mean, and be ready at any instant, and in any weather, to execute them to the letter, and no punishment should be too severe for failure to observe them to the very letter, for on their faithful observance depend the lives of passengers—it may be some of your own loved ones—of employees, and the safety of the property entrusted to the company for transportation, as well as its own. And yet, if the instructions contained in the two fundamental rules and those known as the "Flag Rules" had been observed, none of the following cases and many others that help fill the records of my office and the daily press would have happened. It is a standing disgrace to the service that such accidents happen, and the sooner you help get the careless and reckless men and the drones out of the service, as it is your duty to yourself and the company to do, the quicker the traveling public, yourselves, the property in transit, and that belonging to your employer and yourselves will be safe and the greater your certainty of getting to the end of your run to be welcomed by the wife and children awaiting you.

In this connection I want to suggest to the enginemen that when you discover a cause for the sending out of a flagman give him a chance to go back before you get stopped, so that he can cover the required distance quicker. And as these rules are among the most important, if not the most important, in the book, I give the substance of them as I understand them.

Flagmen shall have for day signals not less than two torpedoes and a red flag; for night signals not less than two torpedoes, two red fusees, and red and white lanterns; conductors shall see that flagmen have these signals when they go on duty.

When any train makes an unscheduled stop (whether at a station or between stations, or whether such stop be caused by accident to the train, or by signal, or in any other way), the train shall be protected as follows. In the night time the flagman shall immediately place a lighted red fusee in center of track about 500 ft. behind the rear of train. He shall then go back as rapidly as possible with red and white lanterns to a point not less than three-fourths of a mile (24 telegraph poles) distant from rear of train and until he reaches a point where the danger signal can be seen not less than one-fourth of a mile (eight telegraph poles) by the engineman of any approaching train. When the character of the road or weather makes it necessary the flagman shall go a greater distance with signals, so as to insure absolute safety. In the day time he shall carry a red flag and proceed to a like point. When he reaches such point, whether in the night time or day time, he shall at once place one torpedo on the rail on the engineman's side and shall remain at that place until recalled. If a train approaches he shall flag it and remain until the train stops. When recalled, if no train is approaching, he shall place a second torpedo on the rail 200 ft. nearer his train and return with all possible despatch.

When any train makes a scheduled stop at any station, and occupies the main track longer than usual at that station, whether on account of baggage, passengers, or for any other reason whatever, the flagman must protect his train in the same manner.

When any train has been stopped by a preceding train in the manner above mentioned, the flagman of the last train must protect his train in the same manner.

When it is necessary to protect the front of a train, it shall be done in the same manner.

In all cases above mentioned it shall be the first and immediate duty of conductors to see that flagmen obey this rule. Both conductor and flagman will be held responsible. When a flagman goes out, the next brakeman or baggageman must take his place on the train, as required by Rule 248.

The engineman on approaching train, on seeing flagman's signal, shall immediately indicate it by one short blast of the whistle, and immediately reduce the speed of his train and find out the purpose of the signal, and if he does not hear the second torpedo he will bring his train to a stop. If the engineman on approaching train sees no signal (the flagman having been recalled), but hears the first torpedo, he shall reduce the speed of his train and thereafter proceed cautiously, and prepared to stop within vision, until he is notified by signal or otherwise that the track is clear. On hearing the second torpedo, the engineman will know that the flagman has been recalled and will proceed cautiously, keeping a sharp lookout for train ahead and prepared to stop within vision, until he is notified by signal or otherwise that the track is clear. If a fusee is seen, the engineman shall not pass it until it is burned out, and thereafter shall proceed cautiously and prepared to stop within vision, until notified by signal or otherwise that the track is clear.

When the whistle is sounded recalling the flagman if there is not a clear view to the rear for one-fourth of a mile (eight telegraph poles) the train should be moved ahead at a speed of not less than six miles per hour, until a point is reached where the track is straight for one-fourth of a mile in the rear of the train, always bearing in mind that the time of the flagman's return is the period of greatest risk.

The following cases will illustrate how much room there is for improvement in this regard:

Joseph Atkinson, brakeman, injured Sept. 26, at Muggleton. He was

*From a paper prepared by the Claim Department of the A. B. & C. Railroad, parts of which appeared in the *Railroad Gazette*, of Dec. 15 and Jan. 5, under the headings "Injuries to Passengers" and "How to Avoid Accidents."

standing on top of way car in train hauled by engine No. 1392, which stopped just west of the depot and then started up and ran into side of freight train.

Alexander Peabody, engineer, George F. Smivins, fireman, injured at 10 p. m., Oct. 3, on track 3, near Penryn Ave., Peltonville; engine No. 784, was backing down track 3 and collided with engine No. 1891 standing on that track. Instructions require engines running on this track must run at slow rate of speed, so as to be able to stop within their vision. The engine was running so fast that it could not stop, although Engineer Peabody saw engine No. 1891 when 300 ft. distant.

J. L. McPherson, yardmaster, and Jacob Gonorowski, brakeman, injured at Peeweezle, July, 28, were in caboose of extra engine No. 674, which was stopping for drawbridge, when engine No. 937, engineman Isidore Guggenheimer, ran into the rear of train.

Luke M. Peters, engineer, injured April 14 at Aromintap, was in charge of engine No. 2143, backing around Y, when train No. 31 backed into extra No. 7326, to which engine No. 2143 was attached.

L. P. Jarvis, engineer, T. J. Tibbits, engineer, Rupert Leggett and Samuel Minns, firemen, injured Nov. 20, at 7:15 a. m., one half mile east of Peeble's Corners, engine No. 759 had just backed in on side track with work train, and switch had not yet been closed; engine No. 1473, train No. 48, Engineer Tibbetts, Conductor Perry, came along at a high rate of speed, and ran into this open switch just east of the home signal, colliding with engine No. 759.

Rules 418 and 419 say: When you get a train order, conductors must read it aloud and then sign it and show it to the engineman, the rear brakeman or flagman, and the engineman must show it to the fireman and in case of freight train to the head brakeman, who are required to read it, the object being that every employee on the train will know what the order is and if the engineman or conductor forget it the brakemen or fireman may remember and by remembering prevent an accident.

Next come injuries caused by derailments, which generally result from running into open switches, off derails, too fast running at bad places in the track, defective equipment or track. Nearly all of the cases would be avoided by careful running, proper inspection of track and equipment, and by compliance with the rules of the company.

John D. Mickles, engineman, Samuel R. Smetzel, fireman, Michael Stubbs, tramp, and unidentified tramp killed, and seven others, including a telegraph operator, injured one and one-half miles west of Daisy Centre, May 21, 1904, by train No. 36 running off derail and knocking down tower. There seems to have been no pretense of complying with Rule 396, requiring conductors to show their orders to rear brakemen and flagmen, and enginemen to show their orders to the firemen. Train passed Daisy Centre 5 minutes ahead of time, running 60 miles an hour in a terrible rain storm.

P. T. Bines, brakeman, killed by derailment of train No. 17, between Merrieton, and Swimmel, Aug. 15, 1904, at 6:10 p. m. From the investigation it appears that this derailment was occasioned by fast running. A bulletin was issued by Superintendent Rathencrest, June 30, 1903, prohibiting trains going down this hill faster than 30 miles an hour. From the statements of all the train crew it would appear that no attention has been paid to this bulletin, and from what the passengers say it has been customary for a long time for trains coming into Swimmel from Werehere, and from Racketico, if in sight of each other, to make the race to see which train can get there first, so as to get to Eppskokee first.

Lemuel Izzard and L. Wackles, killed; R. P. Bownes, engineman, Roderick Bloke, stockman, Robert Castel, fireman, C. Plympton, brakeman, injured, four miles west of Beadleston at 1:48 p. m., July 24. Train No. 36 had broken air hose or axle, derailing and throwing third car from engine onto westbound track just as train No. 98 was coming. Train No. 98 ran into derailed car and 14 cars of time freight burned up. Izzard and Wackles were stealing a ride on Train No. 36.

I shall next call your attention to accidents caused by defects in the equipment, especially in that of freight cars and engines. They are of so frequent occurrence as to no longer attract attention, but when the time comes that the man who inspects reports not to the foreman, whose duty it is to keep the equipment in repair, but to a superior, whose duty it is to find defects, there will be a material reduction in such cases. Train and enginemen should report defects discovered by them on Form 995 and attach card to truss rod of car or locomotive tank. And first we will take up those caused by defective cars:

J. L. Smindorf, brakeman, killed at Snook's Junction, by falling from car No 667, Sept. 8, at 7:40 p. m. This car was delivered to us at Pealey, Sept. 7; the running board was rotten and full of holes; the brake at the north end of car would not hold on account of having a loose ratchet wheel.

P. L. Merritt, conductor, injured at Pencost, Nov. 12, was climbing down side of O., J. & G. car No 9168; screw pulled out of top hand hold, allowing Merritt to fall to the ground, striking on a rail and injuring his hip, back and side.

Randolph Smuck, brakeman, injured at Parrott, April 3, was going down side of A., B. & C. car No. 4721; stirrup was gone and he fell to the ground, spraining his back.

Matthew Brummage, switchman, injured Jan. 4, at Keewahiah, was riding on A., B. & C., flat car No. 5935, which was being switched; he tightened the brake, but the dog was in bad order and he had to hold brake tight with his hand. There was two inches of slack on the bottom brake rod, the chain slipped, and he was thrown from the car and his left foot run over.

How many of the accidents caused by defective running boards, hand holds, ladders and brakes would have been avoided had Rules 741, 742, and 756, requiring trainmen to examine cars, brakes, and ladders and to set out bad order cars been complied with, I leave you to guess. And why when such defects are discovered by train and yard men they do not report them to the next crew taking the car, so as to prevent any of the latter being injured, I never could understand.

One cause of the great increase in accidents by trains breaking in two and by defective couplers is probably on account of the fact that many of the automatic couplers are commencing to wear out and are not repaired or renewed promptly enough, and, also, because the levers and chains of the coupling apparatus do not receive sufficient attention. Another reason is because of the unnecessarily hard usage given the couplers, especially in the yards where trains are made up. Just why an appliance to save life and limb should be abused by the employees, for whose benefit it was put on the cars and engines, is one of the things which it would take a mind-reader to answer. But the truth of the matter is, as every experienced adjuster knows, that the automatic coupler has cost the railroads for equipment and freight damaged many times over what it cost them to settle claims for personal injuries caused by the old link and pin coupler; and when the brotherhoods take up such matters as this and try to remedy them, they will not have so many crippled members drawing insurance for permanent disabilities, which would have been avoided by the proper handling of cars.

Another class of injuries which has come with the safety appliance is that caused by the bursting of air hose, and it is surprising how many of them there are.

Some day a man will get up a hose which won't burst, or which will give notice of its intention so to do, and we will all rise up and bless him. The following are samples taken from a job lot of such cases:

G. A. Graham, conductor, injured June 1, three-quarters of a mile north of Bogle; caused by air hose on A., B. & C. car No. 3864 bursting, causing Graham to fall against stove in way car.

K. L. Grobbet, brakeman, injured one mile north of Brandon; caused by the air hose bursting, throwing on emergency brakes. This man, who was in front end of way car, was thrown to the ground.

Now let us see the result to persons by reason of improper loading of cars:

R. Puddles, switchman, injured at Grammaton, March 4, was hanging on side of A., B. & C. car No 2479, loaded with lumber, engineman shut off suddenly, and when car stopped the lumber slid and caught his hand between lumber and stake on car. Lumber was loaded in two piles 16 ft. lengths, leaving a space of about six or eight inches between the piles.

George Brownell, brakeman, injured July 17, one and one half miles south of Cranton, At Cranton train extra, engine No. 1020 picked up A., B. & C. car No. 7841, loaded with logs; two stake pockets broke; logs fell under way-car, which tipped over, injuring Brownell.

And it is just as important to properly unload packages of newspapers and mail from moving trains, and to exercise a little care in throwing coal from engines, as it is to see that freight is securely loaded. The number of accidents caused in this way since the running of fast mail and newspaper trains commenced would fill a book and could all have been avoided by the exercise of that care which employees or postal clerks would have exercised if they, instead of the company, had to foot the bills caused by their carelessness. To me, it seems not a difficult or unreasonable precaution to look, before you throw out a heavy bag of mail or half a dozen packages of newspapers, to see that no one will be hit by them, and that they could and should be dropped just beyond the far end of the station platform, but never in a street or public highway; and don't throw your clinker bars or ash bars off engines, or anything else for that matter, without looking to see if anyone is passing and when through with them put them in a safe place so they won't project and strike anyone on the next track or fall off and injure someone. If this had been done cases like the following would not have happened:

Henry Forbes, roadmaster, injured Nov. 3, at Marionette, was walking west on station platform, when mail sack was thrown from train No. 08, struck him on the legs and knocked him down.

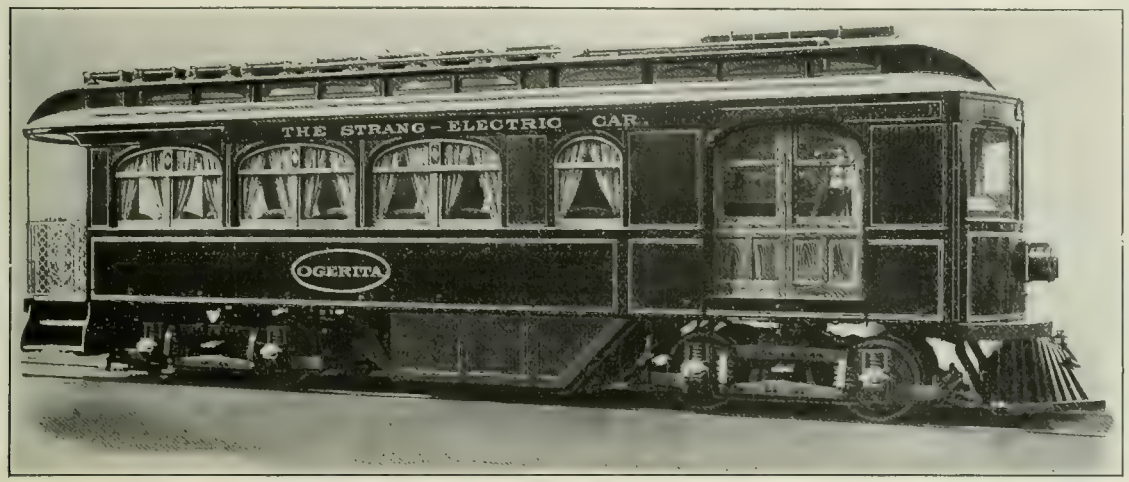
Paul Rhelips, injured at Dragitt, May 15, at 5:30 p. m.; caused by his being struck with a block of hard wood which was tied to a letter thrown from train by the baggageman, while passing through the station at 45 miles per hour.

The Strang Gasolene-Electric Rail Motor Car.

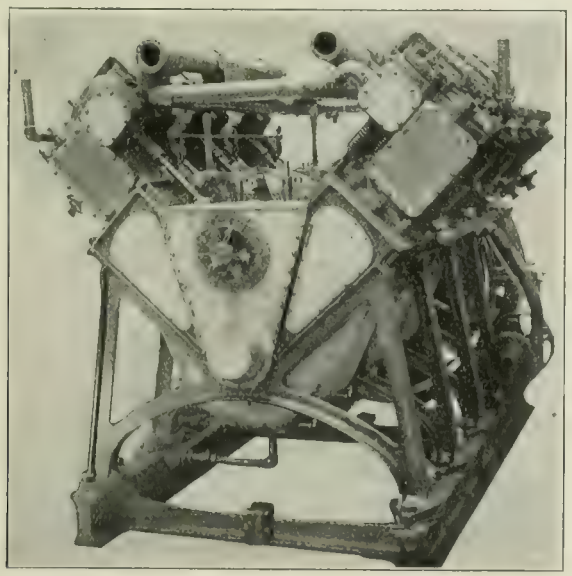
The accompanying illustrations show an experimental gasolene-electric rail motor car built by the J. G. Brill Company for the Strang Electric Railway Car Company. This car has made a number of experimental runs near Philadelphia recently, and is now on its way West to have further experiments made with it. The propelling apparatus consists of a six-cylinder gasoline engine direct connected to a direct-current dynamo in the engine compartment, a starting rheostat, storage battery mounted under the car, a series-parallel controller and two motors on the axles.

The engine is of special construction, and includes a number of governing devices which are unique in design and operation. It was built by the Strang Electric Railway Car Company, and designed by its chief engineer, Mr. Lars G. Nilson. It is of the four-cycle type, and has six 8 by 10-in. cylinders. To secure a short crank shaft and reduce vibration to the minimum, the cylinders are partially opposed, three on each side, and are set at an angle of 90 deg. to each other. An advantage of this construction is in the

accessibility of the parts. The bearings and wearing surfaces in general are large, but the weight of the entire engine is reduced by using aluminum for covering parts where there is no strain. The engine frame is a substantial cast-steel structure, securely bolted to a rectangular base of the same material. The vaporizer is arranged to work with the utmost economy with all kinds of loads. Kerosene, alcohol or crude oil may be used instead of gasolene with a slight change of adjustment of the vaporizer. The ignition is of the high-tension, or "jump spark" type, with coils of a special design, one coil for each cylinder, and all operating from one interrupter. The commutator is driven from the end of the cam shaft and is outside the casing at the rear of the engine. The oil is contained in a reservoir placed beside the base of the engin and pumped to the different bearings; it is returned to a filter located over the reservoir. A centrifugal pump belted to the flywheel draws water from a tank in the vestibule at the center of the car and forces it through the cylinder jackets and to radiating pipes upon the roof. In cold weather the passenger compartment is heated by the water from the cylinder jackets. The gasolene is stored in a tank underneath the car floor, and is pumped to an overflow cup at the side of the vaporizer and the excess returned by another pipe to the tank. The cells of the storage battery are placed on a cradle underneath the center of the car. By the use of 250 volts instead of the usual 500 the number of cells is reduced and a more reliable insulation is secured.



Experimental Strang Gasolene-Electric Rail Motor Car.



Six-Cylinder Engine and Frame.

The electrical equipment consists of a 50-kw, 250-volt, d.c. generator, 400 r. p. m. directly coupled to the gasolene engine; two 50-h.p. series-wound motors of the regular street railway type, two K-13 controllers, and a storage battery of 112 cells having 200 ampere-hours' capacity.

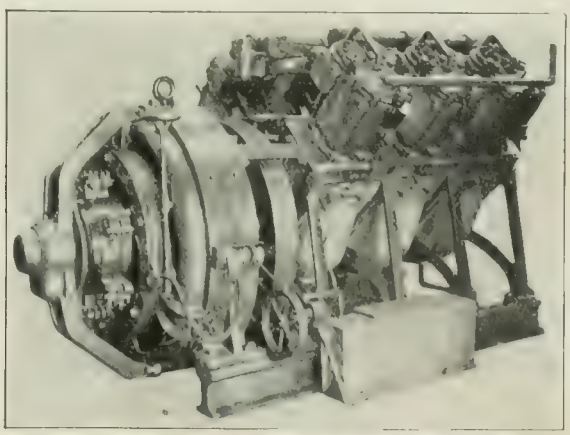
When running on a level track under ordinary conditions, the current goes directly from the generator to the motors, but when coasting down grade, slowing up or standing still, the surplus of current is taken up by the batteries and furnishes the extra power necessary for acceleration, and for ascending steep grades. This arrangement is entirely automatic and does not require to be watched by the operator.

The use of a direct-connected gasolene engine requires one which is large enough for the maximum load, therefore, it runs most of the time at one-third its normal power. In the Strang system the storage battery enables the engine to run practically at the same speed at all times, with the air and fuel adjusted but once and for the best possible combustion. The battery acts as a balance or equalizer and the engine takes care of the normal load. The battery is of comparatively small size, as it is rarely called upon to furnish current for more than a few minutes at a time.

The engine is provided with automatic governing devices dependent entirely upon the condition of the batteries and the consumption of current. This arrangement has nothing to do with the speed of the engine or the motors, but is simply an additional safeguard against overcharging the batteries, and is entirely automatic and solely for the purpose of economizing fuel and saving the battery when the car is running light or standing still. The switchboard is placed against the left side of the engine compartment within easy reach of the operator. It includes voltmeter, ammeter, starting rheostat and spark control. The platform at the rear of the car is equipped with a controller and a combination volt- and ammeter.

The maximum speed of the car which can be maintained is 50 m. p. h. The average gasolene consumption is 0.45 gallons per car-mile. One hundred gallons of gasolene are carried, which gives a mileage radius of 225 miles.

Several cars of this type are now being built by the J. G. Brill Company for the Missouri & Kansas Interurban Railway, to be used on the line running over the old Santa Fe trail from Kansas City, Mo., to Olathe, Kan. These cars will closely resemble standard interurban cars, will be 52 ft. 9 in. long over vestibules, and will be mounted on Brill 27-E trucks. They will be divided into an engine compartment in front, 14 ft. 8 in. long, a smoking compartment 10 ft. 8 in. long, and a passenger compartment 27 ft. 5 in. long. Accommodations for 41 passengers will be provided.



Engine and Dynamo.

The patents on the Strang System are controlled by the Strang Electric Railway Car Company, 15 Wall street, New York City.

Technical Considerations in Electric Railway Engineering.

On January 25 the London Institution of Electrical Engineers considered an exhaustive paper, under this title, read by Mr. F. W. Carter. If we quote his last remarks first the author's object may at once become apparent. "There is at present a little natural conservatism amongst railroad managers, and a disinclination on the part of directorates to sanction the outlay of a large amount of capital when the best system of operation appears to the superficial observer still a matter of speculation. It is hoped that this paper will serve in a measure to define the spheres of usefulness of the several systems of electrical operation, or at least to

prove that the most suitable system can be determined in any particular case."

Mr. Carter did not take up the economic engineering aspect of railroad electrification, nor did he describe particular apparatus and material, preferring rather to deal with the technical side of the problem. He contended that it was because generalization had been attempted without detailed investigation that so much misleading information had been published tending to create and foster the idea among railroad men that electrical engineers did not really grasp the conditions of railroad work.

Details were given of the methods employed in investigating the preliminary and exact engineering features of the electrical system, the author's work being based for the most part on the use of continuous current railroad motors, as applied to suburban service under conditions obtaining in England.

The engineering details throughout are affected by the size, importance and location of the system. Where but few trains are operated these may with advantage be made smaller and arranged to accelerate at a lower rate than might be advisable and practicable in the case of a large and crowded system, in order to diminish the overload capacity necessary in generating and distributing systems, since this is likely to govern the capacity of the plant. Suitable provision must always be made to minimize the trouble and delay due to a breakdown, but the amount of capital that can be economically sunk in spares, duplicate feeders, and stand-by plant will depend largely on the importance of the system.

Mr. Carter took as being available for railroad service (1) the continuous current system; (2) the single-phase alternating current system, and (3) the polyphase system employing induction motors, remarking that the numerous alternative combinations of service and system could mostly be disposed of when general principles had been elucidated. At considerable length, and by the aid of a number of train resistance, motor, energy consumption, acceleration and other curves, he showed how, from the requirements of the service, the dynamical characteristics of the motors necessary for driving the train may be deduced. There is not at present a general agreement as to how railroad motors should be rated, though the rule most generally followed was that of the Committee of Standardization of the American Institute of Electrical Engineers. That rule is not by any means universally followed in England—the motors on the Liverpool Overhead Railway being an instance of this. A brief account of the methods of making service tests and of expressing results, as developed by the General Electric Co. of New York, was given, and later Mr. Carter endeavored to show why, under suburban conditions, the single-phase alternating system compares very unfavorably with the continuous current system. Some of the disabilities of the single-phase system disappear at low speeds, where the equipment weight is in any case a smaller fraction of the train weight and its increase therefore of less importance. Again, a service involving infrequent stops and moderate speeds, where the input per ton is small and the motor losses can accordingly be kept within reasonable limits, may often prove quite suitable for operation by the single-phase system. In short this system shows promise of having extensive, but by no means universal, application to railroad work.

The polyphase system, employing induction motors, has the disadvantage of requiring two or more overhead conductors, which complicates matters considerably at junctions, although it is not so serious an objection on continuous track. It is not well suited for suburban or other service in which stops are frequent and a high rate of acceleration is necessary. With tandem-parallel control about one-third of the input during the time of controller acceleration is wasted in rheostats, and since controller acceleration is continued until practically full speed is reached, after which the power required is small, the waste in rheostats is nearly one-third of the whole input if stops are frequent. It is true that some of the energy of the moving train can be recovered when stopping, but only by imposing extra duty on the motors and so diminishing their service capacity. There is not the long range of efficient speed-curve running which characterizes the continuous current motor, the change from accelerating to free-running being almost sudden. "The equipment weight, moreover, for suburban service is almost as high as in the single-phase system." "The polyphase system is practically confined to trains drawn by a single locomotive or motor coach. A small difference in the size of the driving wheels would result in a considerable inequality in the loading of the motors, and if some of the wheels are new and others old—as would be sure to be the case at times with multiple unit trains—some of the motors would do all the work and might even drive others as generators. The difference in size of the wheels is almost without effect in the continuous current and single-phase systems." For a class of service to be suitable for this system of operation, it must be such as will provide the motors with an efficient load during the greater part of the time they are taking power. A mountain line can be satisfactorily operated by polyphase motors, since the continuous grades furnish a sufficient load and there is no need to carry excessive motor capacity to provide for acceleration. In fairly level country, goods or other service, in which stops are infrequent, and the acceleration therefore of small importance, might very well be operated by the polyphase system. High-speed long-distance service is particularly suitable, the high resistance making the grade resistance of relatively smaller importance, so that during free-running the motors can be arranged to operate near the load of highest efficiency.

In his conclusion of the whole matter Mr. Carter showed that it was not the possible saving in operating expenses that constituted the case for the electrification of suburban lines; for a converted line to handle electrically the present traffic would not create a sufficient saving in operating expenses to pay 1 per cent. on the capital sunk in conversion. Taking all things into consideration the author thought the continuous current system by far the most suitable for English suburban service. He remarked that the Liverpool-Southport service, in which the schedule speed is 30 miles per hour, with stops less than a mile and a quarter apart, could hardly be effectively and efficiently operated otherwise than by the continuous current system.

Some of the objections to this system were discussed, and it was stated that the best system of operation is a matter for investigation in particular cases, depending upon the considerations raised in an early part of the paper.

The author said that there did not appear to be much prospect for exceedingly high speed lines in England for some time to come; and that the operation of main line trains would not be sensibly improved by electrification. Electrical operation it was contended was only economically feasible for those classes of traffic in which some special service advantage resulted.

The Whitney Self-Adjusting Chill.

The accompanying illustrations show sections of the Whitney self-adjusting chill, invented and made by John R. Whitney, Farmington, Conn. This device is termed self-adjusting because it is constructed to adjust itself automatically to all of the conditions involved in casting wheels. With the solid chill, when the molten metal strikes the inner surface of the chill, that surface immediately expands in the direction of its circumference, and as the circumference of this surface cannot enlarge until the whole thickness of the chill has become heated, an enormous pressure is exerted to compress the material of which the chill is made. By careful experiments, such expansion has been found to be at least 0.01 in. in every inch. The inner circumference of a 33-in. chill being about 100 in., its total expansion must therefore be about 1 in., and the metal of the chill must be compressed to that extent as soon as it is heated by the molten metal. As a consequence, the chill is at once subjected to a great strain, tending to break it in two. It also becomes warped out of a true circular shape, and on cooling the inner surface becomes broken into many fissures. For this reason, it is necessary to frequently renew solid chills.

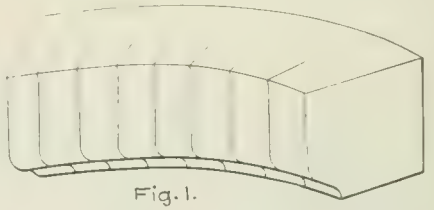


Fig. 1.

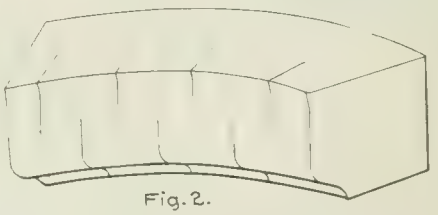


Fig. 2.

The Whitney Self-Adjusting Chill.

To remedy these difficulties, somewhat more than twenty years ago a so-called contracting chill was introduced. It was a kerfed chill, and from the nature of its construction, every form of it was much larger in diameter and much heavier in weight than the solid chill. But in this form of chill, when the molten iron strikes the inner surface, the segments of which it is composed expand laterally, or in the direction of the circumference, as well as radially, or in the direction of the diameter. This lateral expansion amounts in all to about 1 in., while the radial expansion is only $^1/_{32}$ in. The expansion in the direction of the circumference closes up the kerfs, the inner surface is not disintegrated or broken into fissures, and all strain due to the difference of temperature between the inner and outer surfaces is removed. The inner surface thus retains its original size and shape until all of the required chilling effect upon the wheel has been produced; then, when the chill has become

heated through, it expands as the wheel cools and contracts. It is claimed that more than half a million wheels have been cast in chills so kerfed, and that the treads of the wheels so cast were so smooth that not one of them required the least grinding. Chills made in this way, it is claimed, if carefully handled, are as accurately round after ten years' use as when they came off the lathe.

The Whitney self-adjusting chill is a modified and improved form of the contracting chill, by which the size, weight and cost are reduced to practically the same as the solid chills in ordinary use, without lessening in the least any of the valuable features of the contracting chills. Two forms of the Whitney self-adjusting chill are shown in Figs. 1 and 2. The inner surface of the form shown in Fig. 1 is composed of a number of segments, formed by kerfs cut all the way through from the upper to the lower face; while in the form shown in Fig. 2 the segments are formed by cutting the kerfs half way through, and alternately from the upper and lower faces, as shown. The kerfs in both cases are cut in the process of casting, and not afterwards by sawing. They are made by inserting in the chill mold sheets of asbestos paper, and are only about 0.01 in. wide throughout. They extend into the chill for at least 2 in. from its inner face. This new chill is interchangeable with any other chill in use without any alteration in the other parts of the flask.

High Speed Experiments in Prussia.

The Prussian State Railroads are about to resume the experiments with steam locomotives at high speeds. In 1904, with superheated steam, a speed of 84 miles an hour was reached on the Military Railroad (where the highest known speeds had been made with electric motors). This speed was made with a train of three 8-wheeled cars; 80 miles an hour with six such cars. The new tests will probably be made on tracks between Spandau and Hanover. Tests with new power brakes are reported to have been satisfactory for freight trains. The tests with high-speed passenger trains are not yet completed, but it is hoped that by next fall a satisfactory brake will be developed for the highest speeds.

The estimates of the earnings and expenses of the Prussian State Railroads for the current year, now near its end, submitted to the Diet Jan. 9, are that compared with the previous year there will be an increase of $14,446,000 in gross earnings, and an increase of $11,376,000 in working expenses, so that the increase in net earnings will be only $3,070,000, which is a very moderate gain for a business amounting to $380,000,000. Higher prices of materials and better pay for employees have caused expenses to grow out of proportion to the growth in traffic. The profits of the state railroads this year will contribute about $49,000,000 to the national income.

For the coming year (beginning with next April) the Minister of Finance estimates an increase of $27,489,000 in gross earnings and of $15,946,000 in working expenses, leaving a gain of $11,543,000 in net. Of the increase in expenses, $6,660,000 will go to the employees. On capital account the railroads ask for $34,750,000, and $23,800,000 are wanted for new freight cars alone. This for 21,685 miles of railroad.

Train Accidents in the United States in January.[1]

xc, 2d, Auburn Junction, Ind., a freight train of the Baltimore & Ohio backed into a freight of the Vandalia at the crossing of the two roads, and 14 cars were wrecked. One brakeman was injured.

nux, 3d, Southern Railway, Fair Forest, S. C., a freight train was derailed and the engine and several cars were overturned. The engineman and fireman were killed and several other trainmen were injured.

dr, 3d, Tallulah Falls road, Clayton, Ga., passenger train No. 9 was derailed at a point where the road-bed had been weakened by rain, and three cars were overturned. The conductor and three passengers were injured.

rc, 3d, Chicago, Milwaukee & St. Paul, Chicago, Ill., rear collision of freight trains, wrecking the caboose. Ten men in the caboose were injured.

rc, 4th, 3 a. m., Baltimore & Ohio, Chester, Pa., a freight train which had been obliged to slacken speed on account of another train ahead of it, was run into at the rear by a fast freight, making a bad wreck. A conductor was killed.

bc, 5th, night, Gulf, Colorado & Santa Fe, Cleburne, Tex., butting collision of passenger trains, damaging both engines. Several passengers were slightly injured. The collision occurred in the yard, and one of the enginemen says that he was blinded by the electric headlight of the other engine.

unx, 5th, 11 p. m., Southern Pacific, Palisade, Nev., fast mail train No. 9 was derailed and two trainmen and 10 mail clerks were injured, one of the latter fatally.

bc, 6th, Pennsylvania road, Corry, Pa., butting collision between passenger train No. 4 and empty engine No. 900 wrecking both engines and ditching many cars. Both firemen and one engineman were killed and eight passengers were injured.

unf, 6th, Boston & Maine, Walloomsac, N. Y., a passenger train was derailed at a misplaced switch, and the engine and first two cars were badly damaged. The engineman, fireman and five passengers were injured, the engineman probably fatally. It is believed that the switch had been maliciously misplaced.

nux, 6th, Philadelphia & Reading, Brantsville, Pa., a freight train was derailed and 25 cars were wrecked; the conductor and engineman were killed and several other trainsmen were injured.

xc, 7th New York Central & Hudson River, Grand Central Station, New York City, a train of empty passenger cars, being run into the headhouse of the station by gravity, were allowed to run too fast and collided violently with three empty passenger cars standing at the end of the track. The car at the end of this string of three was pushed over the bumping post and against the doorway of the waiting room, killing a man who was trying to enter the door.

bc, 8th, 3 a. m., New York Central & Hudson River, Geneva, N. Y., butting collision of freight trains, wrecking both engines and seven cars. One engineman was killed and one other trainman was injured.

unx, 8th, Texas & New Orleans, Dunagan, Tex., a work train drawn by two engines was derailed and one of the engines fell down a bank. A fireman was killed and one other trainman was injured.

nux, 11th, Terminal Railroad of St. Louis, St. Louis, Mo., a sleeping car in a train of the Wabash road was derailed while passing over the elevated structure at Carr street, and after running a short distance on the sleepers fell over to the right and dropped to the pavement, about 15 feet below. Nine of the 13 passengers in the car were injured.

xc, 12th, New York Central & Hudson River, Liverpool, N. Y., collision between a freight train and a train consisting of an engine and caboose, switching on the main track, damaging several cars. One brakeman was killed and three other trainmen were injured, two probably fatally.

bc, 13th, Louisville & Nashville, Monroe, Ala., butting collision between a special passenger train and a logging train; three passengers injured.

*xc, 13th, Southern Railway, Lawrenceburg, Ky., a freight train backing in the yard broke in two and the rear portion ran uncontrolled down grade some distance and collided with a passenger train, making a bad wreck. A tank car filled with oil and two loaded box cars took fire and were burned up. One fireman was kille and four other trainmen were injured.

eq, 13th, Yazoo & Mississippi Valley, Wakefield, La., a freight car in a mixed train was derailed by the breaking of the flange of a wheel, and three persons were injured.

unx, 13th, Branchville & Bowman, Bowman, S. C., a train consisting of a caboose, a locomotive with the tender in front, and five freight cars, made up in the order named, was derailed on a curve, and the engine and two cars fell over into a pond. Two passengers were injured.

*bc, 15th, 11 p. m., New York, Susquehanna & Western, Paterson, N. J., butting collision of freight trains, wrecking both engines and several cars. The wreck took fire and was mostly burned up. One trainman was killed and three others were injured. There was a dense fog at the time.

eq, 17th, Darien & Western, Glennville, Ga., a freight train was derailed by a brake beam which fell on the track, and several cars were wrecked. Two men were killed and four injured.

dn, 17th, Southern Railway, Cookeville, Tenn., a freight train was derailed at a misplaced switch; one brakeman was killed and two other trainmen were injured.

unf, 17th, Colorado & Southern, Uneva Lake, Col., a passenger train was struck by a snowslide and four passenger cars were overturned; 12 persons were injured.

unx, 17th, Central of New Jersey, Newark, N. J., a passenger train was derailed at a switch and the engine was overturned. The fireman was fatally injured.

rc, 18th, Central of New Jersey, Round Brook, N. J., rear collision of passenger trains, badly damaging four passenger cars. Several passengers were injured.

bc, 18th Baltimore & Ohio, Newton Falls, Ohio, butting collision of freight trains, wrecking both engines and 13 cars. One fireman

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

and an unknown man were killed and one other person was injured.

bc, 19th, Seaboard Air Line, Mina, Ga., butting collision between a freight train and a switching engine, wrecking both engines and 10 cars. The engineman and fireman of the switching engine and a telegraph operator were killed and two other employees were injured. It is said that the switching engine was wrongfully occupying the main track on the time of the freight train.

xc, 19th, New York, New Haven & Hartford, Hartford, Conn., collision of passenger trains at a meeting point, one of the trains running beyond the point where it should have stopped to clear the side track. Two cars were ditched and several passengers were slightly injured. The engineman (63 years old) of the train which was at fault was not injured by the accident, but died of apoplexy the next day.

*rc, 21st, Boston & Maine, Ayer, Mass., rear collision of freight trains, damaging one engine and a caboose. The caboose took fire from the fire in its stove, which was overturned, and with several cars was burned up. One fireman was injured.

unf, 21st, Western of Alabama, Montgomery, Ala., a passenger train was derailed at a switch, which it is believed had been maliciously loosened, and one baggage car and one passenger car were overturned; 14 passengers were injured, most of them slightly.

unf, 21st, Chicago, Rock Island & Pacific, Riceville, Ark., passenger train No. 3 was derailed at a point where the track had been weakened by heavy rains and several cars were damaged. Seven passengers were injured.

rc, 22d, Central of New Jersey, Netherwood, N. J., an empty engine, eastbound, ran into the rear of a preceding freight train which was switching on the main track, and four cars were derailed. A part of the wreck lodged on the westbound track and a westbound express train ran into it, and the cab of the locomotive and the sides of all the passenger cars in the train were badly damaged. Four employees were injured. There was a dense fog at the time. It is said that the empty engine had disregarded distant and home signals set against it .

unf, 22d, 1 a. m., Chicago & Eastern Illinois, Hillsdale, Ind., a freight train drawn by two engines was derailed at a washout, and both engines and several freight cars were wrecked. One fireman was killed and four other trainsmen were injured.

*o, 22d, Missouri, Kansas & Texas, Holland, Tex., a private car in a passenger train too kfire from the range in its kitchen and was destroyed. The occupants of the car escaped, but lost all of their clothing.

rc, 23d, Atchison, Topeka & Santa Fe, Glendora, Cal., a local passenger train, just starting from the station, was run into at the rear by a following express train, and the rear car was crushed for half its length. The conductor and 14 passengers were injured, most of the passengers slightly. The express train approached on a descending grade, and the danger of a collision was seen by the conductor of the local, and he had started his train for the purpose of trying to avoid it. It is said that a block signal operator gave a false clear signal to the express.

unf, 24th, Central New England, Ore Hill, Conn., an empty engine ran against a large tree which had fallen across the track and the cab of the locomotive was wrecked, fatally injuring the fireman and a brakeman. The tree had been partly cut the day before, preparatory to felling it, and it was held upright by a rope. A high wind arose in the night and so strained the rope that it gave way, allowing the tree to fall upon the track.

*rc, 26th, Missouri Pacific, Jefferson City, Mo., a freight train standing at the station was run into at the rear of a following passenger train and 10 freight cars were badly damaged. The wreck took fire and was mostly burned up. Of the 200 passengers on the passenger train many were bruised, but none seriously hurt.

xc, 26th, Chicago, Burlington & Quincy, Omaha, Neb., a switching engine in the yard backed into the side of a freight train passing on the main track, damaging the engine and wrecking one freight car. The fireman was killed.

xc, 26th, 8 p. m., Gulf, Colorado & Santa Fe, Bellville, Tex., a freight train, moving backward, collided with a switching engine, damagnig the caboose. The fireman of the switching engine was badly scalded by steam from the boiler of his engine, which, it is said, exploded immediately after the collision.

nuf, 26th, 7 p. m., Central Vermont, Bolton, Vt., a passenger train ran over a misplaced switch and into a side track, and continued some distance on the side track without being derailed, but on reaching a second facing point switch the engine ran upon one track and the tender the other, and the tender and two cars were derailed and fell against some freight cars. The main track switch had been misplaced, and the lamp changed so that it indicated all right. It is said that no person was injured.

unx, 27th, 1 a. m., Atlanta & West Point, East Point, Ga., passenger train No. 97 was derailed, and the engine and several cars were ditched. The engineman was injured.

dr, 28th, 1 a. m., St. Louis & San Francisco, Dora, Ala., passenger train No. 204 was derailed by a broken rail and the baggage car was overturned. Three passengers and three trainmen were injured.

rc, 29th, 4 a. m., Southern Railway, Campobello, N. C., a freight train which was stalled on a grade, was run into at the rear by a following freight, and the conductor, who is said to have been sleeping in the caboose, was killed.

bc, 29th, Lake Shore & Michigan Southern, Doughton, Ohio, butting collision of engines; four trainmen injured.

*bc, 29th, Atchison, Topeka & Santa Fe, Edelstein, Ill., butting collision between a passenger train and a freight, wrecking both engines and several cars. An express car and its contents took fire and were burned up. Three men were killed and a fourth fatally injured. It is said that a block signal operator had slept at his post and allowed a freight train to pass without being aware of its passage.

bc, 29th, 11 p. m., Great Northern, Columbia Falls, Mont., butting collision between westbound passenger train No. 1 and eastbound passenger train No. 2, damaging the engines and express cars of both trains. Two firemen and one express messenger were killed.

bc, 29th, Cleveland, Cincinnati, Chicago & St. Louis, Lexington, Ind., butting collision between passenger train No. 34 and a freight train, badly damaging both engines and several cars. Five trainmen and four passengers were injured.

bc, 30th, Seaboard Air Line, Columbia, S. C., butting collision between northbound passenger train No. 66 and a southbound freight train, badly damaging both engines and several cars, and wrecking the mail car. One engineman, one fireman and two mail clerks were killed and three other trainmen were injured.

eq, 30th, Atchison, Topeka & Santa Fe, Laura, Ill., passenger train No. 1 was derailed by a broken wheel, and the first four cars were overturned. The conductor and two passengers were injured.

unx, 30th, Missouri, Kansas & Texas, Colbert, I. T., a freight train was derailed and the tender, three freight cars and the caboose were ditched. Six passengers were injured, most of them slightly.

bc, 31st, 7 a. m., Delaware & Hudson, Delanson, N. Y., butting collision between a passenger train and a train consisting of a passenger car, occupied by laborers, pushed by a locomotive. One of the laborers was killed and nine were injured.

xc, 31st, 9 p. m., Delaware & Hudson, Delanson, N. Y., passenger train No. 85 collided with an empty engine, and one fireman was killed.

unf, 31st, Louisville & Atlantic, Foster's, Ky., a freight train was derailed by running over a cow, and the engine fell down a bank. The engineman was killed and the fireman and one brakeman were fatally injured.

Foreign Railroad Notes.

The Bavarian State Railroads have increased the privilege of free traveling for the corps of employees, so that 12 such free trips in a year may be had hereafter. Workmen not belonging to the regular corps of employees may have a pass for their vacation, and when they have served three years may have passes for four trips each year.

In 1904 during a drought in Silesia the woods caught fire from locomotive sparks, and great destruction followed of forests belonging partly to individuals and partly to the Prussian Government. The amount paid by the railroad department for damages was $1,050,000, but it received $325,000 for what was left standing after the fire. The most notable fact in the matter is that all claims were settled without litigation.

Two of the Prussian State Railroad directories (there are 11 in all) have forbidden all employees to drink alcoholic beverages while on duty. The order of the Minister, in force on all the State lines, applied only to trainmen and such station and track men as affect train service.

Karl von Thielen, for eleven years, until 1902, as Minister of Public Works the head of the Prussian State Railroad management, died in Berlin Jan. 10, at the age of 74. Thielen was the son of an army chaplain, studied law and entered the state service, and as early as 1864 the state railroad service. From 1867 to 1880 he was an officer of a railroad company, but returned to the state service when the government acquired his company's lines, and in 1891 succeeded Maybach, under whom the state system was chiefly acquired, as Minister. His funeral was held in one of the great railroad stations of Berlin.

Last October as an express train was standing on main track at Duisburg, in Prussia, the station assistant signalled line clear to another express approaching on the same track, the result of which was a collision with two men killed and two others severely injured. The station assistant had been in the service since the age of 14, and had a record as a faithful and trustworthy man. He recognized his blunder, delivered himself up, and on trial was sentenced to four months' imprisonment.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- The Wallace Testimony 193
- Trainmen Worked Excessive Hours..... 193
- Collision at Branchville, S. C..... 194
- Banker-Directors 194
- Some Consequences of the Chesapeake & Ohio Case 194
- Report of the Illinois Railroad and Warehouse Commission 195
- Pressed Steel Car Company 196
- Rebates on Oil and Religion..... 196
- A Futile Decision 196
- Flangers and Other Things..... 196
- Proposal to Legalize Rebates.. 196
- New Publications 197
- Trade Catalogues 197

ILLUSTRATED:
- Retirement of William H. Brown..... 198
- The Panama Railroad and the Canal.... 200
- Maintenance Economy of All Steel Cars. 203
- New Dining and Café-Smoking Cars for the Burlington 207
- The Hayden Mechanical Stoker 210
- A New Design of Reciprocating Screw-Thread Rolling Machine..... 215
- Disinfecting Apparatus for Railroad Cars 216

CONTRIBUTIONS:
- The Bismarck Bridge of Northern Pacific 197

MISCELLANEOUS:
- President Hadley on the Hepburn Bill... 198
- Mr. Wallace's Testimony before the Senate Committee 203
- Accidents Due to Defective Equipment and Carelessness 208
- The Division Engineer 215
- Washington Correspondence 216

GENERAL NEWS SECTION:
- Notes 63
- Meetings and Announcements 68
- Elections and Appointments 68
- Locomotive Building 69
- Car Building 69
- Bridge Building 70
- Railroad Construction 71
- Railroad Corporation News 72

VOL. XL., No. 9. FRIDAY, MARCH 2, 1906.

A liberal extract from the Wallace testimony before the Committee on Interoceanic Canals is printed this week. It is interesting as a historical document, because it shows graphically the tremendous difficulty our government has had—and is having—in organizing the work at Panama on a practical basis. Incidentally, we think that no one will be disposed to criticise Mr. Wallace after he has read the testimony. But the meaning of it is broader than that. It shows the confusion that must arise when a distinguished engineer, accustomed to put through construction and executive enterprises of the first magnitude with undivided responsibility, does not know whether he has been appointed by a committee, a commission, Congress, the Secretary of War, the private lawyer of the administration, or the President of the United States. We have it on the highest authority that a man cannot serve two masters—Mr. Wallace was expected to serve six, and to report to one or two other unclassified authorities as well. We believe firmly that the Panama Canal is going to be built, and built in a manner creditable to the United States; we trust most devoutly that the present period of crude and unstable organization will be brought rapidly to a close. Great works can be successfully carried through under the military system of graded responsibility or under the civil system of undivided responsibility; but at Panama we have neither one thing nor the other, and the pity of it is that so useful a man as Mr. Wallace should have been sacrificed to demonstrate this. The fundamental difficulty seems to be that government work is everybody's business, while Congress, as the representative of everybody personified, must needs dig up the seed every day or two to see if it has sprouted, and how fast it is growing. Two things seem highly essential at the present state of affairs; that a simple, definite, and withal an honest organization be perfected, and then that it be left alone, for better or for worse, until it has had time to demonstrate beyond doubt or cavil the measure of its capacity

It looks as though South Carolina would have to have a law forbidding the working of trainmen excessive hours, for the State Railroad Commissioners who condemned the practice in a report on a collision a few months ago (Branchville, April 2; *Railroad Gazette*, May 26, page 573, and November 3, page 416) are now compelled to report on a similar case again and to conclude that their warning has not been heeded. Reporting on a butting collision near Blaney, on the Seaboard Air Line, January 30, where four trainmen were killed and 2 injured, they say that—

"The wreck was caused by the freight crew leaving Blaney sidetrack against orders. The crew had orders to remain in the sidetrack at Blaney until both trains Nos. 81 and 66 had passed train No. 81 going south, and No. 66 going north.

"However, we must condemn the practice of working crews as long as the crew of extra freight No. 658 were worked. The testimony clearly shows that this crew was on duty for 25 hours and 32 minutes. Conductor Sondley of the extra freight No. 658, admitted that he was asleep and that all of his crew were asleep while the freight was in the sidetrack at Blaney (55 minutes) and that they thought train No. 66 had passed. We believe that the whole crew was asleep, thus losing sight of the fact that two trains were to pass instead of one. This is the second serious wreck which has occurred within a year on account of the overworking of crews on freight trains, and we must condemn this practice, not only because it endangers the lives of the crews, but on account of the danger to the traveling public."

This case illustrates the wisdom of the rule of the Great-Western Railway of England, mentioned in our issue of February 16, page 146, that trainmen must be relieved after a certain number of hours, even if the relieving men have to be sent out to pick up the train at some point on the road. There was a provision against overwork on the Seaboard Air Line, but it appears that it was not adequate or was not carried out. According to the report, the conductor, being asked if conductors have not a contract with the railroads that after being on duty a certain number of hours a rest can be demanded, replied that a rest can be demanded only at terminals, and then only after registering that rest was needed. He said he asked the operator at Cassatt to request despatcher at Raleigh to make work between Cassatt and Columbia as light as possible, as his crew were worn out, and that the despatcher replied "O. K." The despatcher, when asked about rules demanding rest by crews stated that Conductor Sondley was correct in stating that rest can be demanded at terminals, but that no rule stated that rest could not be demanded at other points, and that "very frequently he receives requests for rest orders and he always grants such requests, allowing trains to take siding and remain dead until sufficient rest has been secured by crew. No request had been made of him by the freight crew for rest. If he had received such a request he would have ordered them to tie up at some switch. Such requests are generally made to the superintendent or the train master." All of which once more enforces the lesson that trainmen cannot be in

variably depended on to carry out proper rest rules any more than we can depend for safety from collision on enginemen's regard for the safety of their own lives. Conductors and brakemen will take risks to make a little money, and enginemen will take risks for the sake of saving time or of avoiding the unpleasant duty of defending an act, however well justified, which has produced unpleasant results.

Though the South Carolina commissioners justly condemn the overworking of men, for which error the company is responsible, they just as clearly place the chief blame for the collision on the men in charge of the freight train, where it rightly belongs. For these men, however tired they may have been, or however long or soundly they may have slept, were awake when they committed their fatal error. The conductor admits giving the order to proceed, and the engineman must have been awake to start his engine, and, besides, he did some switching before starting. This engineman was killed, so that we do not know much about his acts or mental processes, but for a man to assume or conclude that two trains have passed while he has been asleep, or even partially asleep, without any positive evidence as to the time or times, or other circumstances, indicates grave mental or moral delinquency. One brakeman claims to have told the engineman that the opposing passenger train had not arrived. This brakeman expected the collision, and got the front brakeman to go back with him to the caboose. One can imagine circumstances where it would be easy to accept excuses for sleeping while a train is lying on a side track, but it is utterly impossible to excuse taking chances on the main track, after waking. This case indicates that the superintendent of this division not only has a duty in the matter of regulating the working hours of his trainmen, but also in regulating their habits of mind; that is to say, their respect for rules and their sense of responsibility.

BANKER-DIRECTORS.

The retirement of members of the firm of Kuhn, Loeb & Company from the boards of directors of the railroads in which the firm has long been directly represented can be traced more or less directly to the recent insurance investigation. It was Mr. Jacob H. Schiff, the senior partner in the firm, who at the time of the Equitable disclosures spoke out strongly against the present system of directorship in great corporations. His view was that the director in many if not in most instances had come to be considered a negligible quantity by the executive officers. This statement was coincident with Mr. Schiff's resignation from the board of the Equitable Life Assurance Society. The firm's own explanation of the more recent action is as follows:

"The reason for this step is the steadily increasing difficulty which the members of the firm have been experiencing in meeting the demands of their own business and at the same time giving the necessary time and attention to the performance of their duties as directors of corporations."

This is undoubtedly one reason, and a good one, for the step. In the *Railroad Gazette* of October 20, 1905, under the title, "What Should Directors Direct," English and American systems of railroad directorship were contrasted and a plea was made that the American director should not be expected to give the minute detailed oversight to technical departments that was expected in England. On the other hand, it was said in that editorial, that the highest duty and most serious responsibility of directors was in appointing officers, in promoting from the inside so far as possible, in making or reforming the organization so that it will work efficiently and without friction, in watching intelligently the result of the officers' work, and in infusing enthusiasm and loyalty.

It is easy to see how members of a firm of bankers, a single department of whose business—that of bond sales—is said to have amounted to half a billion dollars during the last year, may find it hard to give the time demanded for this ideal of American railroad directorship.

Yet there is another side to the work of the banker-director which is so vital to the conduct of an American railroad that it would indeed be rash to say that Kuhn, Loeb & Co. have taken the only ethical position. There is no country in the world where the capital needs of the transportation system are as urgent and as changeable as in the United States. When the Southern Railway was reorganized in 1894, a mortgage for $120,000,000 was placed upon it to provide for the requirements of a long series of years, as then anticipated. Since that time it has doubled its mileage and nearly trebled its gross earnings per mile. It may be urged that the new mortgage for $200,000,000 to fund the obligations incurred in this expansion and to provide for future requirements could just as well have been negotiated if Messrs. J. P. Morgan & Co. had been less closely affiliated with the property, but this is by no means certain. So, too, when John W. Gates descended upon the Louisville & Nashville like the wolf on the fold, and a serious panic was pending as the result of the sale of unlisted stock which was not a good delivery, this same house, through its intimate railroad connections, was able not only to assume the contracts but to place the property out of harm's way. In theory, if the directors of a railroad concern content themselves with working the property and planning its finances, the bankers can co-operate wholly from the outside, but in practice it is often most helpful to have their interest greater than this.

In short, at the present stage of American development and doubtless for very many years to come, the relation between the railroad and the banker will have to be a very close one, and it may fairly be asked whether it is not better that this relation should be frank and acknowledged. There are perils both ways. The attitude of the banker-director must be such that he engenders no shadow of suspicion due to the fact that he is at once a member of the railroad board and of the firm which is primarily interested in the company's securities. But there is nothing impossible in such a relation. The more immediate question raised by Messrs. Kuhn, Loeb & Co. deals with the ability of the banker-director to direct, and this would seem to be chiefly a question of fact. We have never heard Charles H. Coster spoken of as a dummy director, in spite of the many and complex interests with which he was connected. Yet the recent resignations are thoroughly in line with the great awakening of the public conscience in corporate matters; the attitude of the firm, based as it is on a question of fact, is above criticism, and should do much to eliminate from railroad boards all over the country the element that does not belong there, and is a hindrance, physical and moral, to the best development of the properties. When railroad directorates are honest and efficient it does not matter much whether their membership includes bankers, lawyers, engineers, or ministers of the gospel!

SOME CONSEQUENCES OF THE CHESAPEAKE & OHIO CASE

It is not so much what was actually decided in the recent case of the Interstate Commerce Commission against the Chesapeake & Ohio, as what was implied, that has excited comment and surmise on all sides. The case was what the lawyers call one of first impression. There were no precedents exactly in point. It was interesting and important for this reason alone, to go no further into the merits of the controversy. Any case that calls forth from the Supreme Court of the United States the admission that there are no authorities on the question to be decided is an epoch-making decision because it develops the law and removes its confines a degree further into the domain of untried and undetermined questions. It catches and chains for the common uses of the law those nebulous, wandering and fugacious problems that refuse to emerge from the clouds of doubt until held and fixed by a solution of the court of last resort.

Here the exact point decided was that the Chesapeake & Ohio could not deliver to the New Haven coal purchased or mined by itself, at less than the cost of the coal and the transportation charges in its published tariff. And the reason given by the court is that if this could be lawfully done, it would open a way to ship at less rates for one person than for another, and so nullify the prohibition against discrimination in rates. The court accordingly holds that the arrangement was unlawful, and being so neither side could or should enforce it. The consolation to the Chesapeake & Ohio must be that it thereby escapes a loss of $100,000 on its deal with the New Haven, while the latter may comfort itself with the reflection that, after all, its profitable contract with the Chesapeake & Ohio was really unlawful, and it did very well to have gotten so far along with it before this unsatisfactory interruption.

The broad and plain principle here involved and decided is that a carrier may not charge less than its published rates by producing, or dealing in, the subject of transportation.

The court has not actually decided that a carrier may not engage in any business except that of transportation, but then there are some necessary implications on this subject which the roads so engaged would do well to consider. We are confronted with conditions in respect to the period when carriers first became involved in such outside business and then again in respect to the charters

which authorize it. Some of these railroads acquired the right or exercised the power of such dealing before the Interstate Commerce Law was passed, while others did so after that. Some roads claim the privilege by virtue of early charters, granted generously and readily in times when the abuses of them were neither imagined nor realized. And such roads claim immunity from disturbance in their charter rights, notwithstanding changes in state constitutions, on the ground that corporate charters are contracts between the state and the companies chartered, and so inviolable under the federal constitution. Those carriers, whose charters, though equally favorable, are neither so ancient nor so entrenched, still claim that their corporate privileges cannot be abridged for reasons as applicable to them as to their more venerable fellows.

Through the haziness surrounding such differing conditions, and the claims attending them, there shines the light of one or two fixed principles which may show a way out of these perplexing questions. First, there is the doctrine so often promulgated and so freely acknowledged, that no state may pass any law or confer any right in conflict with the constitution that binds all the states, or with any law of Congress passed by the authority of that invincible instrument. And there is yet another principle, not so often pronounced, nor so familiarly known, but equally fixed and essential, that every measure of Congress passed under the mandate of the constitution requires the subjection and abandonment of all rights or privileges inconsistent with it, however inveterate or lawful they may theretofore have been. Even those most injuriously affected by the application of these powerful and pervasive principles must realize the cogency and necessity of them. For what is essential to the welfare of the whole state compels the acquiescence of all its citizens.

It would seem to follow that it matters little in determining the survival of a right inconsistent with a law of Congress, that such right arose prior thereto. In considering such questions, it is a necessary and fundamental presumption that all rights are granted subject to the constitution and the powers to be exercised by Congress for the benefit of all the people. Such rights therefore are to be considered as accepted upon the condition that, when inconsistent with a statute subsequently enacted, they must be at once and forever abandoned.

And thus that the rights of carriers arose prior to the Interstate Commerce Act, seems quite immaterial on the question whether they survive the passage of that Act. That question is to be determined by an entirely different test: Do those rights conflict with the law?

Those carriers who claim under ancient charters may occupy impregnable positions against attacks by the state granting such charters, and yet be helpless and defenceless under a federal law. No state by its constitution or its statute can grant a right inconsistent with the constitution of the United States or repugnant to any power granted thereby to Congress. It is immaterial whether a state charter is safe from state attack, or that such charter was granted prior to the exercise by Congress of any power conferred upon it. All state charters must, under the principles above stated, be held to have been granted subject to the exercise by Congress of its constitutional powers. And those powers do not originate as of the date of the statute exercising them, but of the date of the constitution itself, which, in contemplation of law, no charter may transcend, precede or withstand. The Haddock and Coxe cases, decided by the Interstate Commerce Commission, seem to authorize the inference that the fact that a carrier was, prior to the enactment of the Interstate Commerce law, authorized by charter to be a dealer in commodities transported by it, exempts such carrier from the operation of the decision before us. But it will be found, we think, when this question is directly presented that such position will not and cannot in the nature of things be sustained.

An erroneous decision long undisturbed and frequently recognized becomes in time a rule of property, which the higher courts are loth to abrogate. But this reluctance does not extend to subverting the uniform policy of the nation, and when such rule works out results hostile to that policy the courts have not hesitated to destroy the rule in order to preserve the policy. At best, such decisions are binding, if at all, only upon the courts, and if they evince too much conservatism—and their faults lean on that side of virtue—the legislature may at any time change such bad, case-made law, to conform to its general policy.

From these considerations we are bound to conclude that those carriers who claim exemption from the results of this interesting decision by virtue of their charters antedating the Interstate Commerce Act, or being invulnerable from state assault, are buoyed up by vain hopes, doomed to disappointment. Equally unavoidable is the conclusion that those railroads who are engaged in any other business than that of transportation will eventually have to choose between that other business and interstate transportation. For a carrier that ships its own merchandise over its own road will, by an irresistible temptation, discriminate in favor of itself as a shipper, and thus accomplish the evil that the law forbids; and as the law does not permit one to pursue a course where his interest is constantly opposed to his duty, and especially where duty may be so easily, secretly and effectually sacrificed to interest, the ban of prohibition will ultimately and accurately extend to the cause which tends to produce such forbidden results.

This development and extension of the decision under view may not proceed rapidly or by a regular and measurable progression. Events of large import succeed each other, sometimes quickly, at other times with inexplicable tardiness. On the whole, it is doubtless true that development of law is slow, and wisely slow, that interests affected may gradually adjust themselves to the new conditions without the loss and confusion that a whirlwind of change would entail. But the law, if it advances slowly, at least never recedes. What progress it makes, it never surrenders, and where the way is clear and the occasion urgent, and opportune, the advance is as expeditious as it is timely and salutary. If, emboldened by its success in this case, the Interstate Commerce Commission should ask the court to prohibit the coal roads from dealing in coal as incompatible with the duties of interstate carriers, the questions here suggested would be presented for decision. And then we should doubtless know what now we may merely believe.

Report of the Illinois Railroad and Warehouse Commission.

The thirty-fifth annual report of the Illinois Railroad and Warehouse Commission for the year ending June 30, 1905, recently transmitted to the Governor, again directs attention to the fact that Illinois continues to have the largest mileage of main track of steam roads of any state in the country. The total mileage of main line and branches was 11,637, an increase of 108 miles over the previous year. The total mileage of all classes of tracks was 20,065. The total capital per mile of road is $60,271, which is slightly less than the year before. Casualties showed a considerable increase, 66 passengers being killed, or one for every 811,322 carried, and 707 were injured, or one in every 75,739 carried.

The total income of all steam roads within the state from operation was $150,632,745, an increase over the previous year of $10,883,353. The total income from passenger service, including mails and express, was $38,845,522. Freight service yielded $88,406,542 and unclassified earnings were $9,178,296. The total number of revenue earning passengers was 53,547,290, an increase of 39,092. The average distance each passenger was carried was 32.7 miles, and the average amount received per passenger was 59 cents. The average amount earned per mile of line by passenger service was $3,176, an increase per mile of $253.

The revenue freight tons were 123,584,087. The average haul per ton was 111.6 miles, the average amount received per ton 75 cents, and the freight earnings per mile of road $7,086. There was an increase of 1,556 tons of freight hauled and an increase in the average distance hauled of 9.9 miles, while the average amount received for each ton was decreased 1 cent. The operating expenses per mile of road show a decrease of $44, while the net earnings per mile of road increased $230. Figures for fuel consumption show an average of 101 lbs. per mile in passenger service and 168 lbs. per mile in freight service. The total consumption for all services was 8,049,595 tons.

A further marked increase is shown in the mileage of interurban electric roads. The total for surface electric and elevated lines, exclusive of street railways, was 763 miles, an increase over the previous year of 176 miles. The total capitalization per mile of road of these classes of roads, which in 1904 was $222,615, decreased to $193,338. This high figure is due to the extremely high capitalization of the Chicago elevated roads, which is $2,052,867 per mile, against $82,694 for the surface roads.

An increase in income of $582,383 is shown, the total being $10,354,559. Of this $363,588 was for freight service. Special reference is made in the report to the increasing volume of business of these lines in the transportation of package freight. The fact that the interurban lines are engaged in transportation business exactly similar to the steam roads causes the Commission to recommend that all laws applicable to steam roads be made by law equally applicable to the interurban electrics.

The interurban and elevated roads killed 29 persons, of which only three were passengers, seven were employees and 19 "others." This is seven less than the previous year. The total number injured was 491, or one more than the preceding year.

Pressed Steel Car Company.

The seventh annual report, covering the calendar year 1905, shows profits of $1,106,901, against a loss of $707,111 the previous year, and profits of $2,768,897 in 1903—clear evidence of the fluctuating conditions recently prevailing in the car building industry. During the three years the 7 per cent. dividend on the preferred stock has been maintained. After the $875,000 required for this payment and $175,000 charged off for depreciation, in 1905 there was left a surplus of $56,900, contrasting with a deficit of $2,937,111 in 1904. The total surplus, including profit and loss surplus carried over, was $2,588,775 in 1905, against $2,531,874 in 1904 and $4,568,985 in 1903. The gross sales for 1905 were $19,357,826, nearly $15,000,000 greater than for 1904, when they were only $4,498,268, far the smallest figure in the company's history. Sixty per cent. of the gross sales for the past year were made in the last five months. The Pennsylvania Car Wheel Company, one of the subsidiary companies, during the year acquired a majority of the stock of the Pennsylvania Malleable Company, which controls the Central Car Wheel Company. Both have plants at McKees Rocks, Pa., adjacent to the Pressed Steel works. A new departure in the company's business is the construction of separate works, now almost completed, for building passenger cars. During 1905 the first all-steel street railway car was built for the Metropolitan Street Railway, of New York City.

Gross sales of the Western Steel Car & Foundry Company for the year were $7,563,194. Net profits of this company are not given, but from them a 6 per cent. dividend was paid. On the whole, the statistics given in the report are most meagre. The brief summary of the various allied companies may be worth repetition:

The Pressed Steel Car Company has works at Allegheny, Pa., and McKees Rocks, Pa., with a capacity of about 150 all-steel or steel and wood composite cars per day. Its new steel passenger car shops are to have a capacity of 750 cars per year.

The Western Steel Car & Foundry Company has works at Hegewisch (Chicago), Ill., and Anniston, Ala., with a capacity of about 100 cars per day.

The Canada Car Company, Limited, whose plant has just been completed at Montreal, has a capacity of 6,000 freight and 150 passenger cars per year.

The Pennsylvania Car Wheel Company's foundries at Allegheny, Pa., have a capacity of 250,000 car wheels per year.

The Pennsylvania Malleable Company and Central Car Wheel Company have a capacity of 23,000 tons of iron, steel and malleable castings and 100,000 car wheels per year.

The subjoined table gives the gross as well as net earnings and surplus for the year in each of the seven years since the company's organization:

	Gross sales.	Net earnings.	Surplus.
1905	$19,357,826	$1,106,901	$56,901
1904	4,498,268	*707,111	†2,037,111
1903	26,601,249	2,768,897	1,008,897
1902	33,883,519	4,578,114	2,903,114
1901	23,032,491	1,927,925	409,290
1900	22,540,115	2,075,181	1,200,181
1899	14,108,212	2,237,000	612,000

*Loss. †Deficit.

President Carroll D. Wright, of Clark College, Worcester, Mass., is an authority on political economy and, therefore, is to be listened to when he speaks on a subject in that field. In a lecture before his class in statistics and social economics on "Efforts Made by States to Regulate Industry," he is reported to have said recently: "If I am a minister of the Gospel and I go to a ticket office and ask for a ticket at half price, and get it, just why should I preach against rebates next Sunday? Ethically, there is no difference between John D. Rockefeller getting a discount on the transportation of his oil and the Christian Endeavor Society going to San Francisco for a convention at wholesale rates. We damn the one, and some seem to wish the damning to extend beyond this earth; but we applaud the other for doing the same thing." One reason why the preacher should *not* talk about rebates in his pulpit is that the question has no place in preaching. Rebates may or may not be immoral; and even when presumably immoral are surrounded by so many difficult questions that they can be discussed with profit only where all sides can have their say. But the preacher who accepts a rebate and then denounces Rockefeller is the person aimed at, we suppose; and it must be that Dr. Wright has been misquoted. Surely, he must recognize the difference between an open rebate made to clergymen on the basis of the general public sentiment that they are debarred from accumulating wealth, and a secret rebate paid to a big shipper to aid him in killing off small shippers. As for the San Francisco convention, the railroads earnestly desire the privilege of reducing rates on certain occasions of that kind, in order to increase the profits of their business; would Dr. Wright forbid them? It is true that Christians who do not endeavor may seem to be discriminated against; but have any of them ever complained? Possibly they deserve the punishment, for not belonging to the society. The Hebrew drummer whose visit to California happens to be timed for the convention date ought to have his interests attended to—but perhaps he knows enough to attend to them himself!

The latest decision issued by the Interstate Commerce Commission, prepared by Commissioner Prouty, affords a fine example of fruitless government activity. The New Haven road has decided that through rates on oil from Pittsburg to New England points are so low that it prefers to go without the business—to give it freely to its competitors, and on business to local non-competitive points to charge local rates for its own part of the haul. It would seem that ordinarily this ought to be the privilege of any carrier. But the course taken by the New Haven greatly favors the Standard Oil Company and the Commission virtually declares it against public policy; but finally has to decide that nothing can be done to remedy the alleged injustice. The case is that of the Fred G. Clark Company against the Lake Shore & Michigan Southern and others, and the Waverly Oil Works against the Pennsylvania and others, the New York, New Haven & Hartford being the principal defendant. The New Haven participates in through rates to New England points on other traffic generally. The Standard Oil Company brings crude oil by pipe line to its seaboard refineries and sends the refined oil and the products by tank steamers to distributing stations at Wilson Point, India Point, New London and East Boston. From the distributing stations the oil and products are shipped out locally to interior points. Independent shippers like complainants, are obliged to send shipments by rail to the same destinations. The Commission holds that the combination rates on petroleum and its products from Cleveland and Pittsburg to points reached by the New Haven Company result in unjust rates; that the refusal to participate in through rates is unreasonable, and that the situation is such as to operate greatly to the advantage of the Standard Oil Company. But there is no competitive relation between petroleum and its products on the one hand and other articles of traffic on the other, and the failure to provide joint rates on petroleum, while maintaining joint rates on other traffic, does not constitute wrongful preference and advantage. The Act to regulate commerce does not authorize the Commission to compel the establishment of joint rates, and therefore, notwithstanding the rates complained of are held unjust and the general shipping situation is such as to work a practical monopoly in favor of the Standard Oil Company, the Commission holds that it is without authority to grant relief in these cases.

A committee representing the Brotherhood of Locomotive Engineers appeared before the New York State Railroad Commission the other day and, according to a New York city paper, protested against the practice on several of the railroads hereabout of sending out light engines such as inspection engines which stop along the lines and fail to send out flagmen. It is asserted that this practice is likely to lead to accidents and confuses the engineers of the regular trains. Commissioner Dickey, who acted as chairman, said that he would do everything in his power to stop the practice. The committee also protested against the Priest flange scraper, "a mechanical contrivance attached to locomotives for the purpose of cleaning rust and dirt from the sides of rails." The engineers are reported as saying that the contrivance is dangerous. This "news" has the ear marks of a fictitious issue. The protest looks like a divertisement, the preparation of which served to while away an hour which otherwise would have been dull. We hate to think unkind thoughts, but find it hard to assign any more sensible motive for the first protest than that of helping the brakemen to put in a few more days next month—though friendliness between enginemen and brakemen is a commendable thing. If Commissioner Dickey desires to do everything possible—not merely to please his visitors but to promote safety, he will do well to require that the offending railroads, if he can find them, shall protect each light engine which has to stop between stations by holding all following trains at the last preceding station until the light engine reports at the next following station. That is the simplest cure for this kind of complaint. It will make the flagman unnecessary. As regards the second protest, the query naturally arises whether the intelligence of the complainers concerning the behavior of the flanger is not, perhaps, of the same quality as that which the reporter displays in describing it!

In the 1,236 columns of news that have been telegraphed from Washington, within the past two or three months, on the "Rate question," the funniest item is that of last Saturday reporting Senator Elkins' proposition for helping the coal mine operators of West Virginia, who have complained that the railroads discriminate against them. Senator Elkins says that he would have voted in committee for the Hepburn bill as it came from the House [without the much discussed court review provision] if the committee had allowed one amendment which he had proposed and which

vitally affected the interests of his state, West Virginia. This amendment was as follows:

That carriers of interstate commerce shall, upon application, put in all necessary switches to meet wants of shippers, make prompt connections and operating arrangements with connecting branch or lateral lines, reasonable and just division of through rates and make reasonable and just allowances to connecting, lateral or branch lines for originating freight.

The queer feature is in the last two words. At this distance from the Senate chamber an allowance to a lateral line for "originating" freight seems to be translatable in only one way; it is a rebate to a coal shipper who has a short track from the railroad to his mine. The honorable Senator seems to have been imposed upon by some one of his neighbors who is in the coal business and who wishes to be able to do business *a la* Hutchinson salt works. Who would ever have suspected that the universal—absolutely universal—denunciation of rebates that has filled the ears of the public for the past 15 months would culminate in a bill to legalize rebates in almost the worst form that could be imagined?

NEW PUBLICATIONS.

The Earning Power of Railroads—Edition of 1906. Compiled and edited by Floyd W. Mundy, of Jas. H. Oliphant & Co., 20 Broad St., New York. Price, $2.

This is a handbook of tables and notes showing facts as to earnings, capitalization, dividends, mileage, etc., of 125 railroads in the United States and Canada. The introductory chapters deal with the general theory of a railroad annual report, viewed from the standpoint of the investor, as a means of determining what the property is worth and what it can earn. A number of convenient rules of thumb are given, together with qualifications of their use. The principal part of the book is devoted to an analysis of the annual reports of the roads included, giving through a series of years the principal facts which the banker and investor wishes to know. There are over a hundred pages of notes at the end of the book devoted to roads whose statistics are not wholly self-explanatory. This is a very convenient book to have on the desk for ready reference.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Economizers.—Bulletin No. 128 entitled "Economizers," in the Sturtevant Engineering Series, has recently been issued by the B. F. Sturtevant Co., Boston, Mass. This publication briefly outlines the essential features of an economizer, displays the advantages of the Sturtevant type with staggered pipes and metalto-metal joints, and by means of well selected photographs clearly illustrates the important parts of these machines.

Railroad and Contractors' Supplies.—The Kalamazoo Railway Supply Co., Kalamazoo, Mich., is sending out an advance bulletin to be followed shortly by complete catalogue No. 14. The bulletin shows a few of the important specialties made by this company, including a variety of hand, push and velocipede cars, cattle-guards, track jacks, levels and drills, water tanks and pumping engines. The bulletin is 7¼ in. x 10¼ in., and has 40 pages.

Bolt Cutters.—Bulletin No. 10, issued by the National Machinery Co., Tiffin, Ohio, fully describes and illustrates the national single bolt cutting machine. Samples of work threaded on these machines are shown and the detailed illustrations of the various parts of the machine are remarkably good and clearly illustrate the principal features of the mechanism.

Contractors Dump Cars and Rail Cars.—Benjamin Watson, 66 Beaver street, New York, eastern representative of the South Baltimore Steel Car & Foundry Co., has just issued a 10-page folder containing illustrations and general dimensions of its complete line of narrow and standard gage contractors dump cars.

Rock Drills.—A neat 96-page catalogue issued by the Ingersoll-Rand Co., New York, describes and illustrates the various designs and uses of the Ingersoll-Sergeant rock drills. A number of types of both steam and power-driven air compressors are also illustrated.

Coaling Plants, Hoisting Engines, Industrial Railways, etc.—The C. W. Hunt Co., West New Brighton, New York, sends a 24 page pamphlet containing illustrations and brief descriptions of its general line of machinery, including coaling devices of various types, coal crockers and buckets, pulley blocks and sheaves, "Stevedore" rope, cable railways, steam and electric hoisting engines, overhead power trolleys, scales, industrial railways and cars and electric locomotives.

CONTRIBUTIONS

The Bismarck Bridge of the Northern Pacific.

New Haven, Conn., Feb. 26, 1906.

To the Editor of the Railroad Gazette:

In your issue of February 23 I note a misstatement in your article on the new Bismarck bridge of the Northern Pacific Railway, more particularly relating to the rectification of the east pier of this bridge, which had moved 44 in. toward the river from its established location. Mr. George S. Morison was called into consultation and furnished plans and estimates which provided for tearing down the old pier and rebuilding it in its proper position, but these plans were not used, and the actual method of rectification adopted was one designed by the writer and carried out under the immediate direction of Mr. W. L. Darling, the present Chief Engineer of the Northern Pacific, who was then Assistant Chief Engineer.

An examination demonstrated that the pier was moving on a slippery 1-in. seam of coal about 5 ft. below the concrete base block of the pier. The movement was due to very unusual conditions, as it was found that in some remote time a large section of the bluff parallel with the bank of the river had broken off and slid to the bottom of the slope. Surface material washing down from the bluff masked this condition and entirely concealed its nature. Subsequently, reservoirs for the Bismarck water works were constructed on the high bluff at the east end of the bridge. Leakage from this reservoir, following the natural seams of the stratified blue clay, was intercepted by the fallen mass, setting up a hydrostatic pressure estimated at 7,000 lbs. per lineal foot, extending for a distance of about 1,500 ft. This pressure, in conjunction with the deepening of the river bed caused by scouring, caused the mass to move on the plane of the thin coal seam toward the river channel, carrying with it the bridge pier.

A deep ditch and tunnel were driven at low water level in order to drain away the water. Observations extending over a period of two years demonstrated that the movement had practically ceased, and it was then decided to attempt the rectification of the pier. The old pier, 100 ft. high, and weighing 1,250 tons, was undermined by parallel galleries which were refilled with concrete and provided with roller planes of old rails, between which 2-in. solid steel rods were placed, which ultimately supported the entire weight of the pier and one end of the 400-ft. span. The new base block thus constructed was built on the original center, with its base 13 ft. below that of the old foundation. Strong machine screws, 4½ in. in diameter, provided with capstan heads, were then attached to the upper line of rails, reacting on the lower base block. The capstan heads, 10 in number, were revolved by means of oak capstan bars or levers.

The work progressed satisfactorily at first, and the pier had been moved 5 in. toward its original center when a local slide of the material from the slope of the excavation occurred. The friction of the steel roller bearings was so little that, while the amount of sliding material was not large, its pressure was sufficient to cause a rapid movement of the pier back to its old center, thus accomplishing in a few seconds the work which it has been expected would require at least 24 hours to complete. This unexpected incident caused the utmost consternation at the time, but resulted most fortunately, as the pier stopped within ½ in. of the calculated center.

It should be explained that the expansion rollers for the first and second long spans were on the next adjacent river pier, and that the two spans had been tied together with rods. The anchor bolts on the first pier had been removed and the baseplate well lubricated to permit the pier to move *under the span*.

All interstices between the rollers and the openings left between the two base blocks were subsequently refilled with concrete, and both surfaces were dowelled together by steel rails embedded in concrete masonry.

The remedy appeared to be entirely efficacious, and no further movement was noted for several years. But in some manner the drain pipe mentioned above became clogged, with the result that an accumulating pressure on the pier was caused which threw it out of line slightly. The pressure was relieved by excavating the material back of the pier.

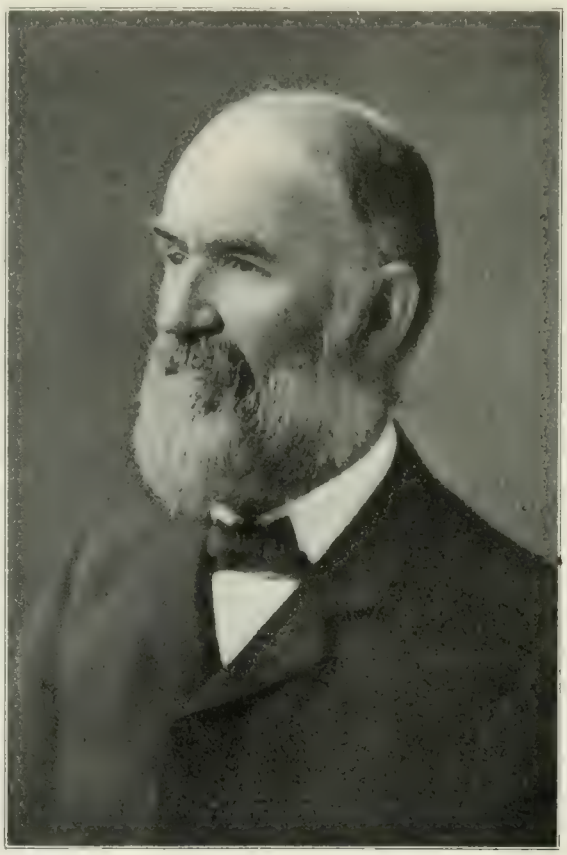
The plans and calculations for the work were made by Mr. S. J. Bratager, Principal Assistant Engineer. Mr. W. C. Smith was Resident Engineer in charge.

L. H. McHENRY,
Fourth Vice President, New York, New Haven & Hartford.

Retirement of William H. Brown.

With the retirement of William H. Brown from the position of Chief Engineer of the Pennsylvania Railroad Company on February 28, 1906, after having reached the age of 70 years, the Pennsylvania Railroad has lost the services of one of its most efficient and trusted officers.

Mr. Brown has kept continually "at it" for the past 40 years, and by his untiring efforts and devotion to his profession, he has become so well versed with the physical characteristics of the great railroad system in which he has played such a prominent part, that he can draw diagrams from memory of the alinement, stations, and crossings of nearly every mile of the main lines. His brain is a vast storehouse of facts and anecdotes of his work and experiences during his many years of active life. Not only has he an unusual memory, but he has also one of the most active minds that one often meets, and he can grasp a proposition and solve it in short order. His motto has always been, "I will never put off until to-morrow what I can do to-day." Whenever a new line was to be laid out or a change of line made, he entered into the work with all his heart, and did not rest until he had completed it. All he wanted was the order to go ahead, and he produced the results. He has always been a hard worker, and frequently has said, during unusually busy times, that there were not enough hours in the day for him.



William H. Brown.

It must have been a great satisfaction to President A. J. Cassatt to have such a man for chief engineer during the last few years when the Pennsylvania Railroad has been expanding so rapidly, straightening and four-tracking its main lines, and building low grade freight lines. Mr. Cassatt, who is without an equal as a fearless, progressive, clear-headed railroad man, found in Mr. Brown just the person to put into execution and rush the various improvements that have helped to make the Pennsylvania Railroad the system that it is to-day.

Born on a farm in the southern part of Lancaster county, of Quaker parentage, Mr. Brown when he left home to make his mark in the world was equipped with a hardy constitution and a mental and moral stamina that have enabled him to cope with the many perplexing problems that have confronted him. When a young man he saved his money and bought a transit, much to his father's disgust, and with this transit he obtained a view of the field of engineering that opened so broadly before him in the future, and in which he had reached the highest pinnacle of success as a railroad engineer.

He was born on February 29, 1836, and has actually had but 16 birthdays; and indeed to one who sees him at work from day to day, he appears to be of an age midway between 16 and 70 years. A broad minded man used to dealing with extensive engineering and business problems, Mr. Brown was able to handle his department with skill and his advice was almost daily sought by the officers of the company, and frequently on subjects not directly connected with engineering. His employees and those who had dealings with his department knew that all reasonable requests which they might make would be granted, and if there was doubt about their being reasonable requests, Mr. Brown would soon dispel all doubts, as his answer "yes" or "no" would be given immediately and in no uncertain terms.

Mr. Brown's first railroad service was in 1861 as Engineer on United States military railroads, having had some experience on surveys previous to that time. The next year he went to the Pittsburg, Cincinnati, Chicago & St. Louis as Assistant Engineer, being promoted in 1863 to Principal Assistant Engineer. One year later, he went to the Pennsylvania as Assistant Engineer of the Pittsburg division. He was afterwards made Engineer of the Oil Creek Railroad, and later Principal Assistant Engineer of the Philadelphia & Erie division of the Pennsylvania. In 1867 he was appointed Engineer of that division, and two years later was put in charge of the construction of car shops at Altoona, Pa., with the title of Assistant Engineer. He was made Resident Engineer of the Middle division in 1870, Chief Engineer and Superintendent of the Lewiston division in 1871, and Superintendent of the Bedford division in 1872. From 1874 to 1881 he was Engineer of Maintenance of Way of the Pennsylvania Railroad Company, being appointed Chief Engineer on the latter date.

He leaves the service of the Pennsylvania Railroad with the very best wishes of all who knew him and admire his great ability, and with the sincere desire that he may enjoy many years of good health and happiness which he so richly deserves.

E. B. TEMPLE

President Hadley on the Hepburn Bill.*

In its external form the Hepburn bill for the regulation of interstate commerce, which passed the House at the beginning of February, varies very greatly from the Esch-Townsend bill of a year ago. Practically, however, there is only one important point of difference. The Esch-Townsend bill provided for the creation of a court which would, among other things, afford a speedy and uniform means of hearing appeals from the commissioners' decisions. The Hepburn bill attempts to put these decisions into effect without the intervention of such a court, and to limit rather than facilitate the right of appeal by making the decision of the commission itself final on all questions of fact.

One of the criticisms made against the Esch-Townsend bill was that it provided for two trials of every case—one before the commissioners, another before the special railroad court which that bill created. In the Boston *Transcript* of April 1, 1905, the present writer urged that a single hearing in the railroad court was better than two successive hearings by two different kinds of bodies. Mr. Hepburn's committee desires to avoid the double hearing, but it undertakes to do it by eliminating the court instead of the commission.

There is reason to fear that this plan will not work.

In the years 1871 and 1872, the railroad situation in England had many points of resemblance to that which now exists in the United States. The consolidation of independent companies had gone so far that the railroad system of England, like that of the United States to-day, was managed and controlled by a comparatively small number of men. The most serious forms of personal discrimination had been prohibited by the Railway and Canal Traffic Act of 1854, as they are to-day prohibited by the Elkins Act in the United States; but there was a great deal of unfairness in granting facilities and much arbitrary difference in rates for different commodities and different localities. The English local shippers felt themselves quite as helpless against these forms of railroad preference as the shippers in the United States do to-day. The courts were slow in giving redress, and were inclined to tolerate a great many things to which not only individual shippers but chambers of commerce seriously and justly objected. Under these circumstances there was a demand for a tribunal which should be ready to deal with railroad rates instead of reluctant; which should give the quick decisions and secure the prompt compliance with those decisions which was needed in order to make them do any good.

Two investigating commissions, one in 1867 and another in 1872, showed how great was the complaint and how wide the demand for special legislation. The outcome of these inquiries was an act known as the Regulation of Railways Act, 1873, which had many points of resemblance to the Hepburn bill. It provided for a commission which, besides ascertaining the rates charged by railroads and making reports to Parliament concerning their management, should also be empowered to investigate complaints concerning unjust rates or discrimination in facilities and give adequate and speedy relief. It was intended to have the quick jurisdiction of these commissioners supplant the slow jurisdiction of the older courts. I quote from Section 6 of the Regulation of Railways Act, 36 and 37 Vict. Ch. 48:

> For the purpose of enabling the commissioners to hear and determine the matter of any such complaint, they shall have and may exercise all the jurisdiction conferred by Section 3 of the Railway and Canal Traffic Act, 1854, on

*A paper by Arthur T. Hadley, LL.D., President of Yale University, in the *Boston Evening Transcript*, Feb. 24.

the several courts and judges empowered to hear and determine complaints under that act; and may make orders of like nature with the writs and orders authorized to be issued and made by the said courts and judges; and the said courts and judges shall, except for the purpose of enforcing any decision or order of the commissioners, cease to exercise the jurisdiction conferred on them by that section.

The twenty-sixth section of the same act undertakes to restrict narrowly the opportunity for appeal from the judgment of the commission. The commissioners themselves may state a case; on the case thus stated, and no further, the courts on appeal may decide what is the law. This was intended not only to shut out the retrial of questions of fact, but to give to the commission, as far as the circumstances admitted, the power of deciding which were questions of fact and which were not.

Much good was expected from the Act of 1873. But in its actual workings it proved a serious disappointment, and Parliament in its recent legislation has gradually abandoned the theory on which that act was based. And let this significant point be noted: Parliament abandoned this theory, not because it hurt the railroads, but because it failed to benefit the shippers. The power of quick decision which the Act of 1873 gave the commissioners was in large measure illusory. The courts insisted on retrying questions in their entirety, instead of acquiescing in the attempt to separate the law from the facts. This was an almost inevitable result; partly because laws and facts were things so closely interwoven that it was hard to separate them, and partly because the courts in England, as they do in every other country, resented attempts to infringe upon their jurisdiction and made difficulties for every legislative act that undertook to do so. The consequence was that the shipper, instead of finding a case decided in his favor without appeal, was subjected to a roundabout and circuitous course of litigation, with the courts prejudiced against him, because they were anxious to vindicate their own past functions against legislative interference. This may sound like a fanciful and far-fetched difficulty, but it is a real one, which has its roots deep in human nature. Hear what the Select Committee on Railways of 1882, itself by no means over friendly to the railroad interest, says of the working of this provision of the act:

> Your Committee think that a case has been made out for granting to litigants before the Railway Commission a right of appeal. Important matters, many of them "primæ impressionis," which fix the law and practice all over the United Kingdom, come up from time to time for decision, and it appears to your Committee that one recognized appeal to a higher court would not only be just but much more satisfactory than the present circuitous and uncertain motions for a prohibition, to which defendants are now constantly having recourse.

Whatever differences of opinion there were in the Committee of 1882—and there were many—all agreed that the attempt to prevent appeals from the commissioners' decisions had been a complete failure.

Not the individual case only, but the whole apparent attitude of the courts toward the matter of railroad legislation, may be prejudiced by a statutory provision of this kind. In suits brought before them at common law the attitude of the courts is friendly to the individual trader rather than to the modern corporation. The rights of the individual trader are a good deal more ancient and his common law standing somewhat better established than those of the large joint stock company. But when it comes to an attempt to infringe the common law rights of a company by acts of special legislation, the case is reversed. The courts view these special acts with close and suspicious scrutiny. They are placed, almost in spite of themselves, in a mental attitude favorable to the corporation and adverse to the individual complainant—favorable to the railroad and adverse to the shipper. The history of the Interstate Commerce Act has already shown us the effect of this mental attitude. Even where the courts have decided against the railroads, they have tended to do so on grounds of common law, rather than of statute. Take the recent case where the Chesapeake & Ohio sold coal to the New York, New Haven & Hartford at a less price than individual shippers were obliged to pay. The Supreme Court decided the contract to be an illegal one on general grounds; but it at the same time threw out all complaints of discrimination as defined by the interstate commerce act. Now, if a statute, in addition to its novelty, contains a provision intending to limit the powers of the courts to supervise its operation, the courts will almost certainly find some way of making it null and void. This renders our legislation wholly ineffective, puts the courts on the side of the big man when they ought naturally to be on the side of the little one, and creates a feeling of popular irritation against the judicial system which is dangerous anywhere, and most of all in a democracy like our own.

But the evil effects of the attempt to give the English Railroad Commission power of fixing rates did not stop here. The attempted performance of this duty took up so much of their time that they failed to perform other duties, which under more favorable circumstances they might have carried out efficiently and usefully. They did not have that influence on the formation of railroad tariffs which their experience and high position would otherwise have secured.

What an advisory commission can do to influence railroad management in these ways was shown by the history of the Massachusetts Railroad Commission under the leadership of Mr. Charles Francis Adams in the years from 1870 to 1875. It was shown in other States, notably in Iowa, in the decade immediately following. It is exemplified in England, even under somewhat unfavorable conditions, in the results of the conferences between the board of trade and the railways. It was illustrated in the history of the Interstate Commerce Commission itself during those first bright months of its existence when its members considered themselves in the light of advisers of the railroads or the public, and had not asked for powers which have since proved their undoing.

The possibility of giving successful advice is dependent upon the fact that your advice is advice, and is not a command disguised under the form of courtesy. In trying to become a poor kind of court you forfeit the chance of becoming a good kind of commission. In obtaining authority to settle specific rates you lose the influence which, properly directed, would have enabled you to systematize and control general tariffs. The more intelligent railroad men feel, and feel deeply, the arbitrary character of many of their rates. They would welcome the counsels of a body which should act with them to indicate what the country needs and to show the country that the railroads were working for it and not against it. From the days of Albert Fink down to the present time the weight which would have been given to the representatives of such a commission in a tariff conference is overwhelming, the actual influence which they would have had is unbounded. But once let these counselors appear, not as representatives of the public to help the railroads to do right, but as masters set over the railroads to determine where they have done wrong, and the relation of openness and equality essential to all harmonious action becomes impossible.

For these reasons I believe that evil and not good will come of the Hepburn bill. It encourages the Commission to try to do what it cannot do. It relieves that body of the responsibility of doing what it can and ought to do. But whether at this late date it is possible to get a bill passed which will produce any better results is a very doubtful question.

There is no doubt that the conservative element in the Senate would be strong enough to insist upon the insertion of a provision for court review like that which existed in the Esch-Townsend bill. But it is not clear that much would be gained by such a course. The Commission would still think that it was a judicial body. It would make enough doubtful orders regarding rates to prevent it from having any real influence on the railroad management of the country as a whole. If you could give the judicial function to the courts and make it clear to the Commissioners that they were expected to do something else, there would be a very substantial gain, but if you only give some of the judicial functions to the courts and leave the Commissioners to exercise others, the gain is too slight to be worth considering.

Moreover, there are several strong positive reasons why the conservative interests in the Senate ought not to insist on a compromise measure. In the first place, if the railroad men attempt to have the bill modified it will be regarded as a selfish effort to block the wheels of legislation for their own private interest. This is always a blunder. From the standpoint of railroad management alone, the good from preventing the passage of the Hepburn bill would not be nearly as great as the harm which would come from assuming an attitude of factious opposition. The Hepburn bill will not greatly hurt the railroads. If anybody is much harmed by illusory attempts to limit rights of appeal it will be the shippers. Now, this is a free country, and if the shippers are bent upon hurting themselves it may be inexpedient for the railroads to go too far in preventing it. Should the Hepburn bill be passed in substantially the form in which it comes from the House of Representatives there is a fair chance that after a few years of unsatisfactory operation it may be repealed. People may do as they have done in England; confess the failure of one method of legislation and try to devise a better one. But if the compromise measure is adopted, nobody will know who is responsible for the failure. Each party will cast the blame upon the other. Ten years hence we shall see that we have accomplished nothing, but we shall be totally unable to tell whose fault it is. The Interstate Commerce Act illustrates the dangers incident to such a compromise. Being based upon no principle or, rather, being based on a mixture of two conflicting principles it was quite impossible for us to draw any sure lessons from its failure or to convince people in which direction it ought to be amended. Unless grave harm is to be done by an experiment it is often better to let the majority try it in their own way, for the sake of fixing the responsibility for the present and enabling our successors to do better in the future.

But apart from any consideration of selfish interests or any attempt to forecast the future, there are immediate public reasons against factious opposition to any popular measure of regulation of a moderate type. The country is to-day in the midst of a great wave of moral sentiment. This has been aroused by the insurance inquiry, by the evidences of political corruption in cities, and by

various abuses of corporate power which have come to light. If the spirit of reform is allowed to have its own way it will result in a good many wise acts, and some foolish ones also, but the good is pretty sure to outweigh the evil. If, on the other hand, this sentiment is resisted, every case of unintelligent resistance will give rise to deep-seated misunderstandings; will intensify the evils and dangers incident to the movement; will make radicals out of those who should have been conservatives, and will during the next time of commercial crisis leave us face to face with the danger of bitter class struggles.

Of this movement of public sentiment President Roosevelt is the recognized leader. He is a man of such many sided activity than very few people believe that he is right in everything, but a great majority of the American people have confidence that he is right in general. Therefore if the President to-day approves of a law, there is more than ordinary reason for giving weight to his views. He does not represent himself alone. He does not represent his office alone. He represents a sentiment which under leadership like his is most salutary; but which, should it fall under the direction of other leaders, might readily become hysterical or pernicious. The position of many of the senators and representatives that they will stand for a bill which has the approval of the President and not for one which fails to have his approval, is in my judgment a wise one. And though I cannot concur with the President in believing that the Interstate Commerce Commission is the proper body for judicial determination of rates, I believe that it is better to acquiesce in a measure that he approves than to insist upon a compromise which would not satisfy him or anyone else.

Let us sum up the different elements in the whole situation.

The Hepburn bill does not appear likely to accomplish its object. The history of English railroad regulation shows that a similar measure passed under closely analogous circumstances, failed to do the good which its advocates expected. The same failure is likely to be repeated in the United States, when an act provides that a commission shall be at once an advisory body, a prosecuting body, and a judicial body. The combination of these three functions in one office is repugnant to the Constitution of the United States, to common law, and to the American sense of fair play. And the bill is subject to this further criticism, that by investing the commission with certain judicial duties and powers which it cannot well assume, it incapacitates it for the most important administrative functions which properly belong to it. What the United States needs is an act under which the commission will take part in the making of tariffs and give effect to the public interest in the general questions of railroad management, leaving the specific cases of violation to be stopped or punished by the courts. The arguments, both historical and economic, in favor of a bill to have a commission do its own business instead of relieving it of that duty in order that it may do somebody else's business, are very strong indeed. If, however, these arguments do not carry conviction, and a measure drawn on these lines fails to get the necessary votes, I would not try to compromise. A law based on bad principles is sometimes better than a law based on no principles at all, and the harm which would come, either to the railroads or to the country as a whole, from the passage of the Hepburn bill or anything at all like it, is a far less serious evil than the spirit of distrust and of class antagonism, which would be aroused by factious opposition.



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York.

West Bank of Culebra Cut, Looking South—Bucyrus Steam Shovel at Work.



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York.

French Cut for Lock at Bas Obispo—Steam Shovel and Dirt Train at Work.

The Panama Railroad and the Canal.

BY FULLERTON L. WALDO.

When in 1904 the United States bought the canal property from the new French company, there was included in the purchase 5,888 of the 7,000 shares which constituted the capital stock of the Panama Railroad. The remaining shares have since been bought for $155,020. At the time of the transfer, the railroad consisted of a single track of 56-lb. per yard rails, from Colon to Panama, with a gage of 5 ft. In April, 1905, it was decided to double-track the road, and since then the energies of a force of 4,000 laborers have been mainly directed toward that end. The track (still retaining the old, inconvenient 5-ft. gage) has been practically relaid with 70-lb. rail. The roadbed is ballasted with rock and gravel. In connection with the great *crux* of the work—the transportation of excavated material from the Culebra cut to fill the swamps or to be dumped in the sea—some 250 or 300 miles of additional track will have to be laid. Were the canal to be built at sea-level, some 270,000,000 cubic yards of material would have to be transported for distances varying from a few feet to 15 miles.

The Commission has recently ordered—to give only a few items in an invoice of mammoth proportions—61 steam shovels, 1,300 flat cars, 12 rapid unloaders, 22 unloading plows, 13 earth spreaders, 324 dump cars, 12 hoisting engines, 120 locomotives, 5,000 tons of steel rails, 125,000 cross-ties, 12,000 pieces of piling, 14 air-compressing machines, three cranes. The Panama Railroad on its own account has lately purchased 500 40-ton box cars, 12 caboose cars, 10 refrigerator cars, six passenger coaches, 24 locomotives, two wrecking cranes, one locomotive crane, one pile driver, three 100-ton track scales, one wooden coal-hoisting plant, one cantilever crane.

With the 89 steam shovels which will shortly be in operation, it is plain that the resources of the railroad will be taxed to the utmost to remove the spoil from the excavations, in addition to handling the abnormal traffic incident to canal construction. Last October, 12,000 tons of commercial freight had accumulated at the canal termini, while at the same time steamships were forced to depart without their cargoes. The reorganized administration of the railroad cleared up the accumulation in a month's time. Formerly, there had been no system, worthy of the name, in car



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York.

View in Culebra Cut.



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York.

Steam Drills at Work in Culebra Cut.



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York.

Panama Railroad Looking Toward La Boca Along Line of Canal.



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York.

Entrance to Main Culebra Cut.



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York

Bucyrus Steam Shovel (3½ Yards Dip) in Operation—Soft Clay Rock in Foreground—Similar Rock Was Blasted by the French Canal Company.



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York

Culebra Cut—Steam Shovels at Work.



From stereograph by C. L. Chester; Copyright, 1906, by Underwood & Underwood, New York

In Culebra Cut Looking Toward Colon.

thick, to bottom of girder of 2 ft. The center girder is 4 in. wider, however, these respective dimensions being 12 in. and 16 in. For accounting or tracing, but when the first 200 of the 500 cars ordered were gotten into commission, the well-nigh paralyzed freight traffic took a new lease of life.

"The nature of the traffic," says Engineer Stevens, "has complicated the handling of the business of the railroad to such an extent that an extremely low cost of handling can never be arrived at. All of the canal business moves from terminals to interior points, resulting in a very light average through train tonnage and a very large empty-car haul, and these factors, coupled with a heavy grade road and extremely light power, resulting in small train loads and large train mileage, will keep operating expenses high as compared with those of roads operating under more favorable conditions in regard to above as well as with cheaper labor."

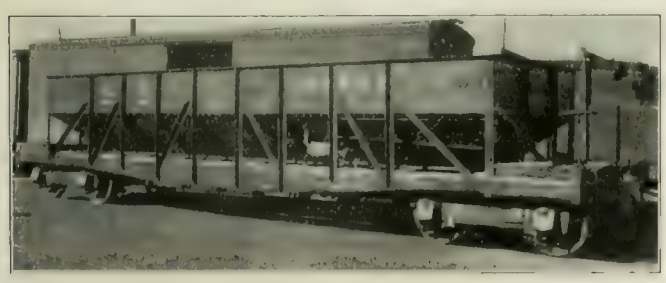
Of course in building the canal the dredge, rather than the steam-shovel on a railroad track, will be used whenever practicable. The service conditions for the steam shovel impose serious difficulties. On rainy days, with wet rails, only four five-yard dump cars per train can be hauled in place of the usual twelve. Derailments are frequent. At Culebra, the clayey material in which the steam shovels are working becomes so sticky that it will not clear itself, but has to be shoveled by hand from the French dump cars. The old Belgian rail (3¾ in. wide at base and 4⅞ in. high), in combination with the short spikes (4 in.) and the ties of soft pine without tie-plates, have been the cause of many derailments, and in default of track tools there have been resultant serious delays. Requisitions for tie-plates dated November, 1904, were not filled until June, 1905. "With new track properly ballasted and surfaced," says Acting Chief Engineer Dauchy, "and the installation of new cars, locomotives, Lidgerwood unloaders, bank spreaders, and modern drilling machinery, the establishment of dumps of the proper height and with tracks leading to them, the troubles that we are now having will be largely done away with, and the output of the steam shovels increased to something like their capacity."

Maintenance Economy of All-Steel Cars.

The economy of all-steel equipment is exhibited in a striking way in the accompanying engravings from photographs, for which we are indebted to the courtesy of Mr. Julius Kruttschnitt, Director



Car No. 80802 Before Repairs Were Made.



Car No. 80802 After Repairs Were Made.

of Maintenance and Operation of the Harriman Lines. The views show two Union Pacific ballast cars which had been badly smashed in a wreck, and these same cars after they were put through the Cheyenne shops of the road. Mr. Kruttschnitt says, "Car 80,802 seemed hardly worth picking up, yet $322 put it in perfect condition. Car 80793 was not quite as bad, yet if a wooden car had experienced such treatment, the body would have been absolutely worthless; $300 restored the steel car to its original condition."

Mr. Wallace's Testimony Before the Senate Committee.

The following extracts from the testimony of Mr. John F. Wallace before the Senate Committee on Interoceanic Canals, Feb. 5, shows most illuminatingly the false position in which Mr. Wallace was placed by Secretary Taft. The testimony is a dignified and convincing document, and it is most unfortunate that the facts of it could not have been brought earlier to the attention of the American people.

Senator Kittredge.—What were the terms of your employment by the Canal Commission?

Mr. Wallace.—When the Spooner bill was first passed, or about the time it was being considered, quite a number of my friends suggested to me the propriety of going on the original Commission; and I gave it some consideration at one time, and even went so far as to permit them to introduce me to various men that were influential. After further consideration I decided that I did not care to become associated with the work in that capacity and give up my railroad work.

In February of 1904 I was in Washington at a hearing before the Interstate Commerce Commission in regard to some controversy over freight rates, and Mr. Fish, our president, was also here, and at that time he had several conferences with Admiral Walker, and several names were mentioned to me of possible commissioners from the south, and I was asked to state which of the various names presented was preferable for the position, and I did so recommend Major Harrod. After I left Washington I received a letter from Mr. Fish, in which he said that my name had been considered for the position, and he transmitted to me a copy of a letter that he had written to Admiral Walker in regard to it.

In that letter Mr. Fish objected to my becoming connected with the Commission, although he indorsed me for it, if it would interfere with my connection with the Illinois Central Railroad, but he left it to me to decide as to whether I desired my name mentioned in connection with it or not. I thanked him for his kindness and told him that I felt much more gratified at the expression of his good will than I would have been if I had received the Commissionership, and that incident was closed.

In May I received a copy of a letter from William Barclay Parsons, which I would like to read to you—it is very short—as it gives you, in a way, the idea that was in the minds of the Commission as to the scope of the duties of the chief engineer.

This is the letter from Mr. Parsons:

"My Dear Mr. Wallace: On this trip from New York to the



Car No. 80793 Before Repairs Were Made.

Isthmus, the Commission has been giving earnest consideration to the selection of a chief engineer, realizing that a very great measure of our success will depend on that official.

"The man for this position must possess exceptional qualifications. He must not only be an engineer, but must also be an administrator and an executive. He must have mature judgment, and yet energy of accomplishment. He must be well known and favorably known. Among the men who have been considered as so qualified naturally your name occurs, and the Commission desires to know whether, if a tender of this position were made, it would be seriously considered by you.

"Owing to a previous professional engagement with the British Government, I will be obliged to leave Panama in advance of the other members of the Commission and will arrive in New York on April 19, so as to sail for England on April 29. The other members of the Commission and I would very much like to have you and me meet to talk this matter over so that I could communicate with them prior to my leaving for Europe. Would it be possible for you to be in New York some time before the dates mentioned on, say, the 21st or 22d of April? If you can do this we can discuss the whole thing, and I can give an answer to my associates.

"I can imagine that you will be disinclined to think of severing

your connection with the Illinois Central, but on the other hand you would attach your name to the greatest piece of construction ever undertaken.

"Hoping that you will be able to meet me, I am,

Yours sincerely,

WILLIAM BARCLAY PARSONS."

That was the introduction to the Commission which afterwards resulted in my appointment.

My object in presenting these papers is to show this committee that I did not seek the position, as has been stated publicly on several occasions.

At the close of this letter Mr. Parsons suggests an interview in New York with him in a preliminary way, as he returned to this country a week before the regular Commission did and they delegated him to have a preliminary conference with me.

As I was in New York at the time designated I called on Mr. Parsons, and in an interview stated to him that the question of my giving favorable consideration to the acceptance of the position of chief engineer depended entirely upon terms and conditions. [Reading:] "Mr. Wallace informed Mr. Parsons that if the Commission were willing to give him a free hand in the conduct of the work under the general supervision of the Commission, permit him to select such assistants as he might require, and also give him full control over all details connected with the work, he would be willing to give the matter favorable consideration. Mr. Parsons replied that he had no doubt the Commission would be willing to tender the position subject to the conditions named."

Senator Dryden.—What is that you are reading from now?

Mr. Wallace.—That is just a memorandum that I had to refresh my memory.

Senator Kittredge.—Were the terms agreed to?

Mr. Wallace.—After the Commission came back I was invited to appear before it in Washington, and I came on from Chicago. On Wednesday, May 4, I first appeared before the Commission, and naturally the first question that I asked them was as to the terms and conditions that they were willing to offer me. I wanted their idea as to how they proposed to conduct this work, and, not being able to get any expressions out of them as to the conditions, they asked me to submit to them my ideas of how the work should be conducted, which I did.

Senator Hopkins.—Did you do that in writing or verbally?

Mr. Wallace.—No; that was verbal, entirely. I particularly stated that I could not consent to take the position except on the consideration that I would not take orders from any one individual, or be under the control of the various Commissioners in their individual capacity; that I would be willing to carry out any instructions which the Commission as a body might give me in the conduct of the work; that I imagined that the only benefit that my services could possibly be to the United States Government or to the Commission in that work would be so far as I might have ideas that were original, or so far as the methods which were my methods and the ways which were my ways could be applied to that work to produce results.

If I was simply to take charge of the work and conduct it according to the ordinary governmental methods or to the regulations of governmental departments, and use the methods which had always been used in the conduct of public works, my services would be of no avail at all; that it would be much better to secure some person who was familiar with those methods and was accustomed to those ways. And I was particular to state that what I apprehended more than anything else was that each individual member would have his own ideas about special things, and that I would in a short time be endeavoring to serve seven masters instead of one.

After quite a conference on that subject, the Commission not giving any expression of their ideas except occasionally asking me a question, I bid them good day and withdrew, and I never expected to be called back again. I thought that would settle it, because I felt the necessity of talking so plainly that I did not imagine that the Commission would care to have that kind of a man as their servant; but the next day Admiral Walker called me in and stated to me the salary which they had proposed to pay me. Although it was not the one that I had named in the tentative proposition, I told them that the salary did not cut any figure; that the thing that I was anxious about was the conditions, because I felt that the conditions were those that were prime requisites to obtaining efficient results. He wanted to know if I would accept the position. I asked him if he had conferred with the President, and he said the President understood the situation in a general way. I told him that I would like to reserve my decision until he could personally see the President and inform him of the conditions that I had made. About a week afterwards I received a letter from him in which he said they were satisfactory, and I then accepted an appointment, which was simply a plain letter telling me that I was engaged as chief engineer.

The primary causes which led me to tender my resignation as chief engineer of the Isthmian Canal Commission were underlying and fundamental, and I must emphatically resent the charge that my motive in leaving the work was a financial one.

A careful consideration of the entire subject had brought me to the decision that I should disconnect myself with the work at the earliest possible date that it could be done without embarrassment to the Administration or injury to the work. It is unnecessary to state the reasons for this decision, except that in fairness I should say that they involve no criticism of any act of the President or the Secretary of War.

My final decision was arrived at as the result of the six days' uninterrupted thought which I was able to give the subject in all its bearings during my voyage from New York to Colon in May. Furthermore, I had pledged myself to my family to give the matter of my resignation as chief engineer, or of any position which would require my continuous residence on the Isthmus, serious consideration.

It was at this psychological moment that I received a cablegram from New York offering me a business opportunity which I was bound to consider. I therefore immediately cabled the Secretary of War requesting a conference and arrived in New York for that purpose on Thursday, June 22.

In the meantime I had addressed a letter to the Secretary in which I confirmed the request for an interview and also requested my annual leave of absence, which was a part of my original understanding with the Isthmian Canal Commission, and which I had requested from Admiral Walker in March to take effect at our mutual convenience some time later in the season, which request, however, was not complied with or answered, owing probably to the sudden change made in the Commission on April 1.

On my arrival in New York I was met by Mr. William Nelson Cromwell, who stated that he was delegated by the Secretary to arrange for a special interview with me, and asked if I would meet him at the Manhattan Hotel at 10 a.m. Sunday, June 25.

While Mr. Cromwell treated me with the suavity and courtesy for which he is noted, he endeavored to draw from me my reasons for desiring to see the Secretary. I told him frankly that I did not consider it would be proper for me to discuss the matter in advance of my interview, and I also requested him to arrange for me with the Secretary that the interview should be absolutely private and that no one but the Secretary and myself should be present.

On arriving at the Manhattan on Sunday I was met by Mr. Cromwell, who ushered me into the Secretary's private apartment, accompanied by my son. Assuming that arrangements had been made for a strictly private interview, my son withdrew, expecting Mr. Cromwell to do the same. However, the Secretary in rather a peremptory manner directed Mr. Cromwell to remain.

This action of course caused irritation and apprehension on my part that the interview would be unpleasant and unsatisfactory; and the irritation under which the Secretary was evidently laboring had a tendency to prevent that calm and dignified consideration of the question in all its bearings which should have been given it.

If the Secretary understood me to say that I had accepted a position in New York, he labored under a misapprehension. I did state to him that I desired to accept one, but under such circumstances and conditions and at such time as would cause the least embarrassment to the Administration and the least injury to the work, and that I was even willing to go to the extent of remaining for an indefinite time on the Commission should he desire my counsel and advice in arranging for the change, assisting in preparing plans for submission to the advisory board of engineers in September, or in the further consideration of the question by the Administration or Congress during its next session.

Much to my surprise he indignantly spurned my suggestion and took the position that I was compelled, under what he called my contract, to remain in charge of the Isthmian Canal, regardless of circumstances or conditions, until the completion of the work, and spoke in such a manner as to outrage my feelings to such an extent that further discussion of the reasons for my action was out of the question.

I did not seek the position of chief engineer of the Isthmian Canal Commission, and, considering my salary as general manager of the Illinois Central Railroad Company and my other sources of earnings, my financial condition was not improved by my acceptance of the position, and it was with the greatest reluctance that I did so.

While it was my own expectation that I should continue my connection with the work, it did not occur to me that I was not free to withdraw if justice to myself and my family and to my reputation as an engineer required me to do so. It was not only my right but my duty to give the matter the most careful consideration in all its bearings, considering not only the general situation as it affected the work, but my family, personal and business relations, and all the various factors entering into the problem, and I could not concede the right to the Secretary of War or anyone to dictate my decision. The only debatable questions were the details as to putting my decision into effect, and while I stated to the Secretary what my desires were, I told him that I was perfectly

willing to conform to his wishes as far as possible as to the time and manner of my withdrawal.

"It was this suggestion to which he chose to refer as a "dicker." To that statement I naturally took exception, particularly as he stated that he did not care for any reports that I might make summarizing and analyzing the results of a year's hard work on the Isthmus; also, that he did not value my counsel and advice, and that the only service he desired was that of a constructing engineer on the Isthmus.

No intimation of friction between the Secretary of War and myself would have become public if it was not accidentally or otherwise given out by the persons in attendance at the conference on Sunday other than myself, and I desire to state emphatically, and the representatives of the press will bear me out, that I have refused absolutely, either directly or indirectly, to be interviewed, and have remained silent under the innuendos which have been daily published since the conference, and would not have made even this statement at this time if it had not been for the severe strictures contained in the published statement of the Secretary, which I consider unjust and uncalled for, and which could serve no useful purpose.

In regard to the situation at Panama, at no time during the progress of the work could my relations have been severed more opportunely than now, and with less damage to the work. A complete organization of departments and bureaus has been effected. Mr. W. E. Dauchy, a gentleman of high engineering attainments, who has been chief engineer of the Chicago, Rock Island & Pacific Railroad Company, and who had occupied the position of division engineer in charge of the Culebra division, was upon my leaving the Isthmus placed in charge of the work as acting chief engineer, he having occupied a similar position during my absence from the Isthmus at the call of the Secretary, during the month of April, and having satisfactorily conducted the work through the demoralization attendant upon the change in organization.

The only work which can be performed until after Congress at its next session shall take some decided action is the gradual increase in the organization and the addition of units of machinery along a well-defined plan which Mr. Dauchy thoroughly understood.

The simple work of excavating at Culebra and preparing for further excavation are the only things which could be done pending a final decision from Congress. The only possible benefit that my personal service as chief engineer could have been to the work was such as might be due to the purely personal element, which would have been largely supplied by my continuance with the work in an advisory capacity. As far as the actual engineering and construction work was concerned Mr. Dauchy was fully as capable as I.

Despite all of the discouragement and obstacles which have surrounded this work (as the Secretary knows and has practically stated in his letter) I endeavored to faithfully and vigorously perform the duties of my office and have never complained or criticised my superiors or any one connected with the work, and, as stated in the Secretary's communication, I have never requested additional emoluments or asked any favors of a personal nature, and any suggestions which I may have made (as his statement will bear me out) have been made because I considered them necessary for the increased efficiency of the work.

The reorganization of the work in April was not considered ideal, but as it was such a decided improvement over the existing condition of affairs and seemed to be all that could be done under existing laws I gave it my hearty approval.

I have made no criticism of personnel or individuals, but do believe that the obstacles due to the governmental methods required by existing laws are so serious that they will have to be eliminated if the American people are to see the Panama Canal constructed in a reasonable time and at a moderate cost.

My only desire in this statement has been to protest against what I consider the unjust denunciations of the Secretary, and to fully inform my personal friends and professional brethren, who have been familiar with my career, of the essential facts relating to this matter. I emphatically disclaim all responsibility for the various statements recently published alleged to have been made by so-called friends.

In regard to the type of the canal I would prefer to be excused from presenting any opinion until I can have access to the reports of the advisory board and the Isthmian Canal Commission, which, I understand, are divided in their views, and one of which favors one type of canal and the other the other. In other words, I think I can give you better service after having an opportunity to see those views than before.

. . . I made a good many mistakes in my attitude toward that work, mainly for the reason that I was enthusiastic in regard to it. That is, I became so as I studied it, and I felt as if nothing should stand in the way of its success. I felt that the Secretary of War and Mr. Cromwell failed to appreciate the character of work that I was best able to give, and when a new chairman of the Commission was appointed I tried to accept that position. I was very grateful to the Secretary for the change, because I felt that in appointing me on the Commission and on the executive committee he was trying to shape the work up in a proper way. But later on, and particularly after I had sailed for the Isthmus and gone back there, to my mind there appeared an indication upon the part of the chairman to dominate the entire work and to place me in a secondary position.

Senator Morgan.—Who was the chairman?

Mr. Wallace.—Mr. Shonts; and I felt that I could not give the best service to the work in that position.

Senator Morgan.—Let me interrupt you one moment, recurring now to the question I put to you awhile ago: When you left the Isthmus was it your purpose to ask to be relieved of your duties as chief engineer, turning them over to the successor that you had left there in charge of the work, expecting to remain as a Commissioner for the purpose of advising in respect of this choice of routes and such other matters as might be useful to the construction of the canal?

Mr. Wallace.—That is, if the Secretary of War desired me to do so.

Senator Morgan.—Was it your purpose, then, in leaving there, to disconnect yourself at all events and absolutely from all connection with the Panama Canal construction?

Mr. Wallace.—I do not like to say that it was my absolute purpose; but it was what I desired to do, and I desired to discuss it with the Secretary, and I desired to suggest that course to him.

Now, if you will let me explain, Senator, my position was this: After mature thought in going down there the last time I felt that the relations between myself and Mr. Shonts and between myself and Mr. Cromwell would in a short time arrive at a point where I felt that friction would be engendered which would be detrimental to the success of the work, and would be embarrassing to the Administration; and I did not think that it was fair to let that situation mature. I thought it was better for the work for me to come north and have a plain talk with the Secretary, and if he felt the same way that I did for him to relieve me and to put some man in there (of whom there are a great number in this country) that could work in a subordinate position to Mr. Shonts, and who was willing to be in a position where he would be dictated to and under the control of the work, as Mr. Cromwell was.

Senator Morgan.—When did you first see Mr. Cromwell on the Isthmus?

Mr. Wallace.—He came down there with the Secretary of War, I think it was, in December. Let me have my notes and I will tell you. It was in November, 1904, when the Secretary came down to revise the Bunau-Varilla treaty, or to make an arrangement to modify some of its requirements; and Mr. Cromwell was with him and acted as the go-between between the Secretary and the Panamanian authorities, or at least that is the way it seemed to me.

Senator Morgan.—How long did Mr. Cromwell remain there after that negotiation was closed?

Mr. Wallace.—He returned with the Secretary of War to the United States.

Senator Morgan.—When did he reappear on the Isthmus?

Mr. Wallace.—I never saw him on the Isthmus again.

Senator Morgan.—You never saw him any more?

Mr. Wallace.—No, sir. The next thing that I heard from Mr. Cromwell was in March, when I received a cablegram from him stating that, on his recommendation, the Secretary of War had authorized the directors of the Panama Railroad to elect me general superintendent. The next day, or the same day, I received a cablegram from Mr. Drake, the Vice-President of the Panama Railroad, stating that I had been elected by the board of directors of the Panama Railroad as general superintendent. I immediately wired Admiral Walker, and told him that I did not understand this—that I had no relations whatever with the Panama Railroad, and that I reported to him and should receive any instructions of that kind from him.

I declined to accept the position as general superintendent of the Panama Railroad, for the reason that I did not care to report to Mr. Drake or Mr. Payne, the general manager of that company in New York, and be reporting consequently, practically, to Mr. Cromwell, who was counsel of that company, and who evidently directed all its movements, because it made a divided responsibility. And again, I did not propose, on account of the positions I had held in the railroad service, to accept a position of that kind, where I would have to get instructions from men that had never visited the Isthmus, and who knew less about it than I did.

. . . Senator Morgan. Did you receive any instructions or directions or advice from him (Mr. Cromwell) in regard to the management of business affairs on the Isthmus?

Mr. Wallace. Except in this way. In our reorganization of the Panama Railroad he wrote out all the resolutions and apparently directed the conduct of the business that was done by the directors of the Panama Railroad and looked after the whole transaction of the reorganization.

Senator Morgan. Was that done in New York?

Mr. Wallace. Yes, sir, that was done in New York.

Senator Morgan. Then he was factotum?

Mr. Wallace.—Yes, sir.

Senator Morgan.—When you came to New York the last time, for the purpose of conferring with the Secretary of War and of tendering your resignation as chief engineer, and, as I understand, of conferring with him about your resignation as commissioner, did you see Cromwell?

Mr. Wallace.—Yes, sir.

Senator Morgan.—Where did you first see him?

Mr. Wallace.—He came to my hotel, at the Marie Antoinette, in the morning, just as I was first coming down in the morning. I had landed during the night.

Mr. Cromwell called to say that he had been instructed by the Secretary of War to ascertain from Mr. Wallace the reasons for his return to the United States and to discuss the situation with him.

Well, I declined to discuss my reasons for coming up. I told him that I thought it was both my privilege and my duty to talk with the Secretary of War, and the Secretary of War alone, first; that he was the officer to whom I reported under the Executive order that outlined the reorganization. Then he said that he was also delegated by the Secretary to arrange for an interview with me. I told him that I would like that interview to be absolutely private and personal. And he said that he had arranged to hold the interview at the Manhattan Hotel, and if I thought that was not private enough he would arrange it at his house. I told him that I did not desire to go to his house; that I wanted to see the Secretary, and I would see him alone; that the hotel or any place was good enough for me as long as that object could be accomplished.

After he left I immediately communicated with the Secretary of War by wire, reported my arrival, and asked him if the arrangement with Mr. Cromwell was satisfactory, or words to that effect; and he replied that it was. I wanted to know whether Mr. Cromwell really was delegated to make arrangements of that kind.

Senator Morgan.—Did you wire the Secretary here at Washington?

Mr. Wallace.—Yes, sir.

Senator Morgan.—When did he arrive in New York?

Mr. Wallace.—I do not know. I met him Sunday morning at the Manhattan.

Senator Morgan.—Well, was the Secretary alone?

Mr. Wallace.—Mr. Cromwell, when I went into the room, met me at the door. We were in large double parlors, and my son was with me.

Mr. Wallace.—Knowing that the interview was to be a private one, he withdrew. Mr. Cromwell made a pretense of leaving the room, when the Secretary said: "Cromwell, I want you to stay here. I want you to hear all this." And he was directed to remain.

Senator Morgan.—What was the first remark the Secretary made to you?

Mr. Wallace.—He said: "Now, Wallace, go ahead and tell what you came up here for." I do not remember the exact words, but that is my recollection of it now.

Senator Morgan.—Did you proceed to tell him?

Mr. Wallace.—I told him that I had two matters to take up with him, one of a personal nature and the other general. The personal matter concerned my connection with the work as chief engineer, and the general matter concerned the general statement that I wanted to make to him in regard to the work.

Senator Morgan.—Did Cromwell stay while you were discussing both these propositions, the personal and the general one also?

Mr. Wallace.—Yes, sir.

Senator Morgan.—Did you invite him to stay?

Mr. Wallace.—No, sir.

Senator Morgan.—Did you protest against his staying?

Mr. Wallace.—I did not protest, because when I told him freely and went to such an extent in my interview with him, telling him that I wanted the interview to be a private and personal one, I thought that was sufficient. I presume, looking back at it now, that I ought to have remonstrated. But I was impressed with the fact that the Secretary was angry, and that he was suppressing his feelings; and, of course, until my resignation was handed in and accepted, I felt that I was his subordinate, and I did not want to precipitate any unpleasant features in the controversy, which I was impressed was going to be unpleasant anyway, from his attitude. Therefore, I simply let it go along on that basis; but it changed my entire attitude, naturally, from the beginning.

Senator Morgan.—Had anything occurred between you and him, by way of correspondence or otherwise, to provoke him to anger?

Mr. Wallace.—No, sir; not that I know of. I supposed of all men connected with the work in a higher capacity, that the one man I could talk freely to was the Secretary, although I had never had any private conferences with him either personally or about the work since its inception. There had always been other persons present at our conferences. When he was on the Isthmus in December or November, and was down there about ten days, he lived in the house with me, but his time was all taken up with these conferences and various things, and we hardly got out of bed in the morning before Cromwell was at my front door, and generally he was in close conference with the Secretary when I retired at night.

At one time during that stay I requested an interview with the Secretary, in order to explain the work to him, and he finally set an hour and a day; and when we went into my library to have the discussion, I had my papers laid out on the table there, and was about to commence, when he said: "I have told Mr. Carpenter to send for Mr. Cromwell, as I promised Mr. Cromwell that when I had this conference I would have him present." And Mr. Cromwell came into the room.

Senator Morgan.—In what light did you regard Cromwell there—as an adviser of the Secretary, or as a spy?

Mr. Wallace.—Well, it struck me that he had a great deal of influence over the Secretary, and that the Secretary relied on him for advice and counsel in every step that was taken in connection with the work. I felt that to such a degree that my motives toward him were very mixed. I felt very kindly toward him in one way, because I felt that the Secretary could not have made the change in the executive committee, or would not have made it, except on Mr. Cromwell's advice, or at least his concurrence in the Secretary's policy in regard to the matter.

. . . I told him that I desired to resign as chief engineer.

Senator Morgan.—What did he say to that?

Mr. Wallace.—He did not make any reply. He let me go ahead, and I outlined to him what I desired to do, and the methods that I thought would accomplish it with the least injury to the work and the least embarrassment to the administration.

Senator Dryden.—Was that the first intimation that Secretary Taft had of your intention to resign?

Mr. Wallace.—In this cable I had sent him I said: "I desire to confer with you and others in regard to matters which may affect my relations to the work as chief engineer." That was about two weeks before I came up here.

Senator Morgan.—That might affect your relations as chief engineer?

Mr. Wallace.—Yes, sir.

Senator Morgan.—Did you proceed to make to Mr. Taft a statement of the causes why you thought that your resignation as chief engineer might be beneficial to the work?

Mr. Wallace.—No, sir; I did not.

Senator Morgan.—Why?

Mr. Wallace.—I did not give him any reasons whatever.

Senator Morgan.—Why?

Mr. Wallace.—I did not think that his attitude was such that it was wise to take up and discuss those features, and I confined myself simply to telling him what I desired to do; and then when I got through he said, "Now, go ahead and tell us the general matters that you want to talk about." Then I went ahead and discussed the general features of the work there, and Mr. Cromwell commenced to cross-examine me.

Senator Morgan.—Who did?

Mr. Wallace.—Mr. Cromwell.

Senator Morgan.—To cross-examine you?

Mr. Wallace.—Yes; that is, about general conditions.

Senator Morgan.—Yes.

Mr. Wallace.—And concerning several statements I made, one in particular, the Secretary said that he disagreed with me most emphatically; and to my mind it appeared as if there was going to be an attempt made to irritate me into losing my temper, which I tried very hard to control. The examination reminded me a good deal of a cross-examination which a lawyer might make of a witness when he tried to force me to answer yes or no, without proper qualifying explanations. It was like some of the experiences that I have had on the witness stand.

After I made him the general statement, then he cleared his throat and got off that denunciation of me, which was almost word for word what he published through the Associated Press later on.

After the conclusion of that I undertook to argue with him and Mr. Cromwell, and to explain my position and his. I said to them: "You certainly do not take the position that I have not got the right of resignation at all—that I could be in a position where I could be discharged by a cablegram on a moment's notice, and you have the right to change the conditions, and yet I have not the right to resign at any time or under any conditions?" And they first took the ground that that was my position there. Then I said to the Secretary: "Mr. Secretary, I cannot let you nor any other man dictate to me what my rights or what my duties are. I know what they are." And I said: "You and Mr. Cromwell are supposed to be the two smartest, shrewdest lawyers in the United States; and do you mean to sit there and tell me that there can be an implied contract that would bind me to give my service to the United States Government forever, regardless of changed conditions or anything of that sort?"

And after some argument he finally said, "Well, you at least ought to give us a year's notice." I said, "If it comes down to a question of notice, that is a proper thing to discuss, and I am willing to discuss that with you. I do not mean to say that what I have advanced here as my desire is binding on you. I do claim that I have the right of resignation, and that I want to resign as chief engineer, but I am willing to discuss the matter with you in

all its phases." Then he turned around and said, "Well, I will not stoop to dicker with you." He said, "That would be to dicker." Then one thing led to another, until finally the conference was broken up.

When I got up to withdraw from the room I told him that I would, as soon as possible after I had composed myself, send my resignation to the President through him, as Secretary of War, subject to the President's acceptance at his own pleasure and convenience.

Senator Morgan.—Did you send in your resignation?

Mr. Wallace.—I sent it in that way.

Senator Morgan.—What offices did you include in that resignation?

Mr. Wallace.—I included the office of Isthmian Canal Commissioner and chief engineer, and made their acceptance subject to the acceptance of the President, at his pleasure and at his convenience.

When I left after that interview I never dreamed for a moment but that I would be called to another one before the matter was finally terminated or that the Secretary would say: "Well, Wallace, you and I seem to have misunderstood each other. Let us take this matter up to the President and discuss it with him." But my resignation was accepted, and that incident was closed, except that the next morning after the interview occurred, all sorts of articles came out in the newspapers criticising me, and on the following Friday morning what I understood was the authorized statement of the Secretary was given to the Associated Press.

. . . I may have been wrong in it, but I supposed an intimation of the offer I had received would be more acceptable to him than any other reason that I could give him, on account of Mr. Morton's having laid down his duties as Secretary of the Navy and accepted a more lucrative position, and Mr. Day's having laid down his duties in the prosecution of the trusts, and things of that sort, and that seemed to "go" satisfactorily. I may have been wrong in intimating anything like that.

I want to say right here, however, that I had not accepted that position then and that I have not accepted it since; and that before I had the interview with the Secretary, I told the parties that had made the proposition to me that, while their proposition was satisfactory in a way, I did not propose to go any further with them until I could find out whether or not I could make a satisfactory arrangement with the Secretary of War to accept my resignation and to make some arrangement by which my leaving would not endanger the work or embarrass the Administration.

. . . Senator Morgan.—If I catch your meaning, and I think I do, part of your office up here was to shake Mr. Cromwell off your shoulders?

Mr. Wallace.—Yes, sir; you have caught the meaning.

Mr. Wallace.—I suggested that he may be perfectly harmless, but it struck me that from his relation to the work, as being the man that brought about the sale of the Panama Canal, that assisted in the Panama revolution, that acted as fiscal agent of the Panama Government in making its investments, that is carried on the Panama diplomatic list as one of its members, is a director in the Panama Railroad, an advisor to the Secretary, a stockholder in a public utility company that was on the Isthmus. I felt that a man that was mixed in so many things was liable to have his ideas perverted, and might some time or other advise the wrong thing, or do the wrong thing, which, if the executive committee that controlled the Isthmian Canal should follow his advice and follow his instructions, might possibly lead to scandal.

Senator Morgan.—I take it from what you say that your apprehension of his capacity for doing dangerous things consisted mostly in the fact that he was on the make and had good opportunities on the Isthmus to make money out of the Government?

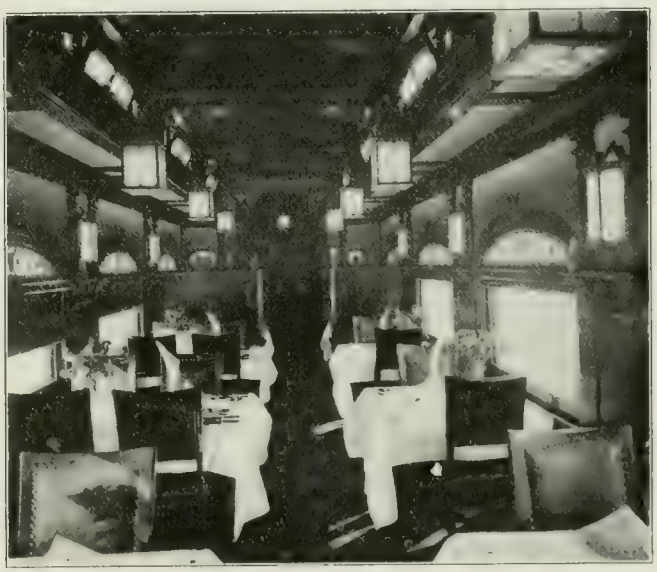
Mr. Wallace.—One of the things that struck me most peculiarly about it was that when I got into the Panama Railroad office I was looking over their reports and I found that the last year that the Panama Railroad was owned by the French company, which owned 99 per cent. of its stock, they declared a dividend of over $100,000 more than they had earned; and that after the declaration of that dividend they sold bonds in their treasury to make ordinary repairs or rebuild their steamships, which should have been rebuilt out of the earnings of the company; and it looked to me as if for counsel to advise that proceeding (which to my mind was practically taking that much money that belonged to the United States Government and putting it into the pockets of the holders—I mean, of the owners of the New Panama Canal Company) bordered on the line of "high finance."

New Dining and Cafe-Smoking Cars for the Burlington.

The Burlington has placed in service on certain of its limited trains out of Chicago new dining and café-smoking cars, built by the Pullman Company. The dining cars have some new features of interior design and arrangement. A photograph of the interior is reproduced, from which it will be seen that the model for the



Interior of Smoking Compartment, Burlington Cafe Car.



Interior of Burlington Dining Car.

arrangement and furnishings is the Vienna rooms of high-class German restaurants. A plate rack encircles the car, on which are specimens of ancient ware and steins. A new feature is the provision at each end of a small private dining room with two tables, one seating four and the other two persons. The seats are high and stationary, being built into the car, and are upholstered in leather harmonizing with the woodwork.

The interior of the car is finished in English oak and an interesting story is told regarding the trees from which the lumber was obtained. They grew on the ancient English estate of Rockingham Park and were centuries old. A short time ago it became necessary to sacrifice some of them and 27 were sold to the Pullman Company. The particular oak which furnished material for the Burlington dining cars was nearly 8 ft. in diameter. In cutting it up a gate-hook was found within 10 in. of the center, apparently driven there 700 or 800 years ago. In the same tree was discovered a slug bullet, such as was used in the first matchlocks. From its position in the tree it must have been there since about the time of Cromwell. There was also found a flattened musket ball that had been driven into the tree some time in the early part of the last century. The ball had penetrated the tree about 3 in., and 6 in. of wood had since grown over the place where it entered.

The buffet of the café-smoking car is also shown. It has room for 18 persons, and the café has room for 12. The dining cars seat 30 persons—18 in the main room and six in each private room. The dining cars are lighted by electricity from an axle generating system, and have an acetylene gas plant for an auxiliary. The café-smoking cars are lighted by acetylene.

Accidents Due to Defective Equipment and Carelessness.*

During the last two years we have had an epidemic of accidents caused by defective grate shaking rigging and defective shoveling sheets on engines, especially of the former. A few years ago they were practically unknown. Now they come so often as to create no remark. The following cases will demonstrate the necessity either of some different apparatus for shaking grates of engines, of greater care in using the apparatus, or of some better method of inspection and repair.

A. G. Kenly, fireman, injured near Windermere, caused by the shovel which he was using catching on the shoveling sheet of engine No. 418.

James Cooney, fireman, injured June 19, in Caster yard, was shaking grates on engine No. 947, and connecting rod brake, catching his hand between shaker rod and quadrant.

H. D. Porter, fireman, injured near Mansfield, May 10; caused by grate rod breaking as he was shaking the grates on engine No. 1280.

Next we come to a class of accidents which is also on the increase and which is of comparatively recent origin, and which I believe could and should be absolutely prevented by the exercise of a little mechanical ingenuity or which, even under present conditions of engine construction, would be avoided by greater care on the part of the engineman. And some day when an injector breaks or a blow-off cock is opened as McGrath or Kennedy or some other mechanical superintendent is passing an engine, and their legs are scalded, I will bet my next month's salary against an 1899 bird nest that they will find a way to prevent such injuries, which are as painful as they are unnecessary and expensive, either by putting the blow-off cocks and injectors under or on top of the engines, instead of having them project from the side.

W. P. Willard, engineman, injured July 22, 4 miles west of Janesville; injector pipe on engine No. 1618 broke, and Willard was scalded about face and head.

Henry Jennings, conducter, injured Oct. 1, at 5:55 p. m., north of Rathburn; was walking by engine in charge of Engineman L. J. Hosmer, who started the injector and threw hot water on Jennings.

Edward Sterns, night engine inspector, injured at Granby roundhouse Jan. 12, at 8:45 p. m.: he told engine despatcher to open valve to see if sand was running properly; despatcher opened the blow off cock instead of sand valve, and steam and hot water scalded Sterns' right hand and leg.

We have every year a number of accidents to employees caused by defects in engines and appliances furnished enginemen, nearly all of which could and should be avoided if we had more thorough inspection, greater care taken in repairs and, what is just as necessary, more care taken by enginemen in reporting defects; and when you report defects, and repairs are not made, call the attention of your master mechanic or division roundhouse foreman to the matter and I doubt not that not only will the defects be repaired but greater pains will be taken in the future to see that your engine is kept in good condition.

William Curbin, stripper, injured at Elmwood shops on the 10th of March, was taking boiler front off engine No. 3461; removed all bolts except one, and while waiting for crane to be attached to the door to lift it away, the door fell on Curbin's leg, who was standing on the pilot beam of engine. Investigation showed that the bolt, which had not been removed, and which had been left to hold door, was a "dummy."

G. M. Cramer, fireman, injured, Sept. 9, at Huntingdon, was climbing up on cab of engine No. 784, to get coal chute down, when brake released, and on account of leaky throttle, engine started back, and caught his leg between cab of engine and chute.

J. B. Olson, fireman, overcome by heat on engine No. 941; caused by absence of lagging on side of engine.

M. H. Woodrow, engineman, and Douglas Evans, fireman, injured half mile east of Peverly, June 19, caused by whistle valve on engine No. 2605 becoming stuck, they being unable to fix it, and they were almost deafened by the continuous whistling. Whistle had been reported on the trip before by the engineman, but was not repaired.

Henry Winterson, a boiler washer, injured on May 15, at Kendrick, was using a 4 ft. nozzle to wash out boiler of an engine, when the collar of nozzle came off, and he was thrown against cab of engine, injuring his back.

The thought has often occurred to me that if the master mechanic or some one other than the foreman, whose duty it is to inspect and repair, would check up the work slips form No. 141 and inspection records to see that the repairs called for on them were made, we would not have so many engine failures or accidents of this kind.

Before leaving the question of engines I want to say a few words about accidents caused by the breaking of lubricator glasses and water gages; they grow more frequent every year and until somebody invents something to take the place of glass, which will not burst, as you value your eyesight, which becomes more necessary every day as the number, speed of trains, and signals increase, carry the shields, which the company had provided for your, not its, protection, over the glass, and not in your seat box as many enginemen do now, and then when the glass breaks, and no one can tell when it will do so, there is little danger of your vision being impaired or lost by your eyes being struck by flying particles of glass.

Accidents caused by use of defective derricks, scaffolds, and the careless handling of derricks being comparatively new are one of the recent surprises in the business, and I venture to say that this company has paid out during the last 18 months in the investigation and settlement of accidents caused by defective scaffolds enough money, not only to furnish for the system the most approved scaffold now known, but to nickel plate them as well. The following cases will show what is going on in this way:

R. B. Babcock, bridgeman, injured at Ferncliff, a mile and a half north of Whiteston, Jan. 14, while standing near derrick mast, which was being raised and put in position on abutment, the mast suddenly slipped, and knocked this man off the abutment to concrete foundation 34 ft. below, breaking his leg in two places and his arm, and bruising his hip.

H. R. Roberts, bridgeman, killed near Red Creek, March 4, at 11 a. m. derrick car was being taken from side track to bridge No. 75, and in rounding a curve an attempt was made to swing the boom of derrick to outside of curve, but it suddenly swung over to the other side of car and tipped the derrick car over; Roberts was standing on front end of car and jumped, falling back onto the track, and the derrick tender, which did not leave the track, ran over him. A 2x4 cleat, nailed on side of mast to hold sling lines in place came off, allowing ropes, which control swinging of boom, to slacken so that movement of boom could not be controlled.

B. H. Jackson, seriously injured at Leicester, Dec. 30, caused by the plank on which he was standing, used for scaffolding, slipping out of the hooks, on account of its being covered with ice and snow, and allowing him to fall 15 ft. to the ground.

Within the last few years accidents caused by defective jacks and drop cables, which, when I commenced to investigate claims, were unknown, have become very frequent. I mention the following to show what they are. All of them would have been prevented by proper inspection—not by inspections made to find things O. K., but by inspections made to find defects; and if not made for that purpose, we had better discontinue them altogether.

L. M. Lumpkins, section foreman, injured Feb. 20, at Graves; he was helping car repairer, and had jacked up a car in order to move the trucks, but when ready to let the car down the jack would not work, and all at once gave way, and Lumpkins was struck on the head by the lever and knocked down, injuring him.

R. J. Hopkins, laborer, injured June 22, at Osazi, was giving signals to have train loaded with ties, moved, when cable broke and hit him in the face.

In the same category, while perhaps not of the same class, come accidents at coal chutes and water tanks, roundhouses, stations, and other places. Had inspectors, repairmen and employees using the appliances, done as they would have done if the loss occasioned by neglect was to be theirs, none of the following accidents would have happened:

Will Flanigan, cinder pitman, injured May 21, at Granby sheps, was raising cinder bucket with hoist; chain broke, and the bucket fell on his foot.

Frank Hogan, fireman, injured in Colby yard, March 16; had just finished coaling engine No. 875, and pushed up lever to shut off the coal, when the pulley, over which cable works, dropped and struck him on the head.

W. R. Brady, fireman, injured at Quarton, June 1; was standing on tank of engine to take water; rope was frozen and coiled up and he could not reach it; got the ash hoe and caught the rope and pulled the spout down, when it was part way down it fell and struck Brady in the back.

D. W. Dalmann, operator and leverman, injured Aug. 12, at Hampton; was in interlocking plant throwing distant signal, when chain connecting lever with counterbalance weight broke and he was thrown to the floor.

Stanley Lord, freight brakeman, injured at Rembrandt, May 20; was unloading freight from a car; the skid which was being used was broken off at one end, causing it to slip, and allowing Lord and the boxes to fall to the ground, injuring Lord.

Another class of accidents which might also be avoided is that caused by defective floors and platforms in roundhouses and at stations, the failure to keep tools in repair, lack of light, and failure to properly secure lights on switches. While, fortunately, they are not so great in number, yet they go to swell the total, as well as the expense, and ought to be cut out, as they could be with proper care and supervision.

L. N. Corbey, brakeman, injured at Calton, Nov. 28; went into coal shed to get coal for caboose. In coming out he stepped on a broken board in the floor of coal shed and sprained his left knee and left hand.

H. L. Minturn, injured at Acworth, Jan. 16, while running to throw a switch, he ran into a three throw switch upon which there was no light.

Jacob Paley, boiler-maker helper, injured July 11, at Hinsdale; was striking punch, knocking out rivet; the punch came off the handle and struck him in the eye.

A. D. Yarrow, injured April 3, at Alberon, while throwing switch near roundhouse, the switch light fell and struck him on the head.

Albert Kaufmann, machinist helper, injured July 6, at Hamburg; was in roundhouse working near dynamo belt, which became unlaced and loose end of belt came round and struck him on the left arm.

Next in order, I wish to call your attention to accidents caused by overhead obstructions, drawbars, lumber poles, cinders, and other obstructions being left too near the rail, holes and trenches left uncovered, and failure to block guard-rails and frogs, etc. Everybody is or should be familiar with Rules 617 and 619, which require blocking of frogs and guard-rails and a clear space of 6 ft. from the rail, and yet one would sometimes think from the appearance of some yards, side tracks and switches that the rules, like the midnight closing ordinance, were dead letters. It, however, is the intention and desire of the management that they, like all other rules, should be enforced, and no one is so much interested in that enforcement as the train and yard men, who

*From a paper prepared by the Claim Department of the N., B. & C. Railroad, parts of which appeared in the *Railroad Gazette* of Dec. 15, Jan. 5 and Feb. 23.

work in the yards and on side tracks and switches. If they had been observed, or if their non-observance had been reported by the men who must have known of their violation, none of the following accidents would have occurred:

P. B. Montgomery, brakeman, fatally injured at Mason, while attempting to uncouple car G., P. & A. No. 593 from O., M. & C. No. 1783; chain on pin being broken; blocking gone from guard rail.

John Lenahan, Switchman, killed at Juniper, June 4; footboard of switch engine on which he was riding struck a telephone pole lying in the grass alongside the track, throwing Lenahan under the engine

P. D. Kendrick, brakeman, injured at Bentley, Jan. 5, 7:00 p. m.; was riding on the side of a box car, when he was struck by a spike sticking in a board, which was part of the fence around the cellar which was being excavated for the new depot at Bentley. It was necessary to amputate two fingers of Kendrick's right hand and his right leg, and he also received a very bad scalp wound.

Peter Alton, brakeman, was climbing up the side of A., B. & C. car No. 2843, at Hackley, when he was struck and knocked off the car by a high-way crossing sign at that place, and so badly injured that it was necessary to amputate both his legs below the knee, and his right shoulder blade was also broken. This crossing sign cleared this car only 2 ft.

K. G. Purdy, switchman, killed in Walton yards, Dec. 10; caused by his being knocked off the top of a car by the Avery Street viaduct and run over and killed.

I want to call especial attention to the Alton, Montgomery, Purdy and Kendrick cases. In the former the crossing sign had been in the same place for over 20 years. The man who put it there, roadmasters, and section foremen, who should have discovered its dangerous proximity to the track and moved it to a safe distance, the one required by Rule 619, were grossly careless, and the injured man and other trainmen who had passed it daily for years must have discovered that it was too close to the track, and if they had reported it, as they should have done, this accident would not have happened, and they were blamable for not doing so. In the Montgomery case the section foreman was at fault for not properly blocking the frog, the roadmaster for not seeing it was done, and the car inspector and repairer for not discovering that the coupling apparatus was defective and repairing it. In the Purdy case the management was at fault for not seeing that warning whips were up for the viaduct—they are now; and in the Kendrick case the man who hung up the lamp too close to the track to warn people, instead of making it a protection, increased the danger, and the division engineer who allowed it to be done were inexcusably careless. Such cases not only swell the total number, but account in a measure for the total increase in personal injury cases.

Section foremen do not seem to realize the importance of examining the whip guards for overhead obstructions every time they pass them to see that they are in proper position and if not, pull them down with the hook provided for that purpose. If the roadmasters would be more particular to see that this is done we would have fewer accidents of this kind in the future.

And in removing hand cars in yards, place them far enough away from the rails so that a man riding on the side of a freight car won't be struck by them, as happened to

A. T. Swanson, brakeman, injured at Tracy, Aug. 30; he was hanging on the side of a car, and was struck by the handle of a hand car, which had been left too near to clear a man on a car.

I shall next call your attention to accidents caused by carelessness of enginemen which you will, I believe, agree with me in thinking should not have happened and by proper care and thoughtfulness will not occur in the future:

George Bowman, engineman, killed at Holstein, on Sept. 9; caused by engine running off the track, this being the end of the road, and the first time Bowman or any of the crew on the train, other than one brakeman, had been over the line. A section foreman, who was sent along as pilot, claims to have told Bowman when he came to the Y, north of the depot, but Bowman paid no attention to the warning, and made no effort to stop. This engineman had been on duty for 14 hours when he got to Creever, at about 12 o'clock midnight, and asked for 8 hours' sleep, but was sent out again in four hours and a half.

Michael O'Neill, turn table man, injured Oct. 17, at Patten; he was pushing turntable with engine on it, and while doing so engine ran off before he got it to the stall where it was to go in; struck him on left shoulder.

Ralph Burnham, rear brakeman, train No. 55, seriously injured at Bradley, night of Dec 21, by being caught between the tender of engine No 641 and the mail car. This man was standing on the east side of track and started to cross over to the west side to help couple the air, steam hose and whistle. He knew the engine was coming back, but owing to the amount of steam escaping from it did not realize it was so close, and before he could get over was caught. The steam was escaping from the steam hose at the back of the tender. It is customary for some engineers to have this steam blowing off as they are backing up to make couplings, others shut off the steam, as when it is blowing off it is almost impossible for the brakeman to see. Why should not all enginemen shut it off?

In a double-track district, if you are running on the wrong track and there are any section men working on the track or employees or others walking or running on the track, you should act upon the theory that even if they know you are coming they will think you are on the track usually occupied, and until you know that they understand the conditions you must be prepared to stop in time to prevent injuring them. And if two trains are passing on the double track and there is anyone around, don't let it be your fault that an injury occurs because ample warning was not given of the approach of two trains instead of one.

John Cooper, section laborer, struck and killed by engine No. 1564, hauling train No. 21, April 16, at 9:00 a. m., 1½ miles north of Steuben, while working on the track, cleaning the crossing. Train No. 21 was running on south-bound track. Although running on the wrong track, engineman is unable to say whether or not he whistled for the crossing. No one on the engine saw the man.

Injuries caused by the moving of cars being iced or on or under which men are working seem to me of a class so inexcusable as to merit the discharge of the party at fault. Think how you would feel if you or your boy was under, on, or in, a car with a flag out and someone moved the car without notice and you or he was run over. The following are a few such cases:

Philip Elder, car cleaner, injured at Armstrong, July 5; caused by train being moved by switch engine while he was on the ladder filling the water cooler.

Patrick Connelly, car repairer, injured Nov. 29, at Falesburg, was under end of car on repair track; Switchman Moody backed train No. 27 on No. 5 track, and cars did not clear coach No. 368; it struck the car under which Connelly was working, moving it about 10 ft. and dragging Connelly, who caught hold of brake beam.

A. F. Brown, car cleaner, injured at Perryville yards, May 3, at 10:00 a. m., was working in smoker No. 762; engine No. 37 coupled onto the car and pushed it down track and it collided with some other cars, knocking this woman down. No switchman riding on the car at the time of the accident.

Injuries caused by carelessness in throwing switches and derails we all know ought not to occur, and yet they are of frequent occurrence. The following are samples:

G. M. Claney, engineman; Alfred Dolan, fireman; injured about 10 a. m., June 4, at Peronia; after going in on side track to get some cars, got signal from Brakeman B. Loomis to come ahead. Loomis failed to throw derailing switch, and while going to main line engine left the track, went down embankment, and turned over.

Richard Jones, brakeman, injured May 7, at Nelson. Foreman Brinson told him to cut off two cars and ride them out onto main line, and after he had started the foreman noticed an engine coming up the main line, and threw switch for side track, the cars collided and he was thrown down in car.

Accidents caused by kicking caboose cars in which men are resting are of altogether too frequent occurrence, and are as inexcusable as they are frequent. Rule No. 341 should, I think, prohibit the practice, as it does that of moving cars containing passengers unless coupled to the engine and air-brakes in use. Had this been done, the following cases would not have happened:

K. M. Simpson, brakeman, injured Dec. 12, at Albion, was in way-car cleaning ashes out of stove, when the way-car was struck by another car kicked into it by switchman, throwing him against end of car.

Paul O'Connor, and E. Putnam, brakemen, injured Feb. 22, at Dodworths, were asleep in caboose No. 1473, on caboose track. Switch engine No. 634, Foreman L. Sherry, went in and got caboose and kicked it out on lead. It did not clear the switch track, and as other cars were kicked back on caboose track it was struck by caboose No. 1289, throwing these men to the floor

Indeed, I believe that if the practice of kicking freight cars in yards and at stations was prohibited the saving in the cost of repairs to equipment and for damage to contents of cars would be much greater than the increase in pay-roll caused by necessary increase in the number of men in the crews.

Speaking of accidents of this kind brings to mind those resulting from careless handling of boarding cars, which are now so common during the summer season at all points on the system. You all know the class of people who inhabit boarding cars, how little they appreciate the danger, that they are on the sides, top, under, and in the cars. So handle them, not as some brakemen do egg cases, but carefully; never move the cars without going to see that no one is under them cooking his dinner, that the occupants of cars are all in a place of safety, and never make a fly or kick with them, always have the engine coupled up, and don't uncouple it until the car has got to the place it is to be left. Roadmasters and foremen should see that the opening for ingress and egress from the cars is on the side away from the traffic. The switch to the track on which the cars stand should be locked and the key in the foreman's pocket, or else a rail taken up so that no one can get in on the track without notice. If you run across any cases where this is not done, report them before, not after, someone is hurt.

Before leaving the subject of injuries to employees caused by the carelessness of other employees, I want to mention some motor and hand-car accidents and injuries to section men caused by the use of defective cars, by fast running, overloading, and by failure to comply with the rules. Why men on motor cars and hand cars coming in from work want to run faster than is safe they never do it on the way out, why they should overload, use defective cars, run closer together than 300 ft., be out after dark without a light, leave their cars on the highways to obstruct the same and frighten horses, contrary to Rules 841, 842, and 843, we may perhaps guess. And yet we can see no good reason for failure to comply with the rules which are made for their own protection

as well as that of the company, and if more careful instructions were given them by the roadmasters and more careful supervision exercised, many of the accidents mentioned below would not have happened. And on account of the class of men now employed on the track, such instruction and supervision is more necessary than ever, as the records show that we have many more such cases in proportion to the mileage and business than we did a few years ago.

G. Botticelli, laborer, injured March 23, about 14 miles south of Yerkesville, was riding on the front end of hand car, which was being followed by another hand car. Section foreman signaled to the rear car not to come too close to first car, signal was not heeded and the second car ran into the first, derailing it.

H. P. Dennis, laborer, injured May 28, 3½ miles west of Orion; caused by the handle of a hand car breaking. He says the foreman was not at the brake.

N. R. Forbes, injured near Larkin, June 24, with four other men, was riding on a hand car going home from work. While going down grade, trying to get to station before train pulled out, car jumped track, all the men were thrown off, and Forbes injured. It is claimed by Forbes that injury was occasioned by reason of hand car being out of order and track out of gauge.

In passing over highway crossings, especially in cities and in running past stations, hand and motor cars should be so run that the man in charge could stop the car in its own length.

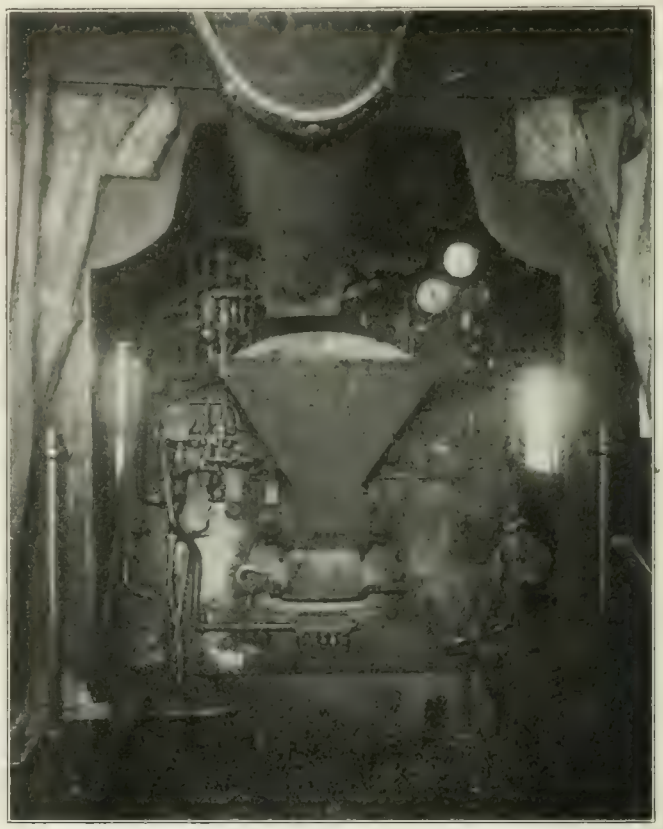
The Hayden Mechanical Stoker.

Without really expressing an individual willingness to assist in the development, there has been expressed a desire on the part of the mechanical officers of the railroads of the country for a stoker that would lighten the labors of the firemen on the large locomotives, now so extensively used. This expression has naturally led to attempts to produce a machine that will do the work; and among the latest to be tried with success is one built by the N. L. Hayden Manufacturing Co., of Columbus, Ohio.

This stoker performs all of the functions of taking the coal from the tender, dividing it into small portions and distributing it in the firebox. For this there is, first, a heavy grating placed just in front of the coal gates on the floor of the tender beneath which the horizontal section of a coal conveyor is made to travel. Coal dropping through this grating is taken by the conveyor and carried up on one side and thence back to the center, where it drops into the tube of a screw conveyor, by which it is carried forward to a point just back of the boiler head, where it drops into a hopper. The bottom of this hopper is closed by a valve which is capable of turning through a half of a revolution and receiving a charge of coal, when its opening is uppermost. The half turn drops the coal on a shelf in front of the firebox, whence it is blown by steam jets to the various parts of the firebox with an even distribution. The rate of feeding can be varied to suit the exigencies of the work that the locomotive has to do and the quality of the coal that is to be used.

This much for the general principles of the device. Turning to the details of the mechanism, the first point to be considered is the receiving grate. This is a heavy casting with openings of about 4 in. by 3⅜ in. that lies in the floor immediately in front of the coal grates. Beneath there is a conveyor passage through which buckets are driven by an endless chain. The coal dropping down through the grates is caught by these buckets and carried up one of the legs of the conveyor and then back to the center, where it drops into the tube of a screw conveyor, by which it is carried to the hopper on the back head of the boiler. This tube is raised above the foot plate so as to afford ample head room beneath it, and is carried by an angle arch springing from the front of the legs of the tank and the cross piece of the conveyor. There is thus no physical connection between the conveyor on the tank and the stoker on the boiler. The conveyor is driven by its own engine, consisting of two 4-in. by 4-in. cylinders driving a worm by which the speed is reduced to that suitable for the work. These engines are simple reciprocating machines similar to those used for the stoker valve, as will be described later. The delivery end of the screw conveyor is well up over the hopper and has ample opportunity to move with the variations of the relative motions of the engine and tender, and yet always be in such a position as to drop the coal into the hopper.

The hopper into which the coal drops from the screw conveyor has an upper opening of about 18 in. by 34 in., and tapers down to one of 6 in. by 10 in. at the bottom. As the depth is about 21 in. the storage capacity at this point is 3½ cu. ft., or about 175 lbs.



View of Stoker as Applied to H-6-A Pennsylvania Locomotive.

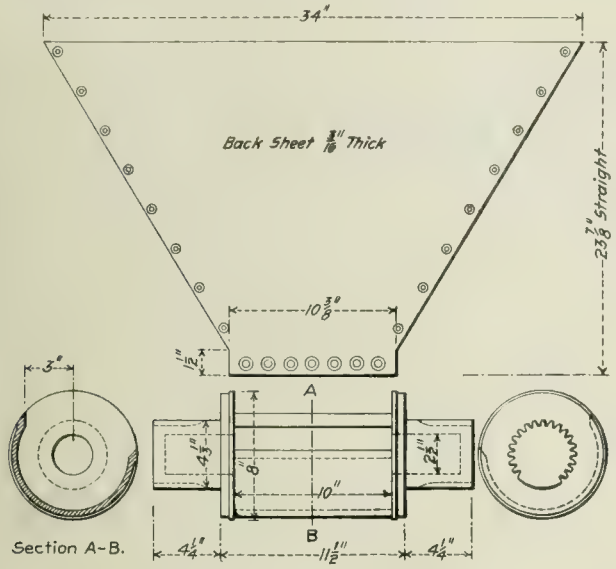
The charging valve is located beneath the hopper. It is in the form of a hollow shell, as shown in the illustration, and will hold about 12 lbs. The coal drops into it when the opening is uppermost. It turns on trunnions that are centered in the main casting and which are fitted with spur gears at the outer ends. These gears mesh with a couple of racks that are directly connected to the piston rods coming from the two operating cylinders AA placed above the door and partially back of the hopper on either side. As the pistons of these two cylinders move up and down the motion is communicated to the rack and by them to the valve, which is turned through a half revolution for each full stroke. The steam admission and exhaust for these two cylinders is regulated by a special valve, which is, in turn, driven by a small two-cylinder engine.

Starting with this source of power, the engine used to drive the valve of the distributing cylinders is of the two-cylinder type without eccentrics or pivoted connections. The cylinders have a



Pennsylvania Locomotive Class H-6-A.

bore of 1½ in. with 1½ in. stroke of pistons. The latter are packed with two small spring rings and are solid with their rods which are screwed into the Scotch yokes by which the rotary motion is given to the shaft. Each yoke also serves as a point of attachment for the valve stem of the mating cylinder, so that the cranks form the eccentrics for the valve motion. As these cranks are set at right angles with each other, when considered as eccentrics, one leads the crank, the valve of whose cylinder it controls; while



Hopper and Coal Valve for Hayden Mechanical Stoker.

the other follows it. The valves are, therefore, arranged for an outside and inside admission respectively; but, owing to the position of the cranks, can have no lap or lead and therefore admit steam for the full length of the stroke.

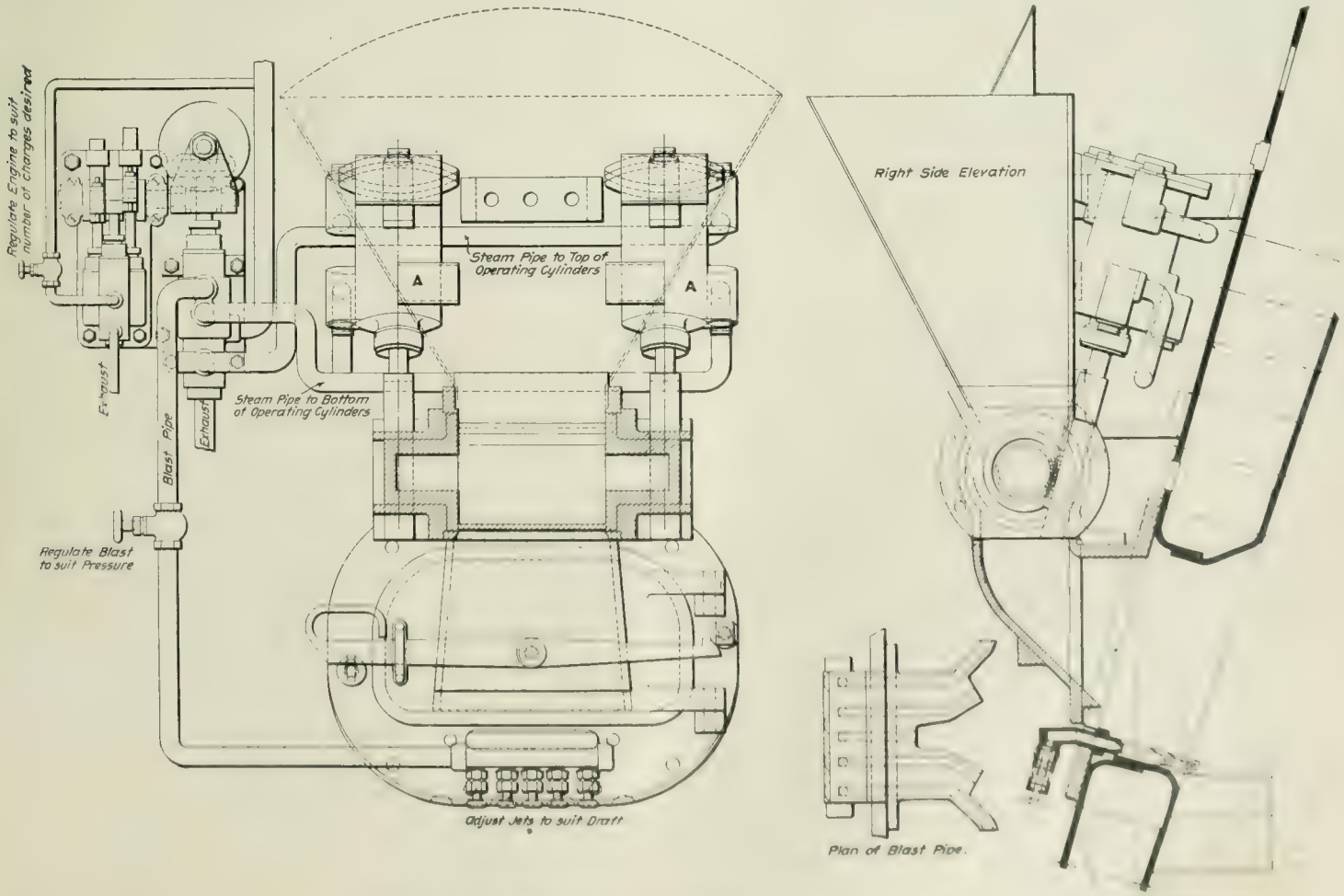
In the case of the outside admission valve, steam is admitted to the upper end of the steam chest and passes down through the center of the valve to the other end, where it leaves by the side opening at B to enter the space beneath the valve and be admitted to the cylinder through the port C when the valve has risen sufficiently to uncover it. For the exhaust of this cylinder the valve acts as an ordinary D valve.

In the case of the other cylinder the flow of steam, with the valve of inside admission, is reversed. Steam is admitted to the center of the valve, and exhausted direct at the upper end; while, at the lower end, it passes to the center of the valve through the side opening D, and thence to the upper end and the exhaust. The Scotch yokes are held in alinement by stems projecting downward in the usual way. These engines are very compact and measure but 17¼ in. by 7 in. by 7 in. over all. The shaft carries a worm at one end meshing with a gear of 72 teeth, on whose shaft is a crank driving another Scotch yoke that is attached to the stem of the distributing valve of the operating cylinders AA.

Before taking up the operation of this valve attention is called to the three functions that it must perform. It must admit steam to the two ends of the operating cylinders and exhaust it from the same. It must also admit steam to the steam jets for the propulsion of the coal at the proper instant as it would be wasteful and inadvisable to keep the jets open and blowing all of the time.

The illustration shows the method of action very clearly. Starting with the left-hand figure and the crank at the upper point the valve is at the extreme of its travel; and, as it is of the inside admission type, steam is flowing out to the top of the operating or distributing cylinders by which their pistons are forced down and the coal valve turned to dump on the receiving plate at the door. This port, which started to open when the crank was 45 deg. from the central position on the approaching side at R, is held open through a quarter revolution or until the crank has reached E. On passing this point the port is opened to the exhaust and almost immediately the one leading to the bottom of the operating cylinder is opened to the steam and the pistons returned to their upper position with the coal valve set to receive a fresh charge. While the piston is down the valve dumps its contents upon the fuel plate, and then, as the crank turns on, the valve is drawn down still lower until, just before reaching the lower center, the port to the blast pipe is opened and the steam admitted that blows the coal out into and distributes it over the firebox. Then, as the valve rises, the ports to the jet and the lower end of the operating cylinders are closed, that to the upper opened and the cycle repeated.

The maximum rate of feed used upon a class H-6-A locomotive of the Pennsylvania Railroad, which is of the consolidation (2-8-0)



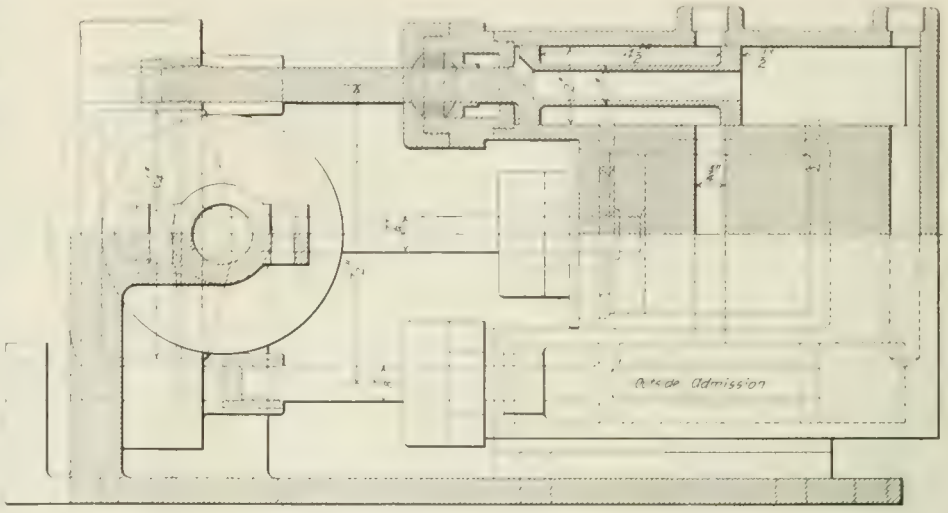
Front Elevation and Section of Hayden Mechanical Stoker.

type, is about 14 strokes per minute. As the worm gear has 72 teeth, the speed of the small valve operating engine is about 1,000 r.p.m.

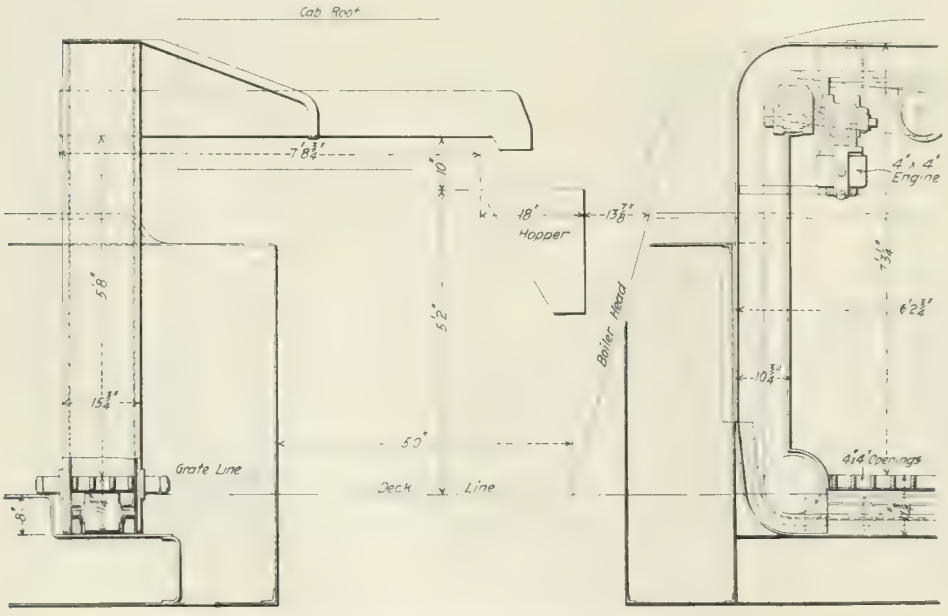
The operating cylinders themselves had to be worked out very carefully so that slamming would be avoided and a proper cushion be given to the pistons at the ends of their strokes.

This has been accomplished by an ingenious arrangement of check valves shown in the illustration. There are two sets of check valves at each end: one for the admission and the other for the cushion. The latter are so arranged that the piston, with a stroke of 6¼ in. travels to within 2 in. of the end with the exhaust port at L open in front of it. This port is then covered and the insignificant resistance of the entrapped steam encountered for the next 1⅝ in.; after which the piston uncovers the port and steam is admitted beneath the check valve N, which is opened against its spring and steam flows to the top of the piston, where in the last ⅜ in. of its stroke it gradually comes to rest. The check valves OO in the steam pipes serve to admit steam above the piston and yet prevent a reverse flow into the exhaust during the period of cushioning. In studying this action it must be borne in mind that the pipes PP serve both as exhaust or admission passages according to the position of the distributing valve; also that the port L is not uncovered by the piston when the latter is at the end of its stroke. Then if steam is admitted to the upper pipe P, it passes up through the check-valve to the top of the piston, forcing the latter down until it passes the port L, when the live steam enters the cylinder above the piston by that passage. In the meantime, as the piston approaches the lower end of the stroke and steam is admitted below, the passage to the exhaust in the lower pipe P is blocked by the lower check valve O so that there can be no back flow or escape in that way. Of course the same conditions are obtained on the reversal of the stroke.

The admission of steam to these operating cylinders starts the pistons with a very rapid action. Advantage is taken of this in the construction of the coal valve. A reference to the side elevation and section will show that the lip of the valve is flush with the edge of the hopper on the boiler side but stands about 2½ in. back of it on the other side. There is thus 2½ in. of motion to the face of the valve before it begins to close the opening to the hopper. In this distance it acquires a momentum sufficient to cut through any projecting lumps of coal that may intervene and thus close with the full stroke..



Conveyor Engine, Hayden Mechanical Stoker.



Side and End Elevations, Hayden Mechanical Stoker.

With the coal delivered from the valve, there yet remains the important function of its proper distribution over the grates. This is done by means of five jet nozzles shown in the plan. Steam is admitted to all of these nozzles through a pipe leading from the operating valve already described and in which there is a valve so that the flow, as a whole, can be controlled. Each nozzle is further provided with adjusting valves by which the intensity of the individual jet can be regulated, to accord with the size of the firebox, the intensity of the draft and the quality of the coal used. The two at the outside turn almost at right angles and serve to deliver in the back corners of the firebox; the intermediate jets throw the coal along the sides and into the front corners, while the one in the center throws it straight ahead. The actual practical working will be considered later.

Finally, the furnace door has been designed so that it can be opened at any time. It carries a chute on the back into which the coal is delivered from the valve, and beyond this simply takes the place of the ordinary door, and can be used as such in case of any disarrangement of the apparatus or when it is desirable to rake or inspect the fires.

This sufficiently covers the mechanical features of the device. As for its practical operation, the experience with it has not been extensive, but it has apparently been satisfactory. The important step in the development was to provide for the proper distribution of the coal. This required a long series of experiments and when the adjustments had been so made that this distribution could be relied upon, an application was made to a consolidation locomotive on the Pennsylvania lines of the H-6-A class having cylinders 22 in. in diameter with a piston stroke of 28 in., and weighing 193,500 lbs., of which 173,000 lbs. are upon the drivers. This engine has been in service for about five months and in that time there have been no delays due to stoker failures. The trial as thus far conducted has been more with the idea of determining the value of the device as a labor saver and an efficient steam producer than as a coal saver. In fact, the coal records that have been kept are nearly worthless as will be shown later.

With this in mind, the log of a single trip will be quite as valuable as indicative of what has been done as an attempt to compile a statement based on an average of all that have been run. A round trip from Columbus to Dennison, taken out at haphazard, will serve this purpose. The distance between the two points is 100.3 miles. On leaving Columbus going west there is an adverse grade of 1 per cent. followed by .94 and .78 per cent., making a total upgrade for a distance of 13.6 miles to Summit, from which point there is a down grade of somewhat smaller percentages into Newark, 33 miles from Columbus. From Newark to Dennison the grades are very light and short and the road may be considered to be practically level. On the eastbound trip referred to, the train out of Columbus consisted of 28 cars weighing 1,281 tons, which was increased to 43 cars and 1,839 tons at Newark. In moving about the yard the firing was done by hand in the usual manner; as the work required was intermittent and it was easier to handle the coal in this way than to start and stop the stoker at such short intervals as would be necessary.

At 12.30 p.m. the engine started with its train, and at 12.33½ the stoker was put into action, delivering coal at the rate of 14 charges per minute. Ten minutes later there was a stop on a siding to permit a passenger train to pass when hand firing was again resorted to.

The safety valves were set to open at 205 lbs. and the pressure was maintained above 195 for the whole trip except on the hill out of Columbus. Here the engineman was not working the engine

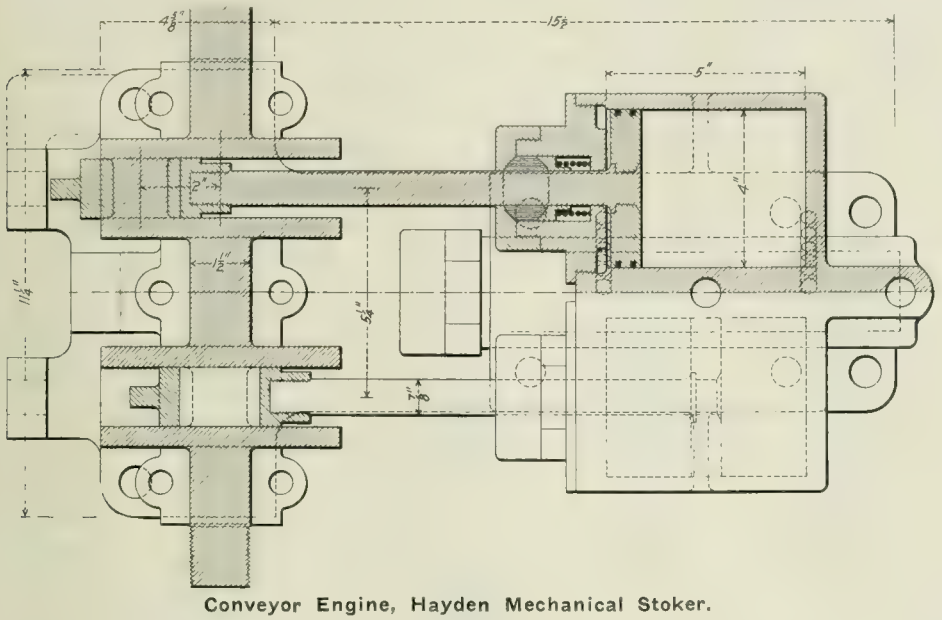
very hard, and the fireman, not noticing it, continued to run the stoker at full speed with the result that a surplus of coal was thrown in and the fire deadened.

It occasionally became necessary to use the hook to level the fire, and this was done 13 times between Columbus and Dennison. The total elapsed time between terminals was 5 hours and 10 minutes, of which 1 hour and 55 minutes were on sidings, giving an actual running time of 3 hours and 15 minutes, or an average speed of 26.1 miles per hour. As a matter of fact the actual speeds varied between wide limits, running from 15 to 50 miles an hour.

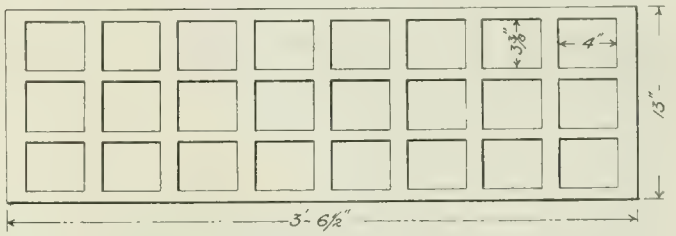
As the stoker was set to feed the coal faster than the requirements of the engine demanded it was necessary to shut it off at intervals in order to let the fire burn down. There was, of course, no regularity in these intervals of stopping. Sometimes they would follow one another rapidly and in quick succession; then they would be separated by wide intervals. In all, under these conditions, the stoker was standing about 22 minutes during the course of the trip. At one point the operating valve stuck for about 6½ minutes and before it was again made operative the fireman threw 37 shovelfuls of coal into the furnace, doing it in eight firings, in which the facility with which the change from stoker to hand firing can be made, was fully demonstrated.

Better results would probably have been attained in this, if the speed of the stoker had been cut down so as to more nearly meet the demands of the engine, whereby the feed could have been made continuous and the necessity for the use of the hook entirely obviated. In fact, on other occasions where attention has been paid to this matter, and the requisite amount of fuel fed with the proper adjustment of the distributing nozzles, it has been found to be possible to avoid the use of the hook. Such a rate of feed would be from six to eight charges per minute.

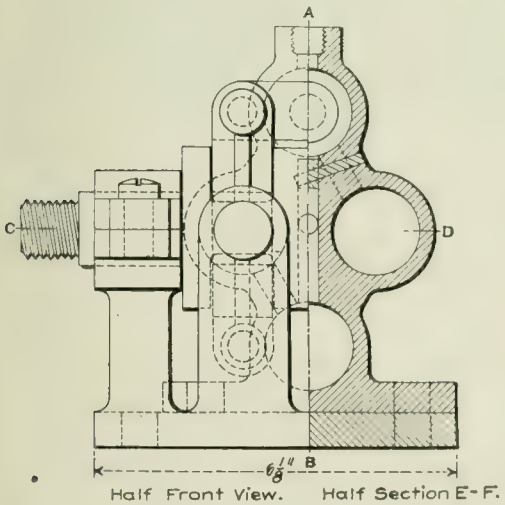
The return trip from Dennison to Columbus was even more uneventful than the other. The engine left Dennison at 8.47 a.m. with 65 cars weighing 2,005 tons, and reached Newark at 12.10 p.m. At this point 20 cars were dropped, and, with the remaining 45, weighing 1,392 tons, the engine left Newark at 1.05, arriving at Columbus at 3.33 p.m. On this trip the stoker was put out of service for nine minutes through carelessness in taking on coal at Conesville. About 5,000 lbs. were put upon the tender at



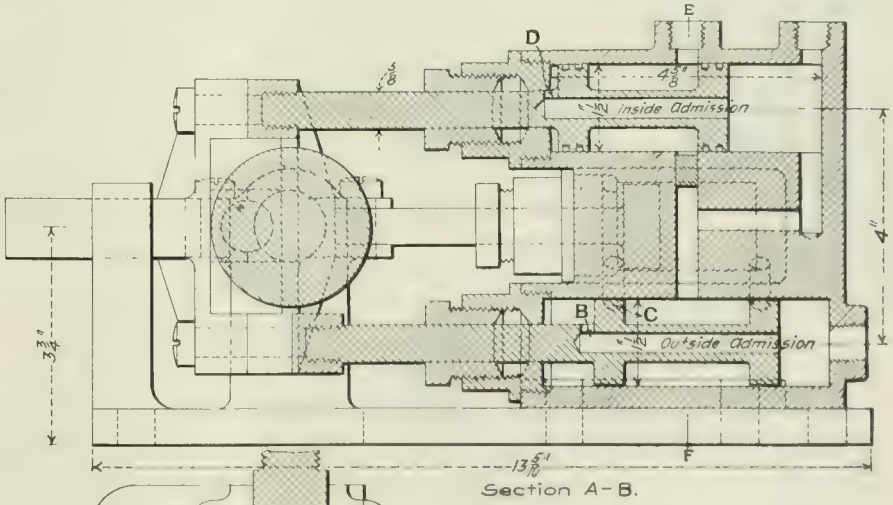
Conveyor Engine, Hayden Mechanical Stoker.



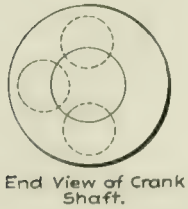
Grating in Tender Floor for Conveyor.



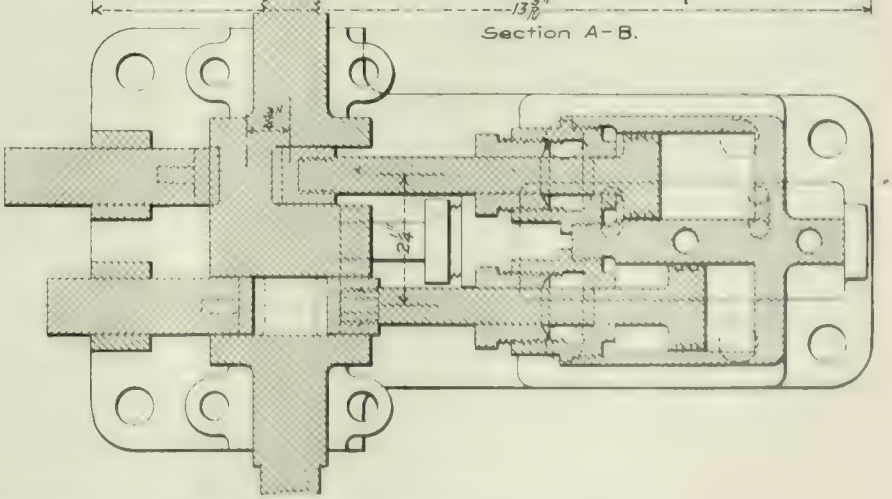
Half Front View. Half Section E-F.



Section A-B.



End View of Crank Shaft.



Valve-Operating Engine, Hayden Mechanical Stoker.

this place without a proper adjustment of the gates so that the coal flooded the grate in large lumps and had to be shoveled away before the conveyor could be worked. The manipulation of the stoker was practically the same as on the outward run. It was started and stopped at varying intervals according to the demands of the service, and in all was standing 2 hours 47½ minutes between terminals. The elapsed time was 6 hours 46 minutes, and the actual running time 4 hours and 38 minutes. So that the stoker was idle, while the engine was in motion, for 39½ minutes, and the log shows that the hook was used nine times. The record of steam gage registrations shows that the pressure did not fall below 200 lbs. on the trip. The train was long and heavy and pulled hard, so at least one thing can be taken as demonstrated and that is that the stoker is a thoroughly efficient means of maintaining steam pressure. This is conceded by all.

As a smoke preventer, the Hayden stoker ranks with the other stokers on the market in that it does not do it. There was a continuous stream of smoke issuing from the stack at all times when the stoker was in use. It lightened somewhat just before a charge was thrown into the firebox, but the change was apparently insignificant. It is probable that a portion of the gases now escaping in this form could be burned by the admission of more air above the fire, which should be made a matter of further experiment. As the door is now arranged there are two ¾-in. holes through it, one on each side, and it is by way of these that all of the air now admitted above the fire passes.

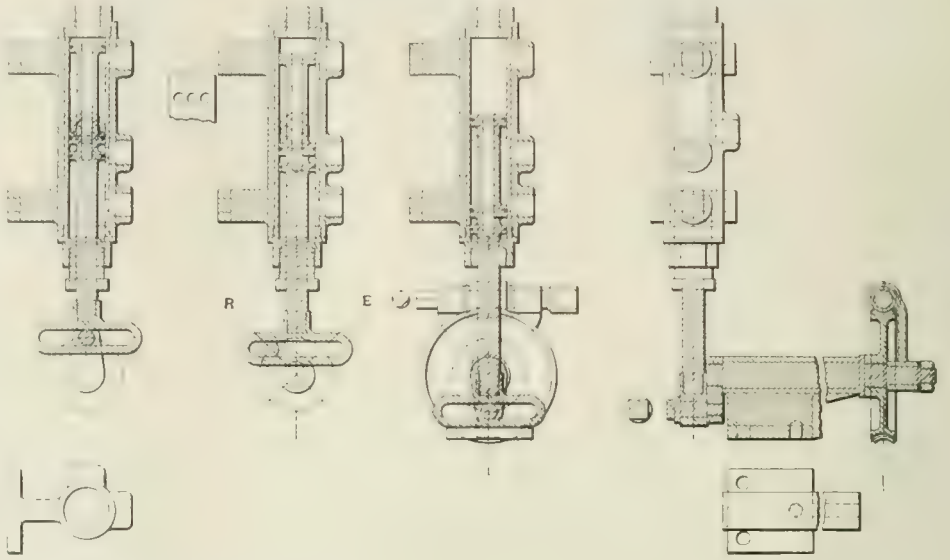
As the stoker has, thus far, been worked solely with a view to the determination of its capabilities as a means of maintaining a steam pressure, no tests have been made as to the coal consumption so as to compare it with engines not equipped in the same service. The railroad officials seem to think that it burns more, while the owners of the device say that they are burning a mixture of pea, nut and slack, while the other engines are served with a large percentage of run-of-mine. As a matter of fact the records in this respect are worthless. When the coal is not weighed and there is a variation of 2,000 in the estimates made on a single tank full, as in the case of the run from Columbus to Dennison, between that of the man on the wharf and the representative of the motive power department it is readily conceivable that the evidence would not be allowed to have much influence in a court of law. It can only be stated that a careful observation of the working of the stoker leads to the conclusion that it can probably be run in a way to effect an appreciable saving in coal as compared with hand firing.

The reason why this combination of pea, nut and slack coal is used, is that it was desired to have coal fine enough to pass through the grate above the conveyor without requiring the fireman to break it. The idea was that this would involve too much labor, though, in reality, this is totally without any foundation in fact, as we shall presently see.

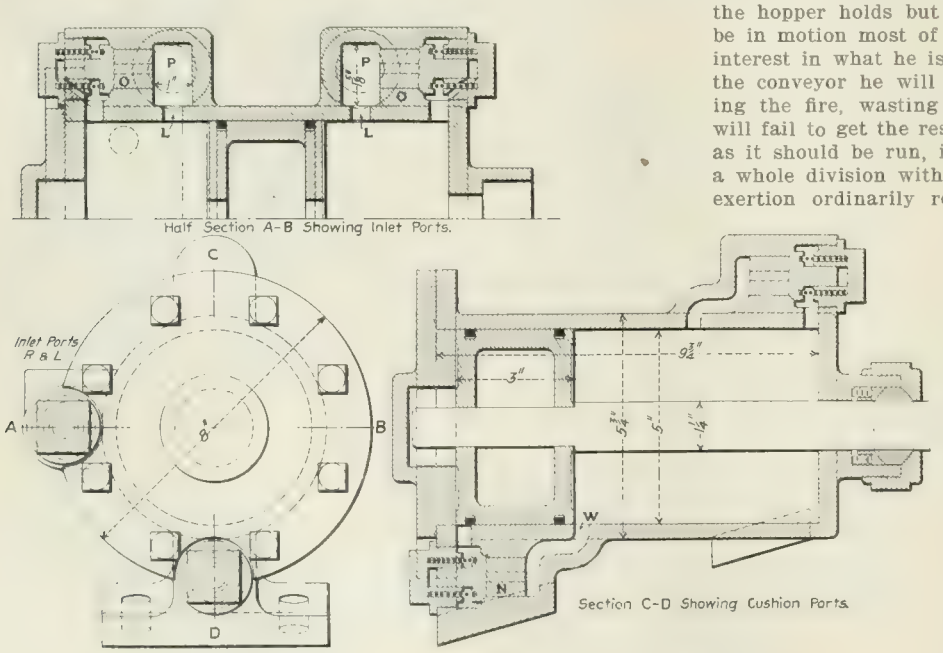
Beyond the possibility of a prevention of smoke and the saving of coal, the successful stoker must be able to maintain the steam pressure and save work for the fireman. We have seen that it can hold up the steam pressure. How is it as a labor saver? As one fireman expressed it, "The stoker saves no work. I would have more time to sit down if I could throw in a half dozen shovelfuls of coal and then sit down and I would rather do it; and as for breaking up coal, I'd quit the job before I'd do that."

Watching such a man at work it is evident that one-shovel firing has no place in his list of accomplishments. With the stoker the fireman is busy, but if it is used intelligently there is no reason why he should not have more time to "sit down" than would be possible without it. It has been taken for granted, too, in some quarters that the stoker would make it possible to use a cheaper man than at present. This is far from being the case as a first-class man must be employed; better, if anything than at present, and one who will realize the necessity for constant and persistent work. The stoker feeds but a small quantity at each charge and the hopper holds but a small reserve, so that the conveyor must be in motion most of the time. If, however, the fireman takes no interest in what he is doing, and gluts the hopper and overcrowds the conveyor he will be spilling coal all over the deck, overloading the fire, wasting coal, putting himself to needless labor and will fail to get the results that he should. But if the stoker is run as it should be run, it can be made to maintain an even fire over a whole division with but an insignificant fraction of the physical exertion ordinarily required. The stoker, however, does require attention and that, too, of a pretty constant character. The steam nozzles must first be carefully adjusted so that they will give a proper distribution of the coal. If the jets are too strong the coal will be driven to the front end of the box, while, if not strong enough, it will fall short and be apt to bank up in the center, requiring frequent raking in order to keep the fire in condition. With these small but very essential details attended to, the physical labor involved drops to a mere bagatelle and a man should be able to fire a heavy engine over a division without any fatigue. There is no coal shoveling to do, none to lift, merely the drawing of it down to the conveyor grates, or guiding it to them in its natural flow.

And here the matter of the fallacy of the need of putting fine coal upon the tender can be shown. In the case of the run referred to, where run-of-mine coal in large lumps was put upon the tender at Conesville, the fireman had no trouble in breaking them up as they came down and delivering coal to the conveyor with far greater rapidity than the engine needed to be supplied, so that coal of any size can be used and with no danger of steam failure because of the extra exertion demanded of the fireman. But above all and in it all there must be an intelligent appreciation of the requirements of the fire in order to get the best that there is out of the coal and the stoker; for it affords chance for waste by overloading the fire that does not exist with hand firing since a man will naturally use as little as he thinks he can in order



Valve for Operating Cylinders, Hayden Mechanical Stoker.



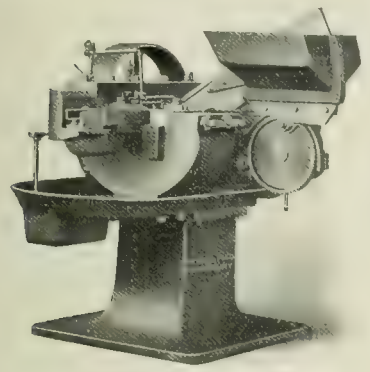
Operating Cylinder, Hayden Mechanical Stoker.

to save his own back, while with the stoker there is no back to save.

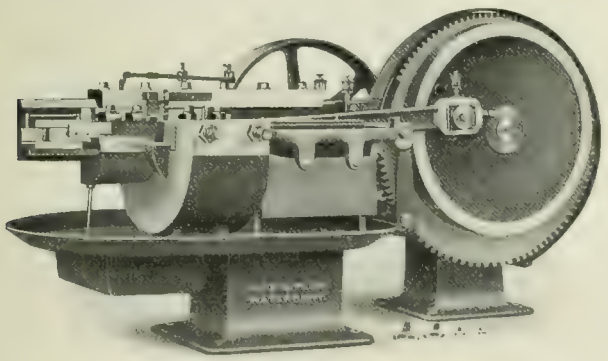
One final word may be said, to call attention afresh to the fact, that a change from stoker to hand firing can be made without one moment's delay, and that the door is ready to be opened at any instant to give free access to the fire for inspection or raking.

A New Design of Reciprocating Screw-Thread Rolling Machine.

The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., has recently placed on the market a new line of its reciprocating screw threaders which have been redesigned throughout. The machines are made in seven sizes with capacities for rolling threads on wire from ⅛ in. in diameter up to and including 1½ in. in diameter. Illustrations of the No. 3 and of the No. 4 machines are given herewith. The smaller machines up to and including the No. 4 size are arranged to be equipped with a hopper feed; above this size hand feeding is considered more economical. The machines are all equipped with an automatic feeding device which insures straight and accurate threads even on the longest work. A pan large enough to catch the drip from all parts of the body is provided as well as a geared pump by means of which a uniform flow of oil is distributed over the dies. It is claimed that with the No. 3 machine 50 blanks ⅜ in. in diameter can be threaded per minute, and with the No. 7 machine 20 blanks 1½ in. in diameter can be threaded per minute.



The No. 3 Reciprocating Screw-Thread Rolling Machine with Hopper Feed.



The Waterbury Farrel Foundry & Machine Co.'s No. 4 Reciprocating Screw Thread Rolling Machine.

The Division Engineer.

III.

When a Division Engineer reports directly to the Superintendent on maintenance matters, it sometimes occurs that the Chief Engineer objects to the Division Engineer's being as useful as possible. I have had a Chief Engineer object to my running grades and centers for track whenever useful to the Superintendent, and when he so requested. Some Chief Engineers think the line and level for the track on maintenance is the track foreman's work, and that engineers should be above it. But of whatever craft a railroad man be, his skill should be used to further the company's interest. We must all strive to be useful. When a track man or a bridge man wants a line or levels to work to, he should have them. A Division Engineer is in an organization to strengthen it by his technical skill and by his team work with other men there. He should strive to be missed very much when he leaves that division. He is working, first of all, for the stockholders.

With the Master Mechanic of the division I always kept on the best of terms. There is no reason for any other attitude. I repaired his buildings, and he repaired my machinery. Whenever he was a mechanical engineer we always moved in double harness, to our great comfort and the company's best interest. The traffic representative could do little for me save to give the glad hand, but I could aid him, and always did so. It is worth much to him for you to say in advance or informally whether or not a track could practically be built to a factory site. It is worth much to him if, in securing business, he can have your interested efforts and tactful aid in treating with the shippers.

Finally, in this important matter of working with officials of other departments of the division, as you go about over the division always listen to the Station Agent. If at a competitive station, you have to listen to him, for he is on the line of battle for business, and you must help in the fight and throw your weight into the balance for your company. If he is only an agent at a local station you must not despise him, either. There are three classes of men in railroad service to-day to whom I always feel impelled to take off my hat, viz., an agent at a one-man station, a section foreman and a bridge foreman. Without these men we are as nothing. They do much for little. Their work is never done. They are always liable to a call of duty. They have more all-round railroad ability and railroad responsibility than any of the rest of us. A Division Engineer should be such a man as the agent at a local station is glad to see around. Mend the hole in the platform, fix the door-lock, give him a new office floor, paint the waiting-room and patch the roof whenever it is necessary; anyhow, look at it with him. He has a rather lonesome job, and appreciates your human interest in his efforts to be all things to all men. Agents get the traffic, and traffic is fundamental, while maintenance is a contingency.

What is the proper way for a Division Engineer to treat his engineering assistants? It is generally conceded that the golden rule is the best foundation for proper treatment between man and man, or, as we now phrase it, "the square deal." In the treatment of those engineers less experienced in railroad work, were I to suggest a variation from that general rule I would engraft on it what may be termed the *eleventh* of the decalogue.

On the first full-sized locating party of which I ever had charge, the assistant and second in rank, was an engineer older than myself, whose health had prevented his advancement. He was a very fine fellow, a captain, wounded at Gettysburg. After a couple of months I privately asked him in what respect I would be most apt to fail as a chief of party. He replied that I would kill the party with kindness. Yet that party within two years reduced the cost per mile of located line 50 per cent., as shown by the company's accounts. Four of the sixteen men remained with me ten years, at which time I left the service. They were the reliable, efficient nucleus of the best party of that company's service.

Never drive young engineers. Lead them instead. If as Division Engineer on maintenance you drive your engineering assistants, then I can go on that division and do the same work in the same time, and loan temporarily one-fourth of the men to the Chief Engineer at any time the service needs them elsewhere. I have never felt the competition of another Division Engineer who drove assistants.

Tell assistants what you wish done, and be most explicit. I asked one of my younger men one day if he understood. He replied, "Why, you have made it as plain as the letters on that box car over there." Give them good instruments and implements, proper plans and enough men. Show them how to do the work at the start, if necessary. Set them a good example by doing your own work well, promptly and cheerfully. Tell them you will judge them by their results. Coach them from day to day and never let them be humiliated by getting far wrong. If after six months of such handling a man is not doing good work and enough of it, then send him in to the chief engineer and say he will not make a man the company needs. Do not be such a fool as to think you can drive a lazy, careless, incompetent young civil engineer and make him a good man to keep. Never wrangle with assistants. Whether they be good or bad engineers, whether you personally like them or not, see to it that they like you and feel that you are their friend. The division engineer must be the most popular civil engineer on that division or he will fail in some degree.

Lest what precedes be misunderstood, I wish to say that I think the young American civil engineer, as he graduates from our best technical schools and from the good homes of this land, is as high a type of young manhood as Almighty God has yet been able to make. They are better educated than we division engineers were when we left college. Given such engineers of sufficient experience for their position on a locating party, fill out the rank and file of that party with ex-soldiers, plainsmen, woodsmen or cowboys, and there is no work, no exposure and no danger a good chief of party cannot lead them to face. These men are each and all invincible when well led. The material for engineer parties in this country to-day is of the very best. Never have two assistants of the same rank. If the title and pay be the same, make seniority of service count as rank as in the army. I find this prevents bickering and fixes responsibility. Whatever else you do, always handle the work so that some one man is responsible for it. Allow no ill feeling between men. Never let engineers fight it out, literally or in spirit, although for laborers this sometimes does very well. Early and late keep before them the necessity of harmony. Go away on a visit, so as to try them out in getting on together. Go on inspection and say you leave other work to them for a week, barring emergencies. I doubt whether a civil engineer

who fails to control his temper can ever be worth $2,000 a year to a railroad company. Team work is the new learning of railroad life to-day, the day of star performers has passed. RAILROADER.

Washington Correspondence.

WASHINGTON, Feb. 27. Washington has not yet fully recovered from the surprise occasioned by the unexpected turn of affairs in the Senate Committee on Interstate Commerce last Friday when the Hepburn railroad rate bill was ordered reported to the Senate without amendment and was put in charge of Senator Tillman, of South Carolina, the senior Democratic member of the committee. This result was brought about by the combined action of two of the most astute parliamentarians in the Senate—Senator Aldrich, of Rhode Island, and Senator Bailey, of Texas. It is doubtful if it will ever be known just what occurred in the conference between these two leaders on opposite sides of the Senate that took place during the two hours' recess of the committee that preceded its final action, but there is little doubt that an understanding was reached between them as to the action to be taken in the committee, and it is not unlikely that the understanding will go so far as to affect the management of the bill in the Senate.

The strength of Senator Aldrich as a Senatorial leader has rested almost as much on his ability to keep in touch with the leaders in the Democratic party as on his influence over Republican Senators, and it may be that the outcome of the Senatorial contest over the Hepburn bill will demonstrate that the Senator from Rhode Island has gained a decided advantage for the advocates of conservative legislation by the seemingly paradoxical method of putting the railroad bill in the hands of one of the most radical men in the Senate. Certain it is that Mr. Bailey, who is not a member of the Committee on Interstate Commerce, and who is himself an advocate of amending the Hepburn bill by including in it an express provision for judicial review, succeeded in persuading Senators Foster and McLaurin, who were insisting on a review provision, to cast their own votes and that of Senator Carmack, whose proxy they held, in favor of reporting the bill to the Senate without amendment but with the express understanding that every member of the committee was to have full liberty to vote for amendments and to offer amendments. The action of the committee, therefore, was equivalent to reporting the bill to the Senate without any recommendation.

There has been a disposition in some quarters to believe that Mr. Aldrich made a tactical blunder in having the bill put in charge of Senator Tillman. What he probably wanted to do was to emphasize the fact that the Senate proposes to deal with the problem of railroad legislation without executive interference. Putting the bill in charge of the bitterest personal enemy of President Roosevelt in the entire Senate served to emphasize this, but Senator Aldrich probably counted on Senator Tillman's taking the first opportunity to give oral expression to the intention of the Senate to disregard White House influence. If this was what Senator Aldrich was counting on he was not disappointed, for Senator Tillman lost no time in issuing a declaration of independence to the press in which he said: "The President has performed his full official duty in connection with this bill. He has nothing more to do with it until it comes before him as an act of Congress for his approval or veto. The Senate alone has the say now." There is no doubt that Senator Tillman will say something to this same effect in the Senate if the opportunity arises and there is any talk of Presidential interference.

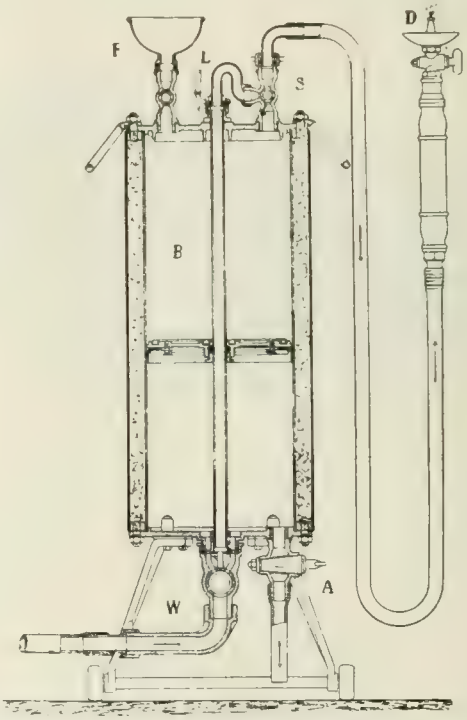
Uncertainty as to what disposition will be made of the Statehood bill—the unfinished business before the Senate—makes it impossible to predict how soon the railroad rate bill will be taken up, but Senator Tillman has given notice that he will push it to the front as soon as possible. He is not likely to encounter opposition from any quarter, as the Senators who are opposed to the Hepburn bill seem to be fully as anxious as its friends to bring the conflict on as soon as possible and have it over with. They will not seek to delay the bill or to postpone the final vote any longer than is necessary for them to present their arguments against it and in favor of such amendments as they may believe should be adopted. It is expected that if the bill can be amended so as to provide expressly for an adequate judicial review it will receive the votes of nearly all of the members of the Senate. Senator Foraker, alone, has announced emphatically, both in the Senate and out of it, that he will not vote for any measure that proposes to give the Interstate Commerce Commission authority to prescribe transportation charges. Senator Morgan, of Alabama, will probably stand with him, and it is possible that Senator Pettus, of Alabama, may also vote against the bill, even if amended so as to provide for review.

Those Democratic Senators who are following the lead of Senator Bailey hope that they will be able to obtain decided party advantages from the fact that the railroad bill has been put in charge of the Democratic side of the Senate. An effort will be made to secure harmonious action by Democratic Senators on all amendments, with the hope that the bill may be put into its final form by the Democrats with the help of a minority of Republicans. This gives great importance to the Democratic position on the question of review. There are decided differences of opinion on this question among Democrats as well as among Republicans, and it may be difficult for Mr. Bailey to get his party solidly in line in support of any specific amendment. At present the indications are that the Democrats who are in favor of review will endeavor to frame an amendment that will receive the approval of most of the men on their side and that will provide for review while attempting to deny to the courts power to suspend an order of the commission pending review.

Senator Lodge to-day introduced an amendment to the Interstate Commerce law, providing for displacement of the present Interstate Commerce Commission by a new commission of nine members. The amendment provides that not more than five of the members shall be of one political party; that three of them shall be lawyers; three, persons of experience in the management of railroads. Salaries are fixed at $12,000 for each member except the chairman, who is to receive $500 more. J. C. W.

Disinfecting Apparatus for Railroad Cars.

The disinfection of passenger and cattle cars by means of carbolic acid is attended with difficulty, and even with danger to the employees carrying it out. If applied with a brush, the acid does not always cover all the surface nor penetrate the cracks. To apply it to the ceiling the employee risks getting burned or blinded; and as the air itself is not disinfected, the workman himself can be



Section Through the Koerting Disinfecting Apparatus.

infected. Washing the car with soda solution at a temperature of 125 deg. Fahrenheit is not always practical in winter, as the solution will not retain the desired temperature long enough. The apparatus here shown is used in Germany with success and satisfaction. There is a cylinder B which is filled with the disinfecting fluid, through the opening F. It is then connected by the nozzle W and inlet hose with a water main, steam pipe or hand air pump—anything to give a pressure of from 10 lbs. to 60 lbs. to the square inch. An air-tight piston in the cylinder is driven down and the disinfecting fluid is driven out through S by the pressure of the steam, water or air, and the liquid is sprayed into the car. After use, the water is let out through A. The fluid used is dilute carbolic acid, lisol, pinol, formaldehyde, or whatever is legal and desirable. The makers of the device are Körting Brothers, Hannover.

Through an unfortunate oversight, the name of Professor E. R. Dewsnup, of the University of Chicago, was omitted as the author of the paper on Railway Education, printed in the *Railroad Gazette*, Feb. 16. We wish to give Professor Dewsnup full credit for his interesting discussion.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Branch Line Rates as Affected by Consolidation. . . . 217
- Dr. Hadley on the Hepburn Bill. . . . 217
- Experiment in Reduced Passenger Fares. 218
- Smoke Prevention . . . 219
- Pennsylvania Railroad . . . 219
- New Publications . . . 222
- Trade Catalogues . . . 223

ILLUSTRATED:
- New Station of the Southern Pacific at Alameda Mole . . . 223
- Railroads and Foreign Enterprises in Korea. . . . 226
- The Electrical Equipment of the South Louisville Shops of the Louisville & Nashville. . . . 230
- Ralston Dump Car and Steel Underframe. . . . 236
- Electrification of the Paris-Orleans Suburban Line . . . 239

CONTRIBUTIONS:
- Injunctions Must Be Specific . . . 223

MISCELLANEOUS:
- Senator Foraker's Speech. . . . 232
- Prompt Handling of Competitive Freight 235
- A Year's Problems Epitomized . . . 235
- Compulsory Temperance in Hungary (Note) . . . 236
- How to Improve Passenger Service. . . . 237
- Washington Correspondence . . . 240
- Foreign Railroad Notes:
  - First Train Through the Simplon. 240

GENERAL NEWS SECTION:
- Notes . . . 73
- Elections and Appointments. . . . 76
- Locomotive Building . . . 76
- Car Building . . . 77
- Bridge Building . . . 77
- Railroad Construction . . . 78
- Railroad Corporation News . . . 80

VOL. XL., No. 10. FRIDAY, MARCH 9, 1906.

The official announcement by President Mellen of a coming two-cent-a-mile rate for regular passenger fare on the Berkshire division of the New Haven system has been followed by much more expansive and radical propositions which only await the ratification of his board of directors. The new plans to be early adopted include (1) the two-cent-a-mile rate on the Old Colony system and the Highland, Northampton and Naugatuck divisions, to be extended a little later to the whole of the New Haven's system of approximately 4,200 single track miles; (2) at as early a period as possible the reduction of freight rates on the whole system also. The passenger reductions, we infer, are a matter now of only a few days, or, at most, weeks; the freight rate reductions probably tarry into the months or perhaps longer. The sweeping passenger reductions particularly have some very striking historical suggestions: In 1886 President Watrous announced the two-cent rate over the 135 miles of the company between Springfield and New York City, predicting, in a general way, as a result a loss of about $500,000 in passenger receipts for the following year. What actually came to pass next year (1887) was a gain of about $90,000 instead of a loss of $500,000—a blasted forecast, which gives fresh interest to President Mellen's new departure, which extends, almost at a stroke, the two-cent rate from one-eleventh of the single-track mileage of his system to the remaining ten-elevenths; nor does the fact that the change has waited twenty years in the coming detract from its interest now that it comes. Another striking phase of the change is the vivid side light that it throws on the values to the public of railroad consolidation. The numberless branches of the New Haven system all get the benefit now of the lower rate based on the immense passenger profits due to the density of passenger business on the main lines. To illustrate, the present Litchfield branch, about 32 miles long, and opened about 34 years ago, used to charge, as an independent line, 4 cents a mile and upwards. It is now to have a two-cent rate, a reduction of 50 per cent. from the old fare, and along with it has been secured a passenger and freight service on the branch incomparably better than the original. Whole tomes have been penned on the merits and demerits, the public vantages and public perils, of the great railroad consolidations of our times. But, trite as the statement is, the benefits of those consolidations to weak branch lines stand unquestioned. And, as proof of such benefits, the new move of the New Haven Company is the most recent, as well as a most lucid and impressive example.

Last week we printed President Hadley's *Boston Transcript* paper on the Hepburn bill in full. Since the appearance of that paper Senator Foraker has made in the United States Senate a long and carefully worked out address in opposition to the bill, some extracts from which are printed this week. It has occurred to a great many newspaper editors to contrast the positions taken by Senator Foraker and President Hadley, and many of the ablest of these editors have condemned President Hadley severely for what they evidently consider a species of temporizing with the problem. For example: "If intelligent men are to hold up their hands at the first demand of the demagogue, what chance is there of resisting his second and third demand? We shall have taught him the trick, and he will not be slow to apply it on every occasion. What need he care for your arguments, your warnings, your law, your precedents, your demonstrations, if you announce in advance that you will abandon them all if he only threatens loudly enough." It seems to us that these editors have allowed their very exemplary senses of justice to run away with their judgment and their understanding of President Hadley's position. As we understand this position, it is that of the highly practical economist who is concerned not with the passage of a bill or the attitude of a President, but with the broad question of the attitude of the American people to their railroads. Dr. Hadley might say with Robert Browning's Ogniben, "I have seen three and twenty leaders of revolts." If he had studied the question of railroad legislation less deeply he would perhaps have suggested amendments to the Hepburn bill to make it workable, but his conviction was so clear that this bill could not be made workable that, it seems to us, he turned his attention from the bill itself to the economical and political causes for the bill. He then saw a great movement throughout the country hostile to the railroads and to strong corporate interests, and it seemed to him highly desirable that this movement should die a natural death and not be perpetuated into a national party. It might be similarly argued that the enactment and working of the Potter law in Wisconsin was a prime cause for the death of the original granger movement in the '70s. But the Potter law, if we remember rightly, was never declared unconstitu-

tional; it merely worked the wrong way, benefiting no one, and retarding the development of the state. On the other hand, we think Senator Foraker has demonstrated that the Hepburn bill, besides being unworkable, is clearly unconstitutional as well, in many of its provisions. Need it, then, be so greatly feared?

AN EXPERIMENT IN REDUCED PASSENGER FARES.

"All local rates two cents per mile" is the announcement which since May 1, 1898, has headed the time-tables of the New York, Ontario & Western. This railroad was, we believe, up to the recent enactment of the Ohio two-cent a mile law, the only one on which a general rate of two cents a mile was in force. The New York Central, on its main line most of the way from New York to Buffalo, and the New York, New Haven & Hartford on certain sections of its main stems, have for some time had a two-cent a mile rate, but, except by mileage book, this has not yet been extended over most of the branch lines of either company. As may be guessed from the history of similar reductions, the adoption of the flat rate was not a voluntary experiment of the Ontario & Western's. Early in 1898 the New York legislature enacted a law providing that the railroads of the state should, in every case where their local rates were higher, sell 500-mile mileage books for $10. Rather than introduce a mileage book system, the New York, Ontario & Western on the day on which the new law became operative made a local rate of two cents a mile effective over its lines. Coincident with this, it withdrew its round-trip, 25-ride, and other reduced rate tickets. The immediate effect of this action was to slightly reduce local passenger receipts; the decreased earnings, according to the statement of the General Manager in the annual report for the year ended June 30, 1898, being due entirely to the reduction in passenger rates. Although the reduction was in force only two out of the twelve months of the fiscal year, the average rate paid per passenger per mile for the whole year was reduced from 2.064 cents to 1.839 cents. Before the reduction, the nominal rate had been three cents a mile. As a matter of fact, as is plainly shown by the average passenger mile rate for the preceding year, the company had not received anything like this rate on most of its passenger traffic. Aside from the very low rates on immigrant traffic—which class of travel, however, was of so comparatively small amount that it could not have had very great effect on the average for the whole—there were the usual classes of reduced rates, already alluded to, in force which brought down to nearly 2 cents the average passenger mile return to the company.

Thus the first year, which included two months under the new reduced rate, showed a loss to the company. In the next succeeding fiscal year, however—the first which included 12 months continuous operation under the low rate—there was an increase of 43 per cent. in the number of passengers carried and of 7 per cent. in local passenger earnings. More than this, the reduction in the local passenger rate was probably responsible for a stimulation of local freight earnings. The annexed table carries the story further. It gives for the fiscal years ending on the dates named the local passenger earnings of the road. These do not include through business, immigrant business, or business ticketed to and from connecting lines, but purely the local passenger earnings between stations. For better comparison, the statement includes the earnings for the two years prior to the reduction in the passenger rate. It also includes the percentage of increase for each full year since the rate reduction went into effect. As the figures for the current fiscal year are for six months only, an assumed percentage of increase for the whole year is obtained by multiplying the half-year's earnings by two in order to get a comparison with the previous full year. The resulting percentage of increase (38.11 per cent.) is probably somewhat overestimated, for, particularly on the New York, Ontario & Western, with its large summer resort business, July-December passenger earnings are normally larger than those in the six months from January to June; but the figure for the half-year makes it plain that the current full year's increase will be a substantial one. The table follows:

	Local passenger earnings	Per centage of increase
Year ended June 30, 1897	$563,390	...
" " " 1898	560,633	.....
" " " 1899	599,844	6.99
" " " 1900	675,074	12.54
" " " 1901	723,628	7.19
" " " 1902	765,288	5.76
" " " 1903	854,868	11.70
" " " 1904	920,005	7.62
" " " 1905	1,031,735	12.14
Half year ended Dec. 31, 1905	712,472	38.11*

*Assuming the full year's earnings double the half year's.

This is a striking record of continued increase in local passenger earnings following a period in which they were stationary or slightly decreasing. In the six years, July 1 1898 to June 30, 1905, inclusive, local passenger earnings increased $431,891, or 72 per cent. Provided this class of earnings for the current January-June six months shall amount to $487,216 or over, the local passenger revenue of the road will have doubled itself within seven years. The value of these increases to the company cannot, unfortunately, be absolutely proven without knowing what proportion of net profit was yielded by the increased business at the lower rate, as compared with net earnings under the old three-cent-a-mile nominal basis; yet without exact figures to cover this point, there seems little doubt that net passenger earnings for at least the latter part of the seven-year period would show almost if not quite as large proportionate increases as gross.

Here a reduction in passenger fares, which in all probability would never have been made voluntarily, has resulted within seven years in doubling earnings from local passenger traffic. The underlying principle is, we believe, one which might be much more generally acted upon by passenger traffic managers. A low and uniform rate is a most effective means of increasing passenger travel. Simplification of passenger charges to the extent that a man can go up to a ticket window anywhere on a road with the assurance that it will cost him (say) two cents a mile—no more and no less—to travel, and that the next man is paying as much as he and no less, has no small influence in increasing passenger earnings. Of course, the primary reason why a reduction like the Ontario & Western's increases passenger earnings is because it makes it cheaper to travel, but such a move also makes it *easier* to travel. Most travelers would be thoroughly glad to be relieved of the necessity of considering whether it will be cheaper to buy a round-trip ticket, or two separate fares, a through ticket or a combination of two locals, a five-day or a thirty-day ticket, involving the probabilities of whether one is likely to wish to stop over on either half of the trip, or to return by some other route, or to be able to come back within the time limit, or to comply with one or another of the numerous restrictions with which many railroad companies seem to believe it necessary to hedge about the daily life of the average passenger. Complications like these, which are often not clearly understood by passengers, add no more to their happiness than does the chance discovery at the end of a journey that a considerable saving might have been made in the cost of the trip by buying a different kind of ticket. A contented mental state is—or should be—a prime consideration for the passenger traffic manager to bring about in his patrons, for it has a strong, though somewhat indefinite, influence on the likelihood of later journeys. The instinct of travel is abundantly latent in American character, and, as has been time and again proved, needs only kind treatment for development to a remarkable degree. The psychological effect of a complication of passenger fares cannot be reduced to figures and accurately in dollars and cents proven a loss to the company; but it is there all the same, and most travelers do not have far to look to recall instances of such vexations. A low, uniform rate goes very far toward removing this hostile mental attitude. More than this, to the, unfortunately, always existent class of passengers who have no regard for a contract printed on a railroad ticket, and to that bane of the railroad company, the scalper, such a rate is admirably adapted. Unless the passenger attempts to evade paying fare on the train, he has no opportunity for dishonesty; and the scalper, no stock in trade for his business. The system, therefore, tends at the same time to the satisfaction of the honest and to the discomfort of the dishonest classes in the community, and increases passenger earnings for these reasons as well as for the primary reason that a lower rate stimulates travel.

It is, of course, obvious that there are a great many cases in which railroads cannot follow the example of the New York, Ontario & Western. For instance, no railroad which enters over its own tracks a large city like New York or Chicago could afford to abolish commutation fares or trip tickets, as was done by that road. Railroads in territory in the West, where population and travel are necessarily thin, could hardly be expected to put in force a two-cent-a-mile rate. Even in the comparatively populous state of Ohio, the general reduction by law to that basis will undoubtedly for some time work hardship to the more poorly situated roads. But the truth of the principle involved is not shaken by these exceptions. Even in the West some reduction and more uniformity in passenger fares might easily be a distinctly paying investment, considered in the light of ultimate advantage to the road. It would tend to stimulate travel, increased travel to stimulate busi-

ness and increased business to stimulate railroad earnings. In Ohio, it seems safe to say that in most cases it will not take very long to create enough new local traffic to bring net earnings to or above the old figure even on the weaker roads. Certainly, if the example of the Ontario & Western counts for anything, this is probable, for in New York State it has far from the best situation or territory to traverse.

In general, the lesson of cheaper and more uniform fares is one which can be more frequently taken to heart by passenger traffic executives. It carries with it large possibilities of ultimate increases in earnings, and, what is sometimes nearly as important, of increase in good will toward the railroad company. The interurban electric lines have pointed the way by their success in creating travel through convenience of service and low rates. If their policy could have been adopted in time, it would in many cases have gone far toward preventing beforehand their competition. But, entirely aside from this phase of the subject, the policy of low and uniform passenger rates is, on its own merits, worthy of much more general adoption.

SMOKE PREVENTION.

At a hearing in Philadelphia the other day sundry men and women testified that certain locomotives belonging to the Pennsylvania Railroad were making nuisances of themselves by emitting large volumes of smoke at all hours of the day and night. These persons urged upon the commissioners the desirability, nay, even the necessity, of doing something to put an end to the nuisance and clarify the air. It was urged that there were innumerable smoke-consuming and smoke-preventing appliances on the market which, if they were only to be applied to the offending locomotives, would cure the trouble and prevent the smoke. This testimony reads so well that the man who did not know would be convinced that it was only because of the greed of a great corporation that the defenseless citizens of the Quaker City were subjected to all this discomfort. Apparently it was only needful that a few dollars be spent and a little care exercised—and, presto! there would be no more smoke. It appeared, incidentally, from the testimony that the switching engines in the West Philadelphia yard were the worst offenders.

This would have made a strong case had not an official of the road testified that he did not know of any practical way to prevent smoke. It may have been dense ignorance on the part of the official, but it is an ignorance that is shared by a great majority of his fellows, who have to do with the locomotive. The citation of certain methods and devices that work well in preventing smoke on stationary plants is not helpful in its bearing on locomotive practice. The conditions of operation are so different that what is a success in one place is worse than useless in the other.

In order to obtain a clear understanding of what must be done to prevent locomotive smoke, it may be permitted to pass in brief review the sequence of firebox occurrences. When coal—we are considering soft coal—is thrown into the furnace there is an instantaneous production of large quantities of hydrocarbon gases. If these gases are evolved and held at a high temperature until they are mixed with the proper quantity of air for their combustion, they will burn without smoke and with the maximum of economy. If they are mixed with an excess of air, and still kept hot, they will burn to carbonic oxide, still without smoke, but with a great loss of efficiency. But if they are cooled below the ignition point, before they receive their air, and the soot is once formed, then there will be smoke, and the smoke consumer will be worthless; in fact, there is no such thing as smoke consumption. Smoke must be prevented from forming, or smoke will issue from the top of the stack. These conditions of high firebox temperatures, the proper admixture of the air and practically complete combustion, may be regulated successfully in the stationary plant. With an automatic stoker that feeds the fuel with constant regularity, with moving grates that keep the air spaces clear at all times; with a brick furnace that maintains a high temperature on all sides and dampers by which the flow of air through the grates and above the fire can be controlled, the combustion can be kept at the desired point of perfection and the smoke prevented from forming. But even here the full supply of air needed for perfect combustion is not admitted. It is cut down so that a slight haze appears at the stack, because it is more economical to waste a little heat in the formation of smoke than to waste large amounts in the production of carbonic oxide, and it has been found to be an impossibility to admit precisely the proper amount of air to produce that complete combustion wherein there is no waste due either to an excess of air or to the production of smoke. This chemical combination of combustion is exceedingly exacting quantitatively, and until all the coal used has the same composition for every shovelful, and the gases are liberated with the same freedom, we will be unable to produce perfect combustion on a commercial scale without waste.

When the requirements of the case are considered it is small wonder, then, that a motive power official said that he knew of no device that would do the work. In the case of a road engine that is working with comparative regularity for long distances, a fireman who will use the one-shovelful method of firing, and who will regulate the flow of air through the door with the utmost care, may, after he has learned the peculiarities of his engine and of his coal, be able to go over a division with comparatively little smoke production. But when it comes to accomplishing such a result on a switching engine, the difficulties seem to be pretty nearly insurmountable. An engine of this class will average a speed of something less than three miles an hour throughout the day. It will stand idle, and then run at actual speeds up to thirty or more miles an hour. It may be running light, or working to the full limit of its power. It will move first forward, then backward, and its fire will be in all conditions imaginable. All these wide variations will follow in quick succession and occur within short intervals of time, and the fireman or stoker that can follow all these changes and hold the fire in a condition to work just as it is desired that it should, at all times, is yet to be produced, and will be awaited until the end of time. When the engine is working hard, the smokebox vacuum may be 10 inches or more, and the air supply just right. The closing of the throttle drops the vacuum to almost zero, and the smoke pours from the stack.

It was asked, in the course of the inquiry, whether a brick arch would not help matters. It might, and it might not. If the arch is hot and the supply of air is all right, the gases may be held at or above the ignition temperature, and the combustion will then be satisfactory. Let us suppose that this condition exists just after fresh coal has been placed in the firebox, while the engine is at work. If the throttle is closed under these conditions, the supply of air is cut off by the loss of the draft, and yet the fresh coal continues to be baked by the incandescent fuel beneath and the hot arch above. The result is that the hydrocarbons continue to be distilled in large quantities, though perhaps in less quantities than before, and owing to the lack of air they drift over to the tubes, where they are chilled and the soot precipitated so that the stack belches smoke of the blackest, densest and richest kind. If the arch is cool it serves as a smoke producer when the engine is working, but will not cause as much trouble when it is standing.

These are only a few of the conditions that bring about smoke production in locomotives, especially those in switching service, and the people who declare that it is a very simple and easy matter to apply an effective remedy show how superficial their study of the problem has been. They count on almost superhuman intelligence on the part of the fireman, and a capacity to use that intelligence to its utmost throughout the whole day, despite fatigue and distractions; and they count further on such a harmony of mechanism and material as is never found in practice. In short, they count upon the impossible.

If the advocates of smoke abolition in railroad yards had but tried to introduce such a little thing as one-shovelful firing, and had learned the impossibility of getting the men to follow it they would realize in a small way what the task really is that must be performed to accomplish their desires. That the smoke nuisance can be somewhat abated there is no doubt, but to think that switching locomotives, burning soft coal, can be made to do their work successfully, without smoke, where the demand for steam and expedition is as urgent as it is in most cases, is to think the impossible.

Pennsylvania Railroad.

No transportation company in the country more accurately reflects general prosperity than the Pennsylvania Railroad. Its recent year, closed December 31st last, furnished a succession of earnings increases little short of marvelous. Month after month particularly in the latter half of the year, gross earnings on the lines directly operated East of Pittsburg and Erie (excluding the Northern Central; Philadelphia, Baltimore & Washington, West Jersey & Seashore and Cumberland Valley railroads) showed increases ranging from one to two million dollars. These, too, were the months which followed not the lean half of 1904, but the latter part of that year when earnings were rapidly on the increase. Reports of the monthly earnings foreshadowed the remarkable returns of the year's show

ing. On the lines East directly operated (excepting the roads already mentioned) gross earnings from freight traffic alone were over $100,000,000. This was an increase of $14,000,000 over the previous year's showing and of $10,000,000 over 1903, which up to now held the record for gross earnings. Gross earnings last year were $133,921,992 against $117,191,812 in 1904, an increase of $16,730,181. Net earnings from operation ($40,531,582) showed an increase of over $5,000,000. To these net operating earnings must be added interest from investments amounting to over $10,000,000 plus various other interest and profit items, a total of $12,036,918. This makes a total of $52,568,500 net operating earnings and other income. Deducting from this total $7,662,810 for rentals paid roads operated on basis of net earnings, and $14,803,173 in fixed charges of various kinds, there remains $30,102,517, the resultant net income for the year. This is an increase of $2,111,650 over the net income for 1904, which had hitherto been the most profitable year in the company's history as measured by this final statement of net income. These figures cover a system of 3,764 miles east of Pittsburg and Erie as against 3,748 miles in 1904.

The advance sheets now at hand contain condensed income accounts of "all transportation companies East and West of Pittsburg and Erie, owned, operated or controlled by or affiliated in interest with the Pennsylvania Railroad system." The total figures for the companies East (5,970 miles) are: Gross earnings, $176,288,208, an increase of $20,473,749; operating expenses, $125,732,473, an increase of $14,563,591; and net earnings, $50,555,735, an increase of $5,910,158. Interest, rentals, dividends and other charges, including extraordinary expenses and extraordinary expenditure funds, took $65,240,249, or practically all of the gross income. West of Pittsburg and Erie, the Pennsylvania Company shows an increase of $4,205,858 in gross and $1,201,432 in net earnings from operation; the Pittsburg, Cincinnati, Chicago & St. Louis an increase of $2,884,620 in gross and $730,899 in net earnings from operation. The aggregate of companies West (5,041 miles) shows the following figures: Gross earnings, $89,781,390, an increase of $8,379,429; operating expenses, $66,367,876, an increase of $6,023,297, and net earnings, $23,413,514, an increase of $2,356,131. Interest, rentals, dividends and other charges, including extraordinary expenses and extraordinary expenditure funds, took $29,407,470. Totals for the entire system (11,011 miles) rise to the remarkable figures of $266,069,598 gross earnings, an increase of $28,853,178 for the year, and $73,969,249 net earnings, an increase of $8,266,289.

Regularly a notable feature of Pennsylvania reports is the amount of money spent in extraordinary expenditures for betterments and additions. From the income of the year on the lines East, directly operated (3,764 miles), nearly eight and one-half million dollars ($8,424,881) was appropriated for revision of grades and alinements, additional tracks, yards, docks, bridges, piers, stations and other terminal facilities, abolition of grade crossings and improvement of equipment. There was also paid $3,249,238 on account of principal of car trusts. These were the appropriations from income. The charges to capital account on this same mileage during the year were as follows:

Cost of Road: Being expenditure on low grade freight line from York Haven to Glenloch; on Pitcairn, Enola, Hollidaysburg, Morrisville and other yards, Duquesne Way Elevated road, extension of four track system on main line, shops, stations, and other facilities	$18,151,688.23	
Cost of Pittsburg, Virginia & Charleston Ry., absorbed April 1st, 1905	11,618,019.93	
		$29,769,708.16
Equipment: 547 locomotives	$7,087,867.50	
Freight equipment	265,000.00	
	$7,352,867.50	
Less credits	29,164.99	
		7,323,702.51
Real Estate		1,647,547.43
Total charges to capital account for 1905		$38,740,958.10

Excluding the cost of the Pittsburg, Virginia & Charleston, this makes the aggregate expenditures for the year for construction, equipment and real estate on the Main Line between New York and Pittsburg $38,797,058 (this aside from similar expenditures amounting to $4,429,102 on the branch and auxiliary lines operated as part of the four grand divisions East)—an immense appropriation for the future betterment of the property. Nor is the past year's record a specially unusual one. During the last five years the sum total of charges to income and capital for betterments has been $152,708,727.

There is no more striking feature of the report than the activity of the Pennsylvania Railroad grand division (with branches, 1,799 miles). On this one division alone, earnings from freight traffic increased more than $9,000,000 over the previous year, and earnings from passenger traffic more than $1,000,000. Freight earnings were $63,217,008, or $34,781 per mile of road. Passenger earnings were $13,064,180, or $7,188 per mile of road, a total of $43,848 gross earnings per mile on this division. This, while not the largest gross earnings per mile in the system (the United Railroads of New Jersey grand division earning, gross, per mile of road, $52,372), represents by far the largest freight tonnage on the system. Even when one has stood at one of the stations between Altoona and Johnstown, or Altoona and Harrisburg, and watched the ceaseless succession of coal and freight trains which pass over the line it is scarcely possible to realize that on this one division alone were carried 92,582,616 tons, or 11,515,465,537 tons one mile; a freight traffic density for the division of 6,335,638 tons one mile per mile of road, or nearly twice that of any other division of this heavy tonnage system.

These figures lead the way to a consideration of the traffic statistics for the entire system. The whole freight and passenger movement on the lines, both East and West, is shown in condensed form below.

Traffic Statistics Entire System.

	Freight, tons		Ton miles	
	1905.	1904.	1905.	1904.
Lines East	200,791,219	173,002,860	19,387,158,170	16,570,807,393
Lines West	132,220,018	111,616,354	10,115,689,192	8,560,688,066
Total	333,011,237	284,619,214	29,502,847,362	25,131,495,459

	Passengers carried		Passenger miles	
	1905.	1904.	1905.	1904.
Lines East	97,743,104	92,077,411	2,252,040,943	2,081,295,039
Lines West	28,341,119	27,871,252	823,361,883	869,602,102
Total	126,084,223	119,948,663	3,075,402,826	2,950,897,141

These consolidated figures show that with the exception of a decrease in the number of passenger miles West of Pittsburg and Erie due, of course, to comparison with the year which included the long-distance passenger travel to the Louisiana Purchase Exposition at St. Louis, both freight and passenger traffic increased largely throughout the whole Pennsylvania system.

The year saw a net addition of 505 locomotives to the equipment of the lines East directly operated. These acquisitions added 20,000,000 lbs. to the tractive power of the equipment in service, or about 40,000 lbs. for each of the new locomotives; showing, as of course is obvious from the other features of the report, that most of them were heavy freight locomotives. In passing it is interesting to observe that on the Pennsylvania Railroad grand division anthracite and bituminous coal and coke furnished 49,947,927 tons out of the 92,582,616 tons carried, and the trainload was 524 tons; clear proof that this heavy tonnage was economically handled. The trainload for the directly operated lines East was 505 tons.

Many of the most interesting features of the report can best be summed up by the following extract from the general remarks of President Cassatt, included in the report:

The tonnage shows an exceptional increase both in volume and mileage over that of 1904, the traffic for the year being much the heaviest in the history of the company, and by reason of the liberal expenditures recently made in the construction of relief lines and large terminal yards and the substantial additions made to your motive power, the movement of tonnage has been materially improved. The prosperous conditions prevailing in the country are reflected throughout the entire system. There was a slight reduction in the average rate, and also in the net earnings per ton per mile, but owing to the volume of traffic carried, there was a large gain in the freight revenue. There was an increase in expenses in all departments, and notably in that of maintenance of equipment, due to the outlays necessary to keep your motive power and equipments up to the requirements of the traffic.

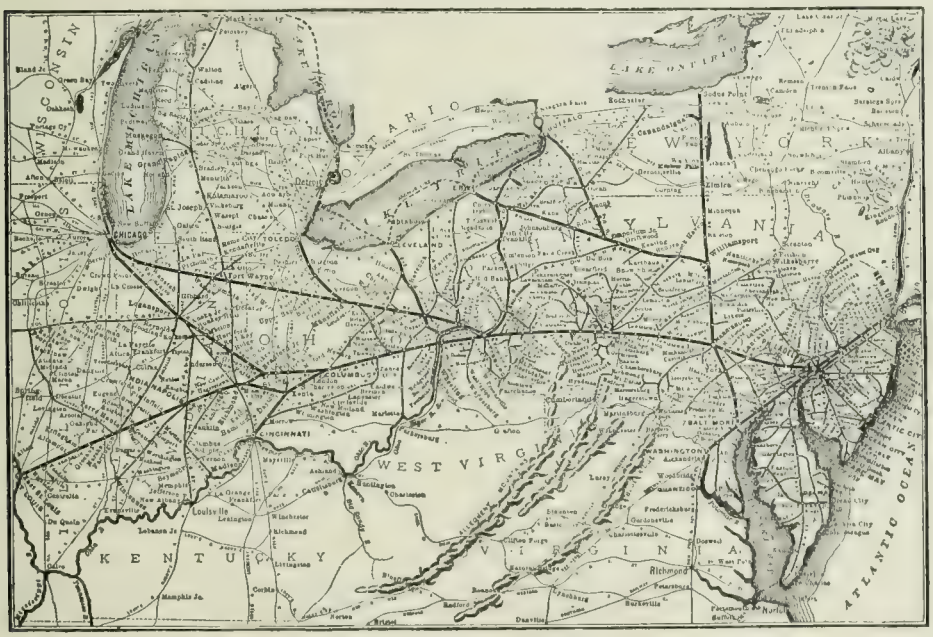
The heaviest outlay during the year was on the low-grade freight line from York Haven to Glenloch, Pa. Work was prosecuted vigorously, and the sections between York Haven and Columbia and between Atglen and Parkesburg are now in service. Between Columbia and Atglen and between Thorndale and Glenloch, grading is rapidly approaching completion, and the entire road will be finished in the early spring. Additional expenditures have also been made upon the yards operated at Enola in connection with this line, and facilities provided at Thorndale and Denholm on the Philadelphia and Middle divisions, through which four freight trains in each direction can be coaled and watered at the same time, and the delays avoided that now result from trains having to follow each other at intervals and wait while those ahead are being served. The yards at Harrisburg, Tyrone, Altoona, Pitcairn and Pittsburg have been further extended, the eastbound classification yard at Hollidaysburg enlarged, and provision made for an extensive westbound yard at the same point, for the classification of coal cars to be distributed over the Pittsburg division. At the Morrisville terminus of the Trenton cut-off, liberal yard facilities are also being furnished for the accommodation of the traffic passing over the New York Division. At Broad Street Station, Philadelphia, the express station has been rebuilt, and the widening out and lengthening of the tracks on the south side is under way. At East Liberty, Pittsburg, a new passenger station is being erected, which will furnish adequate accommodation for the large travel at that point. The elevated road on Duquesne Way and the car-load delivery yard have been completed and the freight houses are under construction. On the Pittsburg division, the four-track system has been finally completed between Bolivar and Blairsville Intersection, and work

is being pushed between Beatty and Donohoe, and on the revised line between Beatty and Southwest Junction. The second track on the Western Pennsylvania division between Tunnelton and Saltsburg has been completed. A jumpover has also been constructed at Ehrenfeld to prevent interference by the South Fork coal traffic with the main line movement. On the middle division, the four-track system on the Canal line at Newport has been put in service, and also the stone arch bridges constructed over the Juniata on the new four-track line between Granville and Mayes. On the Philadelphia division, the elevation above high water of the tracks along the Susquehanna river between White House Road and Harrisburg has been completed. On the United Railroads of New Jersey division, the principal items of outlay, outside of the Greenville Yard, were for the improvement of pier and yard facilities at New York and Harsimus, the extension of the Waverly yard, the reconstruction of the Princeton branch, the erection of the Trenton Shops and the elevation of tracks in Camden. The improvement of the Greenville yard was further continued, and a large sum expended in filling, dredging the channel, construction of lighterage and coal piers, and furnishing other facilities.

One of the most important matters which received attention during the past year was the providing of a sufficient water supply for present and future needs. Owing to the largely increased demand arising from the growth of the traffic, the former sources of supply had become inadequate, and on the lines traversing the coal districts the quality of the water was rapidly becoming unfit for locomotive use. Arrangements have now been made, through contracts with companies organized and owned by the Pennsylvania Railroad Company, to secure an adequate supply of good water at all points of the main line between Pittsburg and New York, and also on the more important branches, and for the construction of the reservoirs and the piping of the water to your lines whence it will be distributed along the right-of-way to the necessary points. The cost of this undertaking will be large, but it will be of incalculable value; while the difficulty in obtaining water in sufficient quantity and of good quality shows that this step could not have been longer delayed. It is proposed to obtain the funds for this outlay by an issue of special securities maturing at short periods, and as there will be a large saving both in cost of water and in boiler repairs, the principal and interest thereof can be met, without undue burden, out of your current income. It was found absolutely necessary also to largely increase the motive power in order to meet the exceptional demands of the traffic. Substantial additions were made to the passenger equipment, and arrangements concluded for the building of a large number of standard freight cars, to replace equipment of small capacity. It was deemed wise to make these replacements at once, instead of distributing them over a period of years. And while the equipment absolutely owned by your company will show a temporary decrease until the maturity of the Car Trusts under which the standard equipment is built, the number of cars available for service is not diminished, while the tonnage capacity is largely increased. Contracts have also been let covering the addition of twenty thousand cars to the freight equipment of the system under the usual car trust arrangements.

On the branch and auxiliary lines directly operated east of Pittsburg the largest expenditure was upon the Cambria & Clearfield, Cherry Tree & Dixonville, Western New York & Pennsylvania and Allegheny Valley railroads. The main items upon the first named road were the construction of the Barnesboro tunnel for second track, and the improvements to the line between Amsbry and Irvona to accommodate the business of the New York Central lines. The outlay on the Cherry Tree & Dixonville road was in the construction of track, sidings and branches necessary to provide for the joint business handled by your own and the New York Central interests, in accordance with existing contracts. The construction of a branch is now under way from West Brownsville Junction up the valley of the Monongahela, 4½ miles, where it will connect with the Pennsylvania, Monongahela & Southern Railroad, which is being built to further develop the Monongahela valley. On the Western New York & Pennsylvania, the principal expenditure was on yards and shops at Olean, on canal and dock facilities at South Buffalo, on the Ebenezer yard, and on right of way and real estate. On the Allegheny Valley the outlay was mainly on the second track from Rimerton to Phillipston, on the Coleman, Phillipston and Cochran yards, and on sidings, right of way, and real estate.

Expenditures for the current year will include the extension of the four track system on the Middle and Pittsburg divisions, and the necessary revision of alinement and grades connected therewith. This work, which is being pushed as rapidly as practicable, will complete the four tracks between New York and Pittsburg with the exception of two three-track sections, one of seven miles between Spruce Creek and Tyrone Forge, and one of 3½ miles immediately east of Conemaugh. This will, however, not obviate the necessity for the construction of additional relief lines for the Pittsburg and New York divisions. As already stated, the low-grade freight line between York Haven and Glenloch will be placed in service in a few months, and will then furnish an entirely independent route, with maximum grades of three-tenths per cent. against eastbound and six-tenths per cent. against westbound traffic, between Marysville and Morrisville, 137 miles. Another double-track relief line is in operation between the eastern end of the Allegheny mountain tunnels and Petersburg, on the Middle division, 47 miles. These two lines will amply provide not only for the prompt movement of the present traffic between the points named, but for a large increase; but it will be necessary to proceed at once with the construction of an additional freight line about 50 miles long, between Morrisville and Newark, and of one between Glenloch and Philadelphia about 20 miles in length, and also to relieve the Pittsburg division by building an independent line between Pitcairn and Blairsville, 43 miles, and between Johnstown and Altoona, 39 miles. Whether the latter lines should be for passenger or freight service is a question that is now being carefully studied; but whether for passenger or freight, it is deemed best from an operating standpoint, that the relief lines shall be entirely independent rather than that two additional tracks shall be laid alongside of an existing four-track railroad. The necessity for the prompt construction of these relief lines will be apparent when it is stated that the average daily movement of freight cars over the Allegheny mountain summit for October, November and December, 1905, and January, 1906, was 5,669 cars, with a maximum movement in 24 hours of 6,974 cars; that there is a daily average passenger movement of 28 trains in each direction; that freight trains require two assisting locomotives on the eastern and one on the western slope, and that on the eastern slope passenger trains also must have an assisting locomotive. The daily average number of independent train units passing over the eastern slope during the months named, including assisting locomotives when descending without trains, but not counting them as separate units when attached to trains ascending the mountain, was 168 in each direction. It should also be noted, as indicating the provision that should be made for the future, and the increase in tonnage on the line between New York and Pittsburg during the last five years was 40 per cent., and in ton-mileage, 32 per cent. With the completion of the relief lines referred to, you will have a double-track railroad between Pittsburg and Philadelphia and New York entirely independent of your four-track road, with the exception of the section on the Middle division between Petersburg and Marysville, 96 miles, and the short section between Parkersburg and Thorndale on the Philadelphia division. But it is believed that the first of these sections will not require relief for some years, as its very low grades admit of heavy trains and a consequent relatively small number of train units.



Pennsylvania Railroad System.

The construction of the tunnel line into and through the city of New York has been steadily prosecuted during the year. All the real estate required for the terminal station has been purchased and also the greater portion of that needed for the terminal yard in Long Island City. On the section between Newark and the Hud

son river, the draw bridge over the Hackensack river is under contract, and the work on the Bergen Hill tunnel, which is being driven from both ends, is to be further expedited through the central shaft, from which headings are driven in both directions. In the North River tunnels, the shields are at work on both sides of the stream, and it is confidently expected that they will be connected and the iron lining in place before the end of the year. The excavation for the station site and the building of the retaining walls are steadily progressing, the power house from which the terminal station will be operated is under construction, and the tunnels under the city of New York are being driven westward from the main shaft at First avenue and also in both directions from the intermediate shafts located on Thirty-second and Thirty-third streets between Fourth and Madison avenues. On the East River section, the shields on the Manhattan side are in place and working towards the river; and, while the shafts on the Long Island side are not yet completed, a considerable amount of work has been done between those shafts and the eastern portal of the tunnels in Long Island City. The power house in that city is in service and is supplying the electric lines of the Long Island Railroad. Nothing has occurred to seriously delay the progress of the work or to suggest any special difficulties in carrying out the general scheme of construction.

Large expenditures were necessary upon the Philadelphia, Baltimore & Washington; Northern Central; Long Island, and West Jersey & Seashore, in the elimination of grade crossings, construction of additional tracks, erection of stations and other terminal facilities, improvement of bridges, electrification of lines, and the increase of motive power and equipment. On the West Jersey & Seashore it has been determined to electrify the line via Newfield to Atlantic City and thus furnish increased facilities for reaching that important resort. In pursuance of the policy heretofore authorized, your company has placed its guaranty upon a further issue of $5,691,000 of the 4 per cent. refunding bonds of the Long Island Railroad Company, and in conjunction with the other companies, which are co-owners with it in the line between Washington and Richmond, has guaranteed an additional $2,000,000 of the Richmond-Washington Company's 4 per cent. collateral trust bonds.

Following action taken at the last annual meeting, the Pittsburg, Virginia & Charleston was merged into the main line on April 1, 1905. The Pennsylvania Railroad Company having been the owner of more than two-thirds of the capital stock of the South West Pennsylvania Railway, which was built as a feeder to the system, and which, branching from the main line at Greensburg, extends through the coke region to Connellsville and Uniontown and to a connection with the Monongahela division, it was deemed wise to acquire the small amount held by outside parties; and it is proposed to also consolidate this road with the main line. There will be submitted for approval at the annual meeting the necessary resolutions to this effect; and like resolutions will also be submitted covering the absorption of the York Haven & Rowenna Railroad and the Allegheny Valley Railway. The York Haven & Rowenna is a link about five and one-half miles long in the freight line which is nearly completed from York Haven on the Northern Central via Columbia to Glenloch on the main line, as hereinbefore fully explained. As it does not lie in one of the counties through which the Pennsylvania Railroad passes, and therefore could not be built under that company's branching powers, a separate charter had to be taken out for its construction until it could be absorbed. The Allegheny Valley forms the connection through its river and low grade divisions between the main line at Pittsburg and the Philadelphia & Erie at Driftwood, and also furnishes through its line to Oil City and over the Western New York & Pennsylvania a direct route to Buffalo, Rochester, and other important trade centers. Its terminals at Pittsburg are of great value, and its location along the Allegheny river makes tributary to it a territory already largely devoted to steel and other manufacturing industries, and one capable of increased development in the future. As the company is a guarantor upon its outstanding funded debt, and owns or controls more than three-fourths of all its stock, it is deemed advisable to acquire the comparatively small amount held by outside parties and make the road an integral part of the main line.

This summing up by the President of the accomplishments of the year and the necessities of the immediate future, together with the actual figures of the report, help to give fresh realization of the wonderful strength of the Pennsylvania. There is no need to comment upon the traffic wealth of its territory, for only the extent of its future possibilities is unknown. Next to location, its most important asset is a continuity of successful management, such as is capable by judicious economy in a year like 1904, when gross earnings decreased four and a half millions, of showing the largest net income in the company's history. Last year goes on record as the high water mark of the Pennsylvania's prosperity, but other records have been short lived. Already returns for the first month of 1906 show a larger increase over the corresponding month in 1905 than any of the 1905 monthly increases. What new traffic levels the future has in store for the company it is not safe to guess.

The following table includes the principal operating statistics for the Pennsylvania Railroad Company (lines east of Pittsburg and Erie, directly operated):

	1905	1904
Mileage worked	3,763	3,748
Freight earnings	$100,093,828	$86,014,076
Passenger earnings	27,392,393	25,438,978
Gross earnings	133,921,992	117,191,812
Maintenance of way and structures	14,121,800	12,789,398
Maintenance of equipment	24,363,199	19,755,362
Conducting transportation—Traffic	1,435,117	1,337,113
Conducting transportation—Operation	49,473,234	45,129,423
Operating expenses	93,390,110	81,802,388
Gross income*	115,958,910	129,559,534
Net income	30,102,517	27,990,867
Extraordinary expenditures from income†	8,424,881	6,220,921

*Sum total of all receipts.
†Not including car trust payments.

NEW PUBLICATIONS.

Rapid Transit in New York City and Other Great Cities. Prepared by S. D. V. Barr under the direction of a special committee of the Chamber of Commerce of the State of New York. 1906. Cloth, 295 pages.

In April, 1904, a special committee of the New York Chamber of Commerce was appointed to outline a plan to suitably recognize the services of the members of the chamber who had so loyally and honorably served the City of New York as members of the Rapid Transit Commission. This committee suggested the preparation and publication of an historical memoir of the rapid transit enterprise then nearing completion and the awarding of gold medals to the past and present members of the Rapid Transit Commission. On Dec. 7, 1905, at a meeting of the Chamber of Commerce, these medals were presented to Alexander E. Orr, Morris K. Jesup, John Claflin, Woodbury Langdon, Seth Low, John H. Starin and Charles Stewart Smith with appropriate ceremonies. The memoir suggested has just been issued.

Historically the book is of great interest and value, going back to the earliest settlements on Manhattan Island. The gradual growth of the city, its changing centers of business and population and early plans for relief are matters about which there has heretofore been little collected information. The subsequent chapters take up the building of the East river bridges, the tunnels under the Hudson and East rivers, the elevated railroads, early Rapid Transit Commissions and the organization of the Commission which planned and caused to be built the present Subway. A full description of the engineering and operating features of the Subway follows. Rapid transit in other great cities is taken up in Chapter XX., and the facilities of London, Berlin, Budapest, Paris, Glasgow, Boston, Chicago and Philadelphia are briefly considered in order. A summary of the present rapid transit laws in New York and the report of the proceedings of the meeting when the award of medals was made concludes the book. The work of compilation represents many months of patient delving in obscure reports and long-forgotten publications. It has been well and carefully done and the result is a memoir befitting the occasion for which it was prepared.

Practical Electrical Railway Handbook. 1906. By Albert B. Herrick. New York: McGraw Publishing Co. Leather, 4½x6¾ in.; illustrated; 460 pages, including index. Price, $3.

This is the second edition of this useful and comprehensive work. The author covers the various branches of electric railway construction and operation, as the headings of the nine sections into which the book is divided will show: General Tables; Testing; The Track; The Power Station; The Line; The Car House; The Repair Shop; The Equipment and The Operation. Under general tables is included the usual information found in hand books as well as such data as is particularly adapted to electrical work, such as the relative resistance of conductors. The section on testing describes and illustrates various methods and kinds of tests, such as testing rail bonds, motors and other equipment. Considerable space is also devoted to describing the different ways of determining the current flow in water pipes. Types of track construction are explained in the section on track, and illustrations of a number of typical sections are given, with tables of approximate cost per mile of single track. Under power stations, there are numerous suggestions as to the design and equipment of stations and illustrations showing the various types of equipment and general plans of power houses are shown. Various methods of wiring are also considered at length. The section on line includes descriptions and illustrations of line splices, poles, both wood and metal, various types of cross arms, bonds and bonding, manholes and conduit construction and general distribution of current. The construction, heating, transfer tables, doors, floors and general lighting of the car house are briefly described under the next section. Under repairs, is given a general description of the arrangement of the repair house and suggestions as to its machine equipment, including a table showing the number of machines required in houses designed for 30 cars, 60 cars and 300 cars respectively. Some 70 pages are devoted to a general description of equipment, including rolling stock, car bodies, car frames, trucks, motors, wiring and air-brakes. The section on operation covers ten pages and briefly describes

schedules and speeds and signal systems. A list of questions for examination of motormen is also given. The use of formulas and mathematics has been eliminated as much as possible, so as to make the text useful to as many as possible of those interested in the subject. It should be a satisfactory handbook for practical use.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾ in. by 6¼ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Auxiliary Field Direct Current Motors.—Circular No. 1,117, issued by the Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., illustrates and describes in detail the general construction and operation of its type SA motors. These motors are of the direct-current variable speed type and are fitted with auxiliary fields. They are specially adapted to meet the demands of service requiring a wide range of speed variation. A brief detailed description of this motor was given in the *Railroad Gazette* of March 2, 1906.

The Sullivan "Plug" Drill.—A nicely gotten up 12-page pamphlet published by the Sullivan Machinery Company, Chicago, illustrates and describes in detail the Sullivan "Plug" drill which is extensively used for quarrying and contracting work. In a test held at Barre, Vermont, 160 holes 3 in. deep by ⅝ in. in diameter were drilled in one hour with the drill. The air pressure averaged 100 lbs., and the estimated consumption of free air was 15 cu. ft. per min.

Car Lighting.—The Safety Car Heating & Lighting Co., New York, presents in a special catalogue some details of its new incandescent mantle lamps for burning Pintsch gas, by which a steady white light is produced and the candle power of the gas is increased more than three times over the old standard burners. Sections of various types of lamps are shown, together with illustrations from photographs of the lamps. The new designs of lamps, while differing radically from the older standard designs, are characterized by the same artistic appearance. The only change necessary in the piping and apparatus in the car is fitting a different regulator, which maintains an outlet pressure of 1 lb. per square inch. The 1906 edition of the general Pintsch gas catalogue of this company, also just issued, contains 191 pages and illustrates all the car-lighting fittings used with Pintsch gas. Both catalogues are paper bound, 8¼ in. x 10¾ in.

CONTRIBUTIONS

Injunctions Must be Specific.

To the Editor of the Railroad Gazette.

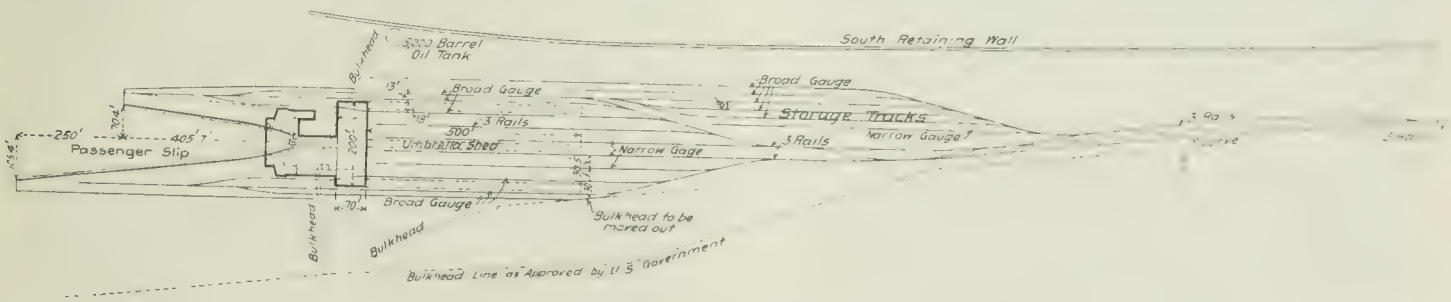
The Supreme Court of the United States has sustained Attorney-General Moody in the position that he took in regard to the case against the Atchison, Topeka & Santa Fe. That road was charged with granting rebates on coal transported for the Colorado Fuel & Iron Company. Mr. Moody held that contempt proceedings could not be successfully prosecuted for violation of the restraining order issued in 1902, prohibiting a departure from the published tariff rates on packing house products, dressed meats, grain, grain products, or any other interstate traffic, because coal had not been included in the articles specified; because the general words "or any other interstate traffic," according to the well-established rule, could be construed to extend only to articles of like kind with those specified. This view is now fully sustained by the decision handed down by the court a few days ago in the Chesapeake & Ohio coal case. In this case the Supreme Court after disposing of the main question involved, passed upon the very question emphasized by the Attorney-General in the Santa Fe case. Discussing the claim that instead of enjoining the Chesapeake & Ohio from the particular violation of law involved, the court should have enjoined the defendant railroads, in general terms, from violating the Act to regulate commerce in any particular, the Supreme Court holds that an injunction of such a general character would be "violative of the most elementary principles of justice," and that granting it would be to lay down a rule which would be "destructive of the fundamental liberties of the citizen."

After Messrs. Judson and Harmon retired from the Santa Fe case, contempt proceedings were begun against the road before Judge Philips, who had issued the original retraining order. Judge Philips held that an injunction must be predicated on some specific wrong; that the bill on which the order was based contained specific complaint only as to rebates on packing house products and grain, followed by a broad, general averment, based on information and belief, that on many other principal articles of traffic, necessities of life, rebates were also granted; that the restraining order enjoined the railroad company from transporting such specified articles "or any other interstate traffic" at greater or less rates than those named in the published tariffs, and declared that the general words "or other interstate traffic" were controlled by the antecedent specifications and limited to traffic of like kind. Judge Philips also held that there was no evidence to furnish any foundation for imputing to Mr. Morton or Mr. Ripley any personal responsibility for the alleged violations of the interstate commerce law.

G. G. G.

New Station of the Southern Pacific at Alameda Mole.

The city of San Francisco is located, as is well known, on a long narrow peninsula on the western side of the bay of San Francisco. All the important railroads terminate on the eastern shore of the bay, necessitating a very complete and elaborate system of ferrying, both for freight and passenger service across the bay. Of such service the oldest and by far the most complete, the best arranged and handled is that of the Southern Pacific Company. Besides its various freight terminals for handling freight, both in bulk and small lots, and its facilities for handling express and wagons over separate ferry lines, this company has two important passenger ferry stations, each located at the end of a long, narrow artificial mole, made by filling in a strip between rock walls, and crossing the shoal water of the easterly side of the bay so as to reach deep water for the ferry boats. These ferry terminals consist essentially of three parts. A slip, or as it is sometimes called, a ferry rack, consisting of piling and wharf work, and having two wings, one on each side, approximately fitting the outlines of the boats. At the head of this slip is a depot for the accommodation of passengers, baggage, etc., beyond which again is a train shed for the protection of passengers and baggage to and from the cars.



Plan of the Alameda Mole of the Southern Pacific Co., California.

About two years ago the more southerly of these two passenger terminals, known as the Alameda Mole, was destroyed by fire, and it was decided by the Southern Pacific Company to replace this with a very elaborate, ornamental and up-to-date structure, which has just recently been completed. The slip follows the usual construction of the Southern Pacific, consisting of two long legs or wharves, with a row of fender or spring piles between, attached to each other by elastic waling pieces and approximating in shape the outline of the boats. When a boat has entered the slip there are three passenger aprons through which communication can be had with the shore, one in the center of and at the forward end of the boat on the lower or main deck, and one on each side of



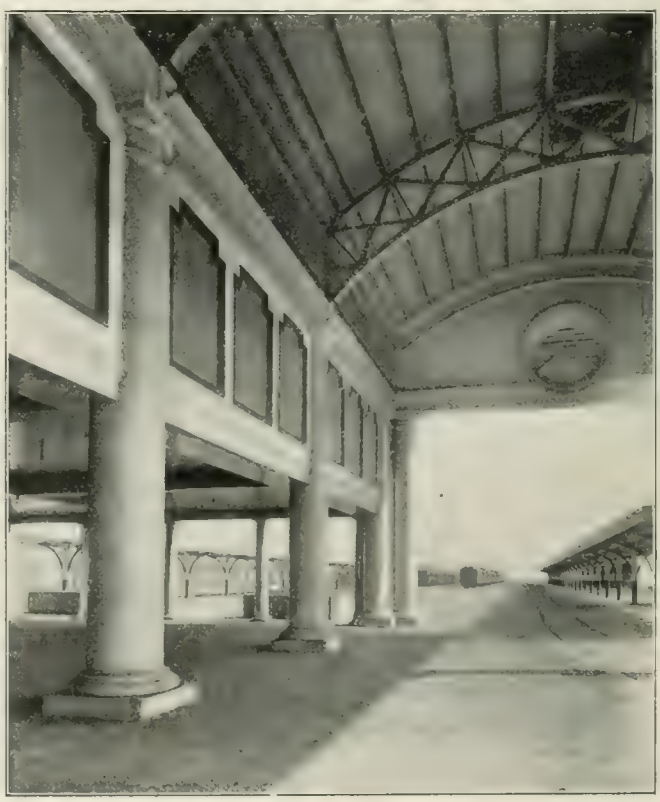
Elevation of Southern Pacific Passenger Station at the Alameda Mole.



Exterior of Train Shed, Alameda Mole.



Upper Waiting Room and Ramp to Lower Floor.



Interior of Tra n Shed, Alameda Mole.

the upper deck, just forward of the saloon, so that passengers can leave the boat for the shore, or enter the boat from the shore in three different directions.

When a boat is in the slip its forward end back to the pilot house is entirely covered by a roof, which is a large elliptical arch spanning the slip. Under this roof are also the three aprons above mentioned, so that passengers, baggage, etc., can leave the boat entirely under cover. At the head of and communicating with either of these aprons is the main head-house or ferry building This head-house is two stories high and is covered with a large rectangular dome, which forms the ceiling of the upper or ladies' waiting room. Passengers leaving the upper deck of the boat pass outside the waiting room down long inclines to the rear of the main building. Passengers leaving the lower deck pass across the central apron through a corridor to the rear of the building.



Interior of Upper Waiting Room, Alameda Mole.

To the rear of this main building or head-house is a covered concourse 70 ft. wide, which extends across the entire rear of the building and is flanked on either end by train-sheds of the same width as the concourse. Still further to the rear, between each pair of tracks and connecting with this concourse, there are umbrella sheds of artistic design. They are 18 ft. wide and 500 ft. long, so that passengers can go from the train by way of the umbrella sheds and concourse to the boats always under protection from the weather. From this concourse there are entrances to the left facing the slip so that passengers leaving the boat on the upper deck incline to the right or left do not cross those seeking to enter the boat from the waiting rooms. The first story waiting room or main floor contains ticket office, news stand and smoking room, and from this floor leads a broad stairway to the large general waiting room on the second floor. On the second floor, in addition to the general waiting room, are the local terminal offices such as trainmasters', despatchers', conductors', ticket takers', etc.

The character of architecture employed is French Renaissance. The concourse is spanned with low flat trusses supported on Doric columns. The train-sheds at each end of the concourse run up to a height of two stories, and have curved or barrel-shaped roofs, and there is a lantern parallel with their axes for ventilation. These sheds are also supported by large Doric columns.

The domed roof of the head house is supported upon steel trusses and its form was carefully studied as regards appearance and outline. The waiting room on the second floor is very ornate in detail and design. The ceiling is domed and hipped with highly ornamental moulded panels between the roof trusses so that the paneling is both horizontal and transverse. In the center of the dome three large ceiling sashes give light from the lantern above. At the spring line of the dome a cornice of classic and ornate design runs entirely around the room. Between the southerly incline and the waiting rooms the roof is supported on Doric columns ornamented. The waiting rooms and inclines are separated by wrought-iron grill work 7 ft. high.

The color scheme in the waiting rooms is old ivory, with the high points of the enriched members almost white, producing a very pleasing and harmonious effect in quiet tones. The exterior of the building is white, which makes it a conspicuous object in almost any weather. There are a great number of artistically arranged electric lights, as the domed roof of the second story waiting room and the arched roof over the end of the slip give an opportunity for elaborate treatment of this kind. At night when a boat enters the slip the elliptic roof is lighted up with a great number of incandescent lamps, which flood with light the boat and all the aprons, producing a very agreeable effect and preventing any confusion in the handling of passengers or baggage from insufficient lighting. The transverse and horizontal lines of lights, spaced at equal distances, give a brilliant effect. As the time for the arrival of a boat approaches the light is turned on, illuminating the entire slip, and making it very convenient for steering the boats.

It was necessary to place this building partly on piles and at the same time keep it isolated from the slip because in stormy weather a boat striking the fender piles might cause considerable vibration in the building. This is the only building of this description in or around the Bay of San Francisco which is artistic and pleasing from whatever direction viewed, whether from the bay, from the shore or from either side, and the impression is not merely that of a train-shed, but of a monumental building dedicated to public use, along ornamental but at the same time dignified lines.

The building was built by the maintenance of way department under Mr. J. H. Wallace, Engineer of Maintenance of Way. Mr. J. D. Isaacs, Consulting Engineer of the Harriman Lines, designed the structure and supervised its construction. The plans and details were prepared by Mr. D. J. Patterson, Architect of the Maintenance of Way Department.



Interior of the Lower Waiting Room.

Railroads and Foreign Enterprises in Korea.*

BY L. F. BENNETT.

In September, 1905, the writer had occasion to visit Korea in order to inspect and make a report on the Seoul electric street railway system for Messrs. J. G. White & Co., of New York and London. The paper which follows contains such parts of this report as are of general interest in their discussion of the interior communications of the country, together with other notes on points of interest not only to those who are interested in Korean railroads from the standpoint of the economist or of the investor, but also to American manufacturers of railroad supplies.

The area of Korea is about 92,000 square miles, and the present population is about 8,000,000, or about 87 inhabitants per square mile; but the country is capable of supporting double this population. At the time of the Japanese occupation of Korea, American capital and enterprise had been most successful in developing transportation facilities in the hermit kingdom. Development of the country itself has been very slow, and there are large areas of good uncultivated land, including extensive tracts of excellent grazing land for live stock.

The temperature in summer is from 70 to 100 degrees Fahrenheit, and in winter from 0 to 30 degrees. The weather during winter months is dry, clear and crisp, and Korea is an exceedingly healthy and agreeable climate the year round. Summer, winter, autumn and spring are about the same as northern New York, except that they have a more clearly marked dry season and rain season. The rainfall is about 60 inches per year, and the months of heaviest rainfall are June, July and August.

The Korean people are very ignorant and superstitious, but



Suburban Line.

naturally peaceful and easily managed if let alone. They are a strong, hardy race, but not very thrifty, and do not accumulate property or wealth. This is owing chiefly to centuries of abuse and robbery on the part of a corrupt official class. Their stock is a mixture of Tartar and Mongolian blood, having almost the same origin as the Japanese. They are almost exclusively an agricultural people. The average Korean does not work for wages, but cultivates the soil. He tries to raise, for sale, only a sufficient surplus to buy such necessary articles of foreign and domestic manufacture as may be absolutely essential, and such as his family is unable to manufacture or produce. The average earning power of a Korean is probably not more than 20 cents per day.

The labor supply is not at all efficient, but is ample for any public works. A common laborer earns from 20 cents to 30 cents per day in the interior, and at the seaports from 30 to 40 cents. Korean skilled labor scarcely exists, but there is plenty of Japanese skilled labor available in Japan which can be imported at small cost. The rate of wages for Japanese skilled labor in Korea is from 80 cents to $1.50 per day, according to the kind of work and skill of the laborer.

One military school and four government language schools exist in Seoul. These latter teach only foreign languages. The mission schools, which are supported and run almost entirely by the American missionary societies, are the best schools in the country. In the interior all education is by private arrangement on the part of the parents of the families with some private tutor. There is no public school system and no educational facilities to speak of in Korea. Few people know how to read and write, and it may be said that education is limited almost entirely to the higher class of Koreans, with the exception of the pupils in the foreign missionary schools. No doubt the Japanese will start a public school system now, as the Koreans would have done themselves if left alone.

The Korean people are exceedingly superstitious, just as the Chinese and other ignorant masses of people are, but they are quite bright and capable of quick learning.

The Japanese are said to maintain a present military force of about 50,000 soldiers in Korea. At present the country is in an unsettled state of transition from Korean to practically complete Japanese rule, and it is impossible to say how the new Japanese government will work out. Scant respect has been shown for the rights and desires of the Korean people and government by the Japanese military force, which has administered martial law in the country up to the present time. The Japanese have abused the Koreans and seized their property under the pretense of military necessity, but in reality the land is afterward occupied by Japanese farmers who cultivate and use it for anything but military pur-



Track and Overhead Structure.

poses. The country swarms with low adventurers from Japan of the coolie class, who are reported to have seized property and exacted signatures to deeds of transfer to themselves by force, and unfortunately the Japanese military authorities seem to have protected these adventurers in their abuses and have persistently refused to listen to the Korean side of the controversy, but have supported all Japanese in the possession of their dishonestly acquired possessions.

The finances of the Korean government have been controlled by a Japanese financial adviser, who, it was asserted, refused to allow even the Korean Emperor to expend his own private funds without the previous consent of the adviser.

Now that Marquis Ito, one of the greatest men of Japan, has gone to Korea to establish a civil government and has turned out of office the old financial adviser and many others who were connected with the provisional military government, it is hoped and believed that the Japanese government will give the Korean people a "square deal" and protect them in the possession of their property rights.

But even the Japanese government has a different idea of fair

*This is the third of a series of papers written for the *Railroad Gazette* by Mr. Bennett. The first two dealt with the Philippines and the next will describe the interior communications in Siam.—EDITOR.

dealing from ourselves. For instance, the government is reported to have seized all the telegraph lines in the country which belonged to the Imperial Korean government, turned out all the Korean operators and replaced them with Japanese telegraph operators and proceeded to charge the Korean government 10 sen (Japanese money) per word to send messages over their own lines, while the Japanese government paid only 5 sen per word for the use of the Korean telegraph lines.

These are, however, very likely only some of the inevitable abuses which occur with every war, and no doubt the Japanese will do differently now that peace is restored. The Japanese will doubtless go very far in the absolute government of Korea, and the Emperor of Korea seems likely to become simply a figurehead.



Combination Car, Seoul Electric Railway.

To one who had just come to Korea from the Philippines, the contrast was very noticeable. In Manila everything reminds one that the Philippine islands are run for the Filipinos, and foreigners and Americans are rather curtly given to understand, if not in so many words, at any rate, by the general attitude of our government, that if they are not satisfied with the policy of concessions to the natives at the expense of the foreigner, they had better get out. No such air of paternal government for the natives pervades Korea, and one is constantly reminded that Korea exists for the benefit and profit of the Japanese.

On the steam railroads in Korea, which are all controlled by the Japanese, no Koreans are employed for any positions whatever, except common laborers, because Japanese laborers are not obtainable in the country. Whenever Japanese laborers are available they are also employed, but there are few to be had. All foremen of gangs, trainmen, station agents and employees, even car cleaners on the railroads, are Japanese. Also all locomotive engineers, firemen and machinists.

Telegraph employees, as stated before, are all Japanese, as well as the post-office force, which was entirely made up of Japanese employees, the majority of which could not speak the language of the country. "Carpetbag" rule seemed to be in force with a vengeance in Korea.

The public debt of Korea was said to be only about 7,000,000 yen, Japanese money, which was recently floated by the Japanese in Japan for the purpose of issuing a new system of Korean currency and based on the gold standard of Japan. This was badly needed, for the Korean currency was in a deplorable muddle. The government revenue from all sources was said to be about $4,000,000 per year.

The commerce of the country amounted, roughly, to the following chief items: Fishing industry produced about $1,750,000, agriculture about $75,000,000, and minerals about $2,000,000. The imports were about $9,000,000, and the exports about $5,000,000, not including extraordinary imports on account of war.

The banking of the country is also fast passing into the hands and control of the Japanese. There are no Korean banks. Branches representing the principal Japanese banking houses practically control the banking business now, and are established in Seoul, Fusan and Chemulpo. A private banking business is established in Seoul by Messrs. Collbran & Bostwick, an American firm, and the principal English banks of the Orient have correspondents in Chemulpo. General business is steady, and shows a healthy increase, but the resources of the country are entirely undeveloped.

The mining industry of the country was first successfully exploited by an American company, which operates at the present time very profitable gold mines in the interior. Gold, copper and coal are the chief minerals known to exist at present. Various concessions for mining and prospecting were granted by the Korean government before the war to American, German, English and Japanese people. These are all being prospected at the present time preparatory to being developed and systematically worked if the prospects are encouraging. It is very doubtful if any more mining licenses will be granted to any one but Japanese companies in the future.

A franchise was also granted before the war to Messrs. Collibran & Bostwick for a system of water works to supply the city of Seoul with good wholesome water, and while no actual construction has been started it is understood that arrangements are being completed to carry into effect this project.

The transportation facilities of the country consist of several railroads of standard gage (4 ft. 8½ in.). One of the rivers, the Chemulpo, is navigable to Seoul, and one or two others for a short distance only. In Seoul there is an electric street railway. The country is also fairly well provided with roads and trails, but few carts or wagons are used. The bulk of transportation is still carried on by means of pack animals, small horses and cattle, which carry 150 lbs. of cargo on their backs, and by means of the natives themselves, who carry as much as 70 to 100 lbs. of freight in a frame strapped to their own backs. In Seoul there are a considerable number of "rickshaws," or man carriages in use, which is an innovation brought over from Japan.

The railroads, which exist at the present time, are the following:

Chemulpo to Seoul, 26 miles, completed.

Seoul to Fusan, 265 miles, completed.

Seoul to Wiju, 250 miles in operation and partially completed.

Seoul to Gensang, 125 miles, building.

The first railroad built in Korea was the line from Chemulpo to Seoul, 26 miles, the franchise for which was originally granted to a Mr. Townsend, of Chemulpo, an old and successful American merchant, who was associated with Mr. Morse, of the American Trading Company, in this venture. The line was constructed by an American company, Messrs. Collbran & Bostwick, of Seoul, and was opened to traffic and operated by them for some time, when it was finally sold to the Japanese at a handsome profit, it is said. It was no doubt bought for political influence, and to keep it from falling into the hands of the Russians.



Type of Wooden Trestle Over Stream.

This line does chiefly a passenger business between Chemulpo,

the principal seaport, and Seoul, the capital of Korea, and in the freight-carrying traffic meets with water competition of the Chemulpo river for eight months of the year.

The river is frozen, however, from November to March, and ice interferes with the water transportation. The line is substantially built with a good, solid road-bed, and good station buildings, but is frequently damaged by floods from the Chemulpo river. The grades are light, but the curvature is a considerable handicap to speed and economic operation. Trains make about 20 miles an hour.

The Fusan line, 265 miles, is the best and most difficult piece of railroad work in the country. It was built under a franchise granted to a Japanese company, and the money probably was advanced by the Japanese government. The line was located and constructed entirely by Japanese engineers. The grades and curvature are heavy, and the work entailed a large amount of rock excavation and many tunnels through rock. Bridge work was also heavy, and it is probable the line cost $35,000 per mile or possibly more. The bridge masonry and retaining walls and culverts along the line are built either of concrete or of rubble masonry made of good hammer dressed stone. The bridges and rails are of American made steel.

Heavy floods occurred in September of last year, and carried away several of the largest bridges, doing much damage to the line in other respects also, so that it required two days to make the trip to Fusan when the writer passed over this line.

The bridge piers were built with too light a cross section to withstand the heavy floods, and when the water reached the steel superstructure, instead of carrying the bridge off the piers as might have been expected, the piers themselves broke off, a clean fracture of the masonry, about 8 ft. below the bed plates of the spans, carrying away the whole of the superstructure.

The water had entirely subsided by September 20, 1904, and the Japanese engineers had erected ferries and pontoon bridges for temporary traffic of passengers and baggage, and it was necessary to change cars several times on the trip. The railroad engineers and workmen were busy getting the steel work of the bridges lifted out of the water, and were already engaged in the re-erection of the bridges.



Temple and Trolley.



View of Main Street, Seoul.

A matter which caused great surprise was the crude and antiquated methods used in all construction works by the Japanese in Korea. As the war was just over and the writer had read so much about the up-to-date methods of the Japanese government and army, it was naturally expected that they would use modern appliances in railroad construction and other engineering works in Korea. Nothing of the sort was visible anywhere. Bridges were being lifted and erected without a single hoisting engine or steam-operated derrick. Piles were being driven with hand-operated pile drivers. Concrete was mixed and placed by means of shovels only, and without any mechanical concrete mixers; earth and rock were excavated entirely by hand and transported in bags, baskets and on a sort of hand platform carried by two men. No wheelbarrows were in use, and no steam shovels or other mechanical devices. Coolies carried earth from a barrow pit up a ten-foot embankment by hand, about half a cubic foot at a time, and placed it in the bank.

In Chemulpo the Japanese were carrying out harbor improvements without dredges. The manner employed was to lay a portable track on the mud flats at low tide, after which iron dump cars were placed on the track. A stone dike was built by hand and the material for the fill was excavated by hand at low tide by Japanese coolies where it was desired to deepen the harbor and the material was transported to the dike in dump cars and placed in the fill by hand behind the dikes. When the tide began to rise it was, of course, necessary to stop work, and the track and cars were inundated until the next low tide.

Japanese naval officers had been working for many months raising the Russian cruiser "Variag," which they sunk at Chemulpo at the beginning of the war. It was afloat and being repaired sufficiently to be towed to Nagasaki when the writer was at Chemulpo. This work must have cost more than the cruiser was worth, and doubtless would never have been undertaken had the Japanese known what a number of Russian ships they were going to secure for their navy later on.

But, returning to the Japanese railroads, the Fusan line is well built and ballasted with gravel and broken stone, and is altogether



Plenty of Room in the Front of the Car!



Korean Soldiers Awaiting Miss Roosevelt.

a creditable piece of work, barring the mistakes in the weight of the bridge piers.

The line from Seoul to Wiju, on the Manchurian border, was originally a franchise granted to a French company, and surveys had been made and construction begun under the direction of the French engineers when it was acquired also by the Japanese, and was built very hurriedly after the war began. It is roughly built, more in the nature of a provisional military line than the other two roads described. This line is being rebuilt, however, and will be extended to connect with Port Arthur and the Manchurian-Russian line some place near Kerin, or south of Harbin. This is all provided for in the new Japanese-Chinese treaty, which has just been published. It is a strategic line built for political and military purposes, and while it is expected to develop the resources of the country it serves, and especially to develop the large forests of the Manchurian-Korean frontier, which was one of the sore contentions which caused the war, still it will probably not pay operating expenses for some years to come; but it is safe to say that the Korean people will be made to stand this burden instead of the Japanese, on the ground that the line is for the protection of the Korean empire.



Ticket Office and Station.

I had no opportunity to see any part of the new Gensang line, which will cross the peninsula from Seoul to Gensang on the northeast coast of Korea, and provide communication with the east coast, and at the same time open up a good and wholly undeveloped country. It was understood that this line has been surveyed and construction work had been started several months ago, but all these Korean projects require a large amount of money, and must, of necessity, proceed slowly, as the Japanese have not the funds at the present time to carry out extensive works in the development of Korea, and they will only accept foreign money in so far as they can control that money and the properties developed themselves. It is pretty safe to predict that the day when railroad franchises, mining licenses and the control of any public utility can be acquired by foreigners in Manchuria and Korea is past. The Japanese will buy foreign goods, railroad materials, rolling stock and machinery for the development of these new possessions, and borrow foreign capital to pay for the proposed works, but at the same time they will keep a firm hand on all franchises and control of the industries of these countries; and there is no doubt that the Japanese hope and expect within the next twenty years to develop their own resources and industrial institutions to the point where they can also manufacture and supply all of the goods and materials, machinery, etc., which will be required for the Manchurian and Korean trade.

The Korean railroads are at present equipped with good American locomotives of standard design and build, and with rolling stock built mostly by the American Car & Foundry Company. The passenger cars are neat and comfortable, even if they are not elaborate or gorgeously fitted. The freight cars are entirely fitted for the traffic.

Passenger traffic is divided into three classes—first, second and third. The first and second class passengers occupy the same cars, which are merely separated by a wooden partition in the center of the car. The difference is simply in the finishing of the interior fittings of the cars, the first class compartment being a little more elegantly finished and furnished than the second class. The third class cars are very plainly finished, with no upholstery and plainly painted inside.

The passenger fares are very cheap being about three cents a mile for first class, two cents for second class and one cent for third class. The great bulk of the traffic is passenger traffic, which forms probably 70 per cent. of the business done by the railroads. Third class passenger traffic predominates, and forms probably 90 per cent. of the entire passenger business. The first and second class cars are never full, and can scarcely pay the railroads for hauling them.



Lines in Operation at Turnout.

Freight rates are reasonable and sometimes very low. For instance, on the Chemulpo-Seoul line, where there is water competition, the railroad has at times carried coal as cheaply as 50 cents a ton, and other merchandise in proportion.

There is ample and excellent steamer communication and connections between the railroad terminal points of Chemulpo and Fusan and the ports of Japan. Steamship service is very frequent, and passage most reasonable. There is a fine new steamship service between Fusan and Shimonisaki, so that passengers can leave Seoul in the morning at 7 o'clock, arrive in Fusan at 8 o'clock in the evening, go right aboard the steamer and arrive at Shimonisaki or Moji early the next morning, or just 24 hours from the capitol of Korea to Japan, where passengers can take train for Tokio, Yokohama or any part of Japan.

With the exception of the gold mines mentioned above, the only purely American enterprise of importance at present in Korea is the American-Korean Electric Co., which owns and operates the Seoul electric trolley lines and the electric light plant.

This was a concession granted to Messrs. Collbran & Bostwick, associated with certain Korean gentlemen, of which the Emperor himself was probably one. The franchise was an exclusive one for 35 years, and may be renewed on terms to be arranged by the parties. On the completion of the line it was to be taken over from the builders by the Korean company and paid for. Probably because it was built to sell, and also because of limited capital, it was laid with 25-lb. rails and with narrow gage track, and generally gives one the impression that it was built to sell.

Upon completion the company found difficulty about securing the necessary funds to pay for the line, and it remained in the hands of the builders who operated the line. Finally, it was reorganized as the American-Korean Electric Co., of which one-half of the stock is owned by the Emperor of Korea and one-half by Messrs. Collbran & Bostwick. The company is incorporated under the laws of Connecticut.

The line was opened in 1899, and was almost immediately stopped by the natives, who forcibly tore up parts of the track, burned cars and caused considerable loss to the company. There was an unusual and long drouth in the country. They said that the power house rested on the "Rain Dragon's" back, and their crops were being destroyed because he could not do his work. Two days after the riot the long-delayed rains came, and upon resuming operations six months later American motormen and conductors were employed in place of the Japanese, who had previously been employed. The superstitions were gradually dispelled, and have finally been entirely removed.

The American motormen and conductors at $100 per month added greatly to the expense of the operation, and the line was operated at a loss. Their contracts were canceled in 1903, and the Koreans who have been employed in their places give good satisfaction and receive $10 per month. The railway is now in the sixth year of its existence, and the earnings have steadily increased since 1903. Its advantages are now recognized by the people, all prejudice having been overcome, and its prosperity is increasing rapidly.

The electric light service was inaugurated by this company in 1901 in Seoul. The demand for electric light continues, and is in excess of the capacity of the plant. The trolley lines have a present mileage of 10.7 miles of street railway. The company aims to run a five-minute service on the principal part of the line. The gage of the track is 3 ft. 6 in.

It is now proposed to rebuild the power plant and increase the capacity greatly. Also to practically rebuild the whole line and extend same by the addition of five miles of new suburban line, as it has been amply demonstrated that the line will have a permanent and increasing traffic. For this purpose, bonds have recently been negotiated in London, which was the object of my visit to Korea. The improvements are under the supervision of Messrs. J. G. White & Co., of New York, who are the consulting engineers to the underwriters of the new bond issue.

The concession carries no obligations as to track level, maintenance of way, paving or regulation of fares, these matters being left entirely in the hands of the company. The company appears to have the right to extend its lines to any part of the city using any public street, and also has the exclusive right of public lighting. It has no fixed contracts with the city for street lighting, although light is supplied for that purpose at agreed rates.

The line is divided into zones, and ticket offices are established at various points along the line where passengers are required to purchase tickets before entering the cars, as fares are not collected on the cars by the conductors. The fare is about 2½ cents per zone, in our money, and the line is divided into four zones, at the rate of about one cent per mile.

The plant is about as follows:

Boilers are of the Babcock & Wilcox type, and engines of MacIntosh & Seymour make.

The electric equipment is made by the General Electric Co. and the Westinghouse Co.

The cars were built in Japan out of Japanese wood, with trucks and iron work by the J. G. Brill Co. The road-bed is simply the public street laid with T rails at any level, and not ballasted except with sand, which is obtainable everywhere from the coarse disintegrated granite formation of the ground. There are no local regulations regarding street traffic.

Bridges are of the wooden trestle type, and built of Oregon fir. Poles are also of pine and may be erected of any size or height the company may desire. The track is single, with numerous turnouts for car crossings. The buildings and power house are usually of good, substantial construction, being built of bricks and granite. The car barns are of wood.

The company pays no taxes of any kind, not even customs duties on imports, and there is no land nor property tax in Korea.

The city of Seoul lies in a valley of slightly rolling hills surrounded by mountains. The population is estimated to be about 300,000, of which 200,000 live in the city proper and 100,000 more in various outlying suburbs, all of which will be served by the street railway. It is a large city, built with fairly substantial houses. The street traffic is very dense, and streets fairly swarm with people.

The people do not patronize the street cars and steam railroads at present to the extent that usually prevails, owing to two principal causes, mainly because of their limited means, and partly on account of the poor service afforded, as it has long ago been demonstrated that even a semi-savage appreciates the difference between a good and bad service.

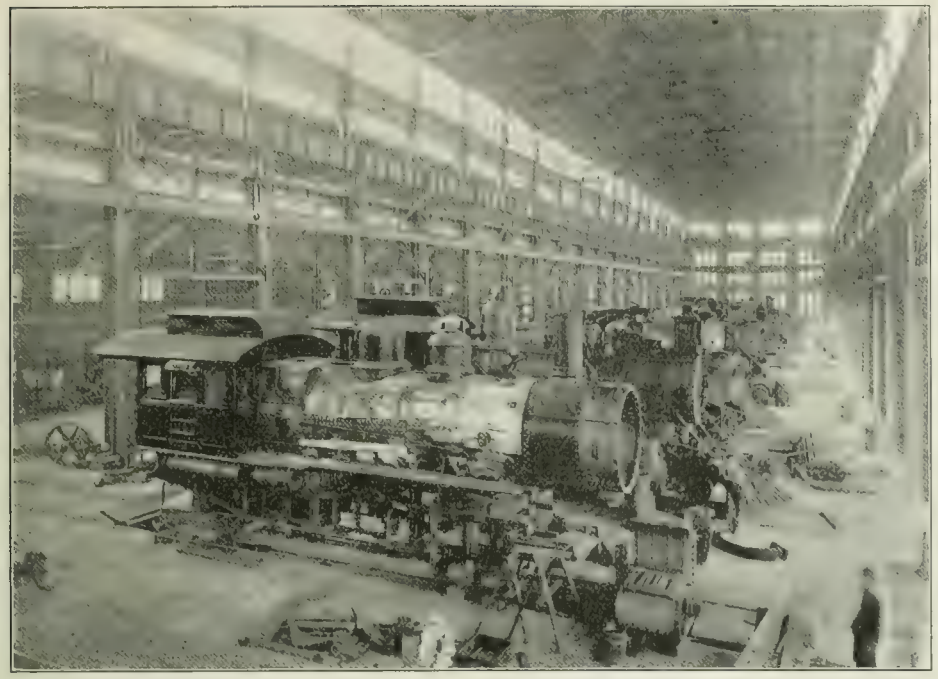
As the earning power of the people increases, as it will do under Japanese direction of affairs, the people will undoubtedly patronize the railroads and street car lines much more than they do at present.

The sensible and logical thing to do with this plant is to consolidate with the Chemulpo & Seoul railway, 26 miles long, and operate the present street railways and light in Seoul, the steam railroad to Chemulpo with its heavy passenger traffic, and the Chemulpo electric light plant under one management, and supply the power for operation from one plant.

The Electrical Equipment of the South Louisville Shops of the Louisville & Nashville.

The electrical equipment of the South Louisville shops of the Louisville & Nashville has been carried out with the same care and thoroughness as was the general layout and other details of the plant which were fully described in the *Railroad Gazette* of June 9, 1905. As was then shown, in the general plan, the shop buildings are grouped around a transfer table having a bridge 100 ft long and a transverse travel of 1,050 ft. The bridge is operated by a railway motor capable of driving it at a speed of 12 miles per hour. By means of sliding clutches the motor may be disconnected from the bridge drive and connected to a drum to pull coaches and locomotives onto and off of the bridge. Along the north side of the transfer table lies the largest building of the group, having a length of 1,000 ft., and including under one roof the boiler shop, the general machine shop, and the erecting shop. The south bay of this building is divided into 40 sections and every section has a track connecting with the transfer table. Eleven of these sections are in the boiler shop which is separated from the erecting shop by a brick wall 12 ft. high. A general view of the erecting shop is given herewith. The distribution of light in this building is excellent as will be noticed. The erecting floor is served by a 100-ton electric traveling crane provided with two trolleys and capable of carrying the largest sized locomotives from any part of the erecting shop over the wall into the boiler shop. A 10-ton crane on a lower runway serves to carry small parts. The traveling cranes, of which there are 11, are all of the Niles Company's make.

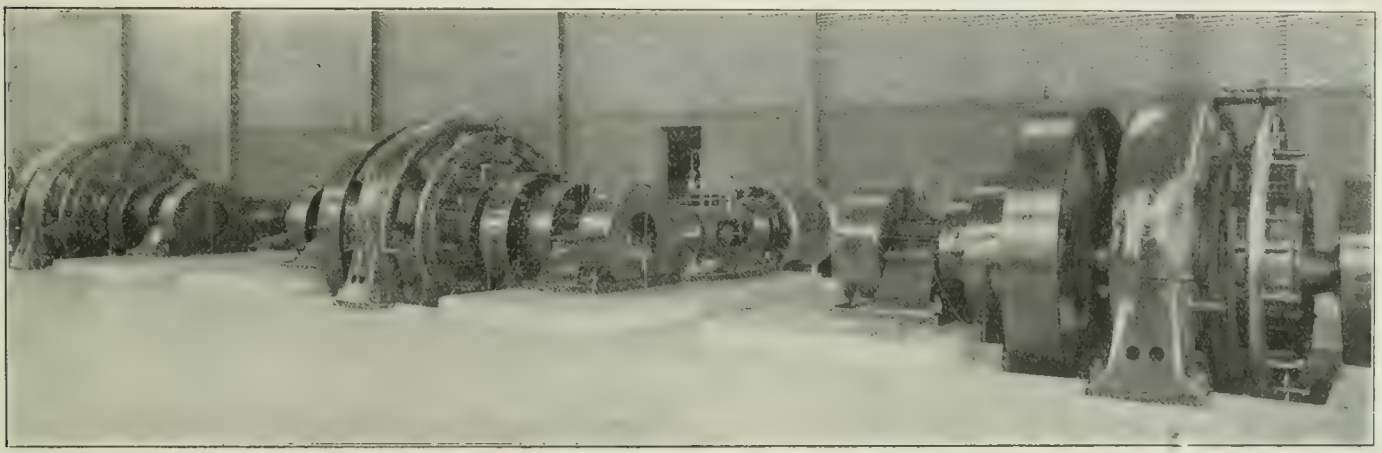
The most interesting applications of electric drive are found in the machine shop. Near the middle of the shop is a switchboard controlling the various local feeders and connecting them to the mains running to the power house. Near the switchboard is located a Bullock three-wire multiple-voltage balancer which is shown in the accompanying illustration. This divides the 240 volts supplied by the mains into 100 and 140-volt circuits. A third wire, in addition to the generator mains, serves to supply three different voltages, viz., 100, 140 and 240 volts, to the motors driving machine tools, which it is desired to operate at variable speeds. These different voltages are applied successively to the motor armatures by means of Bullock type "Y" controllers and intermediate speeds, and speeds above the normal at 240 volts, are obtained by the use of shunt field resistance. A 90-in. Niles driving-wheel lathe is driven by a Bullock type "N" motor operating on the three-wire system. Other special tools are a Bement-Niles three-head frame slotter and an American three-column radial drill. These tools are driven by Bullock variable speed motors as are also a number of heavy lathes and other tools of various kinds. The motors driv-



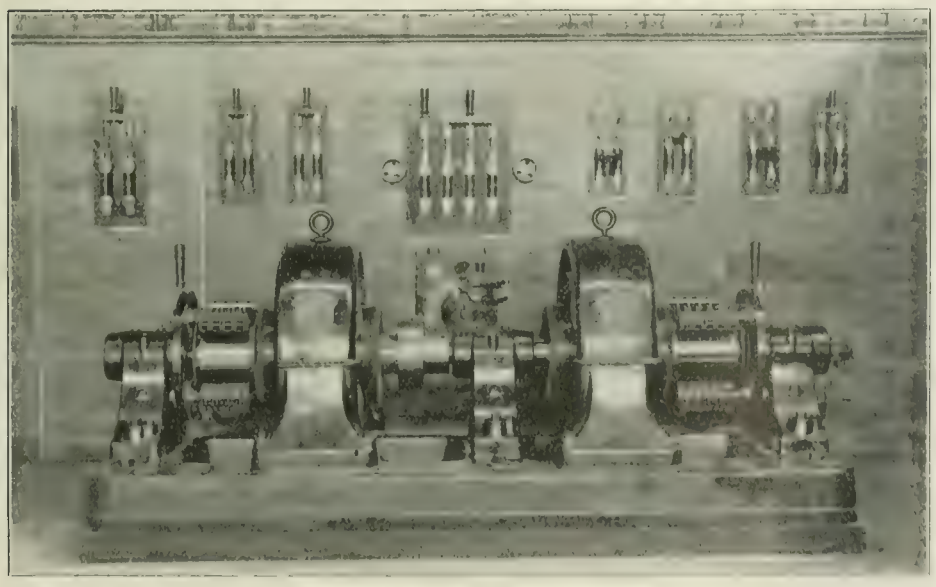
General View of Erecting Shop—South Louisville Shops of the Louisville & Nashville.

ing these large tools are rigidly connected to the machines and the power is transmitted through gears. Such tools as are operated at constant speed are belted to a line shaft which is driven by a belted motor. In the boiler shop the large punches and shears are driven by individual motors which are belted to the tools. Compound wound motors are used, and the usual arrangement is to place the motors close to the machines on foundations built a few inches above the floor. The slipping of the belt in starting, due to the unusually large inertia of this class of tools, allows the motor to start with much less current than would be required if the motors were geared, and the compounding of the fields has the same effect, as it increases the torque of the motor.

To the north of the machine shop lie the forge shop and the wheel shop. In the forge shop, motors are used where possible, but, as nothing has been found thus far to displace steam hammers, the number of motors is not very large. In the wheel shop, the machine tools are all of a constant speed type and are belted to countershafting driven by a Bullock 60 h.p. type "H" motor. To the north of the wheel shop lies the foundry, and electricity is used for all purposes to which it is applicable. The drop for breaking the scrap, the blowers for the cupolas, and the ventilating fans as well



Interior of Power House; Louisville & Nashville Shops, Showing Three 350-K.W. Allis-Chalmers "Bullock" Type "I" Generators Direct Connected to Cross-Compound Engines.



Allis-Chalmers "Bullock" Three-Wire Multiple-Voltage Balancer with Switchboard for Controlling Local Feeders. South Louisville Shops of the Louisville & Nashville.

as the cranes, are all motor driven. The distance from the power house to the foundry is so great that no other method of transmission could be considered. Placed along the east side of the foundry is a runway supporting a traveling crane, and this runway passes along the side of the wheel shop, the end of the machine shop, and extends as far as the transfer table. The crane bridge is 40 ft. long, thus giving excellent yard service to the various shops and affording a very satisfactory method of transporting material from one department to another. In the wood shop the tools are operated at constant speed and most of them are driven by belts from line shafts which are motor driven.

The power house is located at the south of the group of buildings where the handling of fuel and ashes can be done most conveniently. The equipment includes three 350 k.w. 250-volt type "I" Bullock generators direct connected to cross-compound Buckeye engines running at 275 r.p.m. Steam at 125 lbs. pressure is supplied by a battery of Stirling boilers provided with mechanical stokers. The coal elevator is motor driven. In addition to the generators the engine room contains a cross-compound two-stage air compressor and a 12 in. x 18

in. x 24-in. fire pump. The switchboard, built by the Western Electric Co., is equipped with Weston flush type. All the piping between the engines and the boilers is carried under the floor. This gives a neat appearance to the engine room, as is shown in the illustration.

The perfection of detail which go to make the shops one of the notable railroad shop plants of the country is largely due to the careful personal supervision of T. H. Curtis, Superintendent of Machinery, who began the work while Mechanical Engineer of the road.

Senator Foraker's Speech.

The speech made by Senator Foraker before the United States Senate in opposition to the Hepburn Bill constitutes perhaps the best argument which has yet been presented on this side of the case. Senator Foraker commenced by saying that the proposed rate legislation was so contrary to the spirit of our institutions and of such drastic and revolutionary character that if not in its immediate effect, at least as a precedent, the consequences are likely to be most unusual and far reaching. He then gave at considerable length a history of railroad development in the United States which it is not necessary to reproduce in these columns. The abstracts that follow show the main line of his argument.

It is not to be wondered at that the upbuilding of such great interests should have been attended with many abuses and evil practices. It would be strange if it had not been. Rather the wonder is that these abuses and evil practices have not been greater than they have been. It would be strange, indeed, if there were not now, notwithstanding the improvements in the railroad situation, evil practices and abuses still remaining for which a remedy should be provided.

These evils are, generally speaking, of three classes—excessive rates, rebates and discriminations. Of these, excessive rates are the least serious.

Nevertheless there should be some prompt and effective remedy provided by the law against excessive rates to whatever extent they may be indulged in and wherever they may be found.

A more serious class of evils, because more prejudicial in their consequences and results, are rebates. They are granted under many forms and guises, and include not only money payments, but all kinds of discriminations between shippers, such as undue allowances for terminal charges, elevator charges, refrigerator charges, icing charges, and private cars, false weights, improper classification, under billing and many others too numerous to mention. The practice of giving rebates was a result of sharp competition between roads for business. At one time almost, if not quite, every road in the country indulged in the practice. The strongest and most prosperous railroads, although, like the others, granting these rebates, were always, as a rule, anxious to put a stop to the practice. In that behalf many traffic agreements and arrangements, of one kind and another, were entered into, including many others that were known as pooling arrangements. All these arrangements and agreements proved ineffectual to a greater or less extent. The pooling arrangements were more nearly observed than any others, but they were unfortunately named, and because they prevented, in some measure at least, free and active competition they were always unpopular. In consequence they were prohibited by the interstate commerce act of 1887. Subsequent to that statute traffic agreements and arrangements were chiefly relied upon. They were in effect simply agreements between competing roads as to what were regarded as reasonable schedules of rates, coupled with the further agreement to maintain the same.

But the Supreme Court of the United States in what is known as the Trans-Missouri case, and the Joint Traffic case, held that these traffic arrangements were in violation of the Sherman anti-trust law, which, until that litigation was commenced, was not generally understood to apply to railroads; they being fully regulated, as it was thought, by the Interstate Commerce Act. The prohibition against pooling and the invalidity, as established by these decisions, of traffic agreements and arrangements left the roads without any adequate remedy against the practice of rebates, which each road felt compelled, in justice to itself, to indulge in because its competitor did; the weak roads to get business, the strong roads to hold it. Very largely on this account the tremendous consolidations of railroad properties resulted which have occurred during the last five or six years. The effect of these consolidations upon rebates and discriminations as to persons and places was no doubt to restrict them somewhat, but the practices continued to such an extent, and with such consequent dissatisfaction on the part of shippers and railroads alike, that the Congress, to provide an efficient remedy against them enacted, February 19, 1903, what is known as the Elkins law.

The Elkins law has proven a most efficient measure for good, and since its passage the practice of giving rebates and allowing discriminations among shippers has been largely discontinued.

HEPBURN BILL.

This bill increases the powers of the Commission in many respects, but I shall call attention to only its most important provisions of this character.

It makes the order of the Commission condemning a rate effective and thereby disposes of that rate, and then authorizes the Commission to name a new rate and put it into operation in place of the condemned rate.

It authorizes the Commission to compel disagreeing railroads that have nothing in common except a physical connection to operate jointly as through routes on such rates and terms as it may impose.

It dispenses with jury trials in an important class of actions to recover money by providing a procedure that makes such trials impossible.

It imposes such extreme, unreasonable and burdensome penalties as to probably invalidate the measure in that respect. It does not provide for a proper review by the courts of the orders of the Commission, but seeks to exclude the same.

There are other provisions that merit attention, but these raise all the questions I care to discuss at this time.

There is a common agreement that, although the railroad situation is vastly improved as compared with what it was only a few years ago, there are still, as there probably always will be, many evils to remedy, and to that end there should be some kind of appropriate legislation.

The principal difference of opinion is as to whether to accomplish this common purpose the legislation to be enacted should be of an amendatory character, such as to work out these remedies in the courts, where ordinary controversies are settled, or should be such as to confer the rate-making power to be exercised in the way provided by this bill on the Interstate Commerce Commission.

I believe in the court plan, as contradistinguished from the rate-making plan, not alone because it is, as I shall endeavor to show, much simpler, much more expeditious, much more efficient, and without expense to the shipper, but because, in addition to all that, it avoids all legal and constitutional questions, while the rate-making plan as set forth in this bill encounters a number of such questions that are of the most serious character, and some of them, in my judgment, fatal.

In the first place, there arises at the very beginning of this controversy a most serious question as to the power of Congress to fix rates at all.

I know it has been assumed throughout all this discussion, as it has been in framing this bill, that we have that power and that it is unquestioned, and I know that there are many expressions to be found in the opinions of the Supreme Court of the United States that indicate a similar assumption on the part of that court, but nevertheless, the fact remains that the court has never yet passed on that question, and there are many eminent lawyers who are of the opinion that the court will hold, when it does decide that question, that Congress does not have that power.

Their reasoning seems to me to be sound, and the effect of it absolutely fatal to this entire scheme of legislation.

I am confirmed in this opinion by what the Supreme Court said in the Northern Securities case where, after discussing the nature of the combination there under consideration and the evil consequences thereof, Mr. Justice Harlan, speaking for the court, said:

> Will it be said that Congress can meet such emergencies by prescribing the rates by which interstate carriers shall be governed in the transportation of freight and passengers? If Congress has the power to fix such rates—and upon that question we express no opinion—it does not choose to exercise its power in that way or to that extent.

This statement, apparently not necessary to the disposition of that case, is, at least, an announcement to the legal profession that the question of the power of Congress to fix rates in the exercise of its power to regulate commerce is an open one, upon which the court will hear argument whenever that question may be presented. If it be an open question for the Supreme Court, so, too, is it an open question for the Senate, and no mere assumption should be allowed to dispose of it. We cannot dispose of it by ignoring it. It must be argued in the courts, and I shall, therefore, discuss it now, at the beginning, where it properly belongs.

Congress has no power with respect to interstate commerce except that which is conferred by the commerce clause of the Constitution "to regulate commerce with foreign nations, and among the several States, and with the Indian tribes," and to enact all legislation necessary to give effect to this power.

The controlling questions arising upon the construction of this clause are, first, what is "commerce," and, second, what is included in the power "to regulate?"

It is an elementary proposition that the law, whether statutory or constitutional, is what the framers of it intended it should be, if that intention can be ascertained and be not in conflict with the

language employed, and that it never is what, in the nature of things, it could not have been intended to be.

What, then, was the intent of the framers of the Constitution when they put the commerce clause into that instrument?

I shall not stop to gather this intent from the debates of the convention, from contemporaneous history, or from the restrictions imposed by the Constitution upon the exercise of this power, all of which show that rate making was not within the mind of the framers of the Constitution, but shall confine myself to adjudicated cases and recognized rules of construction.

These authorities (quoting a number of Supreme Court decisions) and others that might be cited establish the proposition that the power conferred upon the Congress as to interstate commerce is precisely the same as the power conferred upon Congress as to foreign commerce; neither more nor less.

This power, being identical in both cases, can not include the power to fix rates to be charged for transportation in the one unless also in the other. During the whole period of our country's existence no one down to this moment has ever claimed, or even suggested, either at the bar or on the bench, that it was the intention of the framers of the Constitution to confer on Congress by the commerce clause power to fix rates of compensation for the carriage of passengers or freight in foreign commerce. This is not alone, because the fixing of the carrier's compensation is not an article of commerce to be transported, not an element in the conduct of commerce that affects one way or another the question of safety or convenience in transportation of either life or property, but also because, aside from all questions about treaties and international relations generally, it would be utterly impracticable to exercise such a power with respect to international commerce. To-day but little of it is carried in ships of American registry. Less was carried when the Constitution was framed. Then as now the great bulk of international commerce was carried in ships and transports over which we could not have, if we so desired, any control whatever, except only while the same might be in our ports or within our jurisdiction. Whatever we might be able to do as to American ships we could not fix rates for foreign ships. The mere suggestion of the situation as to foreign commerce, how it is carried on, and the impossibility of intelligent action in prescribing rates of charges is enough to show that such an exercise of power was not and could not have been contemplated by the framers of the Constitution when they conferred on Congress the power to regulate foreign commerce.

But if this power was not conferred as to foreign commerce neither was it as to interstate commerce.

The advocates of rate-making legislation cite decisions of the Supreme Court to the effect that the power to regulate commerce conferred upon Congress by the commerce clause is a complete plenary power. This is true, but the complete power spoken of by the court is the power to regulate. The question remains whether or not within this complete power to regulate is included the power to fix rates of compensation for a carrier to charge for the service he is to render; and for the reason that it is not necessary to the execution of the power "to regulate," which goes properly no further than may be necessary to insure comfort, safety, and uniformity of regulations in the transportation of passengers and property, and because, in the nature of things, such a power can not be exercised and never could be exercised with respect to foreign commerce, it never could have been the intention of the framers of the Constitution that any such power should be conferred.

This does not leave us at the mercy of the carriers.

In other words, if it be held that the Congress has no power to fix rates, it does not follow that there is no power in the Government to control charges to be made for the transportation of interstate commerce.

It does not so follow, because all carriers of interstate commerce, like all other public utilities, are required, in the absence of any statutory provision, simply because of the common-law rule, to charge only reasonable and just rates, and to abstain from the practice of unreasonable discriminations between individual shippers and between independent localities. This rule of the common law has been universally recognized in this country, and has always been enforced in courts of equity when their jurisdiction in such cases has been invoked. If, therefore, there were no legislation on the subject, any shipper who might be charged an excessive rate could either pay and recover back in an action at law, in a law court of proper jurisdiction, or, to avoid a multiplicity of suits, he could exhibit his bill of complaint in a court of equity and secure relief by injunction. These propositions are elementary and do not need a citation of authorities for their support, but the books are full of cases in point.

The framers of the Constitution did not, therefore, when they conferred on Congress the power to regulate interstate commerce without coupling with it the power to fix rates, leave shippers and travelers at the mercy of the carriers as to rates of charges, discriminations, or other wrongful practices, but, on the contrary, provided for them complete remedies in the system of courts for which they made provision.

But if it should be that I am mistaken in claiming that the power to fix rates is not comprehended within the power to regulate interstate commerce, and it be assumed that Congress has the power to fix the compensation of a carrier for the transportation he sells, then the further question arises, how shall Congress exercise that power?

Manifestly it is utterly impossible for Congress by statute to fix all the rates for interstate commerce. It must resort to some plan under which it can avail itself of the help of some kind of board, commission, tribunal or agency. But when it undertakes to do this it must take heed lest it undertake to do it in such a way as to delegate legislative authority and thus make its effort unconstitutional and unavailing, for it will be conceded that it is unconstitutional for Congress to delegate legislative power.

The chief provisions of the Hepburn bill is that if after hearing a complaint the Commission—

> be of opinion that any rates are unjust or unreasonable, or unjustly discriminatory, or unduly preferential or prejudicial,

it shall have power—

> to determine and prescribe what will, in its judgment, be the just and reasonable and fairly remunerative rate or rates. . . . to be thereafter observed in such case as the maximum to be charged: . . . and to make an order that the carrier shall cease and desist from such violation . . . and shall not thereafter publish, demand or collect any rate . . . in excess of the maximum rate . . . so prescribed. Such order shall go into effect thirty days after notice to the carrier.

The first question raised by this provision is whether or not all three of the powers of government, legislative, judicial and executive, can be centered and commingled in a political board, claimed to be administrative in its character.

This proposed legislation is radically different in this respect from the interstate-commerce act. By that act the Interstate Commerce Commission was empowered to hear complaints as to unreasonable rates, and if upon such hearing it concluded that the rates challenged were unreasonable, it could condemn them and order the railroad to desist from further charging the same; but the Commission had no power to enforce this order, and if the railroad refused to comply with it the only remedy was for the Commission to sue the road in court upon the order, to secure there, by judicial decree, its enforcement.

The hearing of the complaint and the making of a finding and order with respect to a rate were to that extent in the nature of a judicial procedure, but it was not judicial in fact, because the Commission had no authority or power to give effect to its order when it made one. The net result of what it was authorized to do was, to employ the language used in the Minnesota statute already quoted, to make a recommendation, for that is all its action amounted to. If the road did not see fit to accept the conclusion of the Commission, resort must be had to the courts, where alone judicial power could be exercised.

I mention this with particularity to show that the very able lawyers who, as members of the House of Representatives and the Senate, framed the interstate-commerce act of 1887, carefully avoided conferring on the Interstate Commerce Commission any kind of power except only executive power, for they stopped short of giving it judicial power by refusing to it authority and power to execute its orders and decrees, and they carefully refrained, as the Supreme Court held, from conferring upon it the legislative power of making a new rate to be substituted for a condemned rate. They gave only the one kind of power, because they were familiar with the rule, and by their action showed their respect for it, that two kinds of power, much less three kinds of power, could not be conferred on what they clearly intended should be in legal effect, as well as in practice, only a purely executive or administrative board. This Hepburn bill, however, gives to the Commission the additional power of executing its judgment of condemnation of a rate, which makes the power purely judicial, and then in addition gives to the Commission the power to substitute a new rate for the one it has condemned and put out of existence, which is a purely legislative act.

In addition to these two new powers, judicial and legislative, never heretofore by any act conferred on the Interstate Commerce Commission, it is allowed by this Hepburn bill to retain all the executive power with which it was originally invested, with much more power of that character added.

That the bill is unconstitional, because of this commingling of all these powers, appears beyond question.

(Senator Foraker here quotes a large number of cases to show that the delegation of legislative power to a commission is unconstitutional, and says—)

The essence of all these decisions is given in the case of Field *v.* Clark, page 693, where, as stating the true rule, they quote Judge Ranney, as the Wisconsin cases did, as follows:

> The true distinction is between the delegation of power to make the law, which necessarily involves a discretion as to what it shall be, and conferring authority or discretion as to its execution, to be exercised under and in pursuance of the law. The first can not be done; to the latter no valid objection can be made.

I repeat this quotation to emphasize it.

This rule indicates the distinction running through all the well-considered cases on the subject of the delegation of legislative power. According to this rule the test is whether or not the party on whom the authority is conferred is intrusted with any discretion to make the law; if so, the statute is unconstitutional. If, on the other hand, no discretion be conferred, but only an administrative duty be enjoined, the statute is valid. Discretion may be allowed as to its execution, but none as to what the law shall be.

When it is remembered that the States, except only as to the powers by them delegated, are complete sovereignties, and when it is remembered that they have complete sovereign power as to rates and railroads within their borders, there cannot be any question of the right of the State, acting through its legislature, when all legislative power is conferred upon the legislature, or acting through commissions, where the constitution provides for the creation of a commission and for the exercise by it of legislative power as in the States of Mississippi, Texas, Louisiana, Virginia, and other States, to make rates, and to prescribe regulations, and to do, generally speaking, all the things they have been authorized in such States to do; but the case is wholly different as to the Federal Government, which has no power, except that which is delegated and such as is necessary to be exercised to give effect to that which is delegated.

The Constitution of the United States expressly provides that all legislative power shall be vested in Congress, and it further provides that the Congress shall have power to regulate interstate commerce. There is here no division of legislative power, nor is there any authority to the Congress to delegate to any commission, board, or tribunal, or agency, any part of its legislative power. The legislative power conferred upon Congress can not, therefore, be exercised by any authority except only the Congress itself, and the only question remaining is whether or not the conferring of the power to make rates upon a commission or tribunal is a delegation of that power, and that question must be determined by the terms of the statute conferring the power. If Congress has the power to fix rates, a commission can be created and it can be utilized in the fixing of rates. But it can be utilized only under some such statute as those enacted by the legislatures of Iowa and Wisconsin, when, in 1873 and 1874, they passed their respective statutes, classifying the railroads according to earnings, and providing that the officials chosen to execute them should, by computation, taking the classification as a basis, determine what statutory rate should apply. That was administrative.

The Congress could also utilize the Commission in the fixing of rates if it should see fit to resort to the policy of a mileage basis. But for the Congress to simply declare what is already the law, for it is only declaratory of the rule at common law, that rates shall be reasonable and just, and then create a commission and empower that commission to say what in its judgment a rate shall be, is, most clearly, to confer legislative power, because the rate to be fixed is the law to be enacted, and that is to be determined by the discretion of the Commission instead of the discretion of the Congress. And not only is it a delegation of legislative power, but it is a delegation of all the power the Congress has on the subject, for Congress cannot constitutionally make a rate that is not a reasonable and just rate. If extortionate the courts would enjoin at the suit of the shipper, and if confiscatory they would enjoin at the suit of the carrier—in both cases on the ground that property was being taken without due process of law.

But if this bill be enacted and be upheld, notwithstanding these objections, then another serious legal question arises. By the sixth paragraph of the ninth section of Article 1 of the Constitution it is provided that "no preference shall be given by any regulation of commerce or revenue to the ports of one state over those of another. * * *"

(Senator Foraker then gave a history of port differentials.)

From the quotations made, and others that might be made, it is clearly shown that the purpose of these differentials is to measure as nearly as may be the respective advantages and disadvantages of the ports of entry named; and what is true as to New York, Boston, Philadelphia and Baltimore, is equally true as to Newport News, New Orleans, Galveston, and other ports of entry, and the purpose of these differentials has no relation, except indirectly and incidentally, to railroad rates, but have reference solely and directly to their effect on the respective ports of entry.

Railroads are not restrained by any law or constitutional provision from making agreements of this character. That they are of the highest importance not only to the ports with respect to which they are made, but to the whole country, is universally conceded. Without these differentials there would be a natural tendency to concentrate exports at the port having the best harbor and shipping facilities, provided it could be substantially as easily reached by rail from the interior. The differentials are, therefore, essential to the maintenance of the system of diffusion and distribution that is now in force as to our export traffic, and which is of such vast importance not only to the railroads and these different cities, but to the whole country. But to maintain these differentials means that cities are not to have the benefit of their natural advantages, for they are to be offset or overcome by the differences in rates that are agreed upon.

The entire history and purpose of these differentials show that they are not indirect nor incidental preferences for the ports they favor, but that they are direct and intentional for the express purpose of overcoming the results of natural advantages and natural competition. Preferences are their principal purpose, not an incident. The cities themselves recognize this, for it was the cities and not the railroads that asked for the recent hearing before the Interstate Commerce Commissioners, sitting as arbitrators, when they had occasion to deliver the opinion from which I have quoted.

Now, as to the application of all this. If Congress undertake to exercise its power to regulate interstate commerce, it must exercise that power subject to all the restrictions and limitations imposed upon it by the Constitution. It must, therefore, avoid, in the exercise of this power to regulate, coming in conflict with any other constitutional provision that has application to it.

The Hepburn bill seeks to avoid the question by entirely ignoring differentials in connection with its expressed purposes. This is open confession that Congress has no power, acting directly by commission or otherwise, to observe these differentials in the making or fixing of rates. Thus the authors of that bill acknowledge that the whole system of differentials is founded on a purpose to give direct preference to the ports respectively favored at the expense of other ports, and, therefore, if done by Congress, in contravention of the constitutional provision under consideration.

The Commission clearly understands that the sole purpose of the differentials is to interfere with and affect the results of natural competition, thus directly and intentionally aiding one city to the corresponding prejudice of others. This is something carriers, unrestrained by law, are at liberty to do, and something that is of great advantage to the whole country, but which the Congress is expressly prohibited from doing, because it shall give no preference whatever as between the ports of different States.

But if we invest the Interstate Commerce Commission with the power to make rates it must exercise that power subject to this prohibition of the Constitution that there shall be no preference for the ports of one State over those of another. The whole system of differentials must in consequence be abandoned. As a result each city will then be entitled to its natural advantages, not only of location but of railroad and shipping facilities and every other kind of advantage it may possess. As a practical result New York will at once have over Boston, Philadelphia, Baltimore, Newport News, and all the other competing ports of entry, respectively, the advantages measured by their respective differentials.

THROUGH ROUTES AND JOINT RATES.

The Interstate Commerce Act of February 4, 1887, provided for the supervision by the Interstate Commerce Commission of through routes and joint rates, but the provision of that act with respect to through routes and joint rates applied by its terms only to the common carriers "subject to the provisions of the act."

In other words, the provisions of that act as to through routes and joint rates were limited in their application to carriers engaged in transportation wholly by railroad and transportation partly by railroads and partly by water, which carriers were "under a common control, management, or arrangement for a continuous carriage or shipment," etc. The provisions of the statute applied when the carriers, if they were separately owned and entirely distinct from and independent of each other, themselves established a through route and made an agreement as to the terms and conditions upon which freight and passengers should be transported over it. There was no attempt to compel carriers that could not so agree, or, for any reason, would not so agree, to submit to the establishment of through routes and joint rates, and the apportionment of the same by the Interstate Commerce Commission.

But the first section of the Hepburn bill amends the first section of the Interstate Commerce Act of 1887 so as to make it read in this particular as follows:

> That the provisions of this act shall apply to any common carrier or carriers engaged in the transportation of passengers or property wholly by railroad (or partly by railroad and partly by water when both are used under a common control, management or arrangement for a continuous carriage or shipment) from one State or Territory of the United States to another, etc.

The effect of this amendment is to make all its provisions applicable to all railroads without regard to whether they are under a common control, management or arrangement or not, and to routes made up partly of rail and partly of water transportation only in a certain contingency, namely, when, as under the old statute, they are subject to a common control, management or arrangement.

What it is thus proposed to do can be done, and done legitimately, but it cannot be done in the way provided in this bill. What this bill thus provides for is a taking of private property for public use, and although that property, if you take again the Pennsylvania road for illustration, is already subject to a public use, it may be put to an additional public use, namely, a use by the connecting carrier or carriers to the extent indicated, but private

property taken for a public use, although it may be a railroad already devoted to public use, cannot be taken without making just compensation. The ascertainment of what is just compensation in such a case is like the ascertainment of what is just compensation in any other case, a purely judicial function that cannot be exercised by a board, but only by the courts. In determining what is just compensation in such a case not only must rates of fare and the apportionment of the same be considered, but the franchises and every other element of value that may be taken or affected must be taken into the account.

Congress has no power to dispossess the courts of their jurisdiction to fix this compensation, neither can Congress prescribe a rule by which the compensation shall be ascertained.

(Monongahela Navigation Co. v. the United States, 148 U. S., p. 312.)

THE BILL ELIMINATES JURIES IN CASES WHERE THE PARTIES ARE ENTITLED TO THEM.

Section 5 of the Hepburn bill purports to amend section 16 of the Interstate Commerce Act as amended March 2, 1889. It would be more correct to have provided that what is set out in section 5 should be a substitute for section 16, because of the great dissimilarity not only in language but also in legal effect between section 16 as it now stands, of the interstate commerce act and the section as it will read if amended as proposed. Section 16 of the interstate commerce act as amended March 2, 1889, authorizes the Commission, or any party interested in any order the Commission has made under the provisions of that act, to apply by petition to the circuit court of the United States, sitting in equity, to enforce such order on complaint that the same is being violated, and the court may, in ordering compliance, make also an order for the payment by the carrier of such sum of money not exceeding $500 per day for each day that the carrier shall fail to obey its order of injunction or other process. This is in the nature of a fine for contempt, and therefore clearly within the power of the court to impose.

Controversies requiring a trial by jury are especially exempted from the operation of this provision of the existing statute.

It can not be claimed for the framers of this provision that they overlooked the fact that under the seventh amendment to the Constitution, in any action brought to recover money, if the amount involved be more than $20, the parties are entitled to a trial by jury, for the provision of law now in force, which they were amending, was framed with careful reference to that fact and so as to preserve that right. It would seem, therefore, that they have intentionally framed this section in plain disregard of that constitutional provision.

The bill does not provide for any proper review by the courts.

Many other objections and imperfections might be pointed out, but enough have been mentioned to show why the framers of this bill should seek by the terms of it to prohibit a full review by the courts of the orders and proceedings of the Commission, except only as to whether they have been "regularly made," which means nothing more than a review of the question in any given case, whether an order of the Commission condemning a rate and fixing another to take its place has been made in conformity with the proceedings and requirements of the statute, not whether the rate condemned was or the rate substituted is reasonable or just or fairly remunerative as the bill allows and requires.

The points mentioned are sufficient, however, to show that if by any possibility this bill should be both passed and upheld by the courts, the powers conferred by it upon the Commission are so vast that there is a special reason in that fact alone for subjecting the exercise of them to the most careful scrutiny and review by the judicial department of the Government, not only on behalf of the railroads, but also on behalf of the shippers.

And yet this bill, thus confessedly unsatisfactory to every member of the House committee and probably to every member of the House of Representatives, passed the House without amendment, because, as the newspapers announced, "the order had gone forth" that, while there might be debate, no amendment—no matter how necessary it might appear—should be allowed. The bill came to the Senate, and, so far as the committee is concerned, there has been a repetition of that experience. No matter what may be its defects and no matter what this, that or the other Senator may think, not an "i" shall be dotted nor a "t" shall be crossed of all this important measure. To even suggest that the bill is filled with unconstitutional provisions or that it will prove impracticable in operation is heralded as a species of treason and disloyalty—to whom or to what nobody knows. The whole proceeding is without a precedent in my experience as a member of this body and probably without a precedent in the history of the nation. If we are to abdicate our functions and permit such an imperfect, ill-advised and ill-considered bill to become a law, discredit will attach and disappointment will follow, not only to "those who desire such legislation," as the House committee suggested, but to all the people of the whole country.

It will prove thus disappointing because if it does not fail and perish in the courts, experience will shortly demonstrate the utter impracticability of satisfactory rate making by a commission.

What, then, are we to do? The answer is plain. We can accomplish everything desired by simply amending the Elkins law so as to broaden and strengthen it and make it more available.

This is easily done. An amendment making such provision will be offered at the proper time. I shall try to find opportunity to speak upon it then at such length as may be necessary to fully explain it. For the present it is enough to say that the purpose of this amendment will be not only to preserve the benefits of this salutary law, but to make them available, for every kind of case that can possibly arise, to the humblest shipper in all the land. This may be done by extending the provisions of the third section of the Elkins law to excessive rates, and by making it specifically applicable to every kind of rebates and discriminations as to both persons and places, and by making it the duty of the Interstate Commerce Commission not to act as judges, and legislators, and prosecutors, and sheriffs, but to address themselves to the purely executive duties of hearing complaints, exercising their powers of conciliation, and, where these powers fail and they find there is probable cause, sending the case at once, through the Attorney-General, to the proper court for immediate proceeding, in the name of the Government, for the benefit of all parties interested, without expense to the shipper.

The great difficulty shippers have had in the enforcement of their rights against the railroads has been that no shipper single handed and alone can, as a rule, afford to resort to the law with a railroad for his antagonist. The disadvantage is too great on many accounts, and particularly because the shipper is likely to be subjected to an expense he should not be required to bear; but if he can invoke the protection of the courts in the name of the Government, and without expense to himself, he will not fear to assert his rights, and if the railroad knows that it is charging him an unjust rate, or subjecting him to an unlawful discrimination, and that if it does not desist from such practice it will be called to account in the courts, where it will have the Government for prosecutor, it will in most if not in all cases make haste to agree with him.

Prompt Handling of Competitive Freight.*

The first thing in the prompt movement of L.C.L. freight is to start trains promptly. The receiving doors of freight houses should be closed at a fixed hour, say 5 p.m., and shippers given to understand that goods received after that hour will be held until the next day. Freight going not more than 200 miles should be at destination the next morning at 7 o'clock, and be at the platform ready to unload. Competitive freight should be put in cars carded with a large letter "C" and waybills should be stamped "COMPETITIVE." Carload freight should be reported by telegraph and be closely watched from the general office. The clerk in charge of fast freight records should be one who has had experience in the operating department and who is conversant with schedules, grades and local conditions along the road. The engines of fast freight trains should be kept in the best condition and should be loaded 15 per cent. lighter than on ordinary freight trains. A reduction of 10 per cent. from the standard load is not enough. The engine and train crews should be assigned regularly to the same runs. This is just as necessary as in passenger service. The crews will appreciate the work to be done, know the conditions and realize their responsibilities. They will also take pride in making good records. If there is anything in the wages agreement with trainmen to prevent the assigning of regular crews to fast trains it should be eliminated. It is important to so arrange the engines on different divisions that fast trains can be run through without breaking up.

It would be a great help to the traffic department if fast freight schedules were absolutely maintained; freight agents would then be relieved of any temptation to exaggerate when promising shippers good time. With anything but perfect service they have to draw upon their imaginations, and in striving for competitive freight their imaginations are liable to be slightly overworked.

A Year's Problems Epitomized.†

The calendar year which has just closed has been by far the most successful we have had in the operation of our western lines, with respect to the volume of business, increased train efficiency, reduction in expense of transport, improvement in the passenger service, and handling of package freight; and I think, also, that the movement of the wheat crop has caused less disturbance of the car and the power supply in districts not directly affected by that movement. There has also been greater efficiency in the carrying out of improvements and in the building of new lines. Much of the

*Extracts from a paper, read at [illegible] Canadian Pacific officers at Field, B. C., Feb. 12 and 13, by R. B. Jamieson, General Superintendent of the Company at Calgary.

†From an address made by Vice President William White in opening a meeting of officers of the Canadian Pacific at Field, B. C., Feb. 12.

work has been hurried through and put in use for the handling of wheat traffic.

The disturbing factor that has given myself and the operating officers most grave concern has been the serious accidents. Let us see if by conference we can gain additional knowledge how to combat the influences or circumstances that lead up to this most regrettable feature. * * * I have urged most particularly upon all concerned the exercise of the greatest care in selecting men for the telegraph, engine and train service, and have pressed upon officers



Ralston Flush-Floor Drop-Bottom Gondola Car for the Toledo & Ohio Central.

supervising these departments the importance of keeping their men's knowledge of the rules up to date; also to notice their habits. By careful selection, by getting men of character, and by inculcating obedience to the rules, we should leave only one chance which we cannot guard against—that of error in judgment.

The matters that I look for the most improvement in this present year are, first, the time of our passenger trains; acceleration of their speed as far as the track conditions will permit, and cutting out all dead time at stations; also the education of enginemen so that they will make greater effort to maintain their schedule, or to recover time, when starting behind time. Second, the first-class freight service. Third, the car supply for points distant from headquarters. Fourth, the hurrying home of foreign cars. In no account in our expenses have we made such an improvement as in this last, but the improvement has not yet reached my expectations.

I would urge upon all to curtail their correspondence. Do as much of your business as possible in personal contact with your officers, thereby leaving more time at your disposal for originating improvements in the handling of traffic.

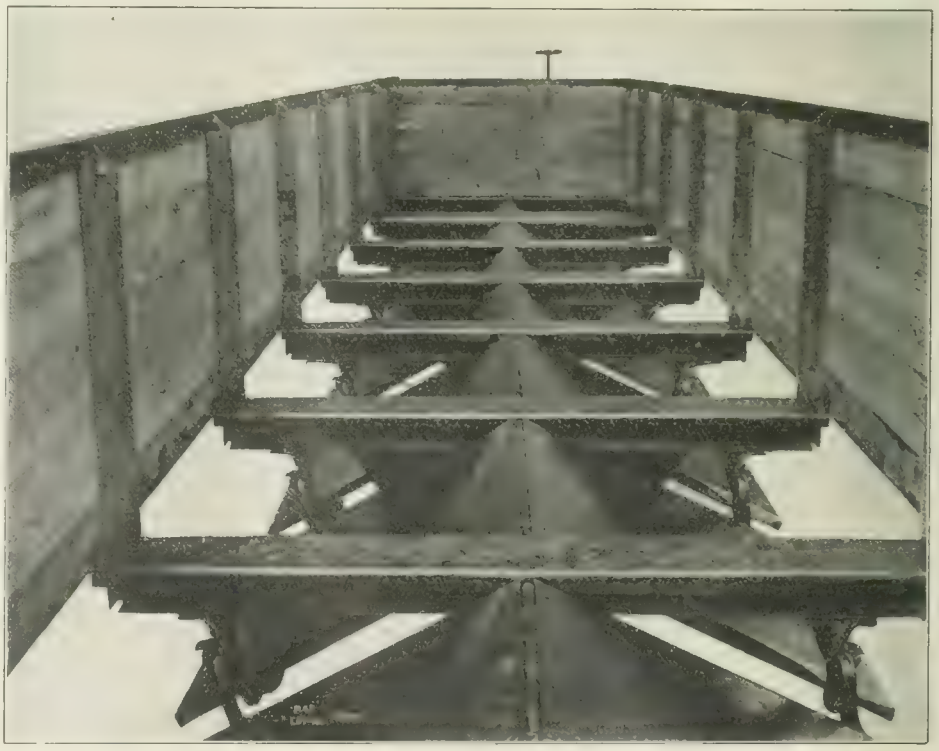
Now that the rates of wages paid in all departments have gone up so much, we should take every means to cull from the service all who are not fully capable of giving service equivalent to the rates paid, and to secure a continued and improved economy in the employment of men in all branches of our maintenance work.

This company has been the pioneer in business enterprise in the west and should retain the lead. This is no small task, for the great increase in the wealth of the country has attracted shrewd men from many countries. If the officers and men of this company will see that all the business offering to it is taken care of promptly, and that all its trains, passenger or freight, are run strictly to schedule; and that the fine courtesy on the part of its employees, for which this company is already celebrated, is maintained, we have no need to be alarmed at the advent of competing lines.

The Minister of Commerce in charge of the Hungarian State Railroads has issued an order forbidding employees concerned in train movement (trainmen and most station men) to drink anything intoxicating while on duty and for eight hours before going on duty.

Ralston Dump Car and Steel Underframe.

The interesting design of flush floor, drop bottom gondola car illustrated herewith has recently been perfected by The Ralston Steel Car Company, Columbus, Ohio. The drawings show the improved design, embodying such changes as were indicated as being advantageous from trials of a sample car built for experimental purposes. The photographs show the first car of the improved design to be turned out. The general features of the design are so well shown by the illustrations that little need be said regarding details. The depth and construction of the girder center sills are worthy of special note, however, as is also the body bolster construction. The doors are raised and lowered by a longitudinal crank shaft on each side worked by a ratchet and lever at each end. In the improved design the number of doors has been increased from 12 to 16, and an important change in their length and method of hinging was made, as will be seen best by reference to the cross-section. The center sills were lowered, an I-beam placed on top of the cover plate, and the doors hinged above this with their backs adjoining, doing away with the material-holding space down the center of the first car. The doors are worked in sets of four by the ratchets and levers. Friction of the doors on the shaft is minimized by the use of small rollers on the latter on which the doors rest, enabling one man to raise the doors with ease.

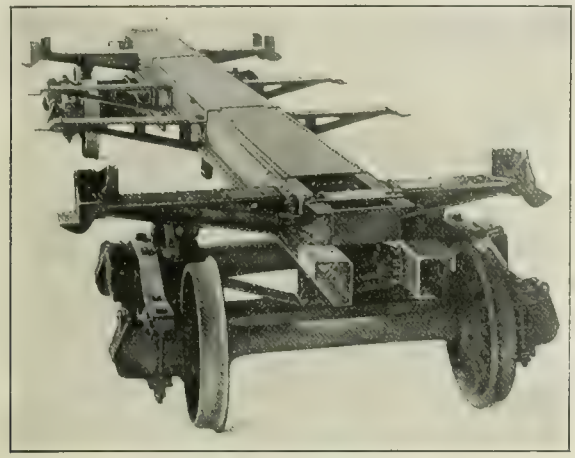


Interior of Ralston Drop-Bottom Car With Doors Dropped.

Also included in the illustrations is a view of a steel underframe design which this company uses in repairing and rebuilding

equipment, of which it does a great deal. The center sills are two 15-in. channels with ¼-in. by 20-in. top and bottom cover plates between bolsters. An 11-ft. reinforcing plate at the center of the sill of the same dimensions completes the box girder. The ends of the center sills are notched and turned down for the wooden end sills.

The needle beams are worthy of note. The top plate is ⅝ in. by 8 in. and is continuous, passing through the center sill webs. The bottom plates are ¾ in. by 8 in., and each passes beneath the center sill flange, being riveted thereto. The plates are riveted together securely at their outer ends and cast-iron filler blocks



Ralston Steel Underframe.

between complete the member. The beam is so designed that when the underframe is applied to the body of an old car the same bolt holes that served for the wooden needle beam can be used for the new one.

The construction of the body bolsters is similar to that of the needle beams, except that the bottom plate is also continuous and the bottom flanges of the center sills and the web are cut out to accommodate it. The sills are reinforced by a ½-in. thick plate at this point. In the application to an old body, the old bolsters can be used by fitting them to the center sills and holding them by a ½-in. cover plate beneath, to which the old center bearing is riveted. This raises the side bearings ¼ in., serving to counteract the permanent set usually existing after a period of service.

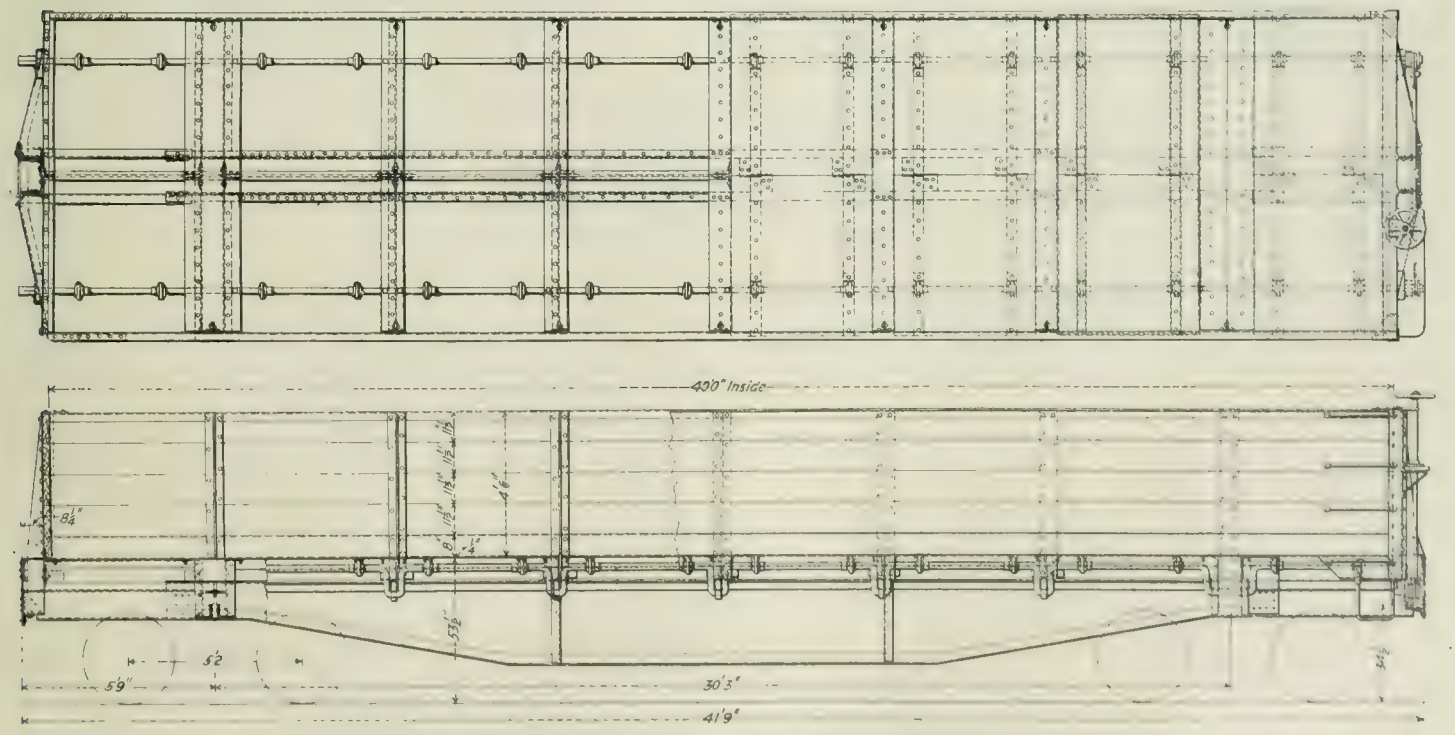
The method of handling the cars in making these repairs is of interest. The old cars on being brought in are fitted at each end with a trunnion which clamps over the end sill above the coupler. The hooks of two cranes are attached to the trunnions and the body lifted off of the trucks, turned over and laid on the floor, enabling the easy removal of the truss rods and brake rigging. By this means the car is stripped in about one-fifth the time that would be required if it were lifted upright and the workmen went under it. The center sills are removed by means of the cranes if necessary. Any needed repairs are then made on the floor, the body painted and stenciled and the underframe applied, little time being required for this last operation. The body is then reversed, set on its trucks and moved into the yard, where any minor repairs needed are made.

The Ralston Steel Car Co. fitted up its present plant in Columbus about six months ago.

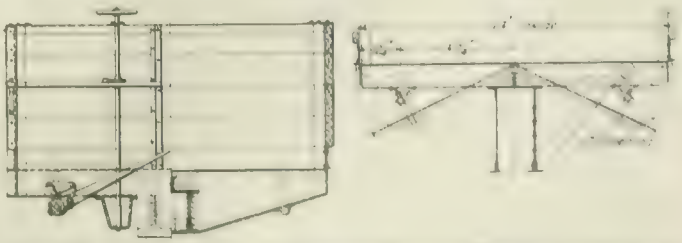
How to Improve Passenger Service.*

There are three essential features in the maintenance of an efficient passenger train service. First, the track. Second, the equipment of the passenger trains, including ventilation and cleanliness. Third, the manning of trains with capable men. Track will be treated by other officers in a separate paper, but we may point out that the preparation of the time-table is intimately connected with the condition of the track. The writer has heard many complaints relative to the nervousness of passengers in the swing of long sleeping cars on curves, due to running trains faster than the elevation of the rail provides for; we alone afford the opportunity to passengers to travel by one line across the Continent, and it behooves us to make every reasonable provision to make such a long journey pleasant, entertaining and satisfactory. There always will be a certain amount of tediousness in such a long journey, the only relaxation a passenger has, outside of ordinary literature and the magnificent scenery in the mountains, is to take a turn on the platform when the opportunity is afforded. The value of buffet and library cars and combination parlor and observation cars is in relieving the tediousness of the journey. We use observation cars on the Pacific division, but this only embraces a small proportion of the journey, and the physical characteristics of the mountain journey are so attractive that time passes more rapidly

*A paper presented at a Canadian Pacific officers' conference at Field, B. C., Feb. 12, by R. Marpole, General Superintendent of that company at Vancouver condensed.



Plan and Side Elevation of Ralston Flush-Floor Drop-Bottom Gondola Car.



Part End Elevation and Cross-Sections of Ralston Dump Car.

than when passing over other sections of the line where the want of points of interest creates monotony.

At times the engines in fast passenger trains were not in first-class condition, and too few engines were run in that service. Too much importance was attached to the mileage performance of such power, with the result of vexatious delays. The practice of restricting the allotment of passenger power to the bare necessity is a mistake, and a costly and aggravating one at that. It is absurd to put at the front end of a train an engine which is not either in appearance or condition fit to handle it. We must have the best of our power allotted to our fast passenger trains, to make it in keeping with the composition of such trains, as well as to avoid aggravating delays. If a man has one or more tally hos in a city for the purpose of securing the patronage of visitors—tourists and the like, and he has competition for such business and desires to advertise and make a good name for himself, he does not put in front of the coach a horse affected with disease occasioned by overwork or natural defects. One of my superintendents says that the practice of using passenger engines in freight service, in order to make a mileage showing is a vicious one; engines assigned to passenger service should be kept only for such service.

A prolific source of annoyance to passengers is that of being compelled to go into a nauseously odorous lavatory—the unsanitary condition of these apartments in the summer season has called for many complaints from our patrons [And those of every other road that we know of.—EDITOR.] and the nuisance must be abated in some way: I refer particularly to first-class and colonist cars; trainmen are remiss in their attention to the lavatories—more frequent examinations and the application of an effective deodorizer and disinfectant is necessary; and this material should be supplied to the brakemen and held by them in a receptacle in one of the cars. If kept in the train box in the baggage car, the men as a rule will not take the trouble to fetch it.

Conductors should make a periodical inspection of all the lavatories in the train, including the tourist and sleeping cars. We now have sleeping car conductors, who will look after the work of the porters, but the conductor of the train must understand that this arrangement does not relieve him of the task of making a close inspection of all cars.

The poor ventilation of cars is a source of complaint, but it is a difficult task to satisfy every occupant of a car in this respect. Regulating the heating of cars requires to be closely watched by the train crew—passengers may be made extremely uncomfortable by inattention or ignorance. With our peculiar and rapid variation of temperature, it occurs to me that special drilling of the men is needed, and this by a competent man acting as train inspector.

An article in the *Railroad Gazette* says "It is against public policy—an injury to the people of the state—that a Railroad Superintendent should use any other than the best man available to run the locomotive of a fast express train." For the first few years all enginemen are in some degree uncertain quantities; but by the time these men are entitled by seniority to promotion as passenger engineers, their fitness therefor should be pretty well known to the road foreman, and through him by the Master Mechanic—I think we now have a loyal, reliable and competent lot of men in the passenger service—and who are anxious to maintain a good record in the operations of trains. The satisfactory movement of trains depends largely upon the engineer—given a machine in good condition and not overloaded, a fireman with brains as well as muscle, and good fuel and water, he will cover his run with despatch, and with a certain amount of pride. The selection of suitable men for firemen, and especially for passenger trains is important. I am satisfied that lots of delays to such trains have happened through the incompetency of the fireman. The subject of securing a better class of wipers and consequently good firemen, will be introduced at this meeting.

Passenger trainmen are not always as quick in their movements as they should be, and this remark applies especially to the brakemen. I am in favor of appointing Train Inspectors, who should travel constantly from point to point on passenger trains, detecting and reporting, or posting men who are not properly performing their duties. While it may be claimed that this is the duty of the Trainmaster or Superintendent, it is not possible for these officers to give the close and expert attention to the work that it undoubtedly warrants; we have inspectors for nearly every departmental work, and it occurs to me that it would be to the company's interest to copy the example of the Southern Pacific. The selection of suitable brakemen for the passenger trains is a matter of importance—we should only engage men for this service who are fairly educated and have a smart appearance, and who are able to converse intelligently and intelligibly with passengers—this applies especially to that section of the line where we have something of interest to show our patrons. It is gratifying to state that our train employees are noted for their unvarying courtesy and politeness to passengers—and this is a feature that has helped to make the Canadian Pacific popular with the public. The neat and natty appearance of trainmen is quickly noticed by, and pleasant to passengers. This remark applies to conductors as well as brakemen. It is a recognized rule that the officers of our steamship department are to wear white shirts and black bow ties and boots—we should follow this practice as regards trainmen.

Our last summer's record of transcontinental passenger trains was unsatisfactory. While no human foresight can always prevent the detention of trains; it is well known that a very large percentage of the causes were preventible—the use of defective power, poor fuel and water, overloading, and a time schedule too fast. When such a condition becomes chronic it soon results in a general deterioration in the service and demoralization of the employees concerned. We have as loyal and efficient a class of employees in our train and engine service as any other railroad in America—and to further the improvement in our train service we must sustain them in their efforts to give satisfaction to and enlist the good will and favor of our patrons by practising what we preach—providing proper power and good fuel and water, and the most expeditious means of supplying fuel and water to the engine.

From an old copy of the *Railroad Gazette* I take the following: "A letter in a recent issue, to the effect that the average individual would rather ride on a train running on a slow schedule and 'get there' on time, than start under the hallucination of high speed and reach his destination late is a reiteration of a remark that so many men have made before that it has become threadbare—yet there seems little hope of its ever reaching the eyes and permeating the brains of the men who have to do with making time-tables and controlling the movements of trains. The large percentage of late trains on American railroads makes the close calculation of connections a pure case of gamble."

The demoralization that follows the movement of continuously delayed trains means a loss to the company in delays to freight trains, and where dining cars are not handled on the transcontinental trains, and meals are supposed to be taken at hotels and restaurants, delays are most exasperating to the passengers. They either have too long a time between meals, or else must eat at hotels or restaurants where no provision can be made to provide suitable meals. The only remedy for such a condition is to use a dining car on every train from coast to coast. If trains are on time and the mountain hotels are not overcrowded with regular guests, it is perhaps not necessary to haul dining cars over the Mountain section—but judging from our experience of last year, it seems to me to be an important feature in our efforts to "improve our passenger service" to use dining cars over the entire run—Montreal to Vancouver.

Passengers like to get out for a meal and relaxation and to view the magnificent scenery at Field and Glacier when the opportunity is afforded them, but only at seasonable hours; delicate women and children should not be expected to get out of a train for the purpose of taking a meal at unseasonable hours or in inclement weather.

Finally, I may say that in my experience delayed trains, especially near the end of a long and tedious journey, create more disappointment and worry and cause more harsh criticism of our train service than almost any other feature in it. With comfortable cars, for sleeping or sitting, good wholesome food at reasonably moderate prices, civil attention and delivery sharp on time at destination we shall ensure satisfaction to the passengers and a good name for the company.

There is one other source of discomfort which should and can be remedied—the stops at water tanks. The injudicious manipulation of the air-brake in making a short stop at a water tank causes discomfort and alarm to the passengers. The writer visited Winnipeg twice in two months last year and particularly noticed the occasional violent character of the stops made at water tanks. It behooves Superintendents and Trainmasters as well as Master Mechanics and Road Foremen to detect and promptly discipline enginemen who are guilty of this totally unnecessary act. . . . There should be a stand-pipe at the other end of the platform from the tank so that trains in either direction need make only one stop for station and water and thus avoid a cause of discomfort to the occupants of the coaches—the fewer stops made by an important train the greater is the satisfaction of the passenger. That excellent journal, *The Railway and Locomotive Engineer*, says: "The aggregate for extra costs for stopping trains is considerable and the possibility of saving is worthy of more consideration than it has received. The work which Mr. Peabody has done in directing attention to the cost of making unnecessary stops is highly creditable." If we provide a water supply to our engines by the method mentioned and thus curtail the number of stops, the cost of the extra stand-pipes and connections will be more than covered in a short time by the reduction in the wear and tear of the rolling stock and power and extra fuel used, as well as often in damage to the rails. I take it for granted that a paper will be presented by some other officer on the subject of station staffs.

Electrification of the Paris-Orleans Suburban Line.

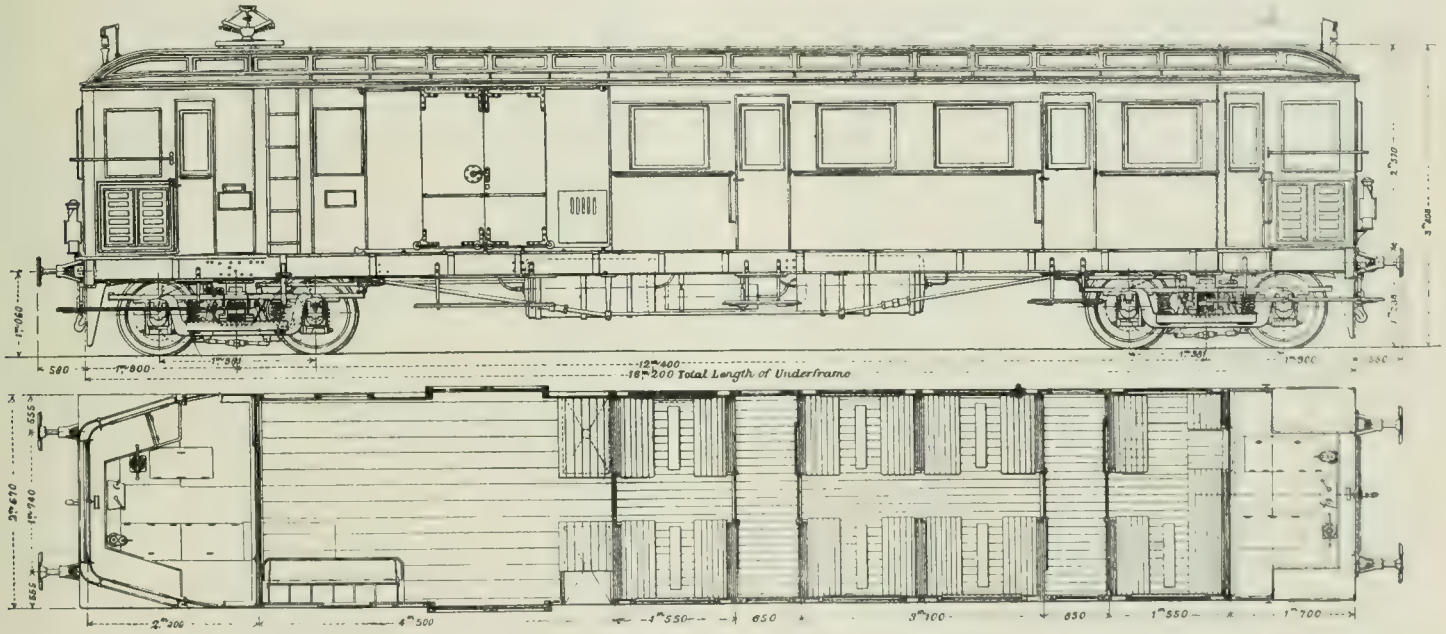
Engineering for January 5, prints the following description of the electrification project of the Paris-Orleans suburban line out of Paris:

The French railroad companies have hitherto moved very cautiously in the matter of electrifying portions of their lines. The first to adopt electric traction by locomotives was the Paris-Orleans Railway on the extension from their old terminus at the Quai d'Austerlitz to the new one at the Quai d'Orsay; but the primary object in view in this case was to prevent the emission of smoke and noxious gases inside the almost continuous tunnel which joins both termini. In a treatise on electric traction he has recently published, Mr. P. Dubois, one of the engineers to this company, appears to have been unfavorably impressed by the cost of electric traction on this extension built by his company within the city limits. He considers electric traction at best as an auxiliary to steam traction; he, however, recommended a trial on a small scale, and for part of the suburban traffic only. This trial is now being carried out, and the traffic with some of the nearer suburbs is being dealt with electrically; so far, however, the train service has not been sufficiently developed for the new system to yield all the advantages that may be derived from it.

Quite recently the Paris-Orleans Company doubled their lines from Paris to Brétigny, a distance of 20 miles, over which there are now four parallel tracks—two for main line and two for suburban traffic. Electric traction has been for the present limited to the Paris-Juvisy section, the company having decided that the traffic beyond the latter township did not justify departure from steam traction. It is very likely, however, that had the section been electrified further out than Juvisy, and had a logical extension in the number of trains followed the electrification of the longer section, a paying traffic would have rapidly developed, leading to increased profits and a better utilization of the power available at the generating station. In the work of electrification of part of the suburban line in question provision has been made with a view to meet future extensions, and the underground cables, which have been laid to Juvisy only, are amply suited to take the pressure of 11,000 volts, which would be required were the current to be carried as far as Brétigny. One of the advantages first derived from the transformation was the greater rapidity with which the electric suburban trains reached the Quai d'Orsay terminus without having to stop at the Quai d'Austerlitz for an electric locomotive; the saving in time is at least 15 per cent. Juvisy is 11.8 miles from the Quai d'Austerlitz terminus and 14.4 miles from the new terminus at the Quai d'Orsay. There are eight intermediate stations over the latter distance. The profile of the line is comparatively a very easy one; the gradients are 1 in 200, except over a length of about three-quarters of a mile at a point where the suburban lines cross the main lines, over which they are 1 in 100. At no part are the curves of less than 40 chains radius. The total distance is covered in 34 to 38 minutes by the trains which stop at every station, this corresponding to an average running speed of about 28.5 miles an hour. The through trains run the whole distance in 26 minutes, this giving a speed of 31 miles per hour.

For the electrification of this suburban line the system that was adopted for the extension to the Quai d'Orsay has been followed, and traction is effected by electric locomotives or rail motor-cars, which take continuous current at 600 volts from an outside third rail. The current generated in the central station is 5,500-volt three-phase, transformed down and converted in three sub-stations. For the extension to the Quai d'Orsay, two small sub-stations had been put down for this purpose; one of these has been done away with, and has been replaced by another, which has been installed within the generating station building. A third has been built at Ablon, a distance of eight miles from the generating station. The power of the latter has been considerably increased, and it now contains three electric generators of 1,000 kilowatts each, direct coupled to four-cylinder triple-expansion Corliss-Dujardin tandem steam-engines, having cranks at right angles.

The steam-valves of the high-pressure cylinder only are controlled by the governor. The engines run with superheated steam; all the cylinders are steam-jacketed. Each engine, at a speed of 75 revolutions, develops 1,500 indicated horse-power, with a cut-off equal to 0.046 the volume of the low-pressure cylinders; the output, however, with later cut-off, may be raised to 2,250 horse-power. When running under the most favorable conditions, the steam consumption does not exceed a maximum of 11 lbs. per indicated horse-power hour. The fly-wheel has a diameter of 24 ft. 7 in.; its rim weighs 33 tons. The alternators are Thomson-Houston 40-pole machines, with fixed armatures and revolving fields. Each alternator weighs 38 tons, and has a normal output of 1,000 kilowatts; it can withstand a 25 per cent. overload during two hours, and one of 50 per cent. during five minutes. The exciting current is at a pressure of 125 volts, generated by three continuous-current compound-wound dynamos. Steam is supplied to the engines by 12 Babcock & Wilcox boilers, mounted in four sets, and provided with superheaters and economizers. A large portion of the fuel used consists of slack coal mixed with the cinders taken from the locomotive smoke-boxes. The boilers are fitted with Bennis automatic stokers; the ashes are removed automatically, the machinery being driven electrically. The main switchboard is at one end of the engine-room; the high-pressure switches are operated by a system of levers. There are two sets of high-pressure bus-bars, so that the traction service can be separated from the lighting service. The static transformers at the Quai d'Orsay sub-stations lower the pressure of the three-phase current from 5,500 volts to about 370, the rotary converters converting the latter current to continuous at about 600 volts. The high-pressure three-phase current distribution to the furthest sub-station, at Ablon, is through two underground three-phase mains, in parallel, one of which would suffice, were the other to be put out of service. The mains contain three conductors, 80 square millimeters (0.12 sq. in.) in section, paper insulated and lead-covered. They have been tested at the manufacturers' works at a pressure of 40,000 volts, and in the conduits at a pressure of 30,000 volts during one hour.



Electric Motor Car for the Paris-Orleans Suburban Service.

The current for traction is picked up from a third-rail. On starting the trains take a current amounting to as much as 1,500 or 2,000 amperes, and the third rail has been given a high conductivity in order to limit the drop in pressure. It consists of a mild-steel flanged rail, weighing 100 lbs. per yard, along which are placed, for the greater part of the distance, two lengths of mild-steel rails, fitted as fish plates and forming counter rails, the latter weigh 50 lbs. per yard. The three rails are bolted together every three meters. They are in 72 ft. lengths, and are electrically bonded at each joint by four flexible copper bonds 0.34 sq. in. in section, two being for

the third rail and one for each counter rail. The third-rail is protected by planking at the stations and at a few other points where foot traffic is large. In order to increase the conductivity of the return circuit the track rails of the neighboring main lines for steam traction are electrically bonded, as well as the tracks for electric traction; junction boxes are mounted along the track in the usual way.

The railroad company has increased the number of its electric locomotives, and has recently put in service, besides, five electric carriages, or rail motor-cars. It now owns 11 electric locomotives, in the latest of which a part of the body serves as a luggage-van. They are carried on two bogies. Their principal dimensions are the following:

Length of underframe	33 ft 6 in
Total length outside buffers	37 " 4 "
Inside width	8 " 10 "
Outside width	10 " 2 "
Height above rail	12 " 8 "
Wheel base of trucks	7 " 10 "
Distance between truck centers	18 " 6 "
Diameter of wheels	4 " 1 "
Total weight of locomotive	54 tons.
Drawbar pull on starting	19,900 lbs.
Drawbar when running	13,300 "

The electric locomotives are fitted with four 270 h.p. motors, each driving an axle by gearing, and capable of giving a speed of 43.5 miles an hour to a 200-ton train. Series-parallel control of the motors has been adopted. As is the case with the older type of electric locomotives built for the extension to the Quai d'Orsay, the newer type is also fitted with a sliding contact at top for collecting current from the overhead conductor, formed of ⊥ bars, over switches and crossings.

The electric carriages, or rail motor-cars, contain three third-class passenger compartments, to seat 32 passengers, and a luggage compartment. They have the following dimensions:

Length of underframe and body	53 ft. 1 in
Length outside buffers	57 " 0 "
Inside width	8 " 4 "
Outside width	10 " 6 "
Height above rail-level	12 " 6 "
Wheelbase of trucks	6 " 6 "
Distances between truck centers	40 " 8 "
Diameter of wheels	3 " 4 "
Weight empty	42 tons.

The underframe throughout is of steel. The body is built up of non-flammable wood. The flooring is covered with an asbestos compound, and with a steel plate at the part above the motors. The outside panels are covered with sheet steel. No wood has been used in the fittings of the motorman's cab. The motors are enclosed 125-h.p. machines. One motor is mounted on each axle, and it weighs, with its gear, 4,077 lbs. The working of each group of motors is on the Sprague-Thomson Houston multiple-unit system. The current is collected by lateral slide-shoes, and, as in the case of the locomotives, by a sliding contact at top, which comes into play when the third-rail is replaced by an overhead conductor. The carriages are heated electrically on the Parvillée system; they are lighted electrically by a separate circuit from the third rail. Each electric carriage can haul seven trailers. A train thus made up weighs 175 tons empty, and affords seating accommodation for 520 passengers.

Hitherto the electric locomotives have run an average of 125 miles per day, and the electric carriages 155 miles, and have given satisfaction.

Washington Correspondence.

WASHINGTON, March 6.—One thing that is now regarded as being settled is that any railroad rate bill that is passed by the Senate will contain an express provision for the judicial review of orders issued by the Interstate Commerce Commission. When the Hepburn bill was before the House it was contended by Mr. Hepburn and others that the courts of the United States would have inherent jurisdiction of all applications for review that might be made. Mr. Hepburn took the extreme view that, under his bill, the courts could consider not only the question of whether rates made by the Commission were confiscatory, but could also inquire into the reasonableness of the rates prescribed in the order and could even go back of the order itself and pass upon the question as to the reasonableness and lawfulness of the original rates undertaken to be set aside by the Commission. In other words, he contended that the courts could examine the whole matter in controversy, including matters of fact as well as questions of law, and could try the whole case de novo. Mr. Stevens, another member of the Committee on Interstate and Foreign Commerce, did not go so far as Mr. Hepburn, but contended that the courts would have "more or less" power of review.

Since the bill passed the House some of the Senators in favor of a review amendment have been studying the question, and, when the bill is taken up by the Senate they will contend that there is no such thing as the inherent jurisdiction of a United States court, and that such courts, from the Supreme Court of the United States down, have no jurisdiction except such as has been conferred upon them in express terms, either by the Constitution of the United States or by act of Congress. This contention is based on a long line of decisions by the Supreme Court of the United States, the earliest being that in the case of Turner vs. The Bank, decided in 1799. It is contended that, as the Supreme Court said in the case of Cary vs. Curtis, "The courts created by statute must look to the statute as the warrant for their authority," and that "the courts of the United States are all limited in their nature and constitution, and have not the powers inherent in courts existing by prescription or by the common law." The contention is that unless a specific provision for judicial review should be put into a bill the jurisdiction of the courts as to questions arising under it would be restricted to constitutional questions.

It is evident that much difficulty will be experienced in framing a review amendment that can secure the support of a majority of the members of the Senate, especially if the Democrats unite in insisting that the courts shall be denied authority to suspend the operation of an order pending its review. This is understood to be what President Roosevelt now favors, and he also favors so limiting the rights of review as to prevent the court from inquiring into the reasonableness and lawfulness of the original rate. Notwithstanding Senator Tillman's emphatic declaration that the President has nothing more to do with the rate bill until it reaches him for his approval or veto, Mr. Roosevelt is not keeping his hands off. He is still pressing his views upon Senators and is exerting his influence in such ways as to greatly increase the bitterness of feeling against him on the part of Senators, some of whom have been among his strongest supporters in the past. These Senators complain that the President is using his power of appointment to influence Senators seeking places for their constituents, and it is also alleged that White House influence is being exerted in the House of Representatives to prevent the passage through that body of bills in which Senators not in harmony with the President are interested. On the whole, conditions are ripe for a very acrimonious debate when the railroad bill is taken up.

The speech of Senator Foraker on the constitutional questions involved in the Hepburn bill has produced a marked effect in the Senate. It has raised grave doubts in the minds of some of the lawyers in that body as to whether the Hepburn bill is not fundamentally unconstitutional and as to whether it would not be the height of folly for Congress to put it on the statute books only to have it wiped out by the Supreme Court when the first test case should reach that tribunal. It is not probable, however, that these doubts will be strong enough to change many votes on the question of the passage of the bill. It is not expected that more than two or three Senators will stand out with Senator Foraker against the passage of any bill giving the rate-making power to the Commission, whether that power is to be exercised subject to judicial review or not.

One of the questions that will come up during the debate will be as to the extent of the power over the relation of rates that the bill would give to the Commission. Even Senator Dolliver might favor an amendment if he could be convinced that the bill in its present form gives a large measure of such power. In his speech he defended the decision of the Supreme Court in the Maximum Rate Case and took very strong ground against giving to the Commission such power as it attempted to exercise in that case. Opponents of the Hepburn bill contend that, under it, precisely such a complaint as was made in the Maximum Rate Case could be presented to the Commission and that the Commission could make just such an order as it made in that case. Mr. Dolliver will not admit that this is true, but that it will be strongly argued during the debate, though it does not seem probable that any amendment can be adopted that will restrict the power of the Commission in this respect. Many of the arguments for a judicial review amendment are based on the contention that the Commission would have a large measure of power over the relation of rates and that judicial review is necessary in order to prevent that power being used to apportion commerce among communities in accordance with the theories of the Commission as to the relative importance that rival localities should have.

J. C. W.

Foreign Railroad Notes.

The first passenger train through the Simplon Tunnel left Brieg at 8.46 a.m. Jan. 25, and arrived at Iselle at 9.33. The train consisted of a locomotive and four cars. This was an experimental train. The opening for traffic will be much later.

The Italian State Railroads have established an office in Cardiff, Wales, for the purchase of coal. The Italian coal dealers don't like it. Italian manufacturers were asked to submit bids for very large quantities of rolling stock. They bid, but the authorities found the prices so high that no bids were accepted; and now they threaten to ask foreign manufacturers to bid; which will probably induce the Italians to modify their figures.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Shavings Cut from the Rail..... 241
- Timber Preservation Without Steaming. 241
- Canadian Pacific Officers' Conference.... 242
- The Eleventh Avenue Freight Tracks... 242
- Ties—the Supply and Demand..... 243
- Derailment at Wickham 244
- New Publications 244
- Trade Catalogues. 244

ILLUSTRATED:
- The Western Maryland Extension from Cherry Run to Cumberland..... 245
- The Western Pacific 252
- The Chicago & Eastern Illinois 1905 Improvements 254
- The Fleming Summit Loop. 259
- East Altoona Engine Terminal of the Pennsylvania. 259
- Lackawanna Third Track Work at Scranton, Pennsylvania. 270
- Building the Brooklyn Subway 274
- The Shirley Plant of the Columbia Creosoting Co. 282
- The Kohn "Solid Base" Rail Joint..... 284
- Strauss Bascule Bridges 286
- The Evolution of the Goodwin Car..... 289
- The Progress of Steam..... 292

CONTRIBUTIONS:
- Shavings Cut from the Rail. 245

MISCELLANEOUS:
- Four-Cylinder Balanced Compound Locomotives. 252
- Specifications for Steel Rails. 280
- Italian Traffic Troubles 281
- August von Borries. 281
- Minor Shop Savings 285
- The Care of Air and Steam-Heat Hose and Couplings. 289
- Foreign Mail Service 291

GENERAL NEWS SECTION:
- Notes 81
- Elections and Appointments 83
- Locomotive Building 83
- Car Building 84
- Railroad Corporation News..... 84

VOL. XL., No. 11. FRIDAY, MARCH 16, 1906.

"Shavings cut from rails by wheel flanges" were shown in the *Railroad Gazette*, page 358, April 14, 1905, and in another column in this present issue Mr. S. Whinery recalls the subject and suggests a remedy. Mr. Whinery's wide experience and accurate judgment are sufficient to cause us to accept without question his recommendation that on a very sharp curve, capable for low speed only, the outer rail should have little or no super-elevation, and that a nearly level track will reduce the flange wear and the rail cutting. The engravings shown in April last were of ribbons or shavings nearly ¼ in. wide and 1/32 in. thick cut from the inner edge of the outside rail on a 16-degree curve by the flanges of new 6-wheel switching-engines, and also by new 100,000 lb. capacity loaded cars with insufficient lateral draw-bar motion. Mr. Whinery points out correctly that, due to an elevation of the outer rail the wheels tend to, and do, under motion, work down the plane so that the wheel flanges press against the inner rail, and he says:

"If the tread of the wheels were cylindrical this would not matter, but they are not; they are conical. The result is that when the flanges press the inner rail the diameter of the inner wheels at the point of contact on the rail is considerably greater than that of the outer, and these inner wheels run ahead of the outer wheels, slueing the truck around and throwing the flange of the outer front wheel with great force against the outer rail, at an angle which facilitates shearing the rail."

Perhaps there is an error in this. British car and locomotive wheels are coned from the flange outwards, but American wheel-treads are designed with the idea that coning is not advantageous in running, but, nevertheless, the diameter, near the flange, is increased slightly as a reinforcement of metal where the greatest wear occurs. The diameter of the wheel decreases only .06 in. for a distance of $2^{3}/_{8}$ in. from where the flange curve joins the tread. This makes a possible variation, due to position on the rail, of only two-tenths of an inch in circumference not enough we think to make "these inner wheels run ahead of the outer wheels, slueing the truck." With worn tires there is still less chance for the inner and outer wheels to run on different diameters. Mr. Whinery's remedy no super-elevation on a 16 degree curve is good because the heavy car is less likely to tip and bear so heavily on its side bearings as to prevent the truck from turning properly. Other remedies are the shortest feasible wheel base for the switching engines and, on cars, side bearings with least possible friction and draw-bars with sufficient lateral motion.

Encouraging developments in the timber preserving industry in this country have occurred in recent months. Within the year two different processes for treating with creosote oil have been described in these columns (one being elsewhere in this issue), each of which accomplishes two important results of great practical value, namely, maximum impregnation with a minimum expenditure of the antiseptic, without the preliminary weakening steaming process; and cheapening of the cost of treatment. The second result is a natural consequence of the first, as the omission of the steaming, as well as the reduction of the quantity of oil required to completely saturate the timber, both reduce materially the cost of treatment. The thoroughness of impregnation obtainable by these methods assures indefinite resistance to decay, while the absence of the destructive effect of the heat leaves the treated timber with its strength unimpaired.

In regard to the detrimental effects of the steaming or heating stage of timber preservation, the Government has lately completed an exhaustive series of experiments, involving, we believe, between 6,000 and 7,000 tests, which we understand establish conclusively and exactly the injury done to the timber fiber by the high temperatures used to prepare it artificially for the reception of the preservatives. At this writing a bulletin is in preparation, and shortly to be issued, giving in full detail the results of these tests. The tests carried out at the St. Louis Exposition, while regarded as preliminary to the more extensive tests which followed, justified the investigators in asserting that the steaming process weakens the resistance of the wood fiber to both static and impact loadings, and that the diminution of strength for any given steam pressure is nearly in proportion to the length of time the pressure is applied. It was stated at that time that a pressure of 50 lbs. applied for four hours caused a decrease in strength of about 25 per cent. We understand that the subsequent experiments showed a percentage of diminution appreciably in excess of this. The omission of this arti

ficial seasoning process simplifies the plant mechanism, reducing the initial cost as well as the subsequent interest, depreciation and maintenance charges; it also reduces the number of treating operations, and therefore shortens the time required, thus creating a larger plant capacity by enabling a greater amount of timber to be treated within a given time.

In regard to cost, it is safe to say that with the price for creosoting brought down to from 25 to 30 cents a tie, processes using creosote will largely if not entirely displace all others, which are substitute processes devised in response to the demand for a cheaper treatment than creosoting has heretofore been.

Mr. William Whyte, manager of the operating department of the Canadian Pacific lines west of Winnipeg, outlines for his subordinates an ambitious program in the address which we printed last week (page 235), and from the utterances of other speakers at this conference of officers, it is apparent that the ideals presented are not at impossible heights above the levels of present attainment. The good progress already accomplished is what leads Mr. Whyte to call for a further advance. Though his standards are high, an examination of the different paragraphs of the address shows that he calls for nothing that is not within the reach of any well-disposed and energetic officer of experience. He does not here ask for new things or new methods, but only for greater perfection in the old. The paper of Mr. Marpole, also given last week, indicates some of the details to which attention must be given in order to carry out the wishes expressed by Mr. Whyte. We judge that the weakest point in the operating department of the Canadian Pacific—as it is of most roads—is in the moral and mental qualifications of large numbers of the men. We set standards of wages and then get as good men as can be got for the wages prescribed, whereas, to produce the satisfactory results which everybody desires, it will be necessary to first set the standard of qualification and then pay what is necessary to get men who will measure up to the qualification demanded. The needs are moral as well as mental, for moral qualities are essential in carrying out recommendations like those of Mr. Whyte. An engineman must have moral character to induce him to strive as earnestly to make up time lost on another division as he strives to recover losses for which he is himself responsible. A brakeman needs moral character to do the little acts of help and kindness to passengers which go to make up the perfect service spoken of in these essays, but of which an inspector or boss can rarely take cognizance. To have brakemen who are intelligently polite and who will keep themselves well posted, it is necessary to get men who have some native appreciation of these virtues; mere rule-book training will not secure the desired efficiency. Wages have been increased, therefore, Messrs. Superintendents, be more careful to see that you get what you pay for, says Mr. Whyte. That is a wise admonition. The railroad service has seen many warning examples of raising pay without raising efficiency. Even if an old employee deserves the increase by reason of higher cost of living or greater demand for his kind of service, the grant should be taken advantage of as the occasion to raise the standard of efficiency. Finally, Mr. Whyte puts before the superintendents the highest kind of an incentive for their own self-improvement—the assurance that thus far they have been the leaders of the whole business world in their territory. May they fully retain this leadership!

THE ELEVENTH AVENUE FREIGHT TRACKS.

The bill recently passed by the Senate of the state of New York which, if it becomes a law, will require the New York Central to remove its tracks from Eleventh avenue, in the city of New York, brings up for discussion some interesting questions of public policy entirely apart from the legal question whether or not the company has a right to maintain its tracks on the avenue. The company is now occupying the streets under an ordinance passed by the Common Council, approved on May 6 1847, and supplemented by an agreement between Mayor William V. Brady and President Chamberlain, of the Hudson River Railroad. The agreement provides that the directors of the company may locate their railroad on any of the streets or avenues of the city of New York westerly of and including Eighth avenue, and on or westerly of Hudson street, provided the assent of the Corporation of the City has first been obtained for said location; but it is also provided in the old agreement that the company will at all times be subject to such regulations with reference to the convenience of public travel through such streets and avenues as are affected by the railroad as the Common Council shall from time to time, by resolution or ordinance, direct. The history of the present agitation for track removal, without going into its detail, may be summed up in general by saying that the tracks on the avenue have been unpopular for some time; that the author of the bill made his campaign for election on his promise that he would have the tracks removed, and that the local public sentiment of the majority of west side voters is undoubtedly in favor of removal. The city contends that the company has no valid franchise for its surface tracks, and that if it ever had such a franchise it expired in 1897—fifty years from the date of the Brady-Chamberlain agreement.

On the other side of the question there are two extremely strong reasons why the tracks should remain where they are. One of these is purely physical. If the tracks are taken off grade they must be laid in a subway or on an elevated structure. The west side sentiment is so strong against an elevated structure that it is improbable that permission to build one can be obtained, while a subway would have to be built below tide water for most of the distance. It would be feasible, although expensive, to build a water-tight subway in which freight traffic could be handled by electric locomotives, but it would not be feasible to build water-tight freight yards below tide-water to handle the cars used in the subway. At present there is a west side freight yard on the Hudson river which extends from 72d street south to 60th street, and another one at 32d street, besides the many spur tracks to industries in between. It would be possible to place these yards above grade, should an elevated structure be built—although this would introduce some novel problems in freight yard arrangements—but it is not clear how they could be built below tide water.

It may be urged that it would be possible for the city to buy the company's franchise, after long litigation, and this may be the outcome of the entire matter; but, if it is, public interest will only partially be served. The interest of the truckmen and the foot passengers would be satisfied as soon as the tracks were taken off the streets, but there remain much larger interests which would be greatly harmed thereby. During the last fifty years a very great number of industries have located along these tracks, and are dependent on the transit facilities they received by the spur lines which extend into their respective properties. These industries were located where they are because of the railroad franchise to operate there. They have been very largely instrumental in building up this part of New York, and, with the tracks removed, they must needs find some other way of getting their bulky commodities to the railroad. Considering the greatly congested condition of these west side streets, it is easy to understand that this would be a very difficult matter to accomplish.

With all these facts taken into consideration, it will be seen that the tracks on Eleventh avenue present some difficult problems to the student of justice in the abstract. It may at once be frankly granted that they constitute a nuisance, although the extent of this nuisance has been considerably overdrawn in the political presentation of the case. On the other hand, the tracks serve to make of this whole western coast strip a rather unique manufacturing locality. That portion of the city which the tracks occupy seems to the casual observer to be a good deal more useful as a manufacturing locality than it does in any other capacity; this from the standpoint of the municipality. From the standpoint of the vested rights of those who have located the industries—the packing houses, lumber yards, biscuit works, etc., of the west side—it would surely be a grave misfortune if these transit facilities were taken away. Therefore, even if the city should condemn the company's franchise, thereby satisfying the corporate interest of the New York Central, it would leave unsatisfied a very large number of important industries which have certainly considered in the past, and have doubtless been advised in the past, that they have a right to be where they are. The subway suggestion may as well be at once abandoned, for the reasons which have been mentioned. The plan for track elevation would remove the nuisance of the tracks at grade, and would leave the manufacturing plants their transit facilities. Such track elevation would be extremely expensive to the railroad, and it is probable, therefore, that the latter is rather pleased than otherwise that public sentiment is so strong against an elevated structure that it is quite improbable that one will ever be authorized, at least for railroad purposes. There has already been talk of a two-story west side thoroughfare to relieve trucking traffic, but this plan does not take into consideration the existence of railroad tracks on the structure.

It seems evident that the railroad company, by virtue of its charter and supported strongly by the manufacturing interests, will be able

to put up a prolonged contest in the courts, if any peremptory order for track removal is made. We are not concerned with the result of any such contest, but desire only to point out that this is one of these doubtful cases which sometimes arise in great municipalities where important vested rights are so conflicting that the decision requires an amount of judgment and a breadth of view hard to be attained by any legislative body which has the matter under consideration. The obvious thing that ought to be done in such a case is to take the discussion entirely out of the realm of politics and make it entirely a matter of civics; and yet, almost any resident of the United States in general, and of New York in particular, should probably be pardoned for expressing a belief that this is the last thing which is likely to be done. It is campaign promises and ward politics that leave it to the courts to be the authors of such streaks of good government as this country and this municipality have.

TIES—THE SUPPLY AND DEMAND.

Last December one of the large Eastern railroads closed a contract for the majority of its requirements for ties for 1906 at a cost of 72 cents delivered at its tidewater terminus. It paid 60 cents for the same class of yellow pine ties in 1905. That the price of ties was going up was not altogether new to us, but that they should go up in price 20 per cent. in a year was indeed startling. Quotations received from one of the largest dealers in timber in New York corroborated the information; the price was even higher, 73 cents, and it had increased 7 cents in six months. In order to find out what the general situation was, an investigation into the supply and demand for railroad ties was begun last month by sending out a circular of inquiry to a number of roads scattered over all parts of the United States and Canada. The information contained in the replies received from 21 roads, representing 40 per cent. of the total steam railroad mileage of the country and including most of the important railroad systems, gives an accurate basis for calculations and comparisons. The questions included in the circular covered the number of ties used for renewals, source of supply, trend of prices, provisions made for a future supply, extent of use and experience with treated ties and experience with substitutes for wooden ties.

The 21 roads which replied will require during 1906 29 million ties for renewals alone. According to Poor's Manual for 1905, these roads had a single track mileage of 117,500 miles, or 40 per cent. of the total in the United States. On this basis the total requirements of the steam roads for renewals in 1906 will be 72,500,000 ties. For new construction about 15,000,000 ties in addition will be required, or a total of 87,500,000. Electric street and interurban roads will probably use from 5,000,000 to 8,000,000 for renewals and new construction. This gives a grand total of 95,000,000 ties which will be put in track during the year.

The sources of supply are narrowing to more restricted areas each year. A few years ago most of the railroads had no difficulty in obtaining a large majority of the ties needed along their own lines. Now they are buying them and shipping them, in many instances, 500 and 1,000 miles. The Grand Trunk obtains some ties from Arkansas. In the East and Middle West white oak and chestnut, with some few pine and cedar ties, are used almost exclusively, by far the greater part being white oak. Some red oak, beech and other softer woods are used, but as the demand for these woods for cheap furniture and building material is heavy and they must in most cases be treated, they are not extensively used. Treating cheaper kinds of woods pays better. The supply of white oak is drawn almost entirely from the forests of West Virginia, Kentucky and Tennessee. There is practically none left which is available in large quantities in Pennsylvania, New York, Ohio, Indiana and Illinois. The Pennsylvania Lines West obtain less than 10 per cent. of the ties used for renewals along their own lines. The Lake Shore & Michigan Southern obtains about 16 per cent. of its oak ties along its lines. How long the hardwood forests will last at the present rate of cutting cannot even be roughly estimated. There are, of course, thousands of acres of timber lands that will remain untouched for years to come, because there are no facilities for getting the timber to a market. The Alleghenies in Pennsylvania have been practically stripped of all but scrub second-growth timber, and much of the available supply of the Adirondacks has also been cut out.

In Maine, Michigan and Canada, cedar, hemlock, Princess pine and tamarack, with some few hardwood ties are used almost exclusively in an untreated state. There is still a large area of good timber land in Maine from which the Bangor & Aroostook draws its own supply and ships large numbers to the Maine Central, Boston & Maine and other roads. The Michigan Central uses cedar ties exclusively, except in yards and on sharp curves, and its supply is furnished from the forests in northern Michigan and the Georgian Bay district in Canada. While the timber lands of Michigan are commonly supposed to have been pretty well cut out, there are still thousands of acres of cedar swamps which have not been cut, because the prevailing prices did not make it profitable to get the ties to a market. These will furnish a limited supply for some years at advancing prices. While Canada still has an enormous acreage in timber lands as yet untouched, the present available supply is by no means unlimited. With the exception of cedar, the hemlock, birch, tamarack, and Princess pine ties are not profitable to use for ties unless treated. There are large undeveloped tracts lying north of Lakes Huron and Superior, and in the Province of Quebec, which are being opened up gradually by new railroad construction. The Grand Trunk obtains less than 10 per cent. of the cedar ties which it uses, along its own lines. Mr. Joseph Hobson says: "There is not any serious danger of a tie famine in Canada for a long time yet, but prices will go considerably higher. Antiseptic treatment of timber will ultimately have to be adopted on a large scale, to minimize consumption by giving a longer life to the ties."

In the Southern states, North and South Carolina, Georgia and Florida, yellow pine, cypress and some oak ties are used. This territory is being heavily cut and much timber is shipped over the lines passing through, in addition to the amount supplied for their own use. The supply is still comparatively plentiful and no outside sources are being drawn on.

West of the Mississippi the greatest scarcity of suitable tie timber prevails, and a majority of the tie treating plants in the country have been built in that territory to utilize the inferior soft woods. In the mountainous districts of Missouri which have not been opened up there is a good supply of oak, and the roads which traverse this country, the St. Louis & San Francisco and the Rock Island, obtain practically all of their oak ties from along their own lines. Arkansas, Louisiana and Eastern Texas furnish most of the pine ties. The most active cutting is being done in the loblolly and other pine forests of Eastern Texas. At Somerville, the Atchison, Topeka & Santa Fe has just completed a treating plant using creosote, which has a capacity for treating 3,000,000 ties a year and will meet all that road's requirements for renewals and new construction. The Southern Pacific obtains a large number of pine ties, and also cypress, from Louisiana and Texas. Most of the pine ties are treated with the Burnettizing process. This company also uses some redwood ties obtained in Northern California. The Union Pacific buys about 250,000 pine ties in Texas, and for the remainder of its supply uses mountain pine, all of which is obtained along its own line.

The roads on the Coast obtain their principal supply from the redwood forests of Northern California and the pine and fir timber lands in Oregon and Washington. Enough yellow pine is still to be had in the Rocky mountains to supply the needs of the railroads in that territory at reasonable prices.

This brief outline of the chief sources of supply perhaps gives the impression that the supply is ample and will be for some years to come. The following extract from a reply received from the United States Bureau of Forestry throws some light on the subject, even if in an indefinite way:

> "The Forest Service has no figures on the available supply of timber in the United States. Beginning with the past year, the Forest Service is getting statements from lumbermen on the amount of timber cut, and by 1910, the next Census year, we shall be in a position to make an inventory of the forest. Not having a basis on which to calculate the present supply, the Forest Service has made no attempt to estimate how long the supply will last. Of this we feel certain, that the present rate of cutting is exhausting the supply rapidly, and how quickly the supply is exhausted or whether it is ever exhausted, will depend on whether the private land owners, states and Federal Government will quickly institute a policy of conservative forest management."

There is no doubt that the enormous demand for ties alone is every year exterminating large areas of timber land. In the thickly wooded loblolly pine forests of Texas the average yield per acre is less than 100 ties when the forest is completely cut out for trees over 12 in. in diameter. In the hardwood forests the yield is, of course, much smaller. Assuming an average yield of 75 ties to the acre, the requirements for 1906 will cause more than 1,266,000 acres, or 1,980 sq. miles, to be cleared. If conservative forestry methods were used and a perpetual supply preserved, a forest of more than 35,000 sq. miles, or the area of the state of Indiana, would have to be set aside for tie timber alone.

The effect on prices of this wholesale devastation of the forests

is evident from all of the replies received, particularly in the case of roads which can no longer obtain their supply along their own lines. The increase in the last 10 years has been from 16 per cent. to 80 per cent. and has been more rapid during the last three years. The increase in cost of hardwood ties—white oak—has been greater in proportion than for the inferior woods; pine, chestnut and beech. Cedar, however, has advanced greatly in price. The Bangor & Aroostook is paying 32 cents a tie, as against 18 cents in 1896, and the Michigan Central is paying 40.5 cents for first quality cedar ties, as against 26 cents ten years ago. The average price of white oak ties in the Middle states is now from 60 to 70 cents, as against 35 to 50 cents. Such roads as the Chesapeake & Ohio and the Norfolk & Western, which run through West Virginia and Kentucky, are getting oak ties for 40 cents, although in 1896 the price was 30 cents. In this connection Mr. R. Trimble, Chief Engineer of Maintenance of Way, Pennsylvania Lines, Northwest System, says: "When the price of ties goes up to $1 we will either find some substitute or endeavor to prolong their life by the use of preservatives, tie-plates, wood-screws, etc." The present inquiry throws no light on future prices which may be expected; and guessing is futile.

In view of the present shortage and the upward trend of prices it is interesting to note the precautions which are being taken by some of the larger railroads to insure a steady supply of ties for future years, in the form of long-term contracts with dealers, purchasing interests in standing timber lands and planting timber on the company's property, or encouraging farmers along the line to plant timber. Some few roads have made long-term contracts with dealers, principally those which have treating plants in operation. Among these are the Santa Fe, the C., R. I. & P., the Illinois Central and the Northern Pacific. Others buy from year to year from the same dealers without a long-term contract for a specified number of ties, and these dealers are depended upon to provide a supply. Two, at least, of the transcontinental roads, the Southern Pacific and the Northern Pacific, have reserved a large part of their Government timber land grant as a reserve, a wise precaution.

Only one railroad, the Pennsylvania, has gone into the planting of quick-growing trees on a large scale to provide for future timber supply. Other roads have tried it, but without any encouraging success. In 1902 the Pennsylvania planted 14,000 yellow locust trees on the company's property; in 1903, 43,000 trees; in 1904, 224,000; in 1905, 197,000, and this year about 800,000 will be planted. The Michigan Central has planted 80,000 catalpa trees on 123 acres of company property, but so far the results have been indifferent, and it is doubtful if good results will ever be obtained from the plantings. The Illinois Central has planted two large groves of Catalpa Speciosa, one at Du Quoin, Ill., and the other at Harahan, La. The Norfolk & Western made a similar experiment with a grove of six acres at Ivor, Va., but it has since been found that loblolly pine has a more natural growth in that country, and large tracts of the company's lands have been set aside until the loblolly pine has attained a sufficient growth to cut for ties. On the Northern Pacific, the question is under consideration of planting on company property and encouraging farmers along the line to plant.

Another method of conserving the supply of tie timber adjacent to the company's lines, and one which is of doubtful policy, is the practice of charging extortionate freight rates on ties shipped to other roads. A recent decision of the Kentucky Railroad Commission condemned this practice in strong language and ordered a reduction in rates on ties on all roads in that state. The Commissioner's opinion says:

> No good reason has been shown why this practice should be permitted to prevail. It was clearly shown that ties are less valuable than the low grades of lumber. In one instance the rate upon ties was at least two and one-half times that of the rate upon lumber. This extraordinary rate is now in effect upon the Louisville & Nashville, and it has been in force for a number of years. With such a rate in effect, the movement of this commodity from points upon the line of this railroad has been prohibited, and the producer has been forced from necessity to dispose of his crossties to the railroad companies charging this rate. Nowhere do we find any attempt at a justification of this rate; indeed, counsel for the Louisville & Nashville Railroad Company very frankly admitted that there was no real justification for it.
>
> It will not do to say that because these ties are a necessity to the railroads they should be permitted to charge a rate for their transportation in excess of what may be deemed just and reasonable for the service performed.

Thirty-five years and six months is the average term of service of six employees of the Great Eastern Railway of England who were recently examined by Lieutenant-Colonel von Donop, Inspector of the Board of Trade, in his investigation of an accident. One inspector (of roadway) had been in the service 63 years; a signalman 45 years; a guard 35 years, and other persons shorter periods. A seventh man, not included in our average, the fireman, had been in the service only 6½ years. Long terms of service are very familiar in English railroad literature, but this case would seem to be pretty nearly the "limit." The accident referred to was near Wickham, about two miles from Witham (where 10 passengers were killed in a derailment last summer) and is also peculiar in other respects. The train, consisting of an engine and four small passenger cars, was derailed while running at very low speed, and all of the wheels were left standing inside of the rails, the left rail, which was on the inside of a slight curve, being pushed outward. The Inspector was utterly unable to ascertain the cause. At the place where the derailment occurred the line, which is single track, passes over two wooden trestles from 8 ft. to 18 ft. high. Each rail rests on two longitudinal stringers 13 in. square, one above the other. There are iron tie rods every 10 ft. The gage was slightly wide, but not enough to cause the derailment of the wheels in this train (of which the treads were about *three inches* wide) until one rail had been violently pushed over. Trains were run over the trestles to test the track and structure and it was watched for days, but Col. von Donop could only conclude that "whilst there undoubtedly must have been some defect either in the rolling stock or in the permanent way to account for this derailment, I regret that I am unable to state the precise cause of it."

NEW PUBLICATIONS.

Structural Engineering Tables. By Edward Godfrey. Pittsburg: Published by the Author. 1906. Leather, pocket size, 6½x4 in. 200 pages. Price, $2.50.

This is a handy little pocket book for engineers, draftsmen and others engaged in designing structural members, compiled somewhat in the form of a reference book often made and kept by engineers for their own reference. No doubt it is the outgrowth of such a small scrap book begun and enlarged by the author from time to time in the 15 years in which he has been engaged in work which brought him into daily contact with the various pocket books of the steel companies and others in a search for data. The tables are in some instances taken direct from the pocket book of the Carnegie Steel Company, but most of them have been independently compiled by the author. Some of these are particularly handy, as, for example, the tables of weights and areas of angles, and a table for quickly finding moments of inertia of rectangles. The tables of properties of built sections are quite complete and cover the usual forms employed in structural work. About 70 pages are devoted to drawings of typical constructions for roofs, bridges, floors, arches, etc., and 15 pages to stress diagrams of roofs and bridges. Several tables in the back of the book have been furnished by manufacturers, and include tables of data respecting electric cranes, wire rope and paint.

Reinforced Concrete. 1906. By F. D. Warren. New York: D. Van Nostrand Company. Cloth, 4½x7 in.; 260 pages. Price, $2.50.

This work is intended for the use of architects, engineers and contractors. It is divided into four parts. Part I gives a brief general discussion of the subject from a practical standpoint, bringing out some of the difficulties met with in practice and suggesting remedies. Under Part II. is compiled a series of tests, including the tensile strength of concrete-steel, floor tests, roof tests, etc. Part III. contains a series of tables from which the necessary data for designing the more common cases in practice can be obtained, and Part IV. treats of the design of trussed roofs from a practical standpoint. The author states that if this work will tend to do away with the use of some of the "empirical formulae" and "rule of thumb" methods of designing reinforced concrete structures and tend to concentrate all toward a standard and universal system, as well as remove some of the prejudicial influences at work tending to demerit its worth because of unfamiliarity with its design, it will have accomplished its purpose.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal card circulars	3¾ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Friction Springs.—The Harvey friction spring for draft gears, pedestal trucks, bolsters, equalizers, bumping posts, etc., is fully described and illustrated in Catalogue C of The Frost Railway Supply Co., exclusive selling agent, Detroit, Mich. This spring was described and illustrated in the *Railroad Gazette* April 7, 1905. The

catalogue explains in detail the principle and design of the spring, its characteristics and advantages, gives results of various tests on machines and in service, and illustrates it in detail by numerous engravings. The "Adjustable" center-line draft plâte also is illustrated. The catalogue is a very nice piece of work.

Grinders, Polishing Wheels, etc.—The Gardner Machine Co., Beloit, Wis., is distributing a binder containing the first sheets of matter describing and illustrating the products of this company, which include disc grinders, band polishing wheels, disc wheel circles, sectional wheel chucks, etc. Additional sheets regarding the latest products of the company will be sent for insertion in the binder as fast as issued. The present sheets are devoted to Gardner's improved disc grinder No. 4, illustrating and describing the machine in detail and the work it will accomplish.

Valves.—A neatly gotten up seven-page pamphlet containing illustrations and detailed descriptions as well as sizes and price lists of the "Eurema" Y valves, is being distributed by the Western Tube Company, Kewanee, Ill. These valves are made of special high duty metal and are tested to 300 lbs. hydraulic pressure. They are recommended for working pressures up to 175 lbs.

Paint.—The Joseph Dixon Crucible Co., Jersey City, N. J., has just issued a folder entitled "Colors and Specifications," in which five classes of steel construction are illustrated. The specifications suggest best methods for construction and maintenance, painting of steel work, based on the company's experience of 43 years as makers of protective paint.

CONTRIBUTIONS

Shavings Cut from the Rail.

New York, March 12, 1906.

To the Editor of the Railroad Gazette:

In looking over some numbers of the *Railroad Gazette*, which, for want of time, were unopened when they came out, I just now find in the issue for April 14, 1905, page 358, an account and illustration of some remarkable shavings cut from the outer rail on sharp curves, by the wheels of passing locomotives and cars, and the article closes with an invitation for further information about the matter from those who may have observed similar phenomena.

More than thirty years ago my attention was called to a similar occurrence. On a road with which I was connected my attention was called to the fact that the outer rails were being whittled away very rapidly on a sharp curve in a city yard. Handfuls of shavings, smaller, as I recollect them than those illustrated in the article, could be picked up along the outer rail. Upon investigation I found that the outer rail had been originally elevated in accordance with a then accepted rule requiring a specified super-elevation for each degree of curve, the rule being based on a speed of about 40 miles per hour. When the yard section boss observed that the wheels were chipping the outer rail he concluded that he had not used enough elevation for the outer rail, and gave it more. This was repeated a number of times with the result that the trouble seemed to increase with each additional boost of the outer rail.

After a little study I concluded that the trouble came from excessive elevation of the outer rail, and against the judgment of the track foreman, had the track readjusted so that the rails were almost on the same level, after which the trouble ceased.

Further observation in a number of cases convinced me that the excessive wear and shearing away of the outer rail on sharp curves in yards is due entirely to excessive super-elevation of the outer rail.

The accepted theory is that the elevation of the outer rail shall be such that the tendency of the wheels to slide down the transverse inclined plane of the track shall balance the outward centrifugal force of the train at a given speed; or in other words, that the resultant of the weight upon the wheels and the centrifugal force shall be normal to the plane of the track. As the standard rules for super-elevation are usually based on high speed, and as the speed in yards is comparatively low, the result is much too great an elevation of the outer rail and the wheels tend to, and do, under motion, work down the plane so that the wheel flanges press against the inner rail. If the treads of the wheels were cylindrical this would not matter; but they are not; they are conical. The result is that when the flanges press the inner rail the diameter of the inner wheels at the point of contact on the rail is considerably greater than that of the outer, and these inner wheels run ahead of the outer wheels, slueing the truck around and throwing the flange of the outer front wheel with great force against the outer rail, at an angle which facilitates shearing the rail.

To go into details would require more of your space than would perhaps be warranted. I suggest that where trouble of this kind is experienced the track be adjusted with the outer and inner rails almost on the same level, and I think the remedy will be found effectual.

S. Whinery.

The Western Maryland Extension from Cherry Run to Cumberland.

By Ralph C. Davison.

The aggressive policy shown by the Gould System during the past few years in its effort to reach the Atlantic Coast is again brought into prominence by the completion of the Cumberland extension of the Western Maryland from Big Pool, Md., to Knobmount, a distance of about 60 miles. It will be remembered that some years ago, when Mr. Gould's effort to reach New York proved futile, he bought from the city of Baltimore control of the Western Maryland, and shortly after obtained control of the West Virginia Central & Pittsburg.. The Western Maryland extended west to Big Pool, directly across the Potomac river from Cherry Run. It is from this point to Knobmount, a few miles south of Cumberland, that a single track connection has been made with the West Virginia Central & Pittsburg, known as the Cumberland extension of the Western Maryland. The country between these two points is extremely rough, and was a difficult one in which to locate a line that would be reasonably free from heavy grades and curves. Several alternative preliminary location surveys were made and then lines compared, both with reference to construction cost and economical operating value. After careful consideration of the several routes, the location shown in the accompanying illustration was decided upon, and the final surveys for it were completed in the early part of 1903. As shown, the new line follows along the Chesapeake & Ohio Canal side of the Potomac River Valley and occupies for the greater part of its distance the side of the valley opposite from that on which the Baltimore & Ohio is built. Owing to the mountainous nature of the country, the canal, and to the occupation of the opposite side of the river by the Baltimore & Ohio, the new route necessitated the building of five tunnels and 23 bridges, including nine over the Potomac river, seven over the canal, and three over the tracks of the Baltimore & Ohio, which it parallels most of the way. Near Baird the new line is on the same side of the river as the Baltimore & Ohio, and in many cases is so close to it as to be within a stone's throw. At Baird rail connection was made with the Baltimore & Ohio for the purpose of transferring material to the new line.

The exact length of the Cumberland extension is 59.3 miles, containing 37,046 miles of tangent and 22,238 miles of curves. The maximum grade eastbound is 0.3 per cent. and the maximum grade westbound is 0.5 per cent. The total curvature is 3,182 deg., an average of 54 deg. per mile. The maximum curvature is 6 deg. The line for construction purposes was divided into three divisions. The first division extended from Big Pool to Sideling Hill Creek and was 22.10 miles long; the second division extended from Sideling Hill Creek to Paw Paw, 14.2 miles; and the third division extended from Paw Paw to Knobmount, a distance of 23.1 miles. The first and third divisions were provided with three residences and three resident engineers each, and the second division was provided with two residences and two resident engineers. The residences in each division were placed from six to eight miles apart. The general contract for constructing the first division was awarded on Aug. 1, 1903, to the Degnon-McLean Contracting Company, now the Degnon Contracting Company, New York, and the general contract for the second and third divisions was awarded jointly to the McArthur Bros. Co. and Kilpatrick Bros. & Collins Contracting Co., of Chicago and Beatrice respectively. These two divisions, as shown in the illustrations of the plan and profile of the line, contained about 80 per cent. of the work, including all the tunnels and Potomac river crossings. The contract for furnishing and erecting all the steel work was awarded to the Pennsylvania Steel Co., Steelton, Pa. The line, as previously mentioned, is a single track road, although all of the bridge piers and abutments have been built to carry two single track bridges. Many of the fills were also made wide enough for double tracking, and all other construction along the line, when possible, was made so as to facilitate double tracking later on.

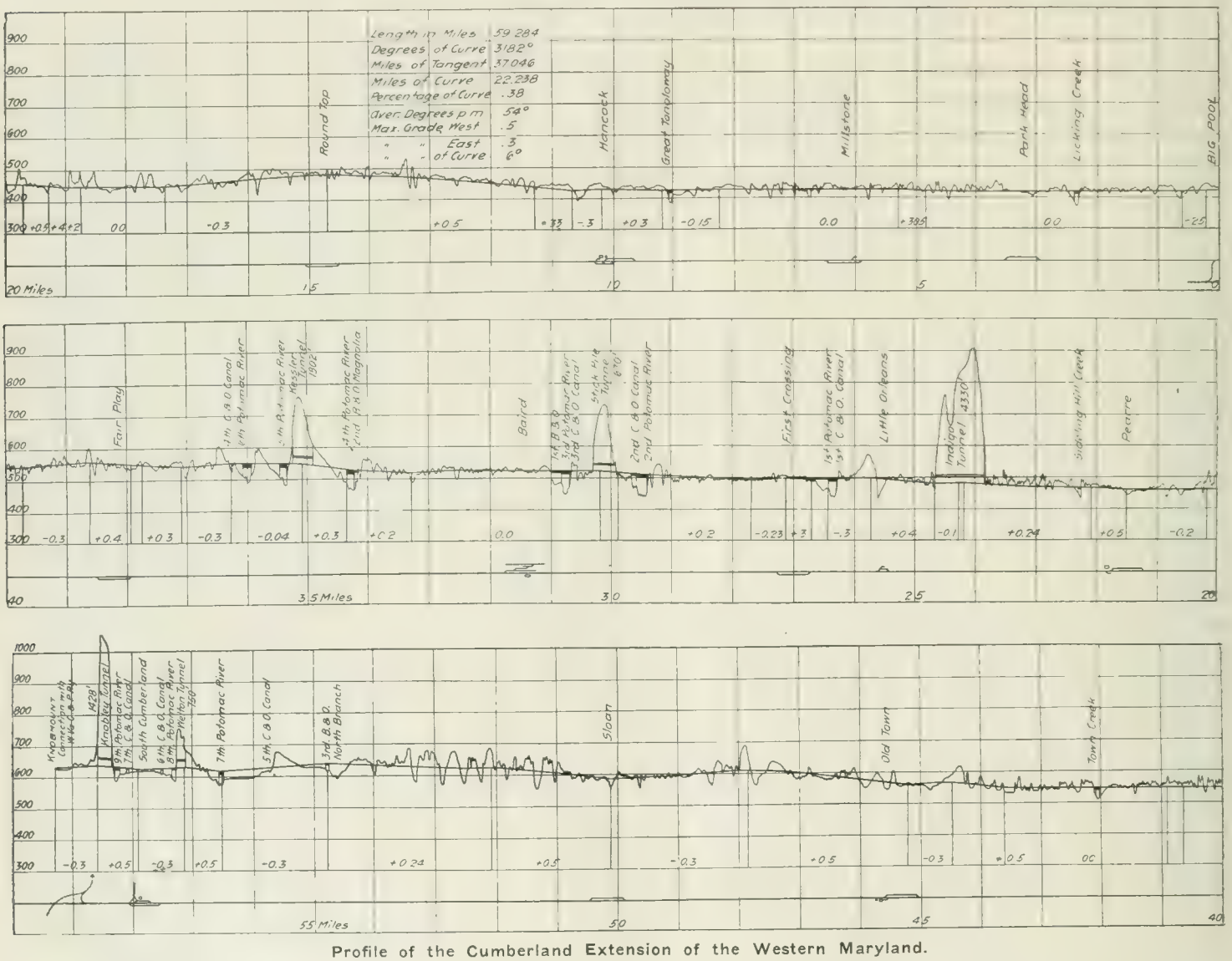
Starting from Big Pool, the first division to Sideling Hill Creek, a distance of 22.1 miles, closely parallels the river and the canal. Part of this division is located on a public highway known as the old National Turnpike. The railroad company had to relocate and reconstruct this road for a considerable distance, and is also required to keep such work as was done in repair for a period of two years. The first division as far as Hancock, a distance of 10 miles, is comparatively free from difficult work. There are two bridges in this stretch; one over Licking Creek and the other over Great Tonolway. Each of these are deck-girder bridges with three 80-ft. spans resting on concrete piers and abutments. The grading as far as Licking Creek bridge, about 2½ miles, is earth and loose rock work of ordinary character. Beyond this some heavy work was done, including a fill just east of Mill tone, 650 ft. long containing upwards of 27,000 cu. yds. of earthwork. About three miles west of Mill-

stone and one mile east of Hancock another heavy fill, containing upwards of 55,000 cu. yds., was made to carry the line across the Tonolway bottom. About one-half mile west of Hancock another large fill was made. This contains a 25-ft. concrete arch which provides a waterway for the Little Tonolway Creek. From Little Tonolway Creek to Round Top, a distance of about three miles, the line has a 0.5 per cent. up grade. Considerable heavy rock work was encountered between these two points which, in some places, averaged as high as 50,000 cu. yds. per mile. Just west of Round Top the line has a 0.3 per cent. descending grade, and for a considerable distance is carried along on the abrupt face of the mountain side on a bench built into the solid rock. The preparation of the roadbed at this point necessitated the removing of a large amount of solid rock, and much retaining wall work had to be done. A short distance beyond this sidehill work the line passes through a cut from which upwards of 50,000 cu. yds. of material had to be removed. The material from this cut was used in making a fill 60 ft. high just west of it.

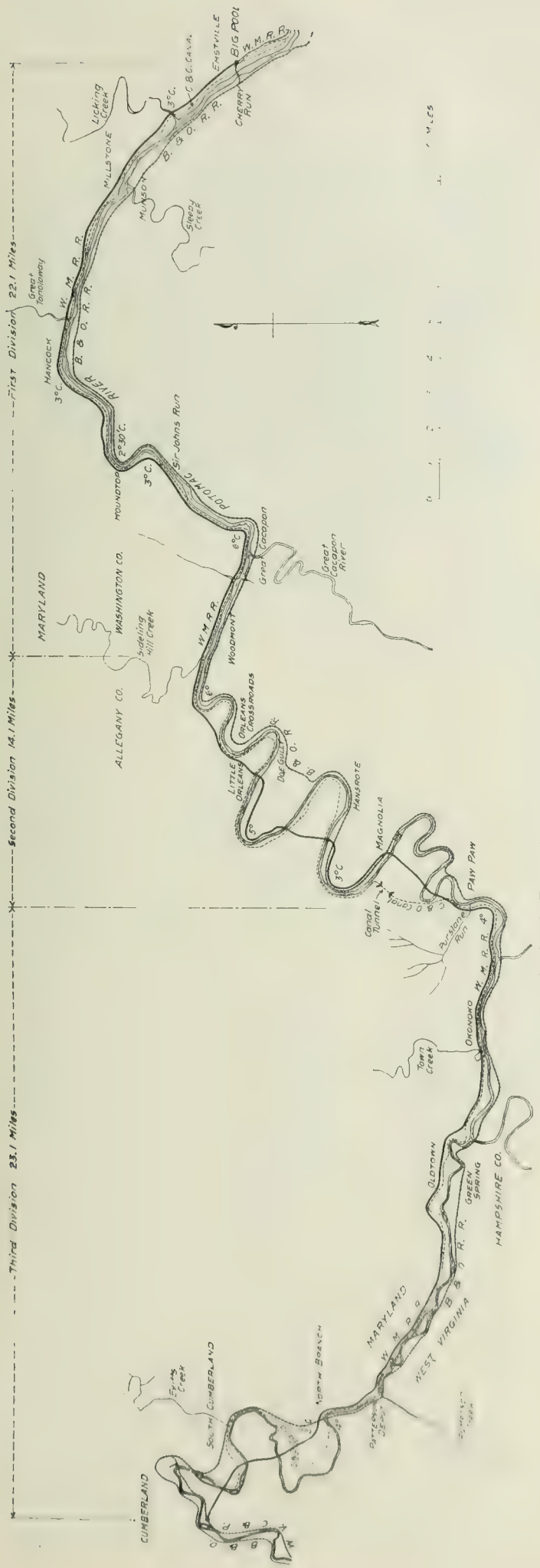
From this fill on, for the next two to three miles, some heavy work was encountered which required the removing of approximately 50,000 to 60,000 cu. yds. of material per mile. Beyond this heavy work the line approaches near to and parallels the canal for some distance. Considerable trouble was encountered along the stretch, inasmuch as the tracks had to be carried on a shelf 12 ft. to 20 ft. above the canal, cut into the face of the abrupt solid rock mountain side, rising directly from the water's edge. West of this work the line crosses the canal basin on a 600-ft. trestle, at the west end of which is a fill containing upwards of 45,000 cu. yds. of material. The remaining half-mile of the first division to Sideling Hill Creek was comparatively light work. In prosecuting the work on the first division steam shovels were used to some extent, but in the greater part of the work little machinery was used. The east end of the first division from Big Pool to Hancock, a distance of 10 miles, has been completed and has been in operation for the past 6 to 8 months.

The Sideling Hill Creek is the separating line between the first and second divisions. The railroad crosses this creek on a three-span deck-girder bridge consisting of one 95-ft. span, one 50-ft. span and one 20-ft. span, resting on concrete piers and abutments. The foundations for the piers and abutments, except in the case of one of the abutments for the construction of which a cofferdam had to be built, gave but little trouble. The concrete for the work was prepared in a concrete mixer placed directly above the site of one of the abutments. From the mixer it was delivered to the piers and to the far abutments by means of a temporary pole trestle built across the creek. The concrete for the near abutment was delivered to it by means of a chute from the concrete mixer. For a short distance west of the bridge the road is carried in a fill and then for about two miles it runs close to the canal and is built on a bench cut into a solid rock hillside which rises abruptly from the edge of the canal. This bench is in many places supported by fills held in place by both masonry and concrete retaining walls.

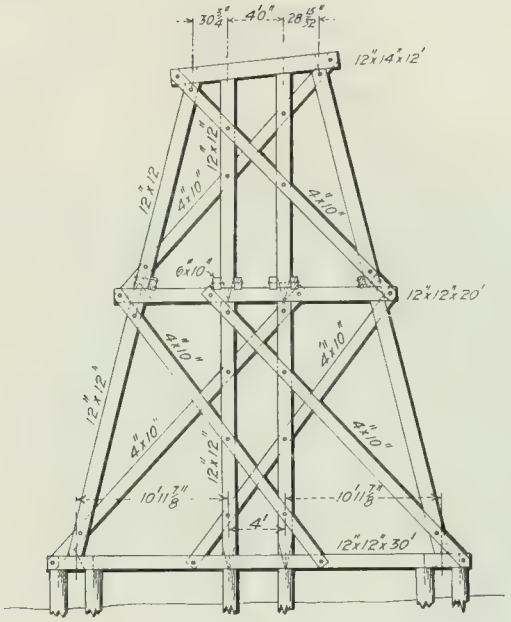
This side hill, or canal work as it is called, was the heaviest and most expensive work done on the entire line, its estimated cost in some places being as high as $150,000 per mile. In order to form the bench along the side hill over the canal large quantities of material had to be removed, and in many places blast tunnels were used. These tunnels were started from the face of the cliff at, or slightly above the grade of the railroad, and were run into the rock at right angles to the line until they reached a point directly beyond the inner side of the future roadbed; then a lateral tunnel was driven each way from the head of the previous tunnel, forming the letter T, as indicated in the diagram. These lateral tunnels extended from 40 ft. to 70 ft. from the main stem, and in these laterals the powder was placed. The blast tunnels were just large enough for a man to work in, somewhat irregular in size, but averaging about 3 ft. wide by 4 ft. high. The powder was deposited in charges, anywhere from 25 to 75 kegs placed at intervals of from 10 ft. to 20 ft. Some unusually large charges were fired by this method. The largest shot of this character was fired in the sidehill work near Paw Paw, at which point about 1,200 kegs of black powder, at 25 lbs. per keg, together with a moderate quantity of dynamite at each powder pocket

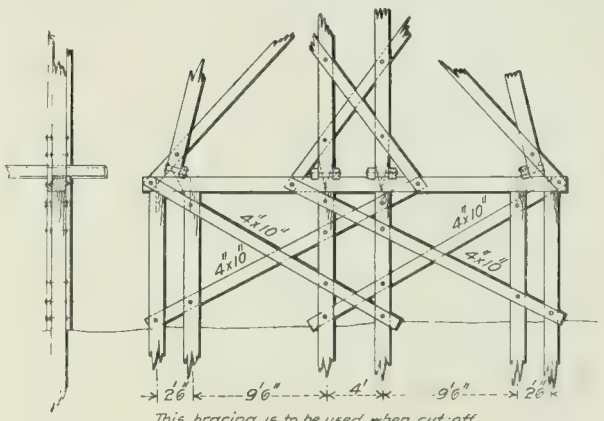


Profile of the Cumberland Extension of the Western Maryland.

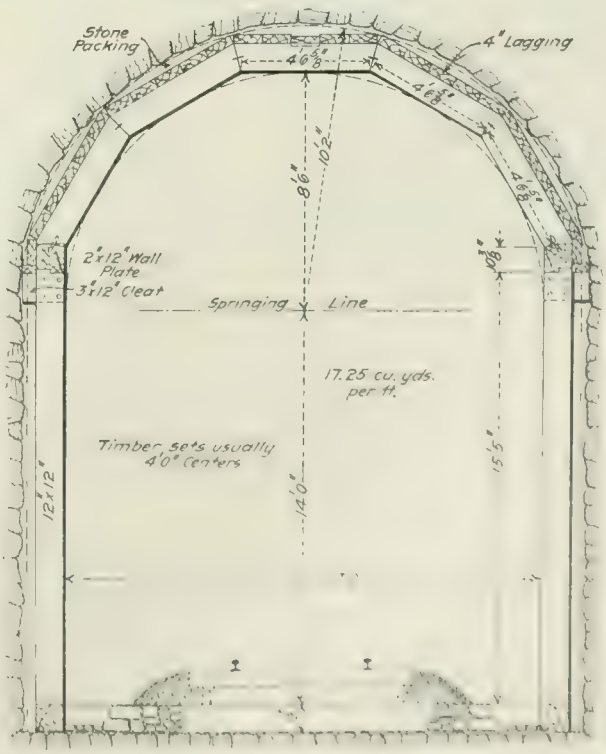


The Cumberland Extension of the Western Maryland.





Detail of Bents; Baird Trestle—Western Maryland.

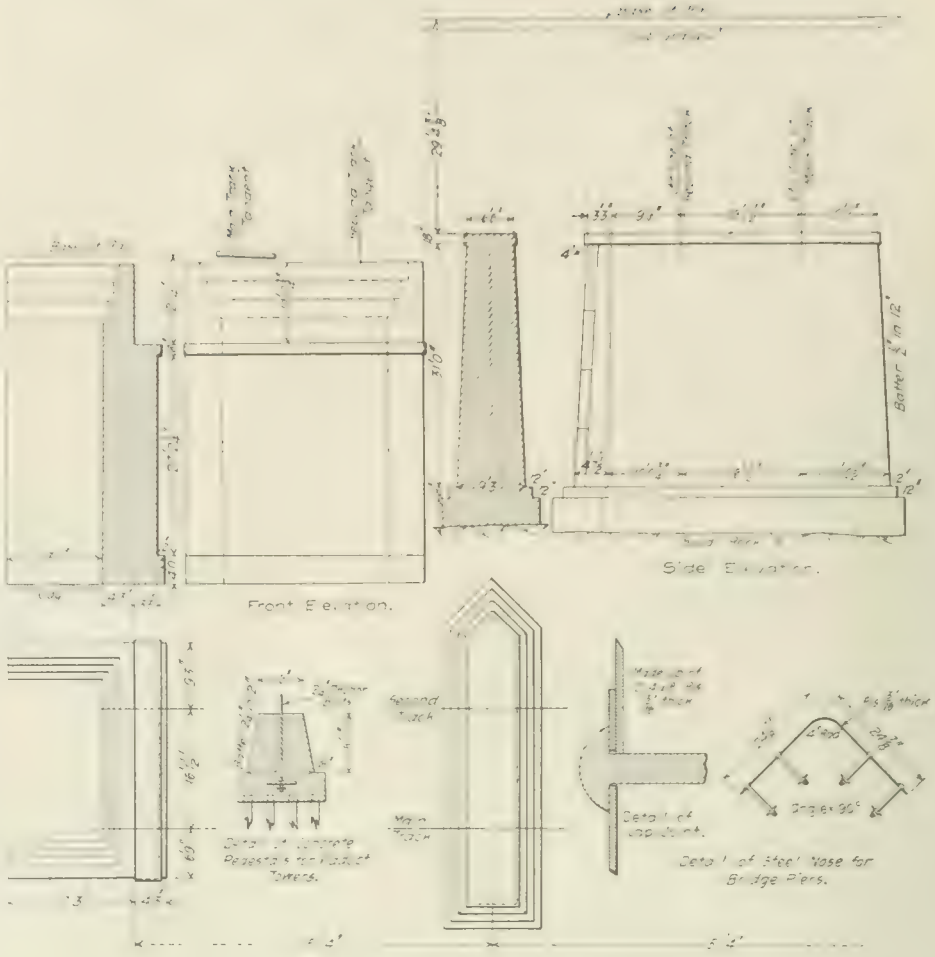


Standard Tunnel Section Showing Timber Lining.

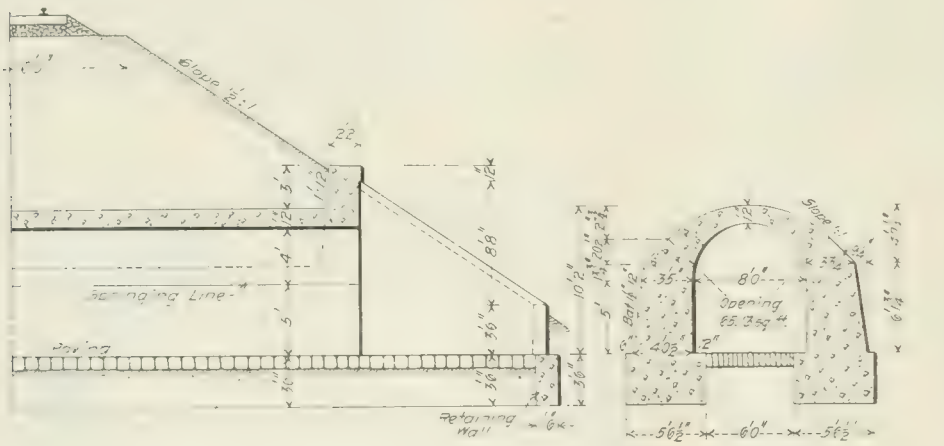
immediately adjacent to the exploders was used. This method was probably repeated on a smaller but similar scale, twenty to twenty-five times along the work. Another method used in blasting on the sidehill work was to lower drill men by means of ropes. A series of 3½ in. drill holes were then bored to grade and filled with powder. In one round of blasting near Sideling Hill upwards of 2,500 lbs. of powder were used in these holes. In a number of cases, pieces of rock from these sidehill blasts cut the telegraph wires along the Baltimore & Ohio tracks on the opposite side of the Potomac river, a distance of about one-half mile.

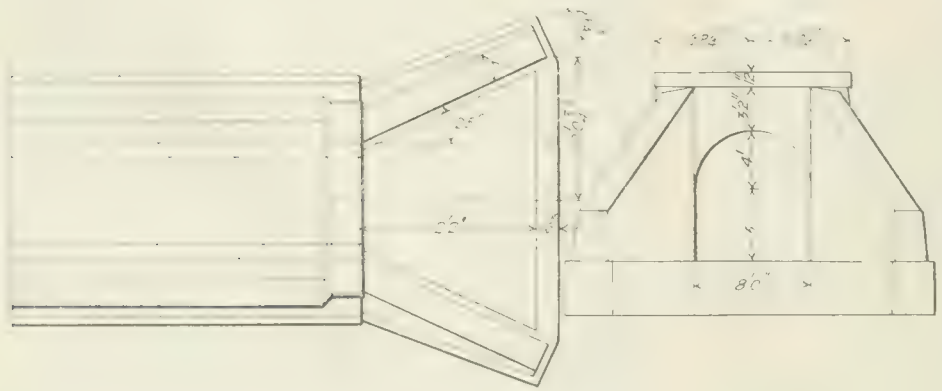
The reason for using such heavy charges was principally the desire to throw as much of the material as possible over the canal and into the river. Even with these heavy charges, however, the greater part of the rock landed in the bed of the canal, from which it had to be removed by means of steam shovels and revolving cranes and dumped beyond the tow-path embankment into the river.

After leaving the two-mile stretch of sidehill work at the west of Sideling Hill Creek, the line passes through Indigo tunnel, which is the first and longest tunnel on the line, being 4,330 ft. from portal to portal. The method of driving this tunnel was novel. Instead of removing the advance drift or heading from the top of the section, as is usually done, a bottom heading 10 ft. high by 20 ft. wide was driven, and then the remainder of the tunnel, or the overhead bench, as it may be called, was removed. The diagram clearly shows the method of drilling the blast holes for the bottom heading. Each round of blasting in the heading contained on an average of 20 holes. These were distributed as shown in the diagrams, and were loaded with upwards of 160 to 175 lbs. of 60 per cent. dynamite. The depth of the drill holes averaged about 11 ft. and



General Design of Concrete Abutments and Bridge Piers—Western Maryland.





Details of Standard 8-ft. Concrete Arch Culvert—Western Maryland.

each blast loosened on an average of 10 ft. of the heading. About 8 hours was required to drill, load and shoot each round. The loosened rock from the heading was removed in narrow-gage dump cars hauled by mules. The top bench was shot by means of drilling on an average of five holes, placed and drilled as shown, on an angle of about 30 deg. A charge containing about 50 lbs. of dynamite was used in each round of holes and each blast removed about 10 ft. of the bench. The loosened rock removed by the blast was shot down and out towards the portal of the tunnel and formed a muck pile as shown. The roof arch was trimmed to the proper section by means of drills worked from the top of the muck pile. A steam shovel operated by compressed air removed the muck from the portal side of the pile and placed it in 3-yd. dump cars which in one end of the tunnel were hauled to the portal by mules and in the other by a small contractors' locomotive.

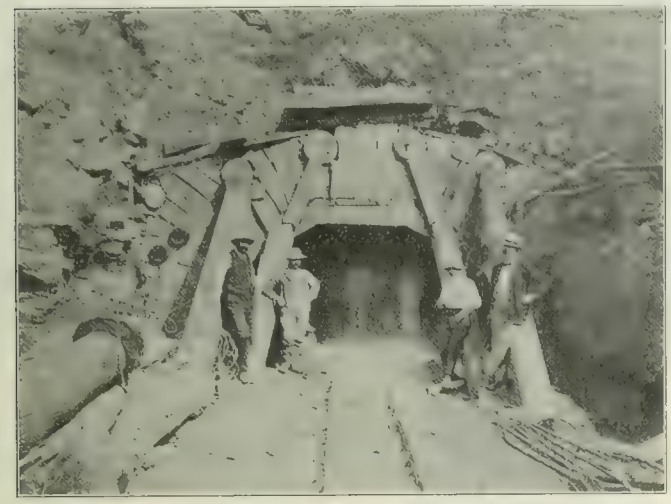
The tunnel was worked from both ends. The material met with throughout the tunnel was a hard shale formation which was easily blasted. It was found to be self-sustaining, and thus no timbering was required. As shown in the progress chart, the greatest progress made in any one month in driving the bottom heading was in January, 1905, when 456 ft. were removed. The greatest progress in any one month in removing the upper bench was made in May, 1905, when 1,259 ft. were removed. The total time for driving the tunnel was 18 months. This, as in the case of time given for other tunnels, does not mean much, as no particular effort was made to make fast time on account of great speed in most cases being unnecessary, for the reason that steel bridge work, and especially right of way matters, could be re-

garded as governing the length of time required to build the road; therefore, in most cases the contractors were allowed to drive the heading entirely through before attempting the bench excavations. In some cases, also, the bulk of the tunnel was driven from one end, for the most part, owing to heavy or troublesome approach cuts which delayed getting at the other end. This was particularly true of the Welton, Knobley and Kessler tunnels.

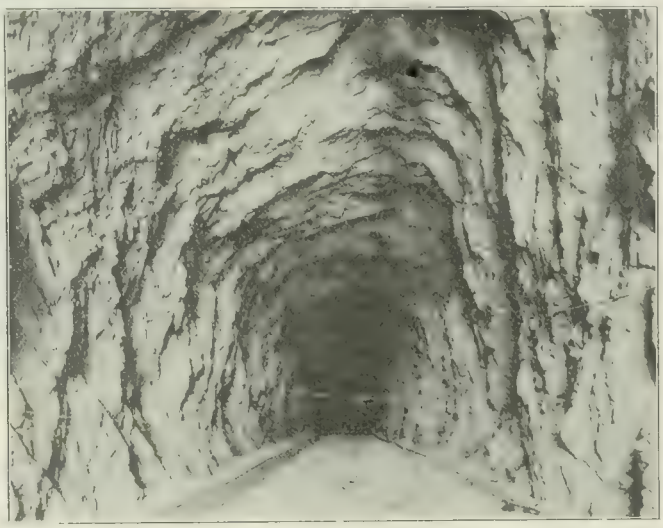
After the bottom heading of the Indigo tunnel was driven there was particularly no limit to the amount of drilling that could be done in the so-called top bench, for the power drills could be applied through the whole length of the tunnel hundreds of feet in advance of the steam shovels, and progress depended solely upon the ability of the shovels to dig and load the muck. The reason for not using this bottom heading method to a greater extent than is done is that the average character of rock ordinarily encountered does not readily permit of it. The success of the method really depends upon the consistency of the rock being such as to readily permit the shooting down of the top enlargement or bench without being subject to disastrous falls, and to be able to cut the upper portion of the tunnel to the true section. Twice before in this country has this method been attempted, but it had to be abandoned on account of the uncertainty of the material; as it was found that at one shot the rock might cut out somewhere near the rock section in the roof, and then again it might not stop coming down until the roof had gone 15 ft or 20 ft. higher than was required.

The character of the rock met with at Indigo tunnel, as well as in all the other tunnels along the line, was considered extremely favorable. Considerable difficulty was met with at both portals of Indigo tunnel in disposing of the spoil, as the face of the mountain at each portal descended for a considerable distance below grade, forming a gulch between it and the face of the hillside, directly over the canal, upon which the line was to be located. The bench for the track on this hillside could not be built until operations on the canal had ceased; therefore some special means for disposing of the tunnel spoil had to be devised. First, that part of the gulch directly in front of the portals was filled to grade; a narrow-gage tramway was then laid up the gulch and the dump cars containing the spoil were hauled up to a dump about 500 ft. above the portal by means of a wire cable operated by a hoisting engine placed on the side of the hill. The line leaves the west end of the tunnel on a 6 deg. curve built on a fill partly made from the material removed from the tunnel, and is carried along the side hill for a considerable distance on a bench built close to the canal. In many places this bench is held in place by retaining walls.

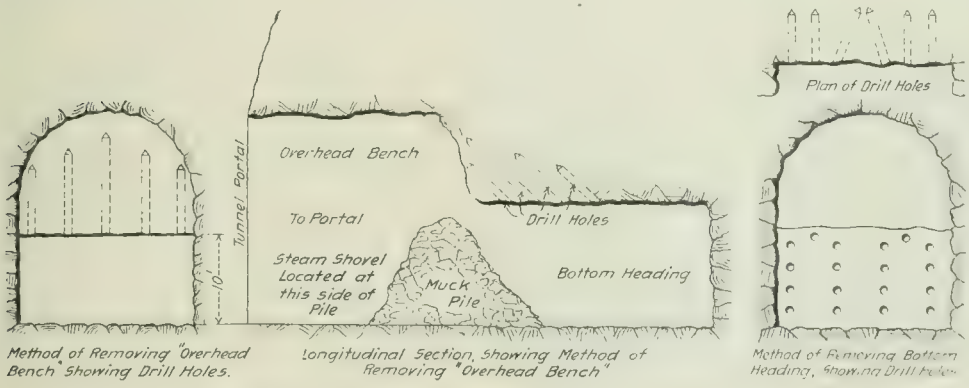
Just beyond the side hill work, near Little Orleans, as seen by the profile, a fill of 800 ft. long and from 25 to 75 ft. high is encountered beneath which a pair of 20-ft. concrete barrel arches 155 ft. long



West Heading of Knobley Tunnel Showing Timber Bracing.

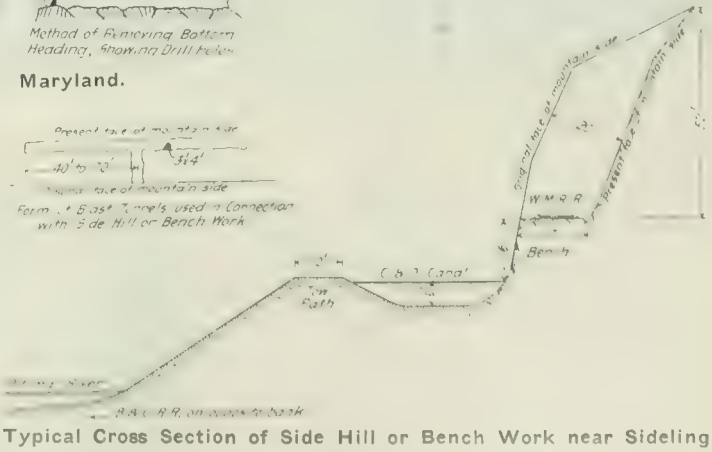


Interior View of Indigo Tunnel.

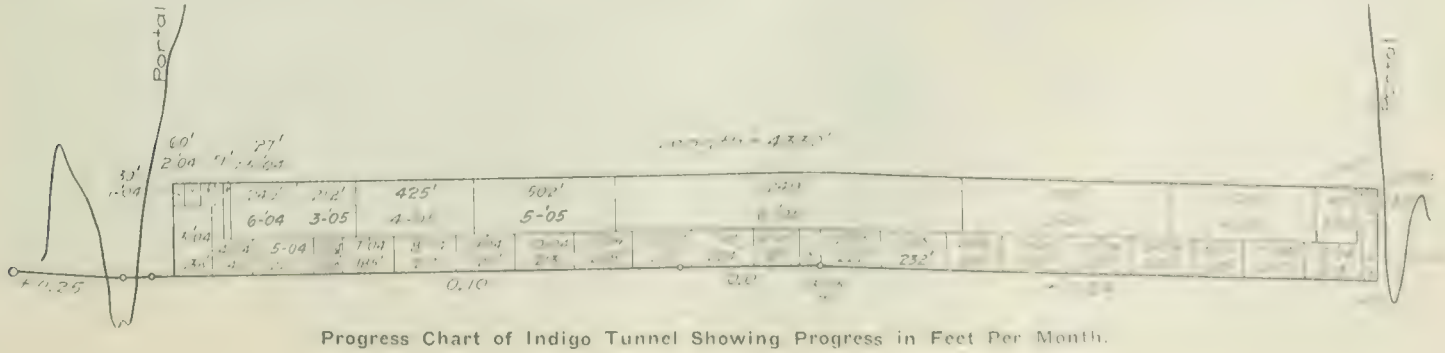


Method of Removing "Overhead Bench" Showing Drill Holes. Longitudinal Section, Showing Method of Removing "Overhead Bench" Method of Removing Bottom Heading, Showing Drill Holes.

Method of Driving Indigo Tunnel—Western Maryland.



Typical Cross Section of Side Hill or Bench Work near Sideling Hill—Western Maryland.



Progress Chart of Indigo Tunnel Showing Progress in Feet Per Month.

are built. The material for this fill was obtained from a heavy rock cut just beyond. This cut is one of the heaviest center cuts on the line, it having a maximum depth of 70 ft., and it is 2,500 ft. long. Great difficulty was met with in getting the sides of the cut to hold. Because of this sliding, it is in many places as much as 120 ft. wide at the top.

A short distance beyond this cut is the first Potomac river and canal crossing. This bridge consists of two 79-ft. deck plate girder spans, one at each end; two 150-ft. deck truss shore spans and two 152-ft. channel spans. The abutments, as well as the five piers, are all of concrete on solid rock foundation. The general designs of the bridge piers and abutments used throughout the line are illustrated in the accompanying cline drawing. The method of handling the forms and material, such as concrete, etc., which were used in the construction of the foundations and piers of the bridge, was by a cable way which had a span of 1,000 ft. The forms for the piers were made in 5 ft. sections and were raised to their new position after the concrete in them was set, by means of the cable way. The track just west of the bridge is carried on a fill built on a 5-deg. curve. The fill is 1,300 ft. long by 20 ft. wide at its top, and is from 18 ft. to 45 ft. deep. It contains upwards of 100,000 cu. yds. of material, most of which was obtained from borrow pits near by, on both sides of the track.



Second Crossing of the Potomac River Showing Concrete Piers and Abutments in Course of Construction and Cableway Used for Handling Material.



Second Crossing of the Potomac River Showing Cantilever Erection of 150-ft. Spans.

From the fill to the second river crossing, the line follows along the side hill for from two to three miles, and just before reaching the river it passes through a fairly deep cut which required the excavation of about 45,000 cu. yds. of rock. The second river and canal crossing is made on a bridge 1,367 ft. long composed of a plate girder span at each end, a truss deck girder span over the canal, five truss deck girder river spans and a viaduct composed of four plate deck girders supported on three 30-ft. steel towers resting on concrete pedestals. A cable way similar to that used in the construction of the piers on the first river bridge was used in building the piers of the bridge, which are placed on a 25-deg. skew with the bridge so as to parallel the flow of the stream. All of the up-stream ends of the river piers are provided with a steel nose to protect them from injury by ice. About 1,700 ft. west of the bridge the line passes through the second or Stick Pile tunnel, which is 1,670 ft. long. This tunnel took 11 months to build. The first 1,100 ft. is on an up-grade of 0.5 per cent., which is the heaviest grade on the line. This tunnel was driven in the usual method, the top heading being removed first, and then the bench was taken out in two lifts. The material met with was a hard shale, and no timber bracing was required during its construction. Near Baird, and less than half a mile from the west portal of this tunnel, the third river and canal crossing is made on a bridge about 860 ft. long, composed of a 3-span deck girder viaduct which spans the canal, two truss girder shore spans and one truss girder channel span with an average length of about 151 ft. From the west end of this bridge the line is carried on a single-track temporary pile trestle, 1,177 ft. long, built on a 6-deg. curve.

As soon as material is available, a permanent fill is to be made at this point. This trestle is known as the Baird trestle, and is shown in one of the accompanying half-tones. The first crossing of the Baltimore & Ohio is made at the west end of the trestle on a 120-ft. through truss girder bridge. The piling shown at the west end of the trestle has been replaced by a concrete abutment on which this bridge now rests. About half a mile beyond this trestle a track connection is made with the Baltimore & Ohio, which the new line closely parallels to Magnolia, a distance of about 3½ miles. No great difficulties were met with between Baird and Magnolia, although some fairly heavy sidehill work, as well as some deep earth and loose rock cuts were made. At Magnolia the fourth river and



Fifth Crossing of the Potomac River Showing Temporary Trestles Used for Depositing Concrete for Bridge Piers.



Licking-Creek Bridge; Three 80-ft. Plate Girder Spans on Concrete Piers and Abutments.

the second Baltimore & Ohio crossing is made on a bridge having a total span of about 1,030 ft., composed of a viaduct supported on trestle towers and a number of truss and deck girder spans resting on concrete piers and abutments. The canal at this point is left about a mile to the northwest, as shown on the plan, where it passes through a tunnel about 2,500 ft. long.

About half a mile beyond the bridge the line passes through Kessler tunnel, the third tunnel on the line. It is 1,802 ft. long and was driven through solid rock. The time consumed in driving it was 16 months. Considerable difficulty was experienced in getting through this tunnel, as a very hard rock formation was met with a short distance in from its east portal. The east approach to this tunnel is through an extremely long and deep solid rock cut, which commences about 1,500 ft. from its portal. It is from 20 to 125 ft. deep, and upwards of 150,000 cu. yds. of material were taken from it. Just beyond the west approach of the tunnel, which is about 300 ft. long and which necessitated the excavation of about 35,000 cu. yds. of material, the fifth Potomac river crossing is made on a deck girder bridge having a total length of about 650 ft. composed of four deck truss girders and two deck plate girders resting on concrete piers and abutments built on solid rock foundations.

The concrete for the piers and abutments of this bridge was delivered through chutes from a temporary pile trestle over which narrow gage dump cars were operated. As the piers were built up, a second story was erected on the pile trestle, as shown in the illustrations. Half a mile beyond this bridge the line again crosses the Potomac on the sixth river bridge, which is practically a similar structure to the fifth river crossing just described. A few short stretches of heavy work were encountered between the fifth and sixth bridges, including a fill about 800 ft. long with a maximum height of 40 ft., as well as a loose and solid rock cut which required the excavation of about 60,000 cu. yds.

Just beyond the sixth river crossing is another fill 600 ft. long by 30 to 35 ft. high. At the end of this fill the line is carried over the first independent canal crossing to Paw Paw, at which point the third division begins. Half a mile beyond this canal crossing, the tracks are carried over Purslane Run on a 20-ft. deck-girder bridge. From this point on to Old Town, about 10 miles, the line closely parallels the canal, and for the greater part of the distance is carried on a bench built in the hillside. The method of building this bench was similar to the method used in the sidehill work near Sideling Hill Creek, which has already been described.

There are several 4-deg. curves in the stretch, and some heavy cuts and fills were also made in this 10 miles of line. Just west of the first canal crossing is a cut from which upwards of 120,000 cu. yds. of loose and solid rock were removed. It has a maximum depth of 60 ft. and is about 2,000 ft. long. The material from this cut was used in a fill 3,000 ft. long by 30 ft. high, one-half mile beyond. From here on, with the exception of a few fairly deep cuts and fills, nothing but sidehill work is found until the line reaches Town Creek, over which it is carried on a deck girder bridge composed of three 80-ft. deck plate girder spans resting on concrete piers and abutments. About $2\frac{1}{2}$ miles west of Town Creek the line passes through a solid rock cut, known as Reeces cut, having a maximum depth of 50 ft. and about 2,500 ft. long. Just west of this cut is a fill over one-half mile long, across which the line is carried to within a short distance of Old Town. A few heavy cuts and fills are then met with in the next two to three miles, at the end of which the line passes through an extremely heavy solid rock cut, known as Knuckols cut. This was the heaviest and most difficult cut on the line. Its maximum depth is 80 ft., and it is 1,000 ft. long. A fill 1,200 ft. long with a maximum height of 70 ft. just east of this cut was made with the material taken from it.

The work from Knuckols cut to one mile beyond Sloan was comparatively light except-ing for a distance of about one mile in which several heavy cuts and a short 60 ft. fill were made. For a distance of from three to four miles beyond Sloan the line passes through some extremely heavy cuts as can be seen by the profile. The material removed from



Temporary Trestle at Baird Baltimore & Ohio Tracks in the Foreground.



Ninth Crossing of the Potomac River Showing Concrete Piers—Portal of Knobley Tunnel in the Background.

these was mostly limestone and hard shale. About one mile beyond this heavy work the line leaves the canal and passes over a heavy fill which carries it to the first independent Baltimore & Ohio crossing near North Branch. After passing over a fill at the west end of this bridge the line again passes through a deep cut to the fifth canal crossing over which it is carried on an 85-ft. span deck girder bridge. From the west end of this bridge the line is carried on a fill, upwards of one mile long, with an average height of 25 ft., to the seventh Potomac river crossing. This bridge is 382 ft. long and consists of four 95 ft. 6 in. deck girder spans resting on concrete piers and abutments.

From this bridge the line passes over a fill to the east approach



Fill at Collier's Run, 60 ft. Deep; Showing 10-ft. Arch Culvert in Course of Construction.

of Welton tunnel. This tunnel is 750 ft. long and is the fourth and shortest on the line. The time consumed in driving it was five months. The west portal of this tunnel is in the abrupt face of the mountain at a considerable height above the river. The first blast holes for the heading were drilled by men working from a rope ladder which was suspended from the top of the mountain. As soon as sufficient progress had been made with the heading, a cable way was erected which carried the spoil from the tunnel to the other side of the river, where it was used in making a fill. From the west portal of this tunnel the line crosses the river on the eighth river crossing, which consists of a deck girder bridge 382 ft. long, similar in design to the bridge just described at the east approach of the tunnel. From the west end of this bridge to Knobly tunnel, a distance of about 1¼ miles, there are two canal crossings and one river crossing.

The canal crossing consists of one 85-ft. deck girder span sup-



Concrete Arch Bridge Over Wagon Road, and Retaining Walls; Little Orleans, Maryland.

ported on concrete abutments, and the river crossing, which is the ninth and last on the line, consists of a 4-span deck girder bridge similar in all respects to those over the seventh and eighth river crossings. About 250 ft. from the west end of this bridge the line enters Knobly tunnel, the fifth and last tunnel on the line. This tunnel is 1,428 ft. long, and it took six months to drive. The material met with was mostly hard rock, with the exception of a few hundred feet in its west end, which was of loose clay and sand. Considerable trouble was experienced in holding this material up, and timbering had to be used during the construction of this portion of the tunnel. The heading had also to be held to form by heavy timber bracing, as shown in the illustration. The material taken from the west end of the tunnel was used in making a fill a short distance from its west portal, and that taken from the east end was carried to the other side of the river in dump cars on a temporary pole trestle and was used for making a fill on the river bottom. The new line continues for a distance of one mile west of the fill, where it makes a connection with the West Virginia Central & Pittsburg at Knobmount, which is about two miles from Cumberland.

The first train passed over the new extension on February 8, 1906, when a party of officials, including Mr. J. Q. Barlow, Chief Engineer of the Western Maryland, to whom, with others, we are indebted for the above data, made the first trip over the new extension from Cumberland to Cherry Run.

Four Cylinder Balanced Compound Locomotives.

The American Locomotive Company has just published in pamphlet form a paper on "Four-Cylinder Balanced Compound Locomotives," read by Mr. F. J. Cole before the Pittsburg Railway Club. It is a valuable and interesting discussion of the subject, in which the theoretical and practical advantages of the type are well set forth, together with the trend of the development since the first introduction on the Northern Railway of France fifteen years ago, and the reasons for the machine as it is built in this country.

The forms of crank axles used come in for a liberal amount of attention, though the one adopted by the American Locomotive Company is of the Z shape, with a diagonal member connecting the two cranks. However, owing to the expense of making solid crank axles, the danger of internal strains and of cracking, with the necessity for scrapping the whole axle when cracked, the built-up axle is gradually being substituted. In the built-up axle the danger from internal strains is very much reduced, as there are no abrupt changes of shape. The cracking at the corners is therefore confidently expected to be very much reduced, and if such cracks do occur, the part failing can be replaced without discarding the entire axle.

The pamphlet enters into some detail regarding the construction of the four-cylinder compound built for the New York Central, and shows the value and simplicity of the valve that is used. This engine, with cylinders 14 in. and 24 in. in diameter, with a stroke of 24 in. developed when tested at St. Louis, 1,630 indicated horsepower, 1,470 dynamometer horse-power, and a drawbar pull of 9,796 lbs. continuously at 57 miles per hour, and a cut-off at half stroke. The pamphlet closes with a brief illustrated description of various types of locomotives to which the four-cylinder compound principle has been applied.

The Western Pacific.

The following information comprises what may fairly be termed as full an account as can be compiled at the present time of the Western Pacific Railway Company, which is being built from Salt Lake City to San Francisco to serve as a Pacific connection for the Gould system of railroads. The company was chartered in March, 1903, the charter providing that the line should pass through Oakland, Stockton, Sacramento, Marysville and Oroville, Cal., and the Beckwith Pass in the Sierra Nevada mountains, a distance of about 850 miles, with about 410 miles of branch lines in California; a total of about 1,250 miles. The company has purchased the Alameda & San Joaquin Railroad from Stockton to Tesla, Cal., 36 miles, and has also acquired the property, rights and franchises of the San Francisco Terminal Railway & Ferry Company, the San Francisco & Oakland Railway Company and the Stockton & Beckwith Pass Railway Company.

The Western Pacific was financed by an issue of $50,000,000 of first mortgage bonds, guaranteed by the Denver & Rio Grande and the Rio Grande Western, under a covenant to purchase unsecured obligations of the Western Pacific to an extent sufficient to operate and maintain the road, and to pay its interest and sinking fund requirements. Capital stock has been issued to the amount of $75,000,000, two-thirds of which has been acquired by these guarantor companies. The Rio Grande Western also agrees to purchase second mortgage bonds of the Western Pacific in such amounts as may be necessary to complete the main line from Salt Lake City to Oakland, with adequate terminals, in case the proceeds of the first mortgage bonds are not sufficient for this purpose.

Through its affiliations with the Denver & Rio Grande and Rio Grande Western, the Western Pacific will be able to use on advantageous terms properties and terminals in Salt Lake City valued at $1,000,000, so that it will not have to make expenditure out of capital account for its eastern terminals.

The route and traffic possibilities of the line may be roughly reviewed as follows: Starting from the harbor of San Francisco

the main line proceeds by ferry to the city of Oakland; from Oakland to the forest and mountain regions of the Sierra Nevada mountains the line traverses the valleys of California by way of Stockton, Sacramento and Marysville, crossing the Sierre Nevadas at the Beckwith Pass, the route extends through the Great Interior Basin and continues through the State of Nevada into Utah. Oakland is the suburban residence district of San Francisco and it is estimated that 30,000,000 passengers are carried annually between San Francisco and the Oakland side. Besides being a residence district it is an important manufacturing and shipping center. Over 400 trains of the Southern Pacific System alone arrive and depart each day, and every month that company transports 16,000 cars across the Bay of San Francisco to Oakland. The valleys next traversed are characterized by being owned in small holdings principally devoted to fruit, berries and vegetables.

It will be recollected that Stockton is located at the entrance to the Sacramento and San Joaquin valleys—the two great valleys of California—which extend north and south about 400 miles and comprise an area of about 16,000 square miles, less than 400 ft. above sea level, and now populated by but a few hundred thousand. The present plans of irrigation and reclamation are designed to make these valleys give homes to a great population. In the Sacramento valley the road passes through the citrus belt of northern California and then across the Sierra Nevada mountains through virgin forests which extend for almost fifty miles on each side of the line.

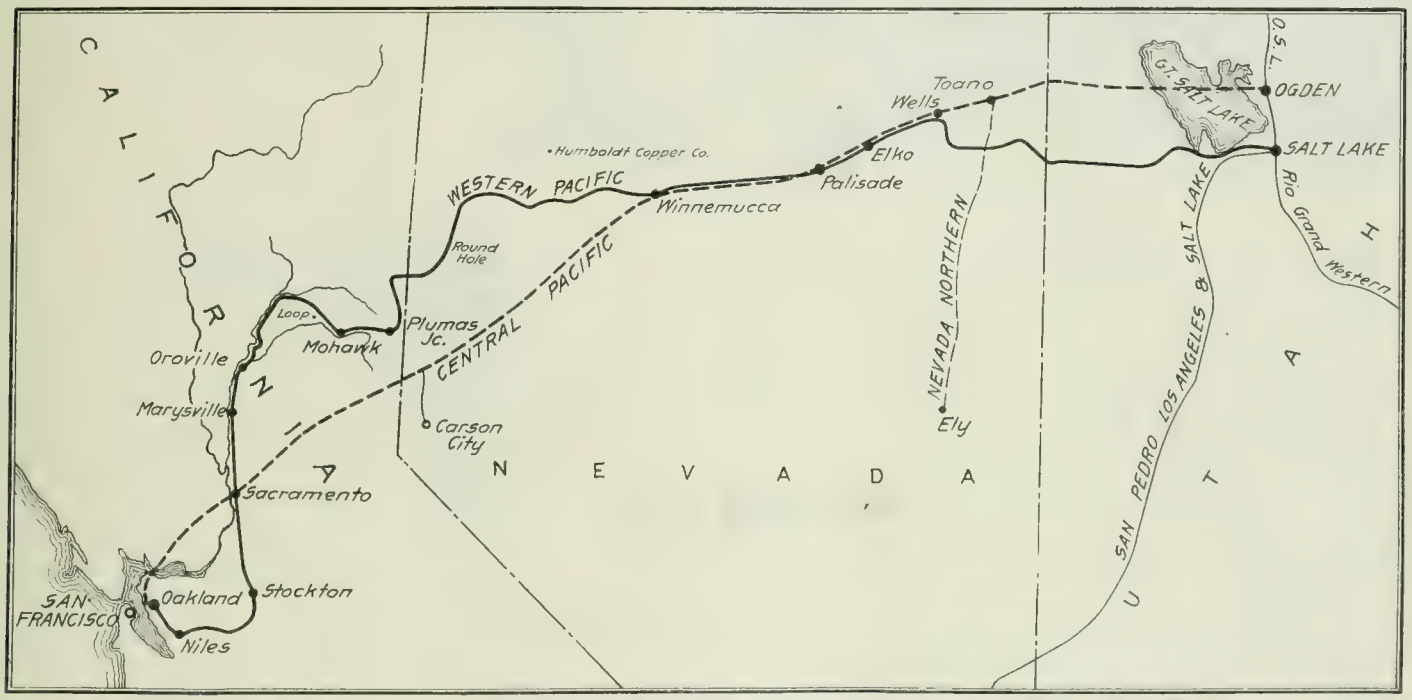
The line finally chosen for the Western Pacific was selected after long and careful consideration of the experiences of all other transcontinental lines, and it is believed that the route as selected will never need to be altered by cut-offs or reduction of grade and curvature. The great problems involved in building a transcontinental line are directness, grades and snow conditions. The maximum grade on the Western Pacific will be 52.8 ft. to the mile, comparing with approximately 106 ft. maximum on the Central Pacific, which also passes through more than forty miles of snow sheds, while the Western Pacific will not require any. The maximum grade on the Oregon line of the Southern Pacific is 3 per cent.; the maximum grade on the Coast line, crossing the Santa Lucia range, is 2 per cent.; the maximum grade on the Valley line, used also by the Santa Fe, across Tehachap. Pass, is 116 ft., with a loop on the grade. Beckwith Pass, occupied by the Western Pacific, is approximately 1,900 ft. lower than the pass used by the Central Pacific, and the line traverses a country which is practically free from snow.

The Western Pacific has two main sources of profit; one arising from the business which the Missouri Pacific will be able to throw over the other the traffic which it will itself originate. The surprising growth of the Pacific coast within the last few years gives reason to believe that this latter profit will be of the highest importance, and it may be added that on the Denver & Rio Grande and Rio Grande Western at the present time about 85 per cent of the total business done originates or terminates with these companies. In 1901 there were 6,459 cars of deciduous fruit alone shipped from California by rail; in 1902 there were 7,141 cars, and in 1903 7,688. Of citrus fruits 8,075 carloads were shipped in 1893 and 29,962 carloads in 1903; of dried fruits 4,539 carloads in 1893 and 14,953 carloads in 1903. As a result of these traffic increases it has been graphically said that the coast country is now flooded with freight of all kinds and there is a chronic car shortage; therefore, it is evident that the Western Pacific will not have to depend for its livelihood upon rate warfare to get a sub-share of traffic already existing, but can find a handsome business in providing for the constantly increasing surplus of traffic over traffic facilities.

The following abstract shows the progress of construction work on the Western Pacific on February 14, 1906:

San Francisco division, extending from San Francisco to Stockton, 92 miles. Line has been located complete and has been cross-sectioned for 21 miles; 18 miles of the right-of-way is covered by the track of the Alameda & San Joaquin Railroad, which the company owns, and 15 miles additional has been purchased. The contractors now have about 140 men and 264 horses on this section and 8,959 ties, 40,260 ft. of rail and 100,000 ft. of trestle timber have been received.

The Sacramento division extends from Stockton to Oroville, Cal., 115 miles. This line has been located complete, 64 miles of it have been cross-sectioned and right-of-way for 60 miles has been bought. There is only a small working force on this division at present. Supplies aggregating 1,782 tons and five cars of rails have been received.



Route of the Western Pacific Railway.

The North Fork division extends from Oroville to Spanish Creek, 76 miles. This has been located for 66 miles and cross-sectioned for 26 miles. Fifty miles of the right-of-way have been purchased and the remainder is on government land. A force of about 1,400 men and 425 horses is working on this division.

The Sierra division extends from Spanish Creek, Cal., to Deephole, Nev., 148 miles. This has all been finally located; 55 miles of it have been cross-sectioned, and right of way has been bought for 91 miles. The contractor is working on 13 sections of this division with a force of about 360 men and 100 horses.

The Humboldt division extends from Deephole, Nev., to Elko, 242 miles. This has been located complete, with the location subject to some possible changes. No cross-sectioning has been done; 22 miles of right-of-way have been bought and most of the remainder is on government land. No contracts for construction have been let.

The Salt Lake division extends from Elko, Nev., to Salt Lake City, Utah, 264 miles. This has been located complete; 66 miles of it have been cross-sectioned and nine miles of right-of-way have been bought. The contractor's force of about 150 men and 300 horses is now at work. Good progress has been made in securing rights-of-way not yet purchased.

On the entire work some 2,250 men and 1,700 horses are now at work, but progress in actual construction has been slow on account of severe weather and storms.

There is a socialist organization of railroad employees in Germany called the "Railroaders' Union." The management of the Saxon State Railroads has warned all employees against this organization, declaring that it will discharge from the service any who is shown to belong to it.

The Chicago & Eastern Illinois 1905 Improvements.

The heavy coal traffic of the Chicago & Eastern Illinois Railroad has for a considerable time past been overtaxing its motive power as well as the capacity of its track facilities, yards and main and side tracks to care for, classify and forward the cars. For years, during the fall and winter months yards, sidings and passing tracks, for many miles south of Chicago, were blocked with coal trains and great delay resulted to main line movements from inability to care for and classify traffic at Dolton, the Chicago freight terminal. The rapid growth of this traffic and the volume



Coal, Sand and Ash Handling Plant at Coaler, Ill., C. & E. I.

attained by the end of 1904 are exhibited graphically in the accompanying diagram showing the ton-miles per year from 1894 to 1904 inclusive. Last year (1905) showed a corresponding increase over 1904, as indicated by the November record, which was 157,000,000, an increase of 13,000,000, or 8.3 per cent., over November, 1904. To meet the requirements of the situation, extensive improvements were authorized for the year 1905 on the Chicago division (Chicago to Terre Haute), as follows:

1. Second track construction on the section between Terre Haute, Ind., and Danville, Ill., aggregating 7.51 miles.
2. Construction of two miles of new double-track line to connect with the Chicago Southern (Danville cut-off).
3. Construction of a locomotive coaling, ash-handling and watering plant at Coaler, near Watseka, Ill.
4. Construction of passing tracks between Terre Haute and Chicago aggregating 11.8 miles.
5. Construction of third track between Momence and Dolton, aggregating 20 miles.
6. Construction of a new northward gravity yard at Dolton.
7. Remodeling of an existing yard at Dolton.
8. Installation of automatic electric block signals protecting 98 miles of main line between Bismarck Junction and Dolton.
9. Construction of 13 water softening plants on the Chicago division.
10. Main line ballasting on all divisions.

Because the Dolton yard work is the largest and most important single feature in the foregoing list, and because these yards have already been illustrated and described in the *Railroad Gazette*



Coal, Sand and Ash Handling Plant at Coaler, Ill., C. & E. I.

(Sept. 15, 1905), they will be considered first. At the time of the previous article they were in process of building from plans which had been carefully worked out. Since their completion and putting in service a number of additions have been made to increase their capacity, efficiency and flexibility of operation. As it will be advantageous to know in detail of just what these changes consist, final plans of the yards are reproduced herewith.

One of the most important changes was in the hump of each yard, by raising the grade of each run-around track to the elevations shown; the northward yard having the knuckle of the run-around 1.27 ft. higher than the knuckle of the scale track. The primary purpose of raising the grade of this run-around track to its present height was to enable it to be used when the scale is out of commission or use of this track is blocked for some other reason. Also, it is for use on very windy days when the elevation of the scale track may be insufficient to carry the cars to their destination in the classification yard, the extra height of knuckle being for this special purpose. In considering the winter season, the profile of the regular scale track should naturally be arranged for the average winter day, the run-around taking care of weather of unusual severity. Practically the same thing is true for the southward yard hump, except that here both tracks have the same grades and elevations. In this case the large majority of the cars handled are empties. A level section at the summit will be noted. This is to provide for such adjustments in profile as may be found desirable. In the northward yard, another scale directly west of and close to the hump scale has been placed on a special track off of the running track. This is for live stock, it not being desirable to run live stock over the hump. One scale tender looks after both scales. The scales in both yards have the Streeter-Amet automatic weighing device.

It will be noted that the classification tracks in the northward yard connect at the north end to the running track, east of and adjacent to the northward main track. This running track in the former plan ended a short distance south of Frederick street, join-

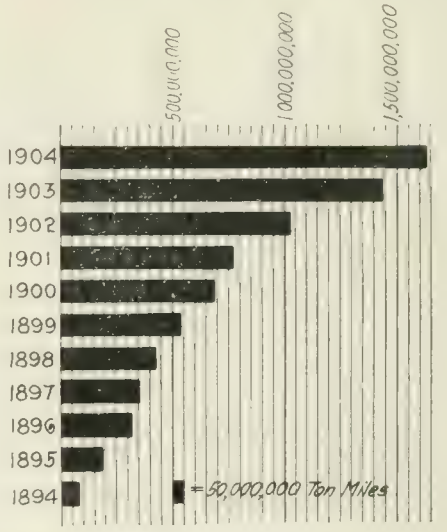


Diagram Showing Increase of Freight Traffic on the C. & E. I. in Ten Years.

ing the northward main at that point. There was one cross-over between running and main track about one-third of the distance from the south end of the yard. To facilitate deliveries to connecting lines and departures to the city yards the running track has been extended northward to connection with the interlocking plant at the P. C. C. & St. L. crossing, and cross-overs put in with the interlocked lines—P. C. C. & St. L., Chicago Terminal Transfer and Chicago Junction railroads—to take care of freight movements into and out of the yard there. This arrangement minimizes the movements through the throat between northward and southward yards, which is across main line traffic, in making deliveries to foreign roads and to the city. An additional cross-over between the running and northward main tracks was put in about midway between the original one and the former end of the running track, and the latter was left in as a third cross-over, giving in each case space between cross-overs for a 50-car train, or three trains in all. The arrangement is such that any one of the three can be pulled out independently of the others, a feature of great convenience.

In the southward yard, the seven tracks west of the hump are new. The four marked "holding tracks for southward trains" are intended for use to relieve or clear the classification yard; as, for instance, if a train is made up but power for it is not immediately available, it is run on one of these "holding" tracks to await a locomotive.

The coal chute has been extended 18 pockets, making 78 in all, 399 on each side. Two additional cinder pits, each 190 ft. long, were put in, the sand house capacity increased from 20 to 35 cars, the storage and oil room capacity doubled, a gasolene motor put on the turntable, and three additonal water cranes for locomotives

put in, making a total of five in this yard. Careful attention was given to the drainage of the cinder turntable and water crane pits and to surface drainage generally, to avoid a repetition of troubles experienced during the severe weather of last winter. Also to minimize troubles heretofore experienced from snow, three miles of snow fence was built along the west side of the two yards.

A series alternating lighting system consisting of a 100 h.p. high-speed Ideal engine and a 60 k.w. Fort Wayne alternating generator, was installed to provide some 40 arc lights and about 250 incandescents. The power plant is adjacent to the roundhouse and the distribution is made through the yards on 35-ft. poles. Particular attention was paid to lighting the two humps. In the northward yard are 194 switch lamps cared for by three tenders having separate cabins as indicated on the plan. The southward yard has 132 switch lamps with two tenders at opposite ends of the yard. The terminal at present has a total of 54.7 miles of track.

Houses for the hump riders were built adjacent to the respective humps, the one in the southward yard having a second story for the yardmaster's office, from which he is able to see the entire yard. In the northward yard the yardmaster's office has a third floor, or lookout, for that purpose. A third story was added to the interlocking tower controlling the crossover between the two yards to be used as an office for the general yardmaster, from which he can overlook both yards.

Car movements over each hump are controlled by a semaphore operated by the man in charge of the hump. Three special hump switching engines are being built for this service by the Baldwin Locomotive Works. They will be 0-8-0 type, weighing 220,000 lbs. total—all on drivers, of course. They will have 23½-in. x 32-in. cylinders, 57-in. drivers, and carry 200 lbs. steam pressure. Their tanks will hold 8,000 gals., to minimize the number of trips to the water crane. There will also be 14 0-6-0 switching engines for general yard work at Dolton, weighing 160,000 lbs., having 21-in. x 26-in. cylinders, 51-in. drivers, and 5,500-gal. tanks.

The assistant agent at Dolton has in his office a complete private telephone exchange with metallic circuit, having 18 connections to all important points about the yards and vicinity with which it is necessary to have quick communication, not including six connections within the office. There are in addition a private wire each to headquarters in La Salle street station and to 12th street freight house (the principal freight house), the latter being a new wire just put in on account of the volume of business between these two. The line out from La Salle street station has connections to the 33d and 37th street and Oakdale yards.

The next important feature of the improvement work is the third track connection between Momence and Dolton. By reference to the accompanying sketch map of the system, it will be seen that the traffic of the entire system is carried by this section of the line. It was here that the greatest congestion occurred as described at the beginning of the article, and an extra track became a necessity. At first it was the intention to build this track through from Momence to Dolton, 33 miles; but after careful consideration it was decided that by extending it from Momence to the summit of Goodenow hill, 17.2 miles, building a long passing track at Chicago Heights, and putting in a third track from Thornton Junction to Dolton, 2.8 miles, the requisite capacity would be provided. This made a total of 20 miles of third track. It was built with a maximum grade of ¼ of one per cent. The Momence-Goodenow section involved 370,000 cu. yds. of earth, 3,300 cu. yds. of masonry, and the extension of numerous culverts. Included in the masonry are two reinforced concrete bridges of the flat-arch type, one containing 1,142 cu. yds. and the other 1,564 cu. yds. The former is Bridge 476, crossing Trim creek, a view of which is shown herewith. The shorter section of the third track work, from Thornton Junction to Dolton, was done in connection with the Dolton yard work. This track enables northbound freights to enter Dolton yard without disturbance to main-line traffic, and under the protection of the Thornton Junction interlocker.

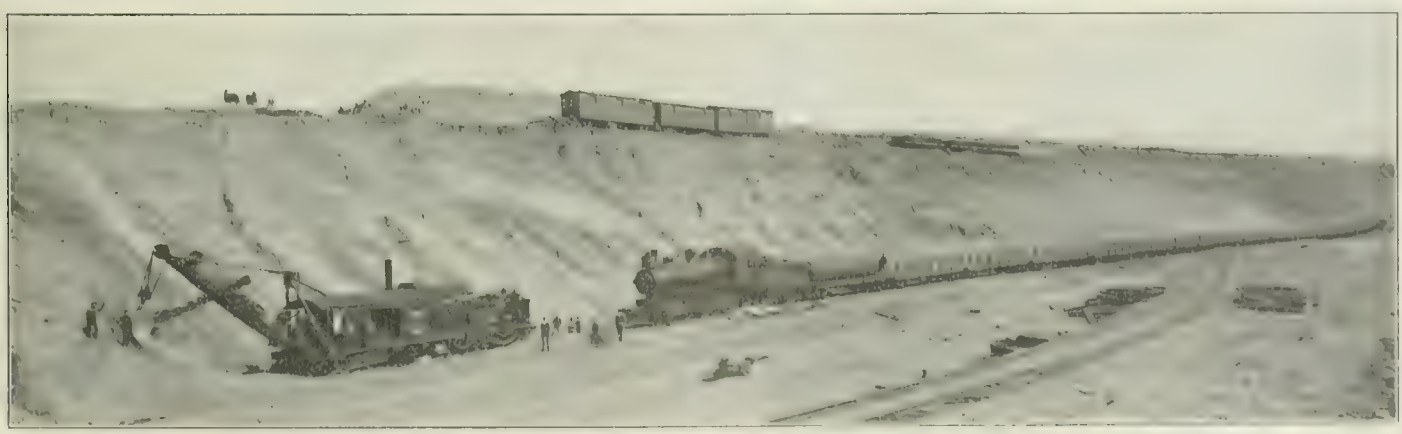


Concrete Bridge No. 476 Across Trim Creek, C. & E. I.

The second item given in the list of improvements is the construction of a double-track connection to the line of the new Chicago Southern just south of Bismarck, by means of which a cut-off between Bismarck and Brewer, around Danville, is obtained. The situation will be clear by reference to the accompanying map. The line of the C. & E. I. into Danville from the north has considerable heavy curvature in it. The line to Terre Haute, in getting out of Danville, runs due east for about two miles, crossing the Chicago Southern just before entering Brewer yard. Therefore, by building the connection south of Bismarck mentioned and using jointly with the Chicago Southern the 6.44 miles of its double-track line between these points, a distance of 2.28 miles, is saved and a considerable amount of curvature and the passage through Danville will be avoided by through freights. The connecting line is approximately two miles long, with a maximum gradient of 13 ft. to the mile and curves not exceeding one degree.

With the building of the 7.51 miles of second track from Newport to Hillsdale on the Danville-Terre Haute section (the first item in the list) the C. & E. I. is now continuously double-tracked from Chicago to Clinton, Ind., 163 miles. The improvement work also involved the construction of 11.8 miles of new passing tracks between Dolton and Terre Haute. Seventy-car tracks were provided for northbound trains, and 90-car tracks for southbound. Where a northbound and southbound siding occur at the same point, they are connected by a facing and trailing interlocked crossover.

On the Chicago division there were formerly eight interlocking plants for protecting grade crossings of foreign roads. Eight new interlocking plants for handling the double crossovers mentioned in the preceding paragraph have been added. Also 98 miles of double track between Dolton and Bismarck Junction are being equipped with electric automatic block signals. They are the three

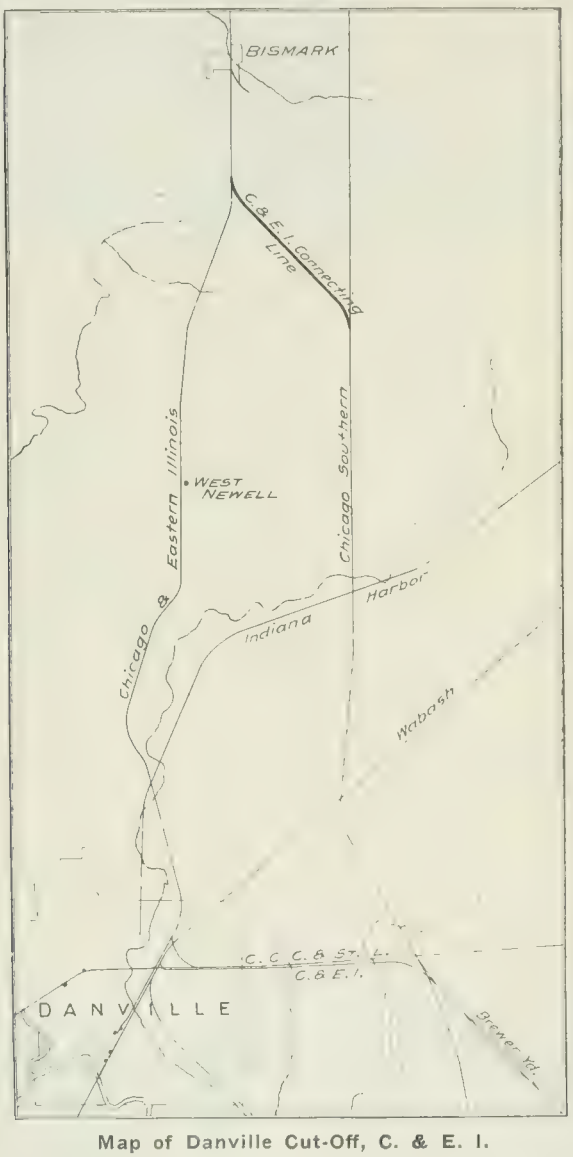


Gravel Pit at Lyford, Ind., C. & E. I.

position, normal clear system, worked by primary batteries. A drawing of the circuit, which is a polarized line circuit, is shown herewith. By this arrangement use of a polarized relay for working the distant signal—a line wire to the distant signal is saved.

The average length of block is approximately two miles, but they are shorter approaching junction points and interlocking plants. The interlocking home signals are three-position, and the full, clear position of the main line interlocking home signal is dependent on the block ahead of the interlocking. The interlocking distant signals also are three-position, their indications being governed by the home interlocking signal. When the distant signal is in the full clear position it locks up the route through the interlocking.

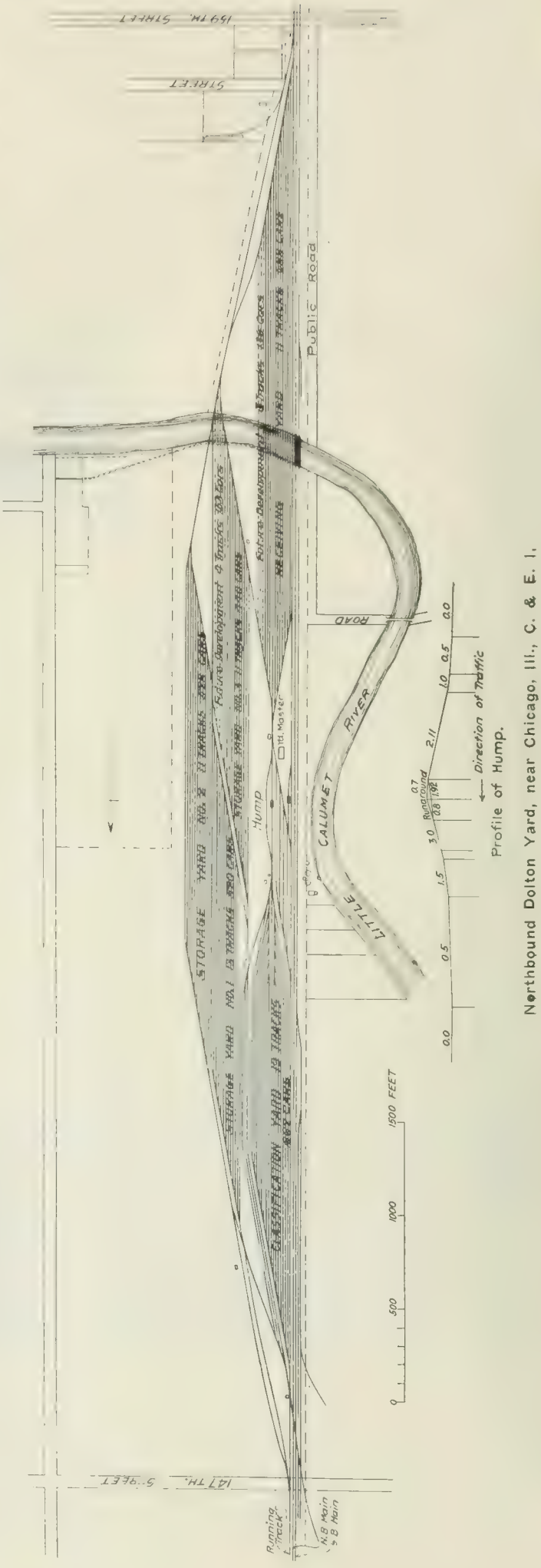
In October, 1905, the manual block signal system was installed on all single and double track not having the automatic signals, where through trains are operated. American Railway Association manual block signal rules are used. To establish this system, it was necessary to string an additional block wire from Woodland Junction to Pana, 122.6 miles, and from Bismarck Junction to



Map of Danville Cut-Off, C. & E. I.

Terre Haute, 63 miles. Although these signals are controlled manually, on single track they are electrically locked by a specially devised machine in a manner which makes it impossible for an operator to pull his signal to clear until the operator at the other end of the block has unlocked it for him. These locking machines are of a type not in use on any other railroad. To operate them there is also an insulated iron wire covering the entire territory.

The capacity of the telegraph department also had to be increased materially, and between July and January new wires were strung as follows: St. Elmo to West Frankfort, 80.6 miles; Lyford to Terre Haute, 13.4 miles; Bismarck to Danville, 9.9 miles; Terre Haute to Danville, 54.1 miles; Terre Haute to Findley Junction, 82 miles; Danville to Rossville, 18 miles; Woodland Junction to Pana, two wires, 254.2 miles; Chicago to Terre Haute, 178.8 miles; Danville to Woodland Junction, via Villa Grove, 105.5 miles; Thebes to North Junction, 4 miles; total, 791.8 miles. To this should be added 500 miles of wire for the automatic signals; also telephone

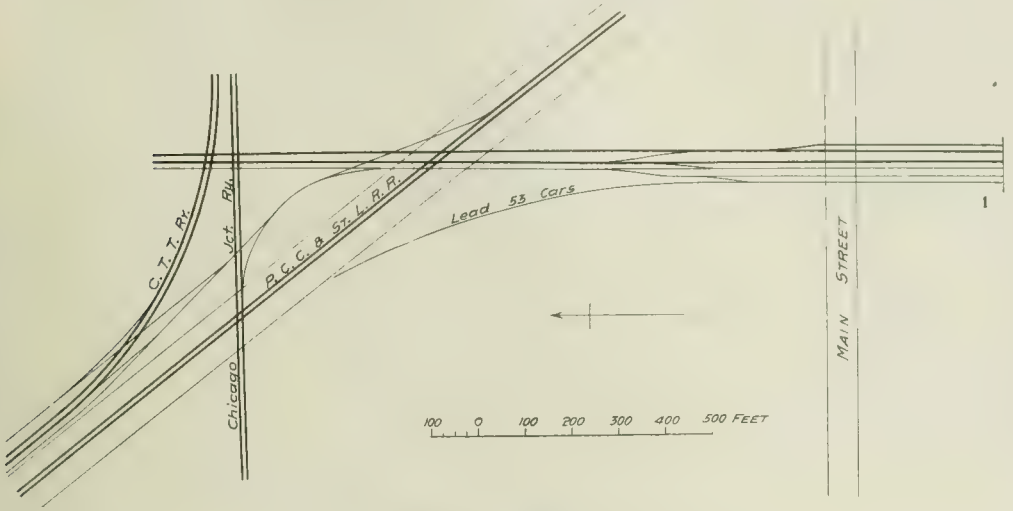


Northbound Dolton Yard, near Chicago, Ill., C. & E. I.

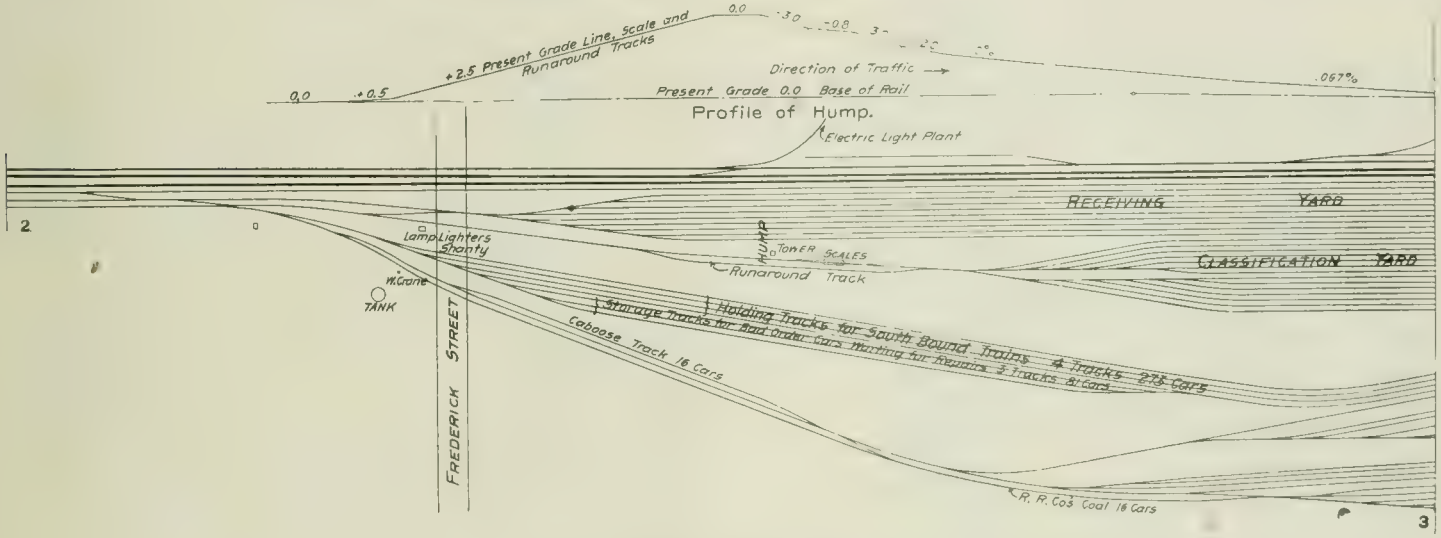
Profile of Hump.

wire in Dolton yards and at block stations, which brings the total amount up to 1,424.3 miles.

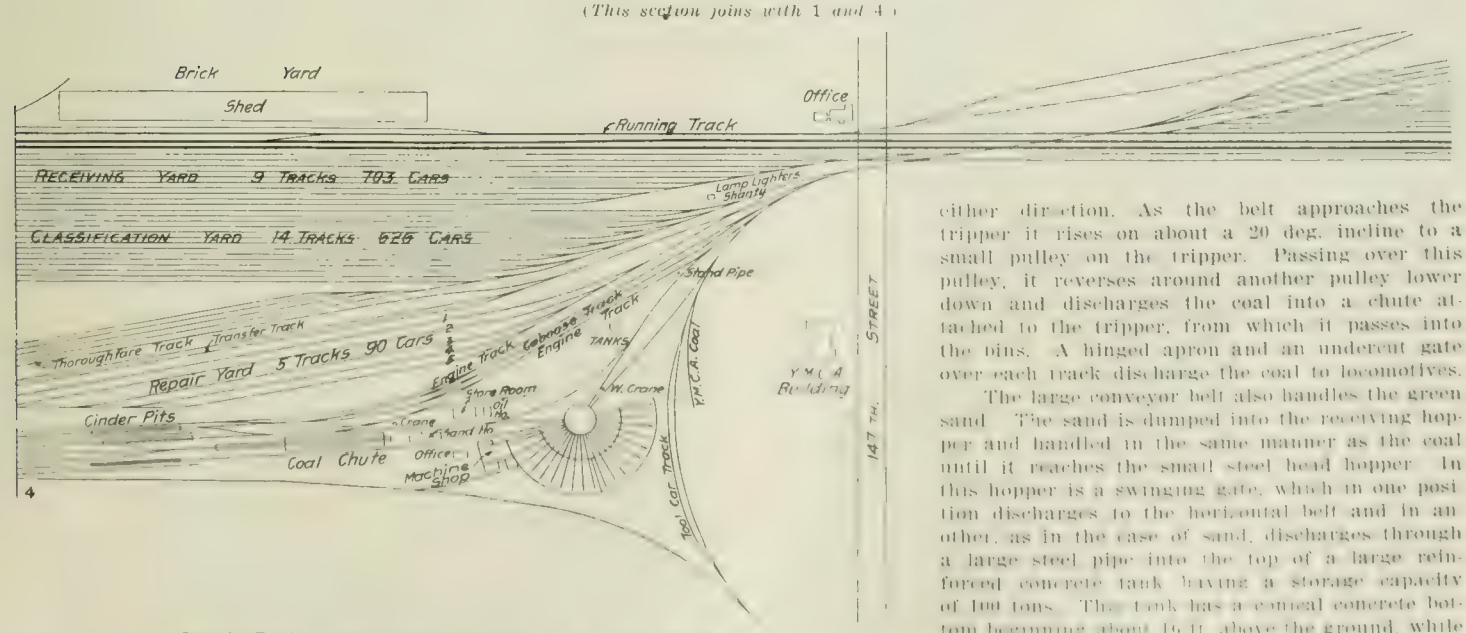
A complete new plant, embodying coaling, ash handling and watering facilities, was built at a point about two miles south of Watseka, now named "Coaler." This is north of Woodland Junction, and so accommodates the trains of the St. Louis division. The plant, which was designed and built by the Roberts & Schaefer Company, Chicago, has a number of novel features. Photographic views of the plant, which is of the belt conveyor type, are shown.



North End of Southbound Dolton Yard, C. & E. I.
(This section joins with 2.)



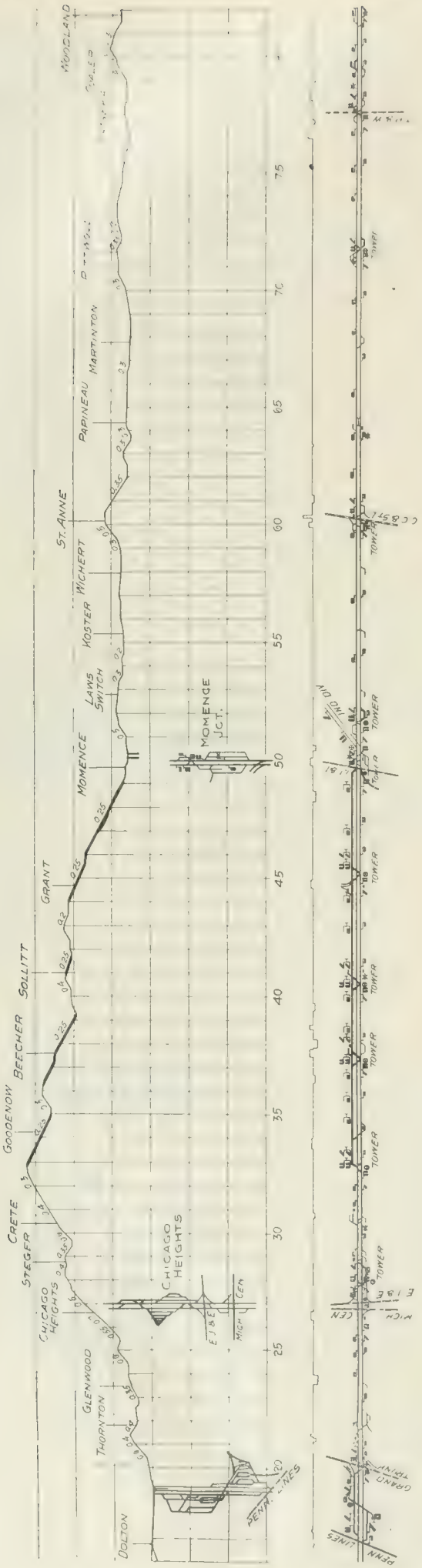
Middle Section of Southbound Dolton Yard, C. & E. I.
(This section joins with 1 and 4.)



South End of Southbound Dolton Yard, C. & E. I.
(This section joins with 3.)

The coal storage bin has a capacity of 700 tons, and extends over four tracks, two main and two passing tracks. Its substructure is of steel, and the pocket itself of heavy wooden construction. The coal is received on a track at one side of the pocket, which is on a slight grade and contains a concrete steel-lined hopper about 190 ft. from the pocket. The coal cars, which are of the side-dump type, are pushed beyond this hopper and are then dropped back over it by gravity and dumped. At the bottom of the receiving hopper is an automatic feeder, which carries the coal in a steady stream to a small hopper above a large belt running at an angle of 20 deg. This belt conveys the coal to the top of the storage pocket at the rate of 100 tons an hour. As the belt turns over the head pulley, the coal is discharged into a small steel hopper, from which it is delivered to a belt running horizontally for distribution over the four tracks. Distribution to the tracks is governed by an automatic belt tripper. This tripper runs on a track below the belt, and is self-propelling in either direction. As the belt approaches the tripper it rises on about a 20 deg. incline to a small pulley on the tripper. Passing over this pulley, it reverses around another pulley lower down and discharges the coal into a chute attached to the tripper, from which it passes into the bins. A hinged apron and an undercut gate over each track discharge the coal to locomotives.

The large conveyor belt also handles the green sand. The sand is dumped into the receiving hopper and handled in the same manner as the coal until it reaches the small steel head hopper. In this hopper is a swinging gate, which in one position discharges to the horizontal belt and in another, as in the case of sand, discharges through a large steel pipe into the top of a large reinforced concrete tank having a storage capacity of 100 tons. The tank has a conical concrete bottom beginning about 16 ft. above the ground, while the outside shell continues to the ground to form a drying room. The tank is 12 ft. in diameter. The green sand passes out through the center of the conical bottom, by gravity through a stove here beneath from which it flows on to the floor of the drying room and thence is passed through a screen into a large steel air-right tank or drum. From the latter it is



Profile and Signal Diagram of Chicago Division from Dolton to Woodland, Ill., C. & E. I.

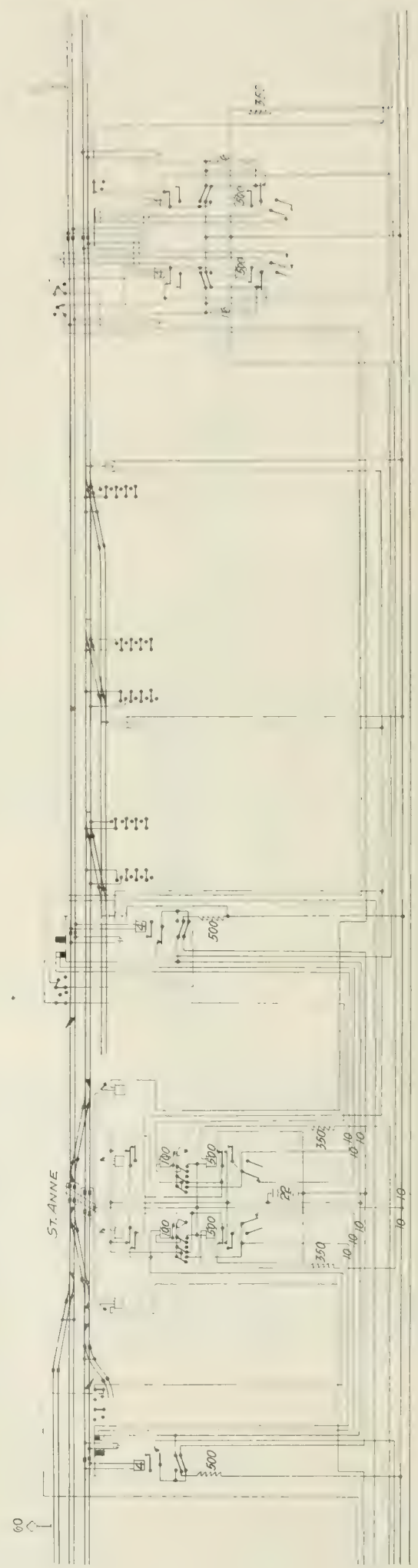


Diagram of Circuits for Automatic Electric Signals, Chicago Division, C. & E. I.

raised by air to two 7½-ton storage tanks located above the coal pocket, from which it is discharged by gravity through telescoping spouts to the locomotives.

To handle the cinders, under each of the four tracks is a concrete pit 5 ft. deep and 50 ft. long. Each pit has a track in the bottom for trucks carrying ¾-ton steel buckets. Overhead, attached to the coal pocket and running its entire length, is a steel I-beam inclined track, which extends over to a large reinforced concrete storage bin. A heavy steel trolley with a double block and heavy hook attached, runs on this track and is moved by a steel cable attached to the drum of a steam hoist in the power house. Therefore, to clean a locomotive's ash-pan, a truck with its bucket is run underneath, the ashes raked into the bucket, and the latter raised and dumped automatically into the reinforced concrete bin. This bin has a storage capacity of 75 tons, and slopes toward the receiving track. A gate and a hinged apron enable the cinders to be discharged into an empty coal car.

Two water cranes, one between each pair of tracks, enable water to be taken at the same time. The arrangement of the plant is such, therefore, that a locomotive on any one of the four tracks, whether north or southbound, may at one stop take coal, water and sand and clean fire. A power plant is located in a brick fireproof building adjacent to the coal pocket. It has a 50-h.p. vertical boiler, a 25-h.p. vertical steam engine, a combined vertical steam engine and air compressor, a 10-h.p. steam hoist and a fire pump.

All exposed surfaces of woodwork about the plant are covered with corrugated galvanized steel and painted with natural graphite paint. In addition, the whole surface underneath the coal pocket and underneath the inclined belt conveyor housing is ceiled with adamant plaster on expanded metal. This is to prevent sparks from locomotives lodging in the woodwork.

Thirteen water-softening plants have been built. Seven are of the continuous type, capable of treating from 15,000 to 20,000 gals. hourly. Six are intermittent, with a capacity each of 300,000 gals. every ten hours. Six of the 13 are Davidson plants, built by the Otto Gas Engine Works, five were built by the Kennicott Water Softening Company, and two by Wm. B. Scaife & Sons Company. One plant, that at Terre Haute, was formerly at Rossville. It was moved to Terre Haute and a new plant built at Rossville. It is expected with these plants to reduce the incrusting solids in the boiler water to 5 grains per gallon.

Last year (1905) 226.5 miles of the system were reballasted. The road owns a fine gravel pit at Lyford, about a mile south of Clinton, Ind., a view of which is shown herewith. About 37 acres are embraced in the site. The face as seen in the photograph will average over 45 ft. in height and is about 3,600 ft. long. To do the ballasting mentioned for last year, the pit was opened in March and worked continuously till the end of the year, something less than half a million cubic yards being taken out. This ballast was distributed in Williamson, National and Rodger cars.

In future treated ties are to be used altogether by the C. & E. I. for main track work. A contract for 300,000 ties, treated by the zinc-tannin process, has been given for 1906.

We are indebted to Mr. H. I. Miller, Second Vice-President and General Manager, and to Mr. R. H. Howard, Engineer Maintenance of Way, for the data for this article.

The Fleming Summit Loop.

One of the sharpest railroad loops in the United States is on the Cherry Tree & Dixonville Railroad, recently built and operated jointly by the Pennsylvania and the New York Central. This road passes through the hilly coal districts of western Pennsylvania, where it is necessary to resort to sharp curves in order to keep within the maximum grade limit of .8 per cent. The loop is about six miles west of Cherry Tree, and is at the point of highest elevation on the line. At this place the engineers encountered a drop of approximately 59 ft. in a distance of 300 ft., as shown on the diagram, between the two stations marked A and B. In order to overcome this difficulty the line was projected in the loop form, and by extending the distance 1.8 miles the maximum grade at any place was reduced to .3 per cent.



Fleming Summit Loop.

Commencing with a 2 deg. curve at A, a series of 10 deg. reverse curves follow, leading up to the point where the actual loop is formed by a long 10 deg. curve passing through an angle of 248 deg. 27 min., from tangent point to tangent point. Continuing, a long tangent and a 4 deg. curve, bring the track to within 75 ft. of the opposite side of the loop approach. Disregarding the difference in levels between the two points X and Y the road practically returns to its starting point after covering a distance of 4,600 ft. (the actual rail distance between X and Y).

The famous Georgetown loop on the Colorado & Southern, near Denver, Colorado, is located in the Clear Creek Canon, where it is necessary for the road to recross itself in order to ascend the heavy grade above Georgetown. This recrossing, however, is accomplished in a much longer linear distance than that illustrated in the present case.

The 10-deg. curve of the Fleming Summit loop has a radius of 573.7 ft. This is about the allowable limit. The shortest possible distance, therefore, in which a loop such as this could be formed would be 3,604 ft., not allowing for any drop in grade. Comparing this with 4,600 ft., the distance between X and Y, it will be seen how close this construction approaches the allowable limit.

The train resistance due to curvature is overcome by the usual method of raising the outside rail. The distance of such elevation was found by the following formula:

$$e = 0.06688 \frac{gV^2}{R}$$

where

e = elevation required.
g = gage of track (4.705).
V = velocity in M.P.H. of fastest train.
R = radius of curvature in feet.

The Fleming Summit loop has been in service for more than a year, and during that time has carried a heavy traffic. It is a single-track line, with 85-lb. rails. There are two bridges on the line around the curve.

East Altoona Engine Terminal of the Pennsylvania.

BY RODNEY HITT.

The new engine terminal of the Pennsylvania Railroad at East Altoona, Pa., is the largest on the system and handles more engines a day than probably any other engine terminal in the country. Altoona is the division point on the main line between the Pittsburg division and the Middle division. This new terminal, which is part of the extensive improvements planned at Altoona to take care of the constantly increasing traffic to be handled at that point, should be studied in connection with the general yard scheme now in use there.

The Middle division has no very heavy grades between Altoona and Harrisburg and a single engine can haul an average train over the road in both directions. From Altoona west, however, the heaviest grades over the mountains are encountered and the average westbound freight train requires three engines, two in front and one pushing in the rear to take it up to the summit at Gallitzin tunnel. All freight engines on both divisions heading into Altoona in addition to the helper engines on the mountain grade, Cambria and Clearfield division engines and yard engines are cared for in this new terminal, a total of about 300 locomotives in each 24 hours, or about one every five minutes throughout the day and night. The engine movements in and out are fairly regular and as the new terminal has been designed to care for that number of engines without overcrowding there is little congestion now that the whole plant is in smooth working order. Passenger engines are still handled at the upper roundhouse west of the passenger station.

The new terminal is located near the east end of the yard cluster in the valley of the Little Juniata river on made ground filled in to an average depth of more than 11 ft. over the entire area. It is between the eastbound classification yard and the fast freight tracks, south of the new westbound empty classification yard. The accompanying drawing of the general layout shows the relation of the terminal and the adjacent yards to each other.

All engines enter at the west end. Incoming engines on the Middle division leave their trains in the receiving yard east of the westbound classification hump and pick up their cabins before starting for the engine terminal. After picking up their cabins they run west on an engine track in the receiving yard past the hump and over a connecting track to the westbound fast freight track. This track is never badly congested and there is seldom any delay in getting on it and running down to the crossover beyond the west end of the engine terminal where the engine and cabin back in on the eastbound fast freight track or the special power track leading to the west end of the yards. Engines are admitted into the engine terminal yard by a towerman who controls the switches leading off of the ladder at the head of the yard.

Pittsburg division engines leave their trains and pick up cabins

at the eastbound receiving yards west of the engine terminal and proceed down the special power track or the eastbound fast freight track to the ladder at the head of the engine yard, where they are admitted by the towerman as quickly as possible. They seldom wait more than five or ten minutes.

The tracks in the terminal yard are arranged for the independent handling of Middle division and Pittsburg division engines. All Pittsburg division engines are inspected, cleaned and coaled on the north side of the coal trestle and Middle division engines on the south side. This arrangement is carried out throughout the terminal operation. The ladder track is on a 1.75 per cent. descending grade which gives the cabins a good run when they are cut loose. Pittsburg division engines head in the yard with their cabins in the rear. An incoming engine cuts its cabin loose and drops it by gravity down the cabin ladder to the storage tracks on the north side. The engine moves down the ladder and enters the inspection track. Middle division engines back into the yard and drop their cabins ahead of them into the storage tracks on the south side, the engine then proceeding to the south inspection track.

At the inspection pits the road crew turn the engine over to the hostlers, turn in their engine failure and repair report, get their time and are dismissed. If the engine needs no attention in the house it has the fires cleaned over the ash pits beyond, takes coal, water and sand and is run around the house, down to the east end of the yard, turned and run in on the storage tracks to await call.

Outbound Pittsburg division engines pick up their cabins and proceed out of the yard at the west end over a special power track which connects by a cross-over with the westbound fast freight track. They run down over this track to the westbound departure yard some distance west, where they take the waiting trains. Outbound Middle division engines leave at the east end and couple on waiting trains in the pull-out tracks to the south.

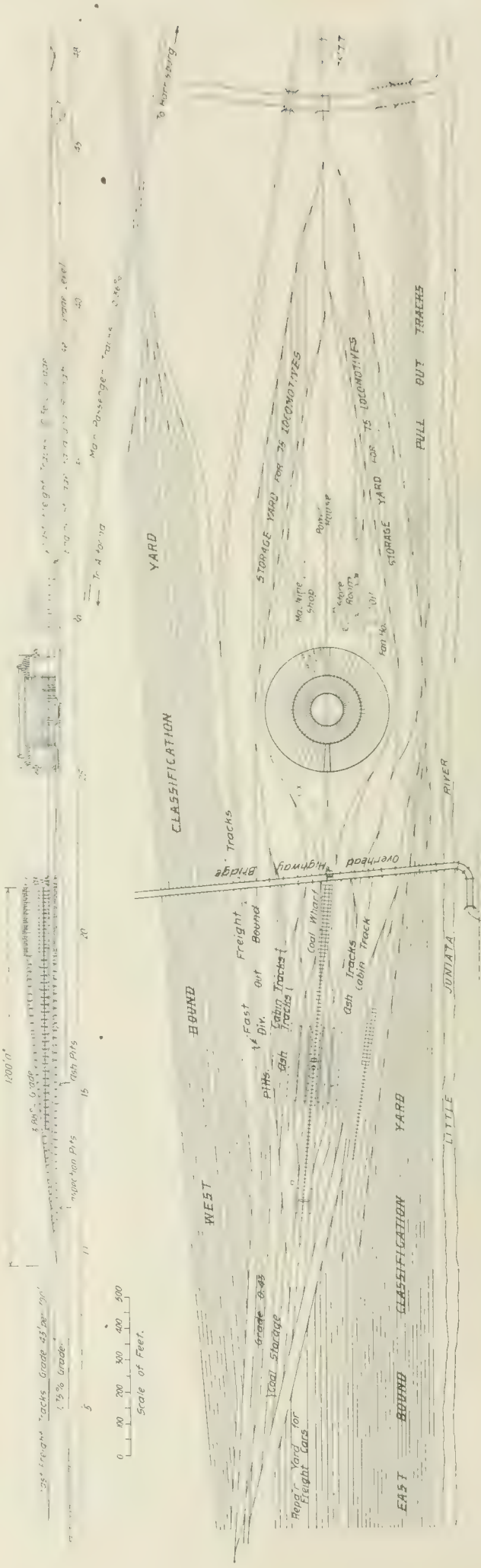
The roundhouse is used only for making repairs and not for storage as is usual. If engines are ordered into the house for repairs the fires are drawn, coal, water and sand are taken, unless repairs to the sand box or tender are to be made and the engine is run into the house, ready to leave when the repairs are completed. A straight track through the roundhouse leads down to the east end of the yard to the turntable track at the entrance to the storage tracks.

The only engines running against the movement are occasional switchers working in the westbound classification yards which are allowed to leave the terminal at the west end and cross-over to the yards where their work is to be done. This interferes only slightly with the general movement and saves a three or four-mile run out at the east end and back through the eastbound yard running tracks which may be blocked and cause a delay of an hour or more before the engine could get to work.

Inspection Pits.—The inspection pits are located on each side of the coal trestle approach, 44 ft. apart center to center. They are 75 ft. long, 4 ft. wide and 3 ft. deep inside, and are connected with a covered underground passageway in the center, 6 ft. deep and 4 ft. wide. The foundations, walls and floor are concrete with a mortar finish on the inside of the pits. A light steel framework shelter house will be built over each pit but at present engines are inspected in the open air. These shelters will be 80 ft. long, 19 ft. 2 in. center to center of side columns and 16 ft. high in the clear from the top of rail. The ends will be open and the sides will be of glass from the ground up to the eaves. A smoke-jack will be put in the roof at each end to carry out the smoke of locomotives headed in either direction. Entrance to the pits is had by narrow steps 2 ft. wide leading down from the ground level to the cross-passage. Steps lead up to the floor of the pits from the passage.

The rails are laid on 2-in. x 10-in. x 12-in. oak blocks spaced 8 in. apart and spiked to 6-in. x 12-in. stringers running along the top of the pit walls. The stringers are held in place by ⅞-in. anchor bolts bedded in the walls 6 ft. center to center. The inside rail is carried over the passageway by a box girder 6 ft. long made up of two 10-in. I-beams and two ⅜-in. plates, 12 in. wide, to which the rail is clamped with bolts and flange washers.

The force of men at the pits consists of a foreman, two air-brake inspectors, two running gear inspectors and two boiler inspectors. These men go over each engine as it comes in and mark any defects found. The boiler inspector looks at the staybolt inspection date tag which is attached to each engine and orders the engine in the house if the prescribed time since the last inspection has expired. The air-brake inspector is likewise responsible for checking the date of cleaning and oiling triple valves, draining reservoirs, etc. Road enginemen turn in their engine report, M. P. 62, to the foreman who enters the inspectors' reports as well and sends the blank, properly filled out, to the work distributor's office at once. While the engine is standing on the ash pits, the necessary orders are given in the roundhouse to take care of the engine as soon as it is placed in a stall. A pneumatic tube system has just been installed to send these reports from the inspection pits to the



Plan and Profile of East Altoona Freight Yards and Engine Terminal, Pennsylvania Railroad.

office in order to save time and have everything ready in the house when the engine is run in.

Ash Pits.—The four ash pits are 240 ft. long and will accommodate four engines each, or 16 in all, eight for the Pittsburg division and eight for the Middle division. They are located about 280 ft. beyond the inspection pits, two on each side of the coal wharf. The track leading from the inspection pit turns out to two tracks spaced 30 ft. 4 in. center to center, which is the spacing at the ash pits. This allows room for a stub track for ash cars between the pits. A second ash car stub track is laid next to the outside pit and an overhead traveling crane of 61-ft. 6-in. span covers all four tracks. This crane runs on a steel runway extending the entire length of the pits and has a capacity of five tons. The electric hoist has a speed of 85 ft. per minute, the trolley 150 ft. per minute, and the bridge 400 ft. per minute. The operator's cab is hung from the bridge close to the runway at one side. The runway has 11 bents and is high enough to give a clearance of 21 ft. under the center of the bridge.

The pits are about 4 ft. deep and 4 ft. wide between the 12-in. x 6-in. oak stringers on which the rails are laid. The walls are of hard-burnt brick and the floor and foundations of concrete. In the bottom of the pit a narrow gage, 2-ft. 4¾-in. track is laid on timber stringers to carry the ash bucket cars. When an engine is run over the pits three of these buckets, which have a capacity of about 48 cu. ft. each, are run under it, one under the front end and two under the ash pan, and the cinders and ashes are dumped into them. After the fires have been cleaned and the engine moved off of the pit the ashes are wet down in the buckets; the crane picks them up and dumps them into the ash cars on the adjacent stub tracks. The pits drain to sumps with perforated covers and removable perforated linings. These sumps extend 2 ft. below the center of the 10-in. drain pipe and all cinders washed down settle in the removable lining at the bottom where they can be easily removed at frequent intervals.

Coal Wharf.—This is a wooden structure supported on concrete piers with 18 pockets on each side, each having a storage capacity of about 25 tons. Only about half of these pockets are in use, however. The timber trestle leading to the wharf has a grade of 3.88 per cent., and the base of rail over the pockets is 36 ft. above the engine tracks. Coal is delivered in hopper cars pushed up the incline with a switch engine and between 25 and 30 cars a day are used. The pockets have a slope of 9 in. in 12 in., but in the winter when the coal is wet or frozen this is hardly enough to make it run freely from the spouts. Two or three men are employed on the wharf all the time in unloading cars and working the coal down in the pockets.

Two types of gates are used, one a special design of the Link-Belt Engineering Co. and the other a pneumatic gate designed by the railroad company. Both are under-cut gates and operate easily and quickly. The Link-Belt gate uses a gear and pinion with a large hand-wheel to move the gate which turns in the arc of a circle. The spout is raised and lowered with counterweights. The pneumatic gate designed by the railroad company has a straight lift. It has an opening 2 ft. 5 in. x 4 ft. 9¾ in., and is raised by a direct-acting air cylinder of 6 in. inside diameter, air being admitted below the piston through a valve on the side of the pockets which can be

M. P. 62

Engineman must report on this form at the end of their trip the condition of Locomotive, Gauge Cocks Water Gauges, Injectors and Safety Valves, also any shortage in Tool Equipment, Reservoir and Train Line Pressures. Air Brake Inspectors must report Reservoir and Train Line Pressures they find when pump is working to full capacity, make the necessary adjustments and state what these pressures are corrected to stroking rate

The Pennsylvania Railroad Company.

PHILADELPHIA BALTIMORE & WASHINGTON RAILROAD COMPANY.
NORTHERN CENTRAL RAILWAY COMPANY
WEST JERSEY & SEASHORE STEAMBOAT COMPANY

Loco. No. *Arrived at Terminal*
Train No *Division* ... *19* *Arrived at Ash Pit*

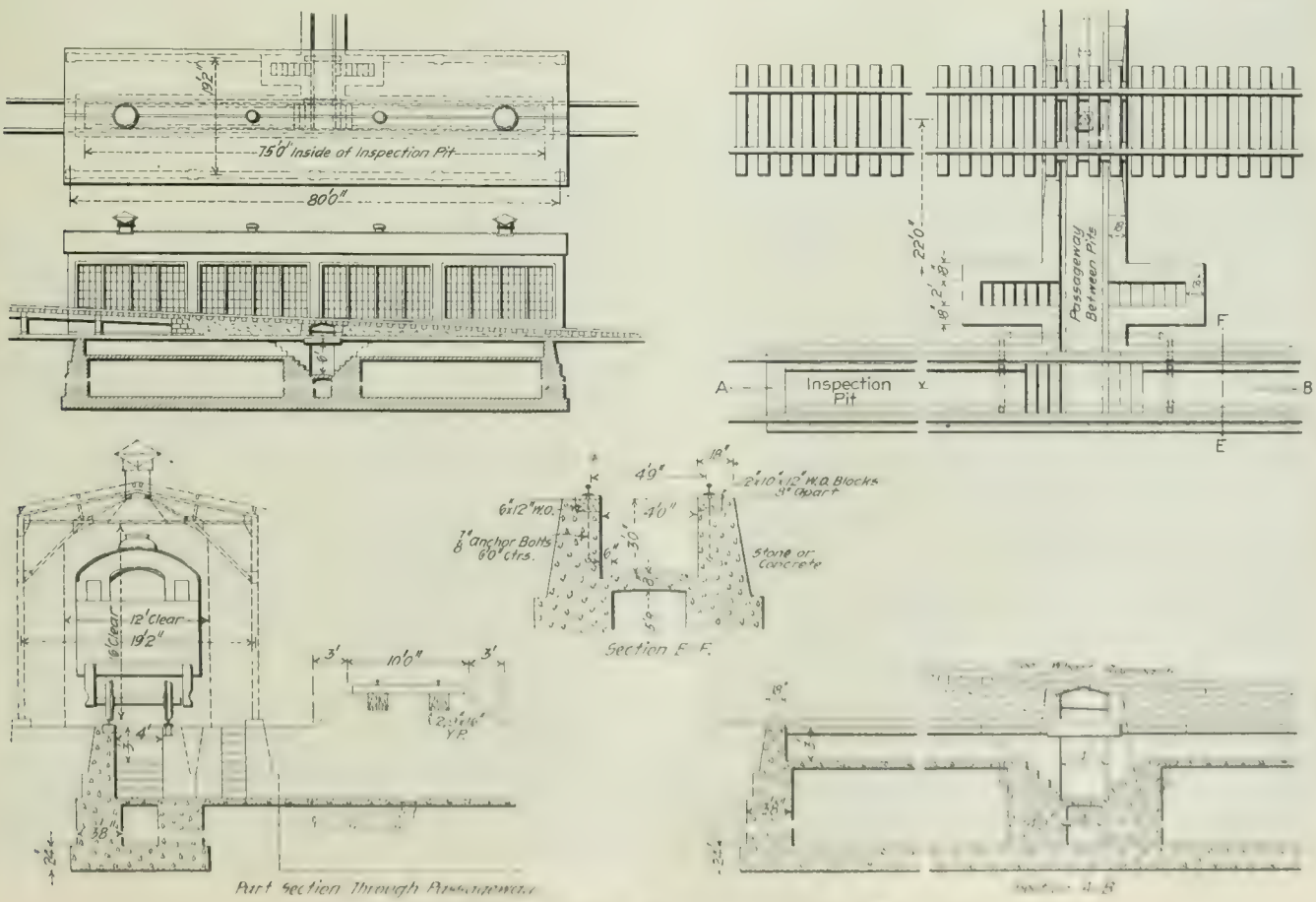
REPAIRS NEEDED	WORK DONE BY

Tool Equipment
Condition of Gauge Cocks
" " Glass Water Gauge
" " Injector "R"
" " " "L"
Safety Valve Lifts at ... lbs.
Safety Valve Seats at ... lbs.
Reservoir Pressure ... lbs.
Train Line Pressure ... lbs.

Eng'man — *Res. Pres...* *T. L. "* } *Found.*
Fireman — *Res. Pres* *T. L. "* } *Corrected to*

Inspector.
Foreman.

Engine Inspection Report, M.P. 62., Pennsylvania Railroad.



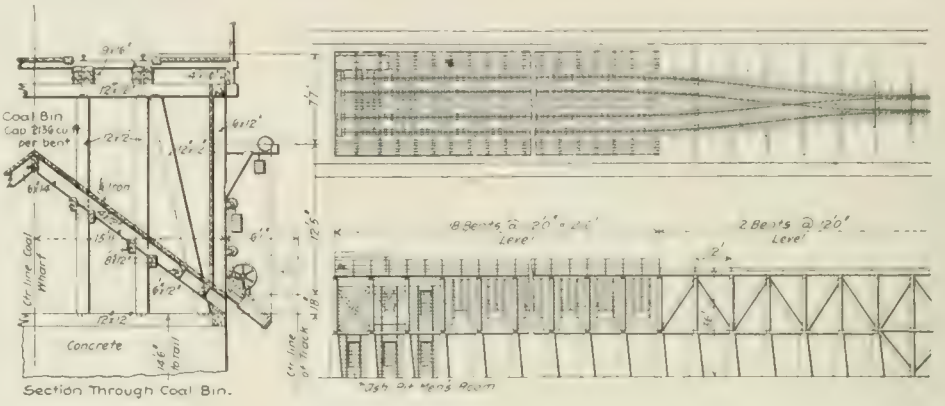
Details of Inspection Pits, East Altoona Engine Terminal.

reached from the top of the tender. Counterweights are used to help out the air cylinder. The spout is raised and lowered by a chain and wheel geared to a sprocket over which a counterweight chain is passed. With the coal running free these chutes will deliver about 1,000 lbs. per second. The average of three observations of the time required to coal an engine was 25 seconds from the time of spotting under the chute until the engine began to move forward. The best time was 15 seconds for a full load. The coal delivered to engines is not weighed but a gager is employed who coals each engine as it comes in and keeps a record of his estimate of coal supplied. This gager becomes very expert at estimating the amounts supplied and the record kept is about as satisfactory as the more complicated but often enough inaccurate weighed records.

Sand Bins.—The three 12-ft. bents at the end of the coal wharf are used for sand drying and storage. The drawings show the arrangement and some of the details of the apparatus used. Wet sand is delivered in cars on top of the wharf and dumped through trap doors into the two wet sand bins which have a slope of 45 deg. Below each wet sand bin is a dryer with a capacity of 2,000 lbs. of sand an hour. The flow of wet sand is regulated by a slide valve in the bottom of the hopper. Passing around the stove and surrounded by the wet sand is a coil of 1½-in. wrought-iron pipe which is connected to the chimney of the dryer. This pipe is perforated with ¼-in. holes and serves as an outlet for the steam generated in the sand as it dries. The inside of the stove hopper is almost vertical and is made up of No. 12 wire netting, 3½ meshes to the inch. The dry sand sifts through this screen and falls into the elevating hopper below after passing over a double wire screen of 12 and 2½ meshes to the inch. Pebbles and dirt fall down to the bottom of the stove hopper where they may be removed through openings closed with slides. The sand as it collects in the elevating hopper drops down through an opening in the top of the air tank, 2 ft. 6 in. x 4 ft. When the tank is full the operator turns an air valve which closes the opening in the top of the tank and admits air under pressure into the tank. The sand is elevated to the dry sand bins above, and as soon as the tank is emptied the valve is opened in the top of the tank and more dry sand runs in.

The dry sand bins are near the top of the wharf and are emptied through a 4-in. galvanized iron spout with a flap cover which prevents rain from entering when the spout is raised. In the bottom of the dry sand bin is a heavy conical plug valve for shutting off the flow of the sand. This is raised by a cord which is tightened when the spout is lowered and falls into place of its own weight when the spout is raised. Any sand which may remain in the spout when it is raised runs down into a funnel below the ball joint which connects to the dry sand elevator hopper.

Water Supply.—The system of water supply consists of the regular supply drawn from two large tubs located between the engine house and the coal wharf and the emergency supply drawn from the high-pressure water mains laid around the buildings. There are in all eight 12-in. standpipes and three 8-in. emergency standpipes. These are distributed as follows: Three 12-in. standpipes on the north side of the coal wharf for incoming Pittsburg division engines; two 12-in. standpipes on the south side of the coal wharf for incoming Middle division engines; one 12-in. and one 8-in. standpipe alongside the outgoing engine track for the Middle division; two 12-in. and one 8-in. standpipe alongside the outgoing engine track for the Pittsburg division, and one 8-in. standpipe alongside



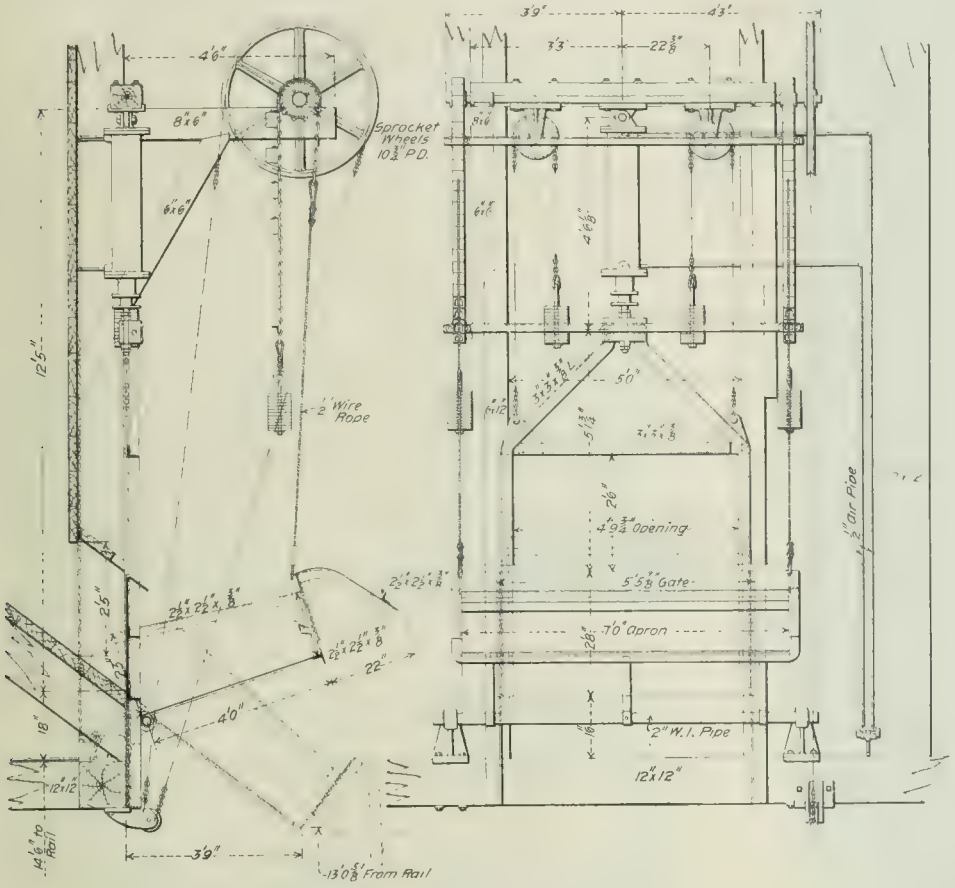
Coal Wharf, East Altoona Engine Terminal.



Coal Wharf, East Altoona Engine Terminal, Pennsylvania Railroad.

the running track through the roundhouse between the machine shop and the office. Two of these standpipes are Sheffield, 12-in.; the remainder are Gulland.

Storage Yards and Turntable.—Engines which do not require boilers washed or repairs to be made are run around the engine house into the engine storage tracks, where they are held with steam up awaiting orders. These tracks are arranged in four gridirons, each with standing room for from 35 to 40 engines, or about 150 engines in all. The ladders at each end of the storage tracks lead to a 75-ft. electric turntable at the extreme east end of the engine yard. Before moving into the storage tracks engines are run on the turntable and turned to head out for their respective divisions. The turntable is driven by a 12½ h.p. General Electric motor. While on the storage tracks engines are in charge of hostlers, each man caring for the engines on two adjacent tracks. A work pit 200 ft. long is provided under one of the storage tracks of each group for inspecting and making light repairs if needed.

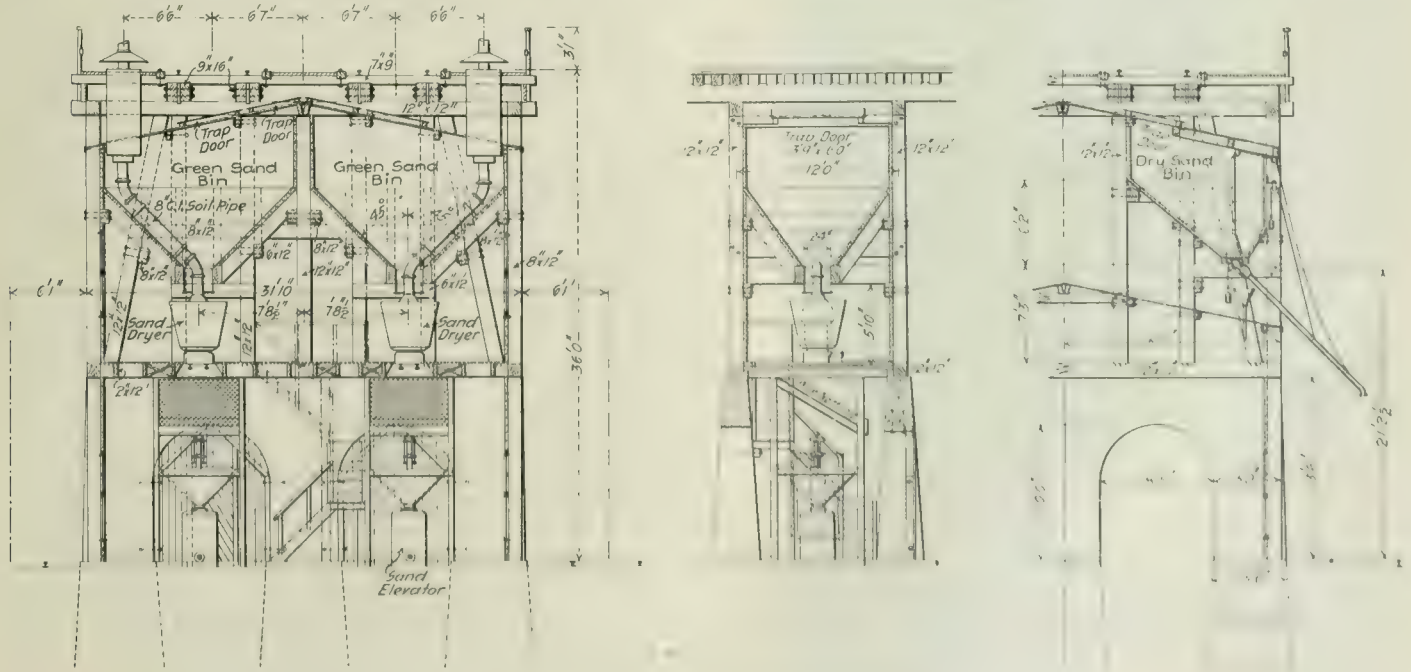


Pneumatic Coal Chute Gate.

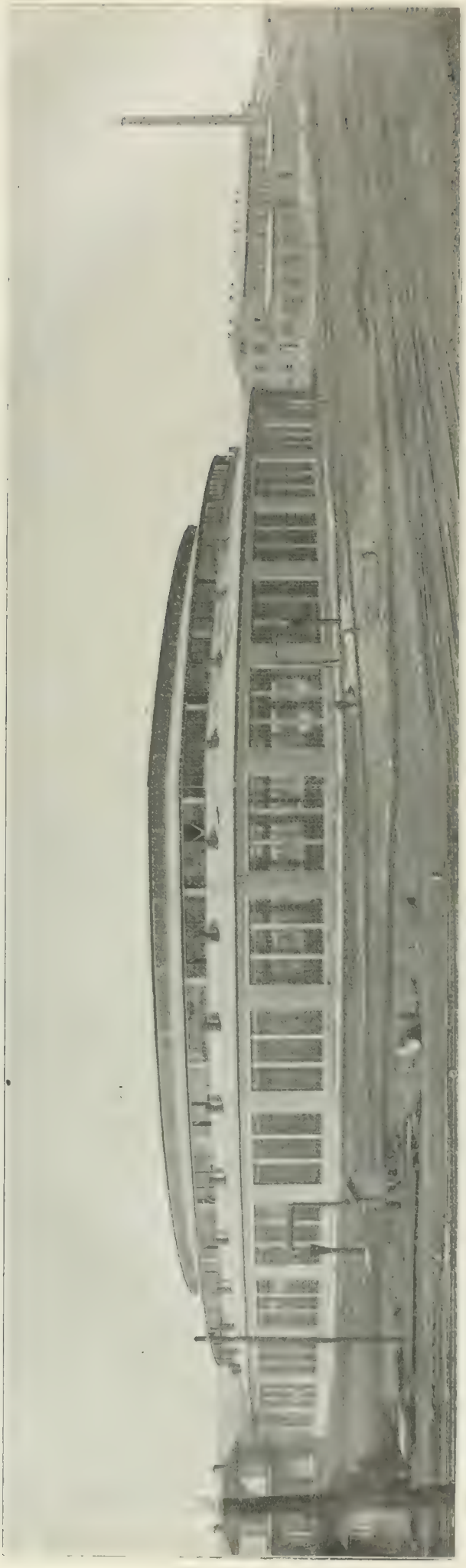
Roundhouse.—The roundhouse is the largest building of its kind ever erected and is of unusual design in every respect. It is 395 ft. in diameter with a 100-ft. turntable in the center, and it contains 50 stalls and two running tracks which pass through it in brick tunnels. The foundations of concrete were carried down from 20 to 25 ft. below the present level of the ground. The framing is entirely of steel, the inner circle is composed entirely of wood and glass doors and the outer circle of brick and glass. The original intention was to install a 12½-ton crane to run entirely around the house, and the building was therefore designed with a high circular bay and a lower lean-to around the outside. The crane has not been installed, however, although the runway supports on the columns were put in.

The main bay is 65 ft. wide, center to center of columns, and 35 ft. 6 in. high at eaves. The columns in the inner circle are spaced 13 ft. apart and the roof trusses are radial. A monitor in the roof provides ventilation and some top light. The bottom chords of the roof trusses are 30 ft. above the floor, which gives a large overhead space and assists greatly in the ventilation. The lean-to is 25 ft. wide and has 18 ft. clearance under the roof trusses. The smokejacks extend up through the roof 3 ft. 9 in. outside the center line of the row of columns which brings the end of the engine pilot within 13 ft. of the outer wall when the engine is spotted with the stack under the smokejack bell-mouth. The bottom of the bell-mouth is 16 ft. 5 in. from the floor, or about 2 ft. 6 in. above the stack of an H6a consolidation engine. The smokejacks are of special design and were made of "Vulcabeston" by Paul Dickinson, Chicago. They are 84 in. across the bell-mouth and the taper to the 37 in. flue is nearly 1 in 2½, so that even if the stack is not spotted squarely under the mouth of the smokejack, the smoke in emerging strikes an inclined surface of such small pitch that it is not thrown down and out into the house. These jacks have proved very satisfactory in service, and to this feature perhaps more than to any other may be attributed the good ventilation of the house.

On each column between engine pits is mounted a jib crane made of a 6-in. 12¼-lb. I-beam, 12 ft. 3 in. long, which carries a 1-ton Weston triplex chain hoist. These hoists are found very useful in dismantling and making repairs as they have reach enough to take down side rods, air pumps and all the heavy parts on the front end.



Sand Drying and Storage Plant.



South Side of Engine House, Showing Store House and Power House at the Right.

Engineman must deliver this report to the Yard Master (or Engine House Foreman) at the end of day, who will see that it is correct, sign and forward promptly to the Superintendent.

Erase the word "Helping" if Engine hauled train, or "Hauling" if a Helper

Show loaded mark "X" when loaded, or "—" when empty

In the column headed "Hours Shifting," no time is to to be shown unless **one hour or more** is occupied in shifting **at one point**, when the time and station number should be shown.

Explain Detentions Here.

Date .....190 Loco. No.

Train No. .....Cond'r

Engineman.

M. P. 358 3¾ x 7½. 3-16-05

Pennsylvania Railroad Company

Philadelphia, Baltimore & Washington Railroad Company
Northern Central Railway Company
West Jersey & Seashore Railroad Company

Division

Time Report of Freight Enginemen and Firemen

Time ordered for M. 190

Locomotive No. ..... hauling, helping Train No. .....

X or —	FROM	TO	LEFT	ARRIVED	HOURS SHIFTING
			M	M	Hrs. at
			M	M	Hrs. at
			M	M	Hrs. at

Time left M. 190

Time relieved .....M. ..190

Engineman

Fireman .....

Conductor .....

Time on Duty hours .....minutes

Allow .....hours overtime

Correct { .....Yard Master
.....Foreman

[OVER]

Front and Back of Freight Engineman's and Fireman's Time Report.

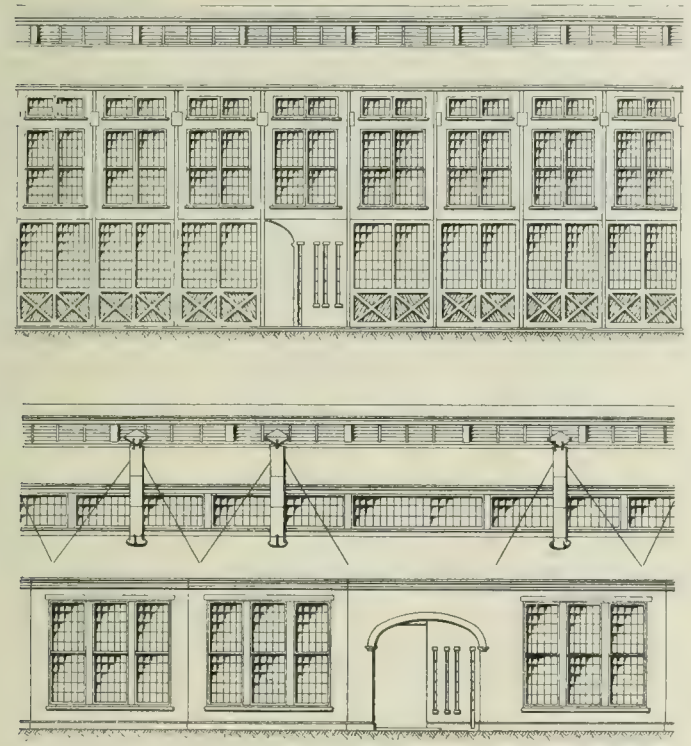
The engine pits are 65 ft. long, 3 ft. 11 in. wide and 2 ft. 6 in. deep at the outer end, sloping to 3 ft. deep at the catch basin at the inner end from which an 8-in. drain leads to the sewer. The bottom is crowned and gutters are formed along each side to keep the pit always dry and well drained. The floor of the house is almost flush with the top of the rails. It consists of 4-in. x 6-in. yellow pine stringers laid on stone ballast on top of the earth filling to which the 2¾-in. T. & G. yellow pine floor boards are nailed. The floor is crowned to 3 in. above the top of the rails to drain toward the pits.

An interesting detail shown in one of the drawings is the form of track stops used to prevent engines overrunning the pits and breaking through the floor into the heat duct. It is a steel casting bolted to the web of the pit rail with a depression 5½ in. deep. The end of the stop, however, is only 3 in. above the top of the rail to allow clearance for the pilot.

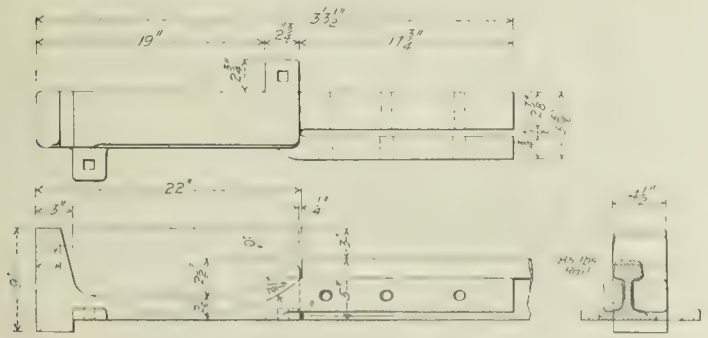
Four drop pits are installed in the house next to the through running track leading out past the machine shop. One pit is 55 ft. long for removing an entire set of wheels under an engine; two have double tables 8 ft. 6 in. long for removing single drivers by dropping the wheels on one table and running them along the bottom of the pit to be raised by the other table; and the fourth is 24 ft. long for work on engine trucks, tenders or use in emergencies. In addition to these pits a fifth is fitted with removable rails for removing tires without dropping the wheel centers. The drawings show the details of the mechanism for the 8 ft. 6-in. tables, the mechanism for the 55-ft. and 24-ft. tables is essentially the same. The pits are of concrete, 9 ft. 7 in. wide and 10 ft. 2¼ in. deep and the trench containing the worm wheel shafts and motor is 16 ft. below the level of the floor. Two long shafts mounted in adjustable bearings and extending the length of the pits are driven by a 27-h.p., 220-volt General Electric motor. To these shafts are keyed the worm wheels which engage the four elevating screws supporting each table, two of which are right hand and two left hand. The motor runs at 480 r.p.m., and the tables are geared to have a vertical movement of 2 ft. per min. Lubrication of the elevating screws is provided by filling with oil the 7-in. pipe casing extending down below the worm wheels. In the 24-ft. table six elevating screws are used and for the 55-ft. table 12 screws. The tables are formed of channels, as are also the foundations for the elevating shafts and worms in the bottom of the pit.

The engine house is heated by hot air which is carried entirely around the house in a heat duct below the floor and between the engine pits and the outer wall. The fan house near the engine house contains two Sturtevant fans 16 ft. wide and 12 ft. in diameter driven by 11½-in. x 16-in. engines. Cold air is drawn in over two exhaust steam heater coils having 10,830 sq. ft. of radiating surface, warmed and forced into the underground heat duct leading to the engine house. The fans have sufficient capacity to change the air in the house in about 20 minutes. At the junction of the feeder and the roundhouse heat duct, the inside wall of the latter is built out in the form of a concave wedge to divide the current of air and make it flow equally in both directions around the house.

The roundhouse heat duct is 6 ft. wide and about 8 ft. deep, decreasing in depth away from the fan house. It serves also as a pipe gallery for the 6-in. steam main, 4-in. cold water, 4-in. hot water and 4-in. compressed air pipes which run around the house supported on brackets on the outer wall of the duct. The cold water main carries 100 lbs. pressure, the hot water main for boiler washing and testing carries 300 lbs. pressure and the compressed air pipe 100 lbs. pressure. From the main, heat duct connections are run under the floor to two openings in each engine pit, one at the front end and another under the tender to thaw out the water scoop. Connections from the steam, air and water mains are located

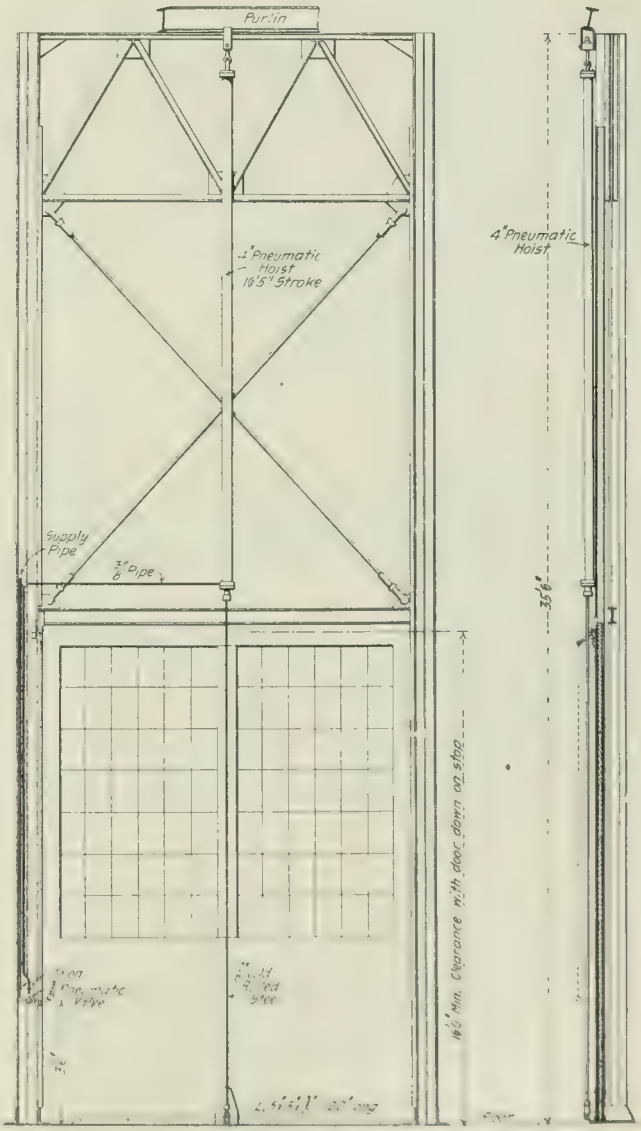


Part Inside and Outside Elevations of Roundhouse.



Track Stop in Roundhouse.





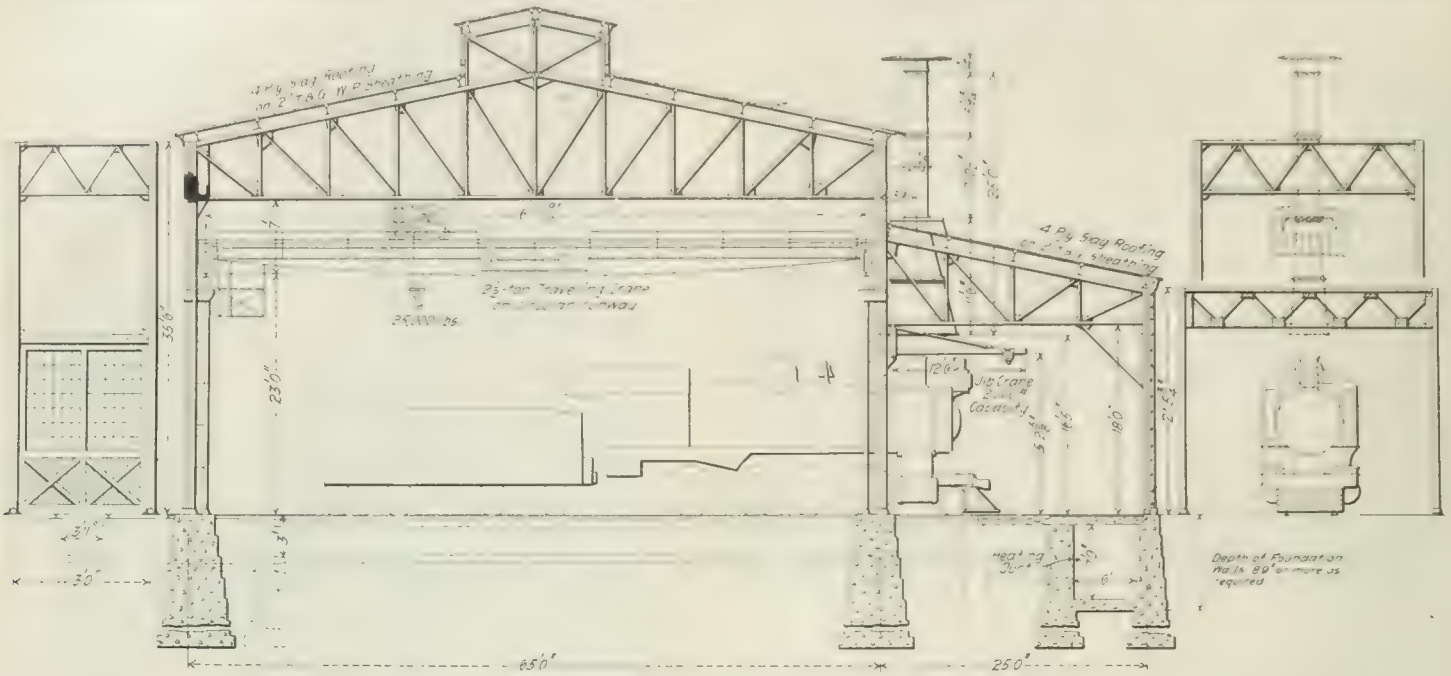
Pneumatic Lift Doors for Inner Circle.

between each pair of pits and a blow-off connection to the sewer is also provided. For much of the work done in the roundhouse pneumatic tools are used and the compressed air is also used for testing brakes on engines not under steam. For boiler washing and filling an arrangement for convenient arrangement of valves, gages and hose connections is mounted on a small shop truck which can be wheeled to any pit. Boilers are washed out in from 2½ to 3 hours and an engine tender can be filled with hot water in about 5 minutes.

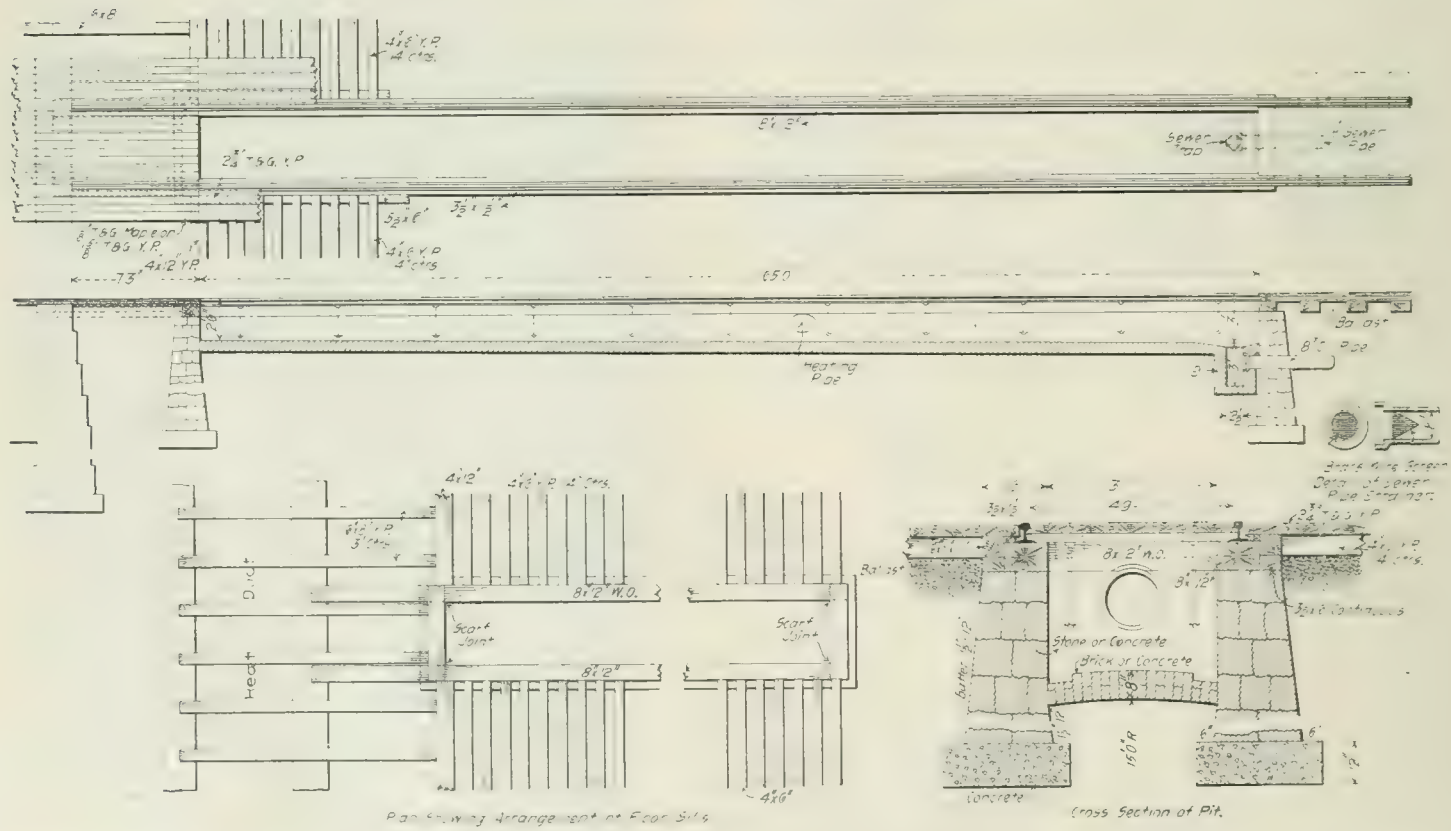
The doors of the inner circle are of wood and glass and are

The other buildings adjacent to the roundhouse are the machine shop, oil house, closet and locker house, office and bunkhouse, and the power house. These are all of brick on concrete and stone foundations.

Machine Shop.—This building is 67 ft. 10 in. x 160 ft. 7 in. and includes also the flue and smith shop, which is 48 ft. long and the full width of the building. The middle bay of the machine shop is spanned by a 7½-ton Niles electric traveling crane which serves the heavier tools. The south bay, which contains a planer, horizontal and vertical boring mills, slotter and some smaller tools,



Cross-Section Through Roundhouse.



Details of Engine Pits and Roundhouse Floor.

raised vertically by an air cylinder of 4 in. diameter and 16 ft. 7 in. stroke. The doors drop by gravity, the exhaust of the air cylinder being adjusted to regulate the downward speed.

The turntable in the center of the circle is 100 ft. long and is driven by a 12½ hp. General Electric motor. The pit is of concrete with a brick floor laid on 6 in. of concrete. The floor slopes from the edges and the center to the lowest point 22 ft. 6 in. from the outer end, and water is collected from the gutter so formed and drained off through a 10-in. drain to the sewer.

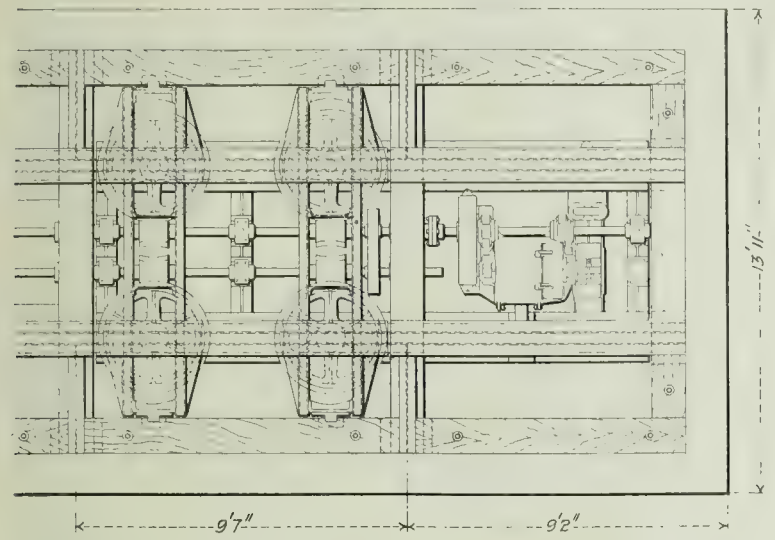
is served by a light air hoist traveling crane. With the exception of the two wheel lathes and two radial drills which have individual motor drive all of the machine tools are group driven from overhead shafting. A 20-h.p. motor is mounted on the roof trusses in each of the side bays and is belt-connected to the main shaft in each bay. The equipment of the machine shop includes seven engine lathes, one Sellers and one Niles wheel lathe, three radial drills, three vertical drill presses, tool grinders, one planer, one shaper, one vertical boring mill, one slotter, two horizontal bor

ing mills, one turret lathe, bolt cutter, hydraulic press, drop machine for forcing out brasses, tool room, head-light bench and benches and vises for small work. In the smith shop are a pipe threader and bolt threader run from the machine shop countershaft.

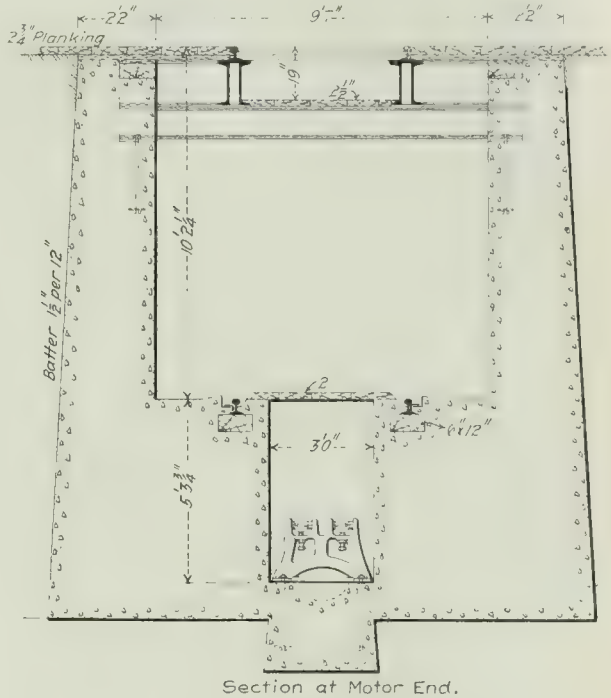
The smith shop, which occupies one-half of the portion beyond the partition, contains four fires and anvils and a 2,000-lb. steam hammer. A large shear and punch are outside the building and are driven by individual motors. The flue shop has a cutter, furnace, welding machine and hydraulic testing machine for testing flues up to 300 lbs. This shop has a capacity for welding 5,000 flues a month. In the roundhouse as high as 8,000 flues have been reset in one month. In the machine shop and roundhouse all repairs are done by piece work.

Oil House.—The oil house is really a two-story building although the lower floor is entirely below ground. It is absolutely fireproof and is built entirely of steel, brick and cement. The basement, 32 ft. x 43 ft., contains 10 storage tanks, which are filled by gravity from tank cars standing on the track alongside the upper story. They may also be filled from barrels from the unloading platform on a level with the car floor. Four of the tanks have a capacity of 80 bbls.; the other six are smaller and are for oils used in small quantities. The ground floor is 43 ft. x 21 ft. 10 in., and is divided into a drawing room 14 ft. 2 in. wide, a waste room 12 ft. wide and a sweat room 17 ft. wide. A brick wall separates the sweat room from the waste room, and a corrugated iron partition separates the latter from the drawing room. The floor is reinforced concrete and the roof is made of concrete with slag finish reinforced with expanded metal between the 8-in. I-beam purlins. Compressed air is used for raising the oil from the storage tanks to the drawing room.

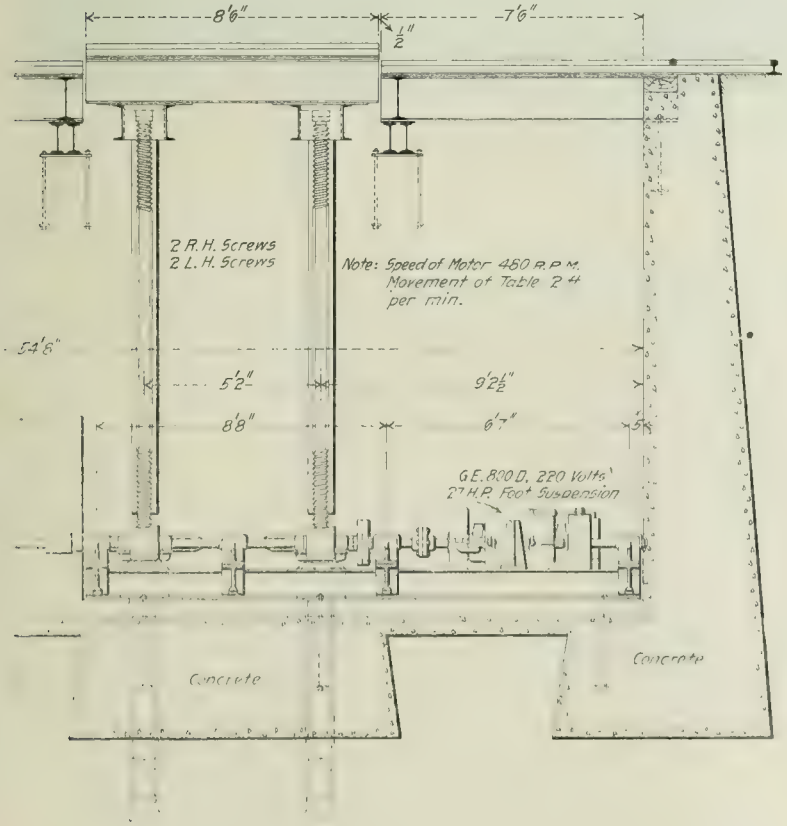
Closet and Locker House.—This building is one story high 24 ft. x 106 ft., and contains 175 expanded metal lockers for the

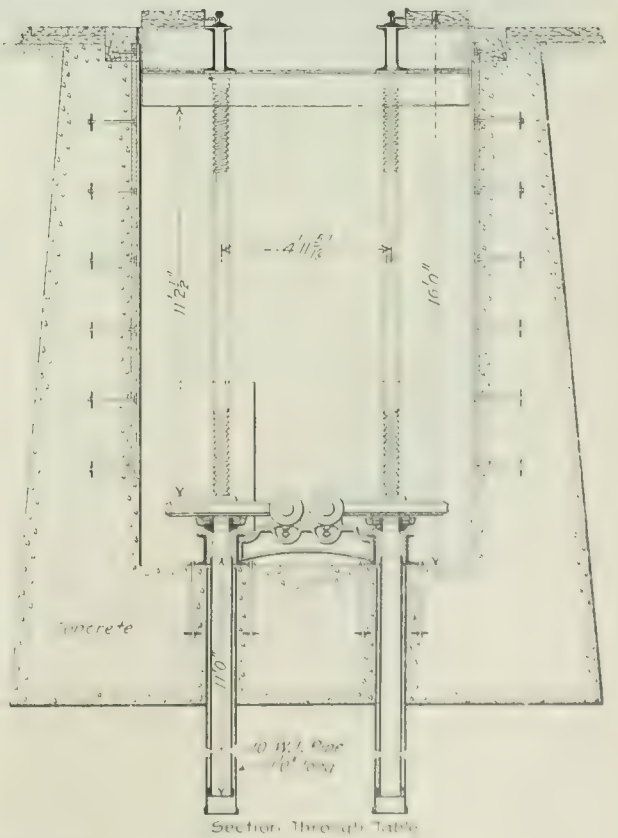


Plan of Machinery in Drop Pits.



Cross-Section Through Drop Pits.

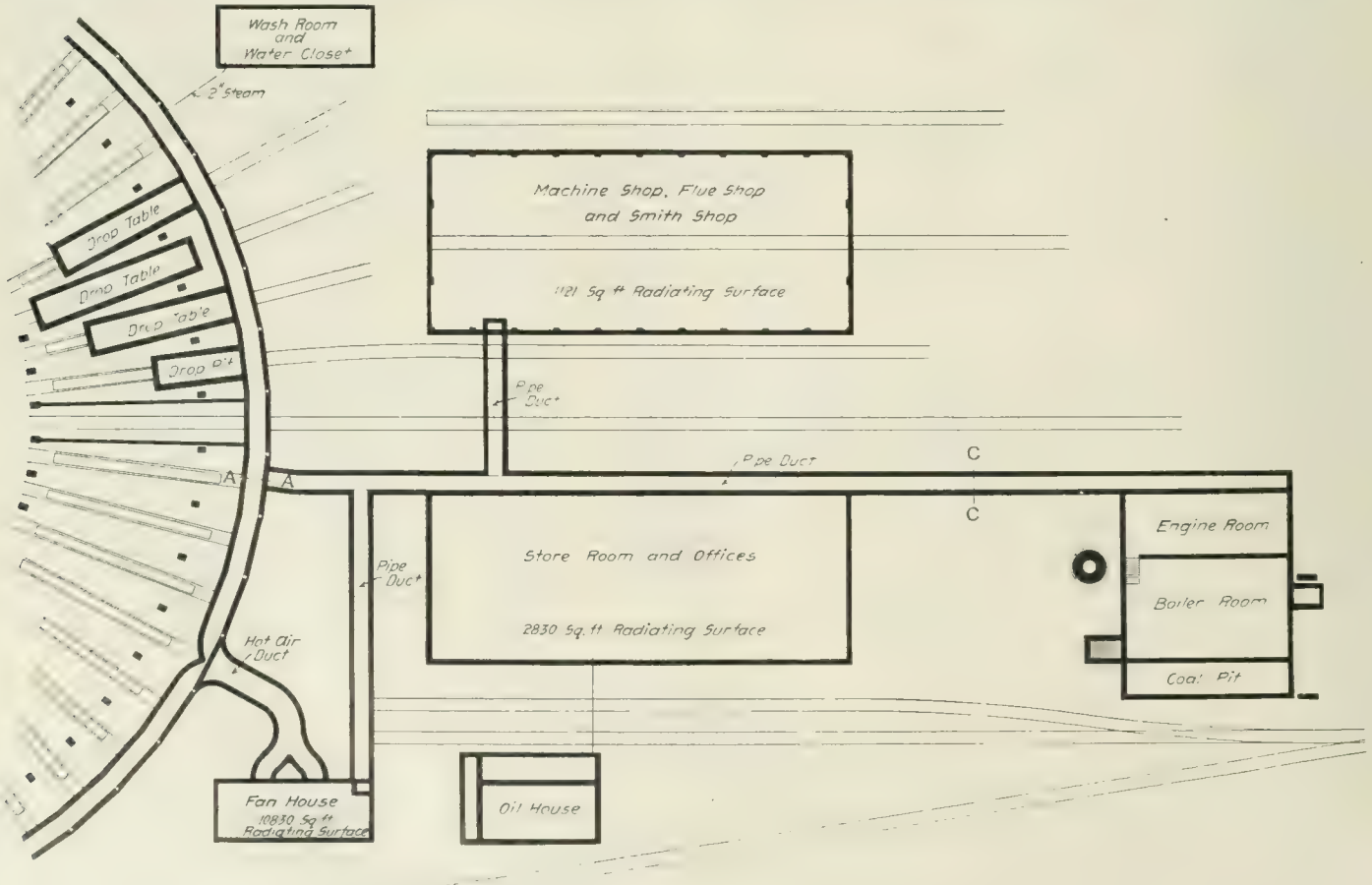




Cross-Sections Through Drop Pits.

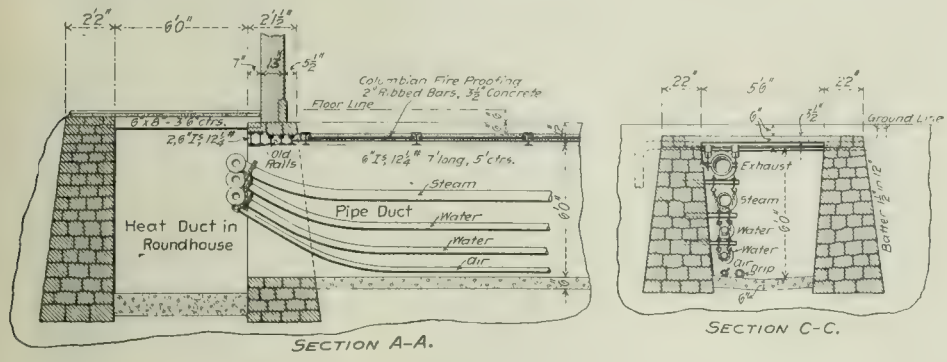


Interior of Machine Shop, East Altoona Engine Terminal, Pennsylvania Railroad.



Plan of Heating and Pipe Ducts from Power House and Fan House.

use of the roundhouse men. Each of these lockers is 12 in. x 12 in. x 5 ft. high. They are arranged around the sides of the building and in four banks of 26 each in the center. Between these banks of lockers are double rows of large wash basins, 70 in all, with open plumbing. At one end of the building are 20 water closets and eight urinals.

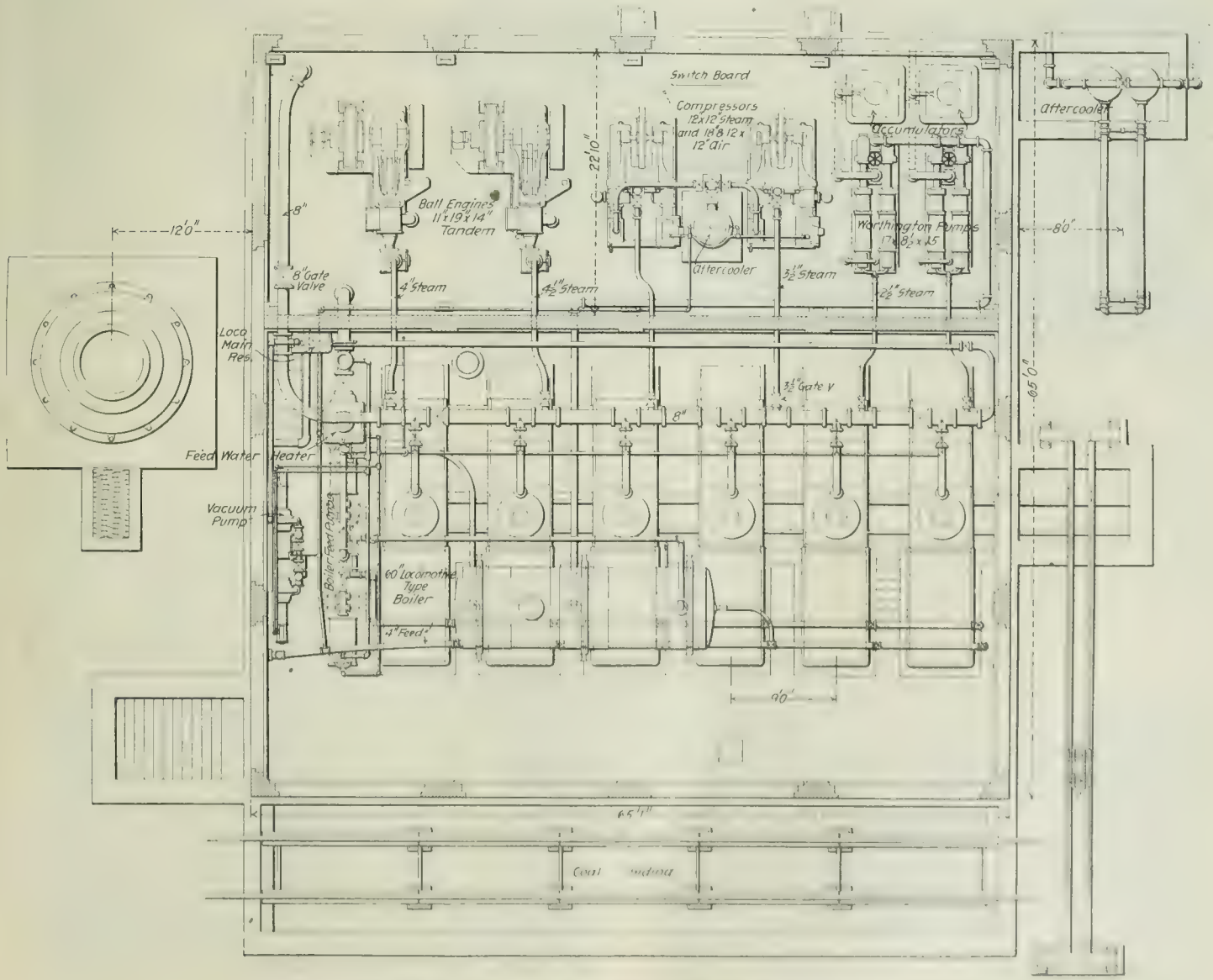


Cross-Sections Through Heating and Pipe Ducts.

Office and Bunkhouse.—This is a two-story and basement brick building of mill construction, 65 ft. x 161 ft. 1 in. The basement and part of the first floor is used for a general storehouse; the remainder of the first floor is occupied by the offices of the roundhouse foreman, road foremen of engines, and train despatcher. On the second floor are nine bunk rooms for road crews running into East Altoona and containing 74 single beds, a reading room 44 ft. x 26 ft., an air-brake instruction room 26 ft. x 52 ft., and a bath-room and water closets. An unloading platform 9 ft. 3 in. wide and 90 ft. long is built along one side of the building for handling stores out of cars. The heavier stores are kept in the basement, a freight elevator being installed in the center of the store-room. The building is heated and ventilated with the Sturtevant hot air system by two fans in the basement.

Power House.—The power house is 65 ft. x 65 ft., and is divided by a brick partition into an engine room 22 ft. 10 in. wide and a boiler room 38 ft. 8 in. wide. The floor of the engine room is a few inches above the ground level; the floor of the boiler room is 7 ft. below it. The foundations of the building are of concrete, the walls are brick and glass and the roof trusses are steel with a wide monitor having swinging sash. In the engine room are two Ball tandem compound engines of 150 h.p. running at 255 r.p.m., direct connected to 250-volt, 100-k.w., direct current generators of the General Electric multipolar type. These machines furnish light and power for the engine terminal. Next to the generators are two Class H Ingersoll-Sergeant air compressors arranged for cross-compound compressing with a water after-cooler between. These compressors have simple steam cylinders 12 in. x 12 in., and 12-in. and 18-in. x 12-in. air cylinders. They will deliver 500 cu. ft. of free air per min. at a pressure of 100 lbs. when running at 150 r.p.m. The air intakes are under the eaves of the building and the compressed air is delivered after passing through an atmospheric after-cooler outside the building. Two Worthington duplex high-pressure pumps with cylinders 8½ in. and 15 in. x 17 in. deliver hot and cold water to two accumulators, one, for hot water, being weighted for 300 lbs. pressure, and the other for cold water, being weighted for 100 lbs. pressure.

The boiler room contains a bank of six locomotive-type boilers of 140 h.p. each, which carry a steam pressure of 140 lbs. These boilers were built at the Juniata shops of the railroad company. The breeching is carried under the floor to the bottom of the stack which is on the west side of the building. It is steel, brick lined



Plan of Power House, East Altoona Engine Terminal.

and is 6 ft. inside diameter and 120 ft. high. A No. 28 Cochrane feed-water heater of 800 h.p. is put in the breeching and supplies hot water at 200 deg. for boiler feed and boiler washing in the engine house. Two Worthington feed pumps with cylinders 10 in. and 6 in. × 10 in. elevate the hot water from the heater to a 6,000-gal. steel tank mounted on a framework above the boilers, and are also used for feed water pumps. Each boiler is also equipped with injectors for use in emergencies. In addition to the boiler feed pumps, two Knowles vacuum pumps have been put in for use with the Webster vacuum return system and the Sturtevant fans for heating.

Coal is delivered in hopper cars on the coal track running over a pit 7 ft. deep just outside the boiler room. Openings are cut in the boiler room wall at the floor level and coal is fired by hand from the pile in the pit outside. Under the front ends of the fire-boxes of the boilers is a trench in which a narrow gage ash-car runs. Ashes are dumped directly into this car, which is run to a pit outside the building. Over this pit is a runway for a pneumatic hoist which also spans the coal track. The ash buckets are lifted from the pit by the hoist, run over the empty coal cars standing on the track and then dumped.

The entire plant was designed in the motive power office at Altoona. A similar plant on a somewhat smaller scale has recently been completed at Hollidaysburg, and another is building at Fairview, on the Middle division.

Roydhouse, Arey & Co., Philadelphia, were the general contractors for the buildings.

Lackawanna Third-Track Work at Scranton, Pennsylvania.

BY HUGH RANKIN.

The most important divisional point on the Delaware, Lackawanna & Western is Scranton, Pa., the junction with the main line of the Northumberland branch, which runs southwest 80 miles through the Wyoming valley and originates large quantities of anthracite coal. The company has important coal workings also in and about Scranton. The centering here of this, the most important class of traffic handled by the road, makes Scranton the traffic center of the Lackawanna, rather than Binghamton, which is the geographical center of the system, being almost exactly half way between Hoboken and Buffalo, and the point of junction of the main line and the two longest branches, one to Utica and Richfield Springs, the other to Syracuse and Oswego. The movement of traffic through Scranton is very heavy. Considerably more than half of the tonnage goes from there east to tidewater. Scranton is in the valley and at the foot of a long grade, both west and east bound on the main line.



Fig. 1—Unfinished Retaining Wall West of Tunnel.



Fig. 7—Bridge 64.

East from the Scranton station and yard toward Hoboken the grade rises for 20 miles to Lehigh; for the first 5.9 miles between Scranton and Nay Aug station, at the uniform rate of 76 ft. to the mile (1.43 per cent.). East from Scranton station there has been for some time a short stretch of third track and about two miles up the hill a 3,000-ft. passing siding. These have been altogether insufficient to accommodate the heavy eastbound traffic out of Scranton. About five miles up the hill, beginning at a point about one mile before reaching Nay Aug station, there has also been eight miles of third track. The distance therefore between Scranton and Nay Aug where the grade is heaviest has been the gap which with only two tracks has limited the capacity of the whole 20-mile grade. Freight and coal trains of from 20 to 30 loads are operated over the grade with one or two pushers. Even with this additional power, it is difficult to keep the freights out of the way of passenger and milk trains.

In order to relieve this condition, in April of last year the company began work on the construction of a total of 3.4 miles of new third track. Together with the old third track and siding, completion of this work will make the third track continuous for 13 miles east from Scranton. The line over almost the whole of this distance is above Roaring Brook, at one side or the other; the track being held up on embankments and retaining walls much of the way. The whole line is very crooked. On the 3.4 miles of new work there are 697 deg. 46 min. of curvature, or 205 deg. and 2 min. per mile. The maximum curve is 6 degrees.

Beginning at the western end of the work at the end of the stretch of third track leading east from Scranton yard, the same problem which reappears throughout almost the whole of the work is met. The line runs between high rock walls on the north side and Roaring Brook on the south side. A retaining wall 850 ft. long is to be built on this section, its height varying from 8 ft. to 34 ft. above the bed of the stream. The creek bed is at the deepest point 85 ft. below the top of rail. This wall is being built on the standard retaining wall plan of the road, the width of the wall at the top of the footing course being $\frac{1}{10}$ of the height of the wall. The



Fig. 9—No. 6 Arch; South Side..



Fig. 10—No. 6 Arch; North Side.

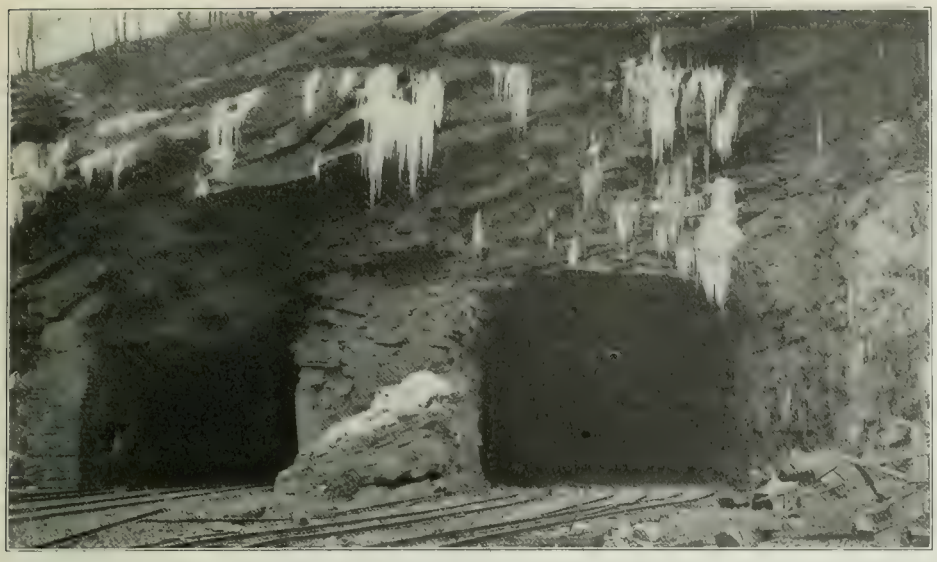


Fig. 3—West Portals, Old and New Nay Aug Tunnels; New Tunnel on the Right.

walls have a width on top of 2½ ft. In cases where the slope is higher than the wall, an inch is added to the height of the top of the wall for each foot which the slope is higher than the height of the wall; that is, a 20-ft. wall protecting a 50-ft. slope would be made 20 ft. + (50—20) in. = 20 ft. + 30 in. = 22 ft. 6 in. high. One of the lower sections of this wall, which is already built, is illustrated in Fig. 1, which also shows the relation of the track to the creek on one side and the cliffs on the other. Two hundred feet before reaching the west portal of the Nay Aug tunnel is a 33-ft. arch, shown in Fig. 2, which is yet to be extended for two tracks. This photograph also shows clearly the relation of the line to the creek.

The present Nay Aug tunnel, which is about two miles east of Scranton station, is a double-track tunnel, unlined, shown at the left in Fig. 3, which is a view at the west end. This shows the portals of the old and new tunnels. The new tunnel, it will be observed, although built to accommodate only one track, will be wide enough for double track. The extra width could be obtained at so comparatively slight additional expense that it was deemed advisable, particularly as, as soon as it is finished, operation of the old tunnel can be temporarily abandoned and a number of necessary repairs made. The width of the bench between the two tunnels is 17 ft. on the west end, shown in Fig. 3, and 20 ft. on the east end. The new tunnel will be 775 ft. long, 30 ft. wide and 20 ft. high above top of rail. Track centers are 13 ft. The headings are at present in for a total of about 720 ft. from both ends, and the bench for about 660 ft. Fig. 4 shows a view taken inside the new tunnel at the east end, showing the method of excavation. The heading is cut down to about 7 ft. from the roof of the tunnel, a convenient height for a man to stand on to get at the roof, and the top excavation then completed before any excavation is made of the bench. The method of cutting for the heading is to drill into the face diagonally from near each side of the heading until the holes nearly meet behind, and then shoot the wedge-shaped section included by the drill holes back into the open part of the heading. This gives the first entrance into the new face and makes it possible for the workmen to easily get at the surrounding rock. Before any shooting is done holes are drilled in at the sides parallel to the length of the tunnel and the portions of the face left after the wedge-shaped piece is out, are blown out sideways into the vacant space. The rock is hard enough so that the side holes in the heading are in no way disturbed by shooting the "V." The excavated material is wheeled out on hand-barrows on to the runway shown in the picture and there dumped into narrow gage cars which are drawn out on the temporary track by horses. At the mouth of the tunnel the rock is loaded on standard gage cars and thence unloaded by work train. The east portal of the two tunnels is shown in Fig. 5. The excavation from the west end is handled by narrow gage cars and dumped directly into the fill along Roaring Brook. Fig. 2 shows at the top of the slope the dummy track for the cars and the method of wasting down the slope. The rock in the west end of the tunnel is a hard sandstone, almost a bluestone, nearly as hard as flint. On the east end the formation is conglomerate, which makes much easier cutting. At this point, as already mentioned, the pier between the two tunnels is 20 ft. wide. A section of the old and new tunnels is shown in the accompanying drawing, Fig. 6.

East from the tunnel are a number of bridges under the right of way which had to be extended for third track. Fig. 7 shows Bridge 64 and the extension of the abutments for the additional track. In 800 ft. on this section of the line are four bridges or arches, including two over Roaring Brook, Bridge 64 and No. 6 arch. Bridges 66 and 67, the other two, and No. 6 arch are shown in Fig. 8, and No. 6 arch, on larger scale, in Figs. 9 and 10; Fig. 9 from the south side and Fig. 10 from the north side. This arch was extended and lined, the lining put in the old barrel being only 20 in. thick. It was extended 28 ft. on the south side and 12 ft. on the north side, on a skew. The old head wall was perpendicular to the barrel of the arch. No reinforcement was used. The retaining wall between Bridges 66 and 67, shown in Fig. 8, was necessary because additional right of way could not be secured. At various points along this part of the line, 5 deg. curves were reduced, some on one side of the track and some on the other. In many cases the third tracking involved changing the original order of the tracks.

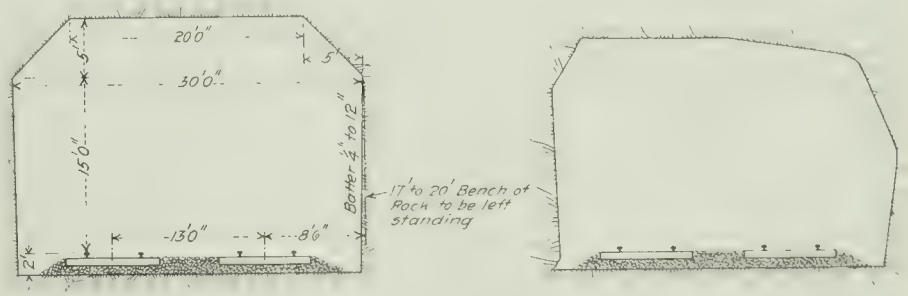


Fig. 6—Section of Old and New Nay Aug Tunnels; New Tunnel on the Left.



Fig. 4—Interior Nay Aug Tunnel; East End.

At a point about 2,100 ft. east of No. 6 arch Roaring Brook again crosses under the track. The old bridge was at a point 156 ft. below the present location. It was built over an old mill dam with a 14-ft. fall, a spot that always had to be watched in spring weather because no secure rock bottom could be found at that point. In order to do away with this weak spot the channel of the stream at this point was changed and brought under the track 156 ft. above the old location. The bridge was lifted from its old seat and carried to the new location over the new channel. The removal of the bridge and the old location filled in are shown in Fig. 11, the new location in Fig. 12. The also shows the new masonry, including the long wing wall to protect the Scranton



Fig. 8—(Left to Right) Bridge 66, Bridge 67 and No. 6 Arch. Wall Necessary as Additional Right of Way Could Not be Secured.



Fig. 2—Concrete Arch West of Tunnel Yet to be Extended for Two Tracks. Narrow Gage Track for Small Cars Carrying Material from Tunnel Shown on Edge of Bank.

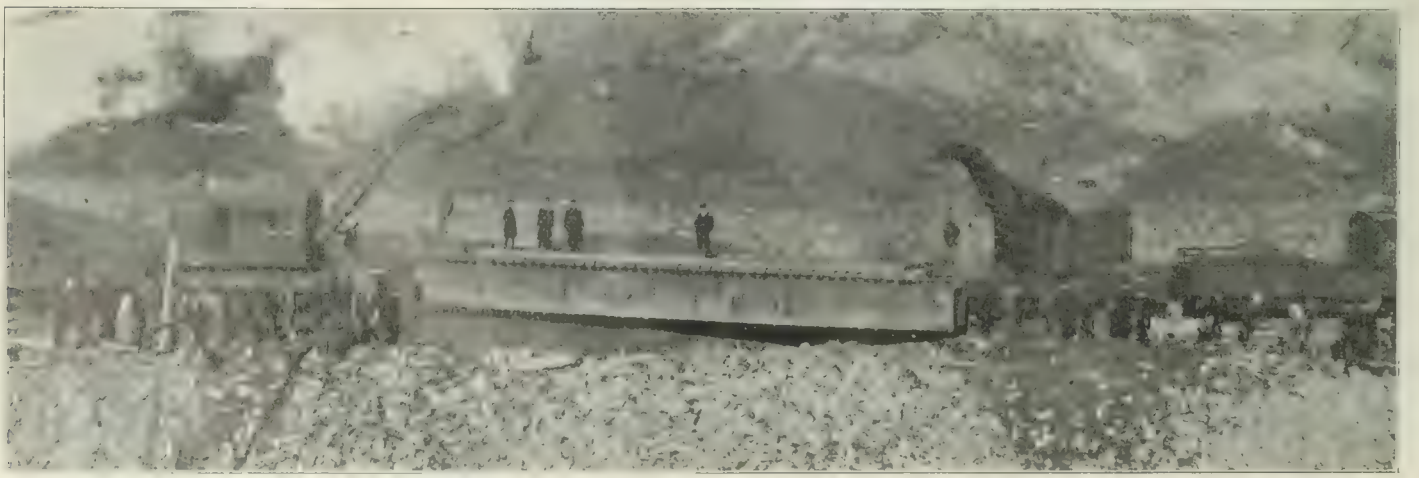


Fig. 11 —Lifting Bridge 68 from Old Location.



Fig. 14—Looking West from Erie Bridge; New Third Track on Left.



Fig. 15—Looking East from Erie Bridge.



Fig. 5—East Portals Old and New Nay Aug Tunnels; New Tunnel on the Left.

Gas & Water Company's pipes, which run parallel to the track throughout all the work. East of this point in a cut with an earth embankment on the north side of the track, located between two coal breakers, one on each side of the track, the company has had great difficulties with cast iron pipes. A 24 in. pipe put in three years ago was in that time so eaten through by sulphur water from the washeries that it was entirely useless, therefore, in connection with the new work, concrete boxes, instead of large-section cast iron pipe, have been put in to carry the drainage water under the tracks.

Further east on the south side of the track, is one of the reservoirs of the Scranton Gas & Water Company. The extreme conservatism of the water company in protecting its property was one of the causes of the expensive character of the third-track work. This is well illustrated in the case of this reservoir which, as shown in Fig. 13, is a considerable distance away from the track embankment. Nevertheless the railroad company was forced to build the retaining wall shown, 977 ft. long.

At a point near the upper or eastern end of the new work, the Erie & Wyoming Valley branch of the Erie Railroad crosses the Lackawanna on a high overhead bridge. The last two photographs are views from this bridge, Fig. 14 looking west down the track toward Scranton, and Fig. 15 looking east up the track. Both of these show well the character of the country through which the whole line runs. Beginning at a point directly under the bridge and



Fig. 12—Bridge 68, New Location; New Masonry Includes Wing Wall to Protect Water Company's Pipes.

extending eastward parallel to the track is still to be built a concrete retaining wall 600 ft. long. East of the bridge is a complication of interests, shown in Fig. 15. At the bottom, 45 ft. below the track is Roaring Brook; above that the D. L. & W. main line; 40 ft. above that the Lackawanna's Winton branch; above that the Drinker turnpike, and still above the highway, the line of the Dunmore & Moosic Lake Railroad. The problem was to widen the main line for the additional track in the exceedingly narrow space available. At the lower side, the creek could not be filled in or interfered with in any way because it furnishes part of the water supply for the city of Scranton. Any moving further over of the Winton branch would have involved moving also the highway, if not the Dunmore & Moosic Lake, further above; therefore, in order to get the extra space, the retaining wall shown in the picture was built to support the slope of the Winton branch. Further east, some 2,000 ft. on the lower side of the track, is a retaining wall, already built, 671 ft. long and 16 ft. high above the foundation, which is 4 ft. below the bed of the creek. This is at the foot of a 44- to 48-ft. fill. The eastern end of this wall, which is about one mile west of Nay Aug station, marks the beginning of the old third track and the upper end of the present third-track work.

The situation of the line hemmed in by the mountain on one side and Roaring Brook on the other, together with the reservoir of the Scranton Gas & Water Company and other structures belonging to coal companies, prevented any great betterment of either grade or alinement. In addition to these natural difficulties, the work had to be done along with regular operation, in a heavy season, of the main line. The average train movement in 24 hours is from 140 to 170 trains. All material, with small exceptions, had to be handled by train service, four work trains being continually on the work. All grading was handled by contract, the contractor loading and unloading the material and the company furnishing the work train service. Derricks and steam shovels were used on the cuts. The total excavation was 62,800 yds. of rock and 36,600 yds. of earth. About 19,200 yds. of concrete will be used on the entire work, including bridges and arch. All concrete work was put in by contract, with the exception of some small repairs under the old tracks. The concrete mixture was 1, 2 or 3 (depending on the character of the stone) and 6. The concrete was put in the forms so wet that the men who were packing it sank in up over their ankles. Mill run rock was used, the maximum size to pass through a 2 in. ring. The rock was not screened, but the dust was put in with it. The retaining walls were built in 30-ft. sections with a key between sections. Burke Brothers, of Scranton, are the contractors for the work. The contractors for the steel work on the three steel girder bridges were the McClintick-Marshall Construction Company, of Pittsburg, Pa.

On January 10 the third track was put in operation from the tunnel east of Nay Aug 3.5 miles, this including the 3,000 ft. of old siding. The third track all the way from Scranton yard to the tunnel will not be in shape for service before summer, as the heavy 850-ft. retaining wall (Fig. 1) and the extension of the 33-ft. arch (Fig. 2) west of the tunnel are still to be finished before the fill can be made. The new tunnel is to be ready for use next month, and the whole new stretch of third track is expected to be in operation by September 1.

For the photographs and information about this work we are



Fig. 13—Retaining Wall to Protect Water Supply Reservoir.

indebted to Mr. Lincoln Bush, Chief Engineer; Mr. G. J. Ray, Division Engineer, and Mr. H. C. Boyden, Assistant Engineer in charge of the work.

Building the Brooklyn Subway.

BY GEORGE L. FOWLER.

The subway of Brooklyn, New York, that is to connect the terminal improvements of the Long Island Railroad with the East river tunnels and the subway system of New York in Manhattan Borough, extends from the junction of Flatbush and Atlantic avenues to Fulton street and thence to Joralemon street, beneath which it runs to the connection with the tunnels. In this there is an easy curve at Flatbush avenue and Fulton street, while the latter swings to the right further down, so that Joralemon street furnishes the direct route.

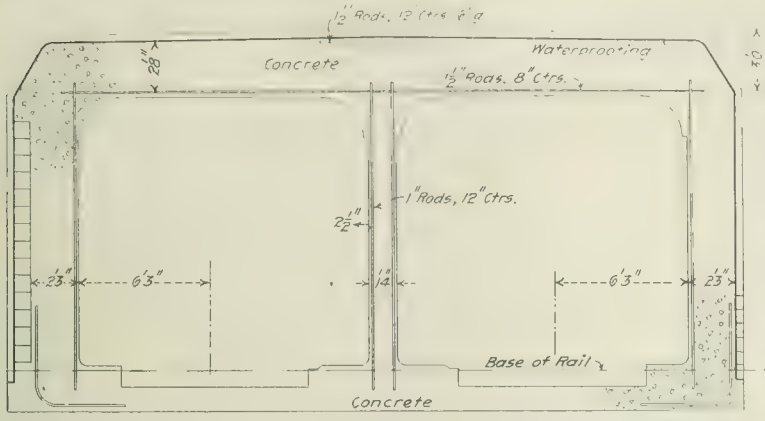
In this distance it is safe to say that Fulton street is one of the busiest streets in the country. From the City Hall, which is at the junction of Joralemon street, to Flatbush avenue, Fulton street is the center of the business and shopping district of the city. It further serves as the main artery of communication between all of the central and southern portion of the city and the Borough of Manhattan; and it is through it that the great army of workers must pass morning and evening. In comparison with the demands that are put upon it, the street is narrow and is congested with traffic at all hours of the day. Above the surface there is an elevated railroad while, on the ground, there is a double-track surface line of trolley road. The sides of the street are bounded by the largest department and retail stores in the borough. During the rush hours of the morning and evening, the street car traffic is run on an average of nine seconds headway in each direction, so that 13⅓ cars pass a given point per minute. The sidewalk traffic, com-

posed principally of women and children, may be gaged by the estimate of a proprietor of one of the large stores, that 50,000 persons visit his establishment daily, while about 8,000 people are employed there.

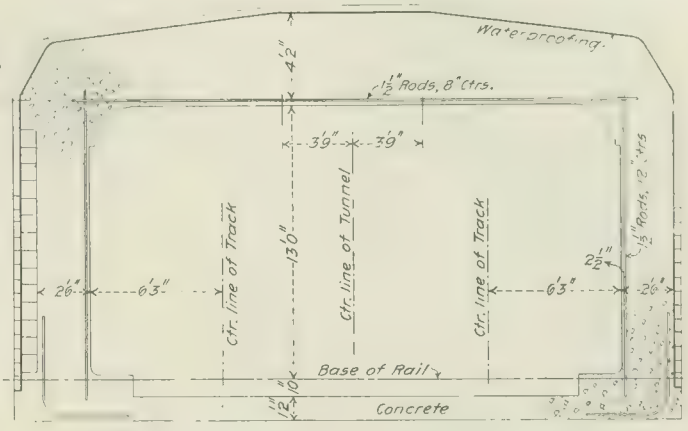
With these facts in mind, it will be readily understood that the construction of a big ditch through this thoroughfare, and extending the full width of the same, is an undertaking requiring not only engineering skill of a high order, but an amount of care and attention to detail that is almost overwhelming, if there is to be a freedom from accident and delay to the traffic upon which the business interests of the city depends.

The construction of the section under consideration is being carried on by the firm of Cranford & McNamee, who are the sub contractors for this section. The material through which the work is carried is a glacial drift consisting of sand and gravel of such consistency and uniformity of distribution that it can be depended upon, and it is free from quicksands and pockets of heterogeneous material that would be apt to cause trouble.

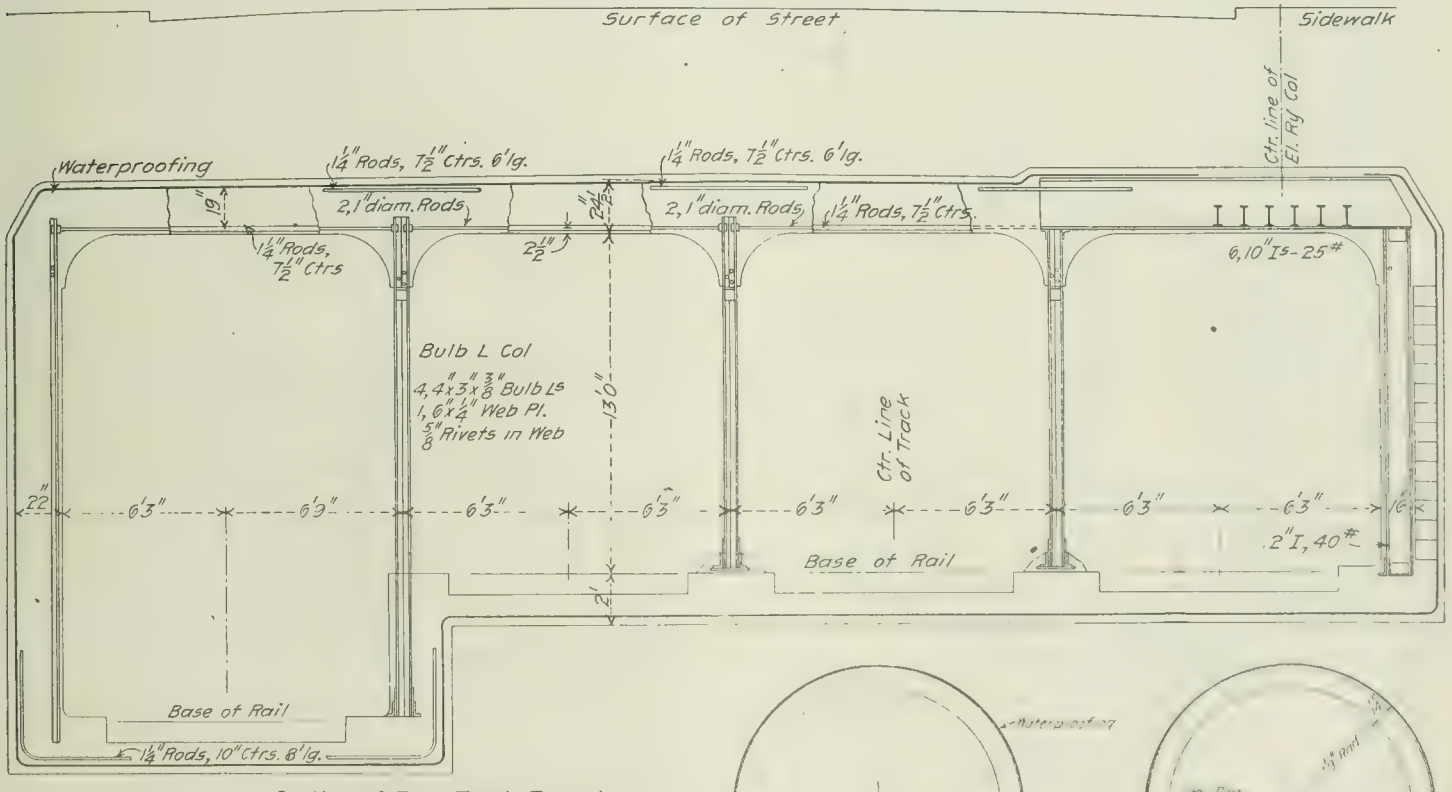
When the contract was let the plans called for a double-track structure throughout nearly the whole distance. After the work was well in hand, the agitation for a four-track road was begun, and while the plans for this were being prepared the contractors were asked to do the excavating in such a way that the subway could be widened to four tracks without unnecessary expense. The contractors were not allowed, however, to do any of the extra work that would be called for by this change in plan until the contracts



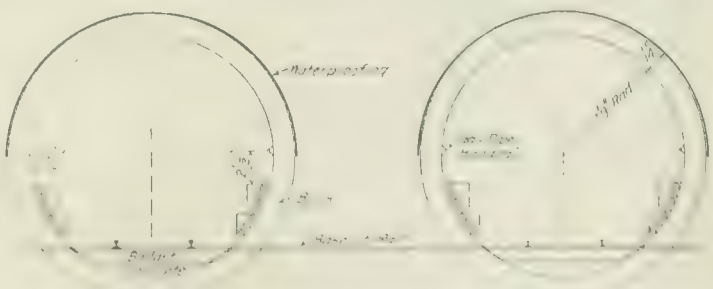
Section of Double Track Tunnel with Center Supporting Wall.



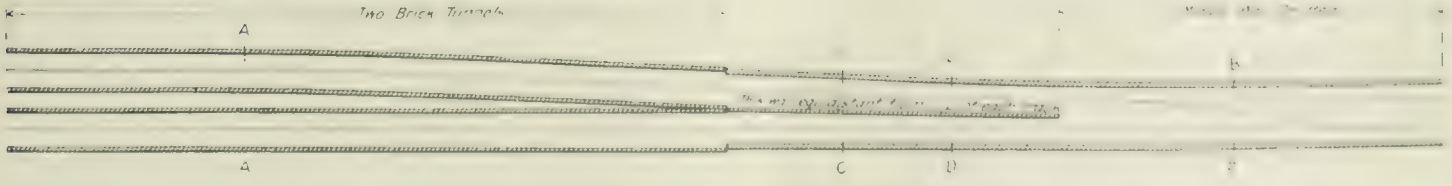
Section of Double Track Tunnel.



Section of Four Track Tunnel.

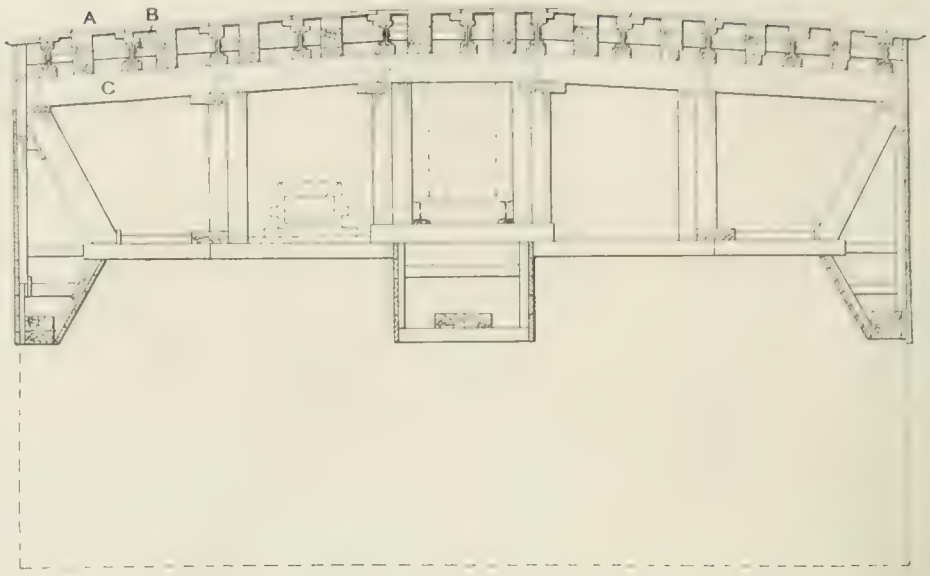


Section of Two Single Track Tunnels.

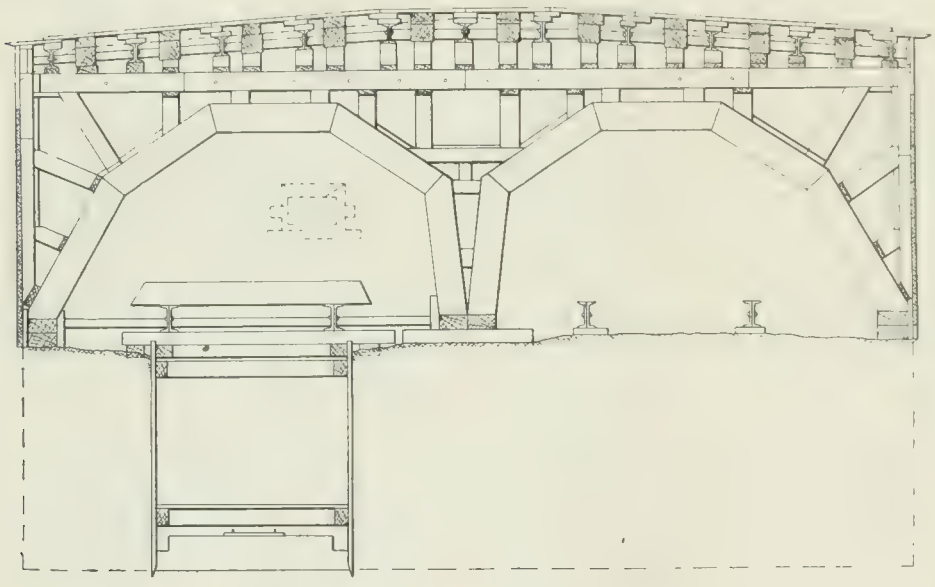


Plan of Run from Single to Double Track Tunnel.

had been signed, sealed and delivered. As the matter stands at present, the subway will be of varying widths. Starting at the East river there will be two distinct single-track tunnels that come together in one at the upper end of Joralemon street. Thence there is a stretch of double-track tunnel which soon widens to four tracks. A part of this four-track work will eventually consist of a central span for a double track with a single-track tunnel on each side. This will be at that portion of the line where the original double-track work was completed before the change was made in the plans. Beyond this there are five, six and seven tracks abreast. At the corner of Flatbush avenue and Fulton street there will be a point where there will be five lines of tracks one above the other. In other words, there will be a five-story railroad line. Above the surface of the street there are two lines of elevated roads that cross, one above the other. There are the surface lines on the street level. Beneath the surface there will be the regular line up Flatbush avenue with an under cross-over to connect with the line that is to be built up Fulton street.



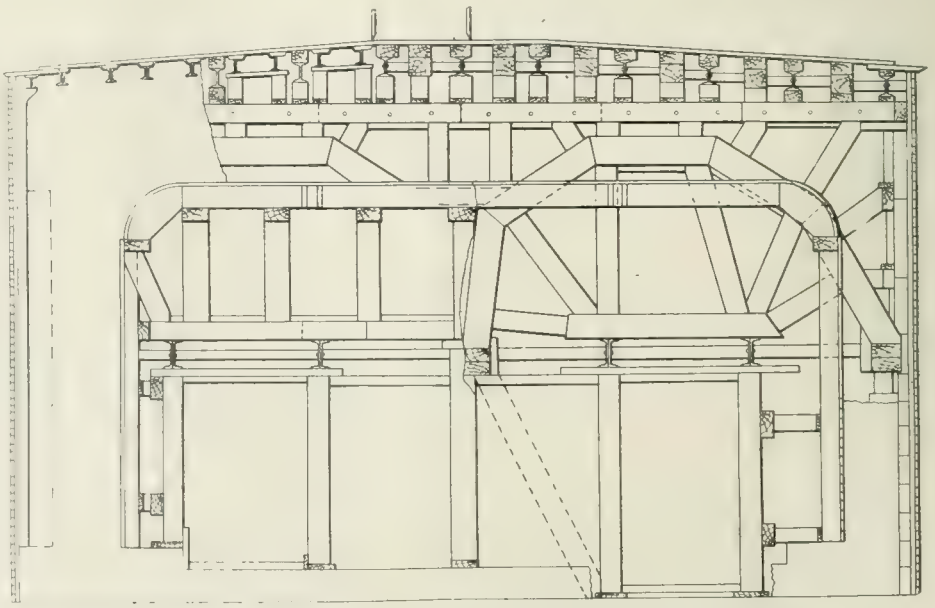
First Stage of Timbering in Double Track Tunnel.



Second Stage of Timbering for Double Track Tunnel.

The methods that have been adopted for the execution of the work are very simple in the general plan, though of course every foot of the way presents its own individual problem to be solved. In the matter of timbering, a standard form of supports has been adopted and the timbers are all cut to the proper lengths, so that when they have served their purpose at one point they can be moved to another further on and used repeatedly without waste and without confusion.

In excavating there is a consecutive order of work maintained throughout. Starting with the street in its original condition, the first step is to remove the pavement in sections about 20 ft. long. The pavement between the rails of the tracks is first taken up and an excavation made that will permit 6-in. x 6-in. cross ties to be slipped in beneath the rails. On these ties a longitudinal flooring of 4-in. x 6-in. plank is laid and on this a transverse decking of 3-in. plank. Then a shallow excavation is made between the tracks, and from this two pairs of 8-in. I-beams are worked in beneath the cross ties so that they form a longitudinal support. The excavation is then made to the depth of the bottom of these longitudinal I-beams for the full width of the street, others being worked in meanwhile beneath the outer ends of the cross ties, as shown in the section. At the same time three lines of 10-in. x 10-in. longitudinal timbers B are laid on each side outside the lines of rails. The remainder of the deck of 4-in. x 6-in. plank is then laid longitudinally on cross ties placed on these 10-in. x 10-in. stringers. The surface of the street has thus been provided for, and the next step is to make a full-width excavation about 6 ft. deep. During this operation the deck beams are carried on blocking until the permanent uprights can be placed. The 12-in. x 12-in. horizontal braces, formed of 6-in. x 12-in. timbers bolted together, are then laid in the bottom of the excavation, with their ends bearing against the rangers at the sides and which have their bearing, in turn, against the sheeting. These, therefore, serve the triple purpose of acting as shores for the sheet piling, as ties to hold the bracing together and as sills for the vertical shores that are then set beneath the I-beams carrying the lines of rails. The sheeting against which these beams C abut is permanent and is formed of square-edged planking 2 in. thick. The timbers C with the structure of which they form parts are set accurately at 10-ft. intervals so as to clear the steel columns that are to be set later as the final structure. Before the beam C is laid across the center line the crown timber D of 12-in. x 12-in. timber is set. The excavation is then carried down on the sides to a depth of about 6 ft. more, the beams C being held meanwhile on blocking until the vertical shores can be placed. At the outside the sheet piling makes it possible to carry the work down vertically, but at



Third Stage of Timbering for Double Track Tunnel.

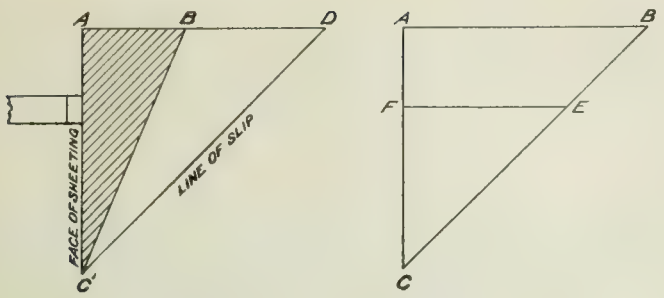
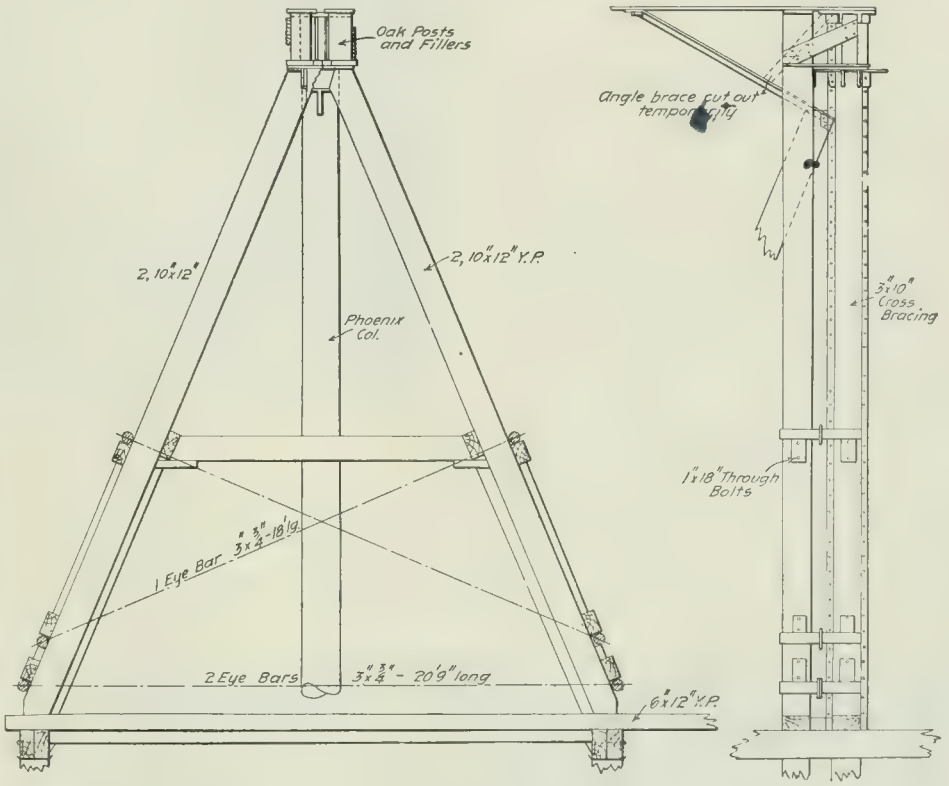


Diagram Showing Location of Maximum Pressure.

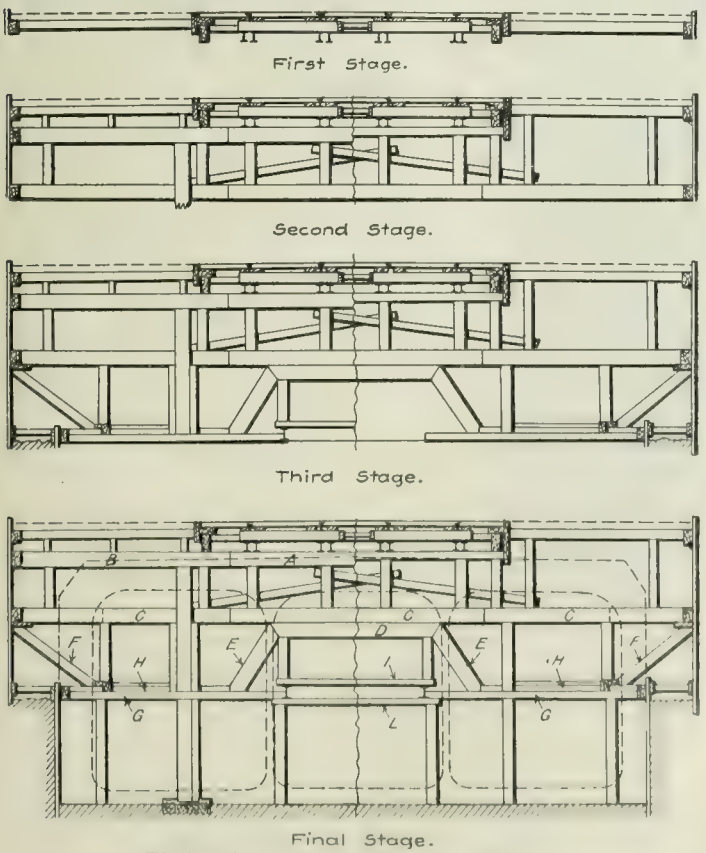
the center it is on a slope. At the bottom of this excavation the beams G are placed in 10-ft. lengths on the upper surface of which the thrust blocks H are fastened. These serve to take the thrust of the inclined side braces F and the arch braces E, which are then set. The excavation is then carried down at the center to the depth of the beams G and a line of 12-in. channels bolted back to back, breaking joints and thus forming a continuous I-beam, is then laid with the transverse struts I between them. These channels serve the double purpose of carrying the street load while the verticals are being placed beneath the shores at the ends of the crown beams D, and as a longitudinal tie and brace for the completed system of timber work below the surface.

In the next operation the excavation is extended at the center down to the line of the subgrade in order to permit the spoil tracks to be run up as close as possible to the heading. This center excavation has sloping sides and is not sheeted except where the soil is bad. It is during this part of the work that the lateral inclined struts F together with the channel beams are used to carry the superincumbent loads; the latter rest on the ground ahead of the work and on their permanent shores at the back, and the span of 10 ft. is such that the street is carried safely. As soon as the central excavation is down to grade the permanent uprights are placed beneath the channels and then the work is carried out to the sides to the full width of the completed subway.

In the designing of this timber support and bracing, special pains were taken that it should not only carry the street traffic without yielding, but that the side sheeting should be so supported that there should be no flow of the earth behind, causing a settlement of the foundations and buildings resting upon it. As the text books give but scant information as to the point of maximum pressures, the matter was taken in hand and thoroughly worked out by the contractors and their engineer. The result of this is shown in the location of the rangers and bracing as indicated on the drawing. The theory upon which these pressures were worked out is based upon the location of the center of gravity of the triangle of material embraced between a line bisecting the angle between

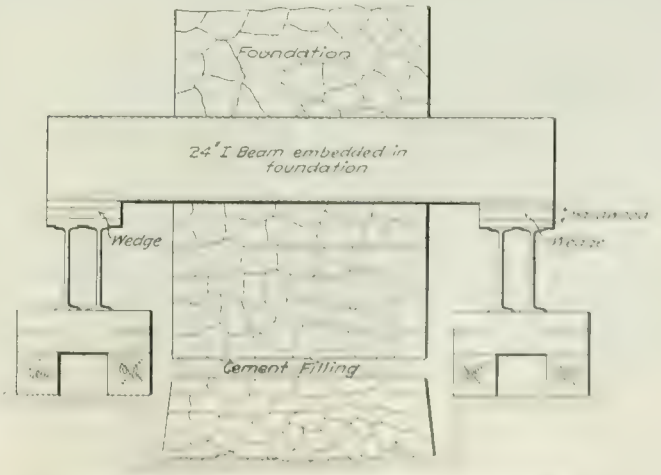


A-Frame for Carrying Elevated Railroad Columns.



Timber Supports for Brooklyn Subway.

the vertical face of the sheeting and the line of slip, and the vertical face of the sheeting itself. This is shown in the accompanying engraving of the triangle A B C'. If, for example, the line of slip of any material is C'D, or 45 deg., then by bisecting this angle with the line B C' and drawing E F at the center of gravity of the triangle A B C we have F as the point of maximum pressure. A ranger placed at F is, therefore, called upon to hold back the greater portion of the earth contained in the triangle A B C. The



Method of Underpinning Building Foundations.

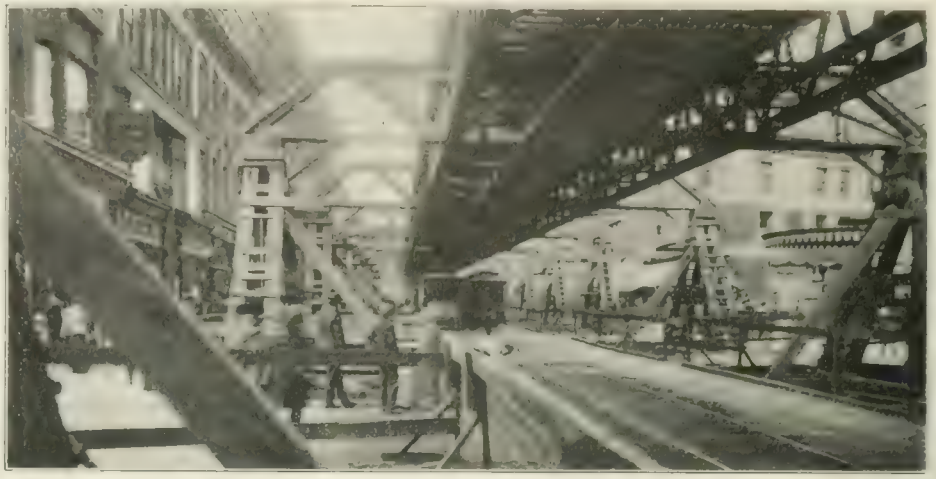
triangle A B C is principally held by the brace at F so that the pressure is that of the tendency of the triangle A B C' to rotate outwardly, and the point F will be that of maximum pressure and the one at which the main ranger should be placed.

This was done throughout the whole course of the work, and it

has been found that the ranger at the point of maximum pressure was usually about 6 ft. below the surface. This theory has received the strongest kind of endorsements in the efficiency of the method and the total absence of all settling along the line of the work.

All of the excavation is done by hand. The loading for the latter part of the work is done directly by shovel, but for the advanced portions of the headings, the spoil is carried back and put in the buckets by a belt conveyor. These buckets hold about 1 cu. yd. and are set on small flat cars, upon which they are hauled by mules from the heading back to a derrick located on the street by which they are hoisted and dumped into gondola cars of 20-ton capacity of the Brooklyn Rapid Transit R. R., in which the spoil is taken to Coney Island for filling in marsh lands.

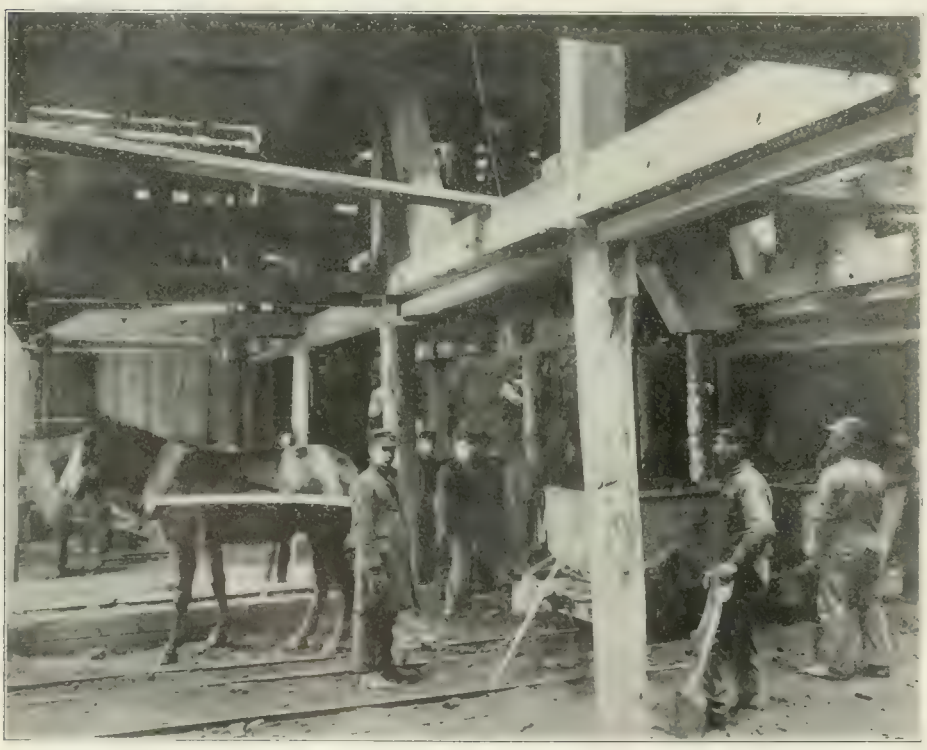
In such a soil as that of Fulton street, and with the elevated structure and high buildings to be cared for there have been other problems to solve than those of the street traffic alone. As will be inferred from what has been said, some of the excavations of the subway extend out beyond the line of supporting columns for the elevated structure. These latter had to be carried and underpinned in every instance. As in the case of the regular street supports, a standard system of A frame was adopted for this work, the design of which is clearly shown in the engraving. The columns of the elevated structure are of the Phœnix design, about 11 in. inside diameter, and are composed of six sections. In the order of the work the load is taken off these columns before any of the street excavation heretofore described is commenced. The first thing done is to dig pits about 5 ft. x 8 ft. whose centers are located 10 ft. on either side of the column to be supported. These pits are carried down to grade and timbered in such a way that the one marked G in the cross section serves as a cap for the lower line of verticals. The upper portion of this work is capped near the street level by 12-in. x 12-in. timbers which, in turn, serve to carry the bottoms of the A frames. These latter are formed by two pair of 12-in. x 12-in. timbers set as shown in the engraving. The sills on which they stand are set to clear the columns and when the frame is set the lower ends are drawn together, thus raising the upper part and relieving the column of its load. The method adopted for drawing these ends together is to place an hydraulic jack on the face of the incline of the frame and force one end of the diagonal eye-bars down the slope. The ends of the timbers are sledged for the purpose and the movement of the upper end is such that there is a slight cracking of the connections between the bottom of the column and its foundation when the complete transference of the load to the A frame has been accomplished.



View on Fulton Street Showing Supports of Elevated Railroads.

This method of support has proven to be exceedingly satisfactory. Though the weight of the elevated structure has been carried for months at a time in this manner it is seldom that there has to be any adjustment of the bracing after it is first put in place. When a train is passing there is no extra tremor and no trouble has thus far been experienced in any way. After the excavations have been brought up to the column, a diagonal side brace is put in that serves to steady the frame, though carrying no part of the load.

There have, of course, been innumerable cases of underpinning of foundations of adjacent buildings, each of which has required individual treatment. Without enlarging upon this matter too much an engraving is presented showing the method adopted in working beneath one of the piers of a large department store. Grooves were cut in the sides of the pier and 24-in. I-beams imbedded therein with concrete. The ends of these I-beams were then carried by cross-beams of sufficient length to reach to blocking that was set clear of the work so as to permit of the necessary excavation. The lower portion of the pier was chained and allowed to hang while the final foundation was brought up to it.



Timbering and Spoil Trucks Beneath Fulton Street.

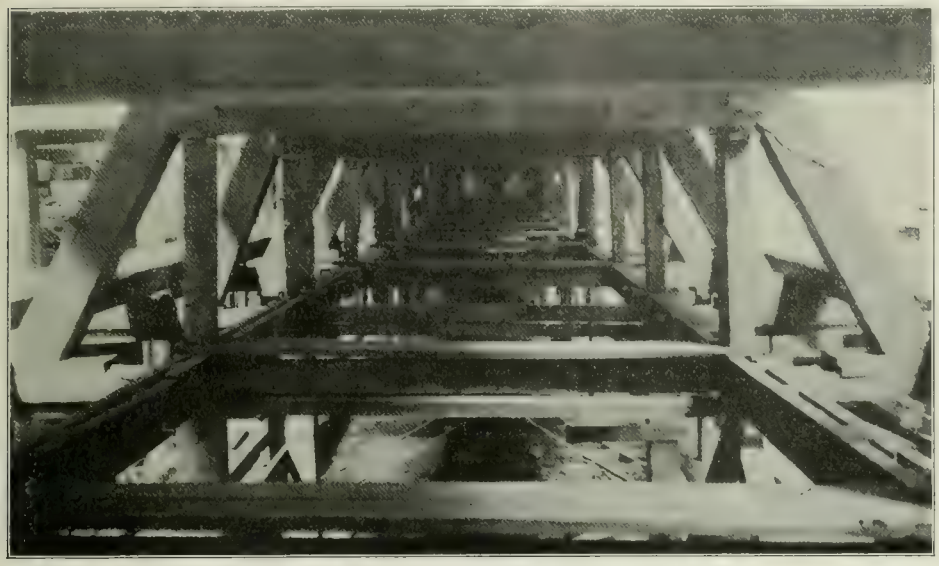
In this as in all of the balance of the work the greatest precautions are taken to avoid accidents, and a personal supervision is given to each detail of the work by those in authority, as far as this is possible. The wedges used in this work are all of hard wood bearing pieces above and below. When the load has been imposed by the driving of the wedges, the excavation is done by skilled timbermen. The result of this care is that there has been a remarkable freedom from injury to the adjacent buildings throughout the whole length of the cut-and-cover work. In one place where there is a restaurant in a sidewalk vault whose foundation reaches down so that the timbering of the subway actually touched it, there has been no cracking of the walls or a leak through the concrete sidewalk above; which means that there was absolutely no settlement.

The same systematic method of conducting the work, though varying in detail, has been followed in the tunnel sections as in the cut work at the upper end on Fulton street. Three engravings are presented showing the consecutive steps that are taken in the timbering. The tunnel is driven through the soft material composed of coarse sand and gravel by means of a roof shield and the advance heading is closely followed by the deeper cuttings at the rear. The sectional roof shield is pushed ahead by hydraulic jacks in the usual manner. The roof boards are placed beneath the tail of the shield and blocked up in place, the blocking being held by I-beams located as shown in the engraving of the first stage of the tunnel timber work. In this the roof boards A are placed, as stated, directly beneath the tail of the shield, and are blocked up and held by the I-beams B below. These are carried by the cross stringers C, which are held up by the vertical bracing shown. At the sides, it is impossible to use sheet piling and so the sides are sustained by longitudinal sheeting placed in position from the top towards the bottom as the excavation is carried down, a ranger being placed near the top to take the thrust.

In the second stage of the timbering the vertical supports have

been replaced by arch timbers with diagonal bracing to the sides and a straight cross brace has replaced the arched brace that was originally put in. This is done when the excavation has been brought down to the line of the spring of the arch.

The final stage is shown in the engraving where the arch timbers have been removed and the moulds with the supporting timbers are in place. This shows the concrete partly in place and the arch timbers beyond that have not yet been removed. In this the only material of the false work that is left in position are the roof boards with their I-beam supports, and the longitudinal sheeting on the side with their holding pieces.



Timbering Beneath Fulton Street.

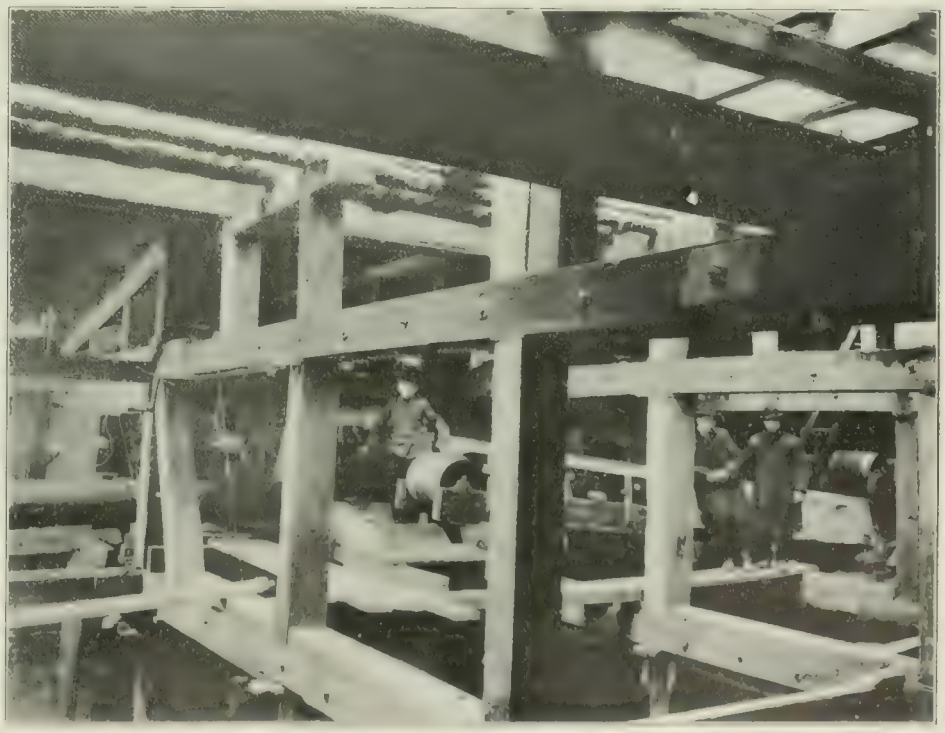
The method of concreting followed has been practically the same throughout the whole of the work, whether in cut or tunnel. It has been to concrete in alternate sections 5 ft. wide. Thus, in the cut work the bents for carrying the street traffic were placed accurately to 10-ft. centers. When it came to the concreting of the roof, a section 5 ft. wide between these bents was taken and the moulds set up and the work completed. After the concrete had had ample time to set the load was transferred to the concrete structure and the bent removed. This left the intermediate space of 5 ft. between those that had been completed ready for concreting. This was then done and the roof thus made continuous. The concrete, as thus placed, is not continuous in the sense of being monolithic, but contains a seam at 5-ft. intervals across the structure. It would be possible for water to percolate through this were it not that the waterproofing was applied on the outside and the whole thus protected from water from above.

The concreting of the tunnel section has been carried on in the same way. The bents, for carrying the roof, were spaced at 6 ft. and 4 ft. intervals between centers. It is, of course, very difficult to do satisfactory concreting in the roof of a tunnel where the material has to be put in from the sides or from below. In this case the roof was not more than from 12 ft. to 20 ft. below the surface. Pits were accordingly dug at 10-ft. intervals and so adjusted that the openings in the tunnel roof came between the sections of concreting. By means of these pits, the concrete was mixed in the street and sent down to position through these chutes. It could thus be placed exactly where it was needed and all spaces filled. The mixture used on all of the work was that of 1-3-4.

In concreting between the underpinning and the original foundations of buildings, a neat cement was used, mixed very thin so that it would flow readily. The space left to be filled was usually about 6 in. A dam was built around this opening and the cement poured in until it was filled. It was tamped continuously as it was put in and for some time after the space was full. Rods were run in beneath the upper parts so as to work out any air that may have been imprisoned, and the tamping was continued until a blow on one side caused a rise or was perceptible on the other. It was then allowed to set thoroughly before the supports were removed.

The finished work will present a number of cross sections varying with the location and the requirements of the traffic. At the westerly end on Joralemon street there will be two single-track circular tunnels spaced 26 ft. apart between center lines. These tunnels are to have an internal diameter of 15 ft. 6 in. and a brick lining of 16 in. inside the board sheathing that, having been placed beneath the tail of the shield, is left permanently in place. The bottom of the tunnel is spread with a layer of concrete 1 ft. thick, upon which the ballast is laid. At the sides provision is made for the wire conduits that also form a footway for workmen, which is provided with a gas pipe hand rail. These tunnels connect with the tubes passing beneath the river and run westerly for a distance of 314 ft.

The two tunnels then come together and the tracks run in a flat-roofed tunnel spanning both tracks, but separated by a wall of reinforced concrete 16 in. thick. The roof and side walls will also be of reinforced concrete. In the division wall the reinforcing consists of rods 1 in. square spaced 12 in. between centers and set vertically 2½ in. from the face of the wall on each side. In the side walls the reinforcing consists of rods 1½ in. square, set vertically 2½ in. from the inside face of the wall and 12 in. between centers. The outside corners at the bottom are also reinforced in the same way as shown in the illustration. The roof is a concrete beam supported at the end and center. The depth varies from 2 ft. 2 in. to 2 ft. 8 in., and is reinforced by rods 1½ in. square spaced 8 in. center to center and set 3 in. from the lower face. At the top the reinforcement consists of rods of the same size spaced 12 in. apart and 6 ft. long. This section extends for a distance of 145 ft., beyond which the center wall is omitted, and the roof consists of a series of reinforced concrete beams with a depth of 4 ft. 2 in. The clear span is 26 ft. and the reinforcing in the roof consists of bars 1½ in. square and 17 ft. 6 in. long extending toward the center from each of the side walls and overlapping about 8 ft. at the center. In both of these sections special waterproofing is applied inside the concrete.



Timber Supports Beneath Fulton Street, Showing Belt Conveyor from Headings.

This double-track single-span tunnel then runs into a double-track subway in which the depth of the roof is less and the center is supported by a row of steel columns. The illustration of the four-track section shows the general form of construction that will be followed. The side walls are of reinforced concrete 18 in. thick, and the roof is of the same material, with 1¼ in. square rods. The spans from center to center of the rows of supporting columns are 12 ft. 6 in.

Where the elevated columns are to be supported on the roof, 12 in. I beams are used in the side walls, and these carry one end of 24-in. I-beams, whose other end is supported by the bulb angle columns between the tracks. The elevated column itself is footed on 10-in. I-beams, usually about six in number, that reach from one to the other of these 24 in. beams, the whole being embedded in the concrete of the roof.

The columns used for the center supports are of the standard bulb angle construction and serve as points of attachment for the reinforcing tie bars of the concrete roof as shown in the illustration. The roof itself is shallow, having a depth of but little more than 24 in., and the top is in places not much more than the same distance below the surface of the pavement.

When the contracts were let it was expected that the work would be completed by Jan. 1, 1907, but the necessary enlargement will require an extension of the time limit.

This work is being done under the direction of the Rapid Transit Railroad Commission of New York, of which Mr. George S. Rice is Chief Engineer, and Mr. Alfred Craven, Deputy Chief Engineer, and Mr. Svere Dahm, Chief Inspector of Designs. Mr. Frederick C. Noble is Division Engineer for this section, and Messrs. White & Goodrich are resident engineers in charge. The contractors for the work are The Rapid Transit Subway Construction Company, of which Mr. George H. Pegram is Chief Engineer and Mr. Percy Litchfield the Resident Engineer on the work. As previously stated, the work is being done by Cranford & McNamee, sub-contractors for this section, Messrs. W. V. Cranford, John McNamee and F. L. Cranford being the active partners. Mr. Fred Cranford is in active charge, and Mr. J. C. Meem is Chief Engineer. Mr. R. N. Cranford has charge of the underpinning of buildings. Mr. Howard Robinson is superintendent of the Fulton street, and Mr. W. I. Johnson of the Joralemon street section.

Specifications for Steel Rails.

The American Railway Engineering and Maintenance of Way Association, the American Society for Testing Materials and the American Society of Civil Engineers have each a standing committee on Standard Specifications for Steel Rails. The committee of the American Railway Engineering and Maintenance of Way Association submitted revised specifications at the last convention of the Association which were adopted as a recommended standard. In June, 1905, Committee A on Standard Specifications for Iron and Steel, of the American Society for Testing Materials, recommended that the specifications of the Maintenance of Way Association be adopted with some changes as the standard of the Society for Testing Materials. At the annual meeting of the American Society of Civil Engineers, Jan. 17, 1906, a special committee on rail sections presented specifications differing in some respects from those reported to the other two societies. As this subject is to come up at the 1906 convention of the Maintenance of Way Association for discussion looking to the adoption of one standard specification by all three bodies, the specifications and recommendations of each are reprinted here for convenient reference and comparison.

SPECIFICATIONS FOR STEEL RAILS.

Adopted by the American Railway Engineering and Maintenance of Way Association.

(1.) (a) The entire process of manufacture and testing shall be in accordance with the best current practice, and special care shall be taken to conform to the following instructions:

(b) Ingots shall be kept in a vertical position in the pit heating furnaces until ready to be rolled, or until the metal in the interior has time to solidify.

(c) No bled ingots shall be used.

(d) Sufficient material shall be discarded from the top of ingot to insure sound rails.

(2.) Rails of the various weights per yard specified below shall conform to the following limits in chemical composition:

	Per cent.—				
	50 to 59 lbs.	60 to 69 lbs.	70 to 79 lbs.	80 to 89 lbs.	90 to 100 lbs.
Carbon	0.35-0.45	0.38-0.48	0.40-0.50	0.43-0.53	0.45-0.55
Phosphorus not to exceed	0.10	0.10	0.10	0.10	0.10
Silicon shall not exceed.	0.20	0.20	0.20	0.20	0.20
Manganese	0.70-1.00	0.70-1.00	0.75-1.05	0.80-1.10	0.80-1.10

(3.) One drop test shall be made on a piece of rail not less than 4 ft. and not more than 6 ft. long, selected from each blow of steel. The test piece shall be taken from the top of the ingot. The rail shall be placed head upwards on the supports, and the various sections shall be subjected to the following impact tests under a free falling weight:

	Weight of rail, lbs. per yard				Height of drop
	45 to and including	55			15 ft.
More than	55	"	"	65	16 "
More than	65	"	"	75	18 "
More than	75	"	"	85	20 "
More than	85	"	"	100	22 "

If any rail break when subject to the drop test, two additional tests will be made of other rails from the same blow of steel, and if either of these latter tests fail, all the rails of the blow which they represent will be rejected, but if both of these additional test pieces meet the requirements, all the rails of the blow which they represent will be accepted.

(4.) The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws of 6 in. for 85 lb. and 6¼ in. for 100 lb. rails, and no artificial means of cooling the rails shall be used between the finishing pass and the hot saws. The above shrinkage allowance may be varied, if necessary, so as to give a finishing temperature of not exceeding 1,600 deg. Fahrenheit at finishing rolls for mills rolling from reheated blooms, and not exceeding 1,750 deg. Fahrenheit at finishing rolls for mills rolling direct from the bloom to finish rail.

(5.) The drop testing machine shall have a tup of 2,000 lbs. weight, the striking face of which shall have a radius of not more than 5 in., and the test rail shall be placed head upwards on solid supports 3 ft. apart. The anvil block shall weigh at least 20,000 lbs., and the supports shall be part of, or firmly secured to, the anvil. The report of the drop test shall state the atmospheric temperature at the time the test was made.

(6.) The manufacturer shall furnish the inspector, daily, with carbon determinations for each blow, and a complete chemical analysis every 24 hours, representing the average of the other elements contained in the steel, for each day and night turn. These analyses shall be made on drillings taken from small test ingot.

(7.) Unless otherwise specified, the section of rail shall be the American Standard, recommended by the American Society of Civil Engineers, and shall conform, as accurately as possible, to the templet furnished by the railroad company, consistent with paragraph No. 8, relative to specified weight. A variation in height of one-sixty-fourth of an inch less, or one thirty-second of an inch greater than the specified height, and one-sixteenth inch in width will be permitted. The section of rail shall conform perfectly to the finishing dimension.

(8.) The weight of the rails will be maintained as nearly as possible, after complying with paragraph No. 7, to that specified in contract. A variation of one-half of 1 per cent. for an entire order will be allowed. Rails shall be accepted and paid for according to actual weights.

(9.) The standard length of rails shall be 33 ft. Ten per cent. of the entire order will be accepted in shorter lengths, varying by even feet to 27 ft., and all No. 1 rails less than 33 ft. shall be painted green on the end. A variation of one-fourth of an inch in length from that specified will be allowed.

(10.) Circular holes for splice bars shall be drilled in accordance with the specifications of the purchaser. The holes shall accurately conform to the drawing and dimensions furnished in every respect, and must be free from burrs.

(11.) Rails shall be straight when finished, the straightening being done while cold, smooth on head, sawed square at ends, variation to be not over one-thirty-second of an inch, and prior to shipment shall have the burr occasioned by the saw cutting removed and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds.

(12.) The name of the maker, the weight of rail and the month and year of manufacture shall be rolled in raised letters on the side of the web, and the number of blow shall be plainly stamped on each rail where it will not subsequently be covered by the splice bars.

(13.) The inspector representing the purchaser shall have free entry to the works of the manufacturer at all times when the contract is being filled, and shall have all reasonable facilities afforded him by the manufacturer to satisfy him that the finished material is furnished in accordance with the terms of these specifications. All tests and inspection shall be made at the place of manufacture prior to shipment.

(14.) No. 2 rails will be accepted up to 5 per cent. of the whole order. Rails that possess any injurious defects, or which for any other cause are not suitable for first quality, or No. 1 rails, shall be considered as No. 2 rails; provided, however, that rails which contain any physical defects which impair their strength shall be rejected. The ends of all No. 2 rails shall be painted white in order to distinguish them. Rails rejected under the drop test will not be accepted as No. 2 rails.

Action of American Society for Testing Materials.

Committee A recommended the adoption of the above specifications with the following modifications:

Clause 3.—Change from "*each* blow" to "from *every fifth* blow." Change heights of drop for 65-75, 75-85 and 85-100 lb. rails from "18, 20 *and 22 ft.*" to "17, 18 *and 19 ft.*," respectively. Insert the words "taken from the top of the ingot," after the words "If any rail break when subject to the drop test, two additional tests."

Clause 4. Action on this clause to be referred to a sub-com-

mittee to investigate the conditions at the various rail mills affecting the amount of shrinkage.

Clauses 7 and 8.—To be recommended for adoption after they have been harmonized by the American Railway Engineering and Maintenance of Way Association.

Clause 9.—Change "33 ft." to "*30 ft.*" and "27 ft." to "*24 ft.*"

Clause 14.—Change "5 per cent." to "*10 per cent.*" Strike out "rails rejected under the drop test will not be accepted as No. 2 rails."

The society adopted the specifications and recommended changes as a whole with the exception of the proposed change in Clause 3 "from *each* blow" to "from *every fifth* blow," and the recommendations as to Clauses 4, 7 and 8, all of which were referred back to Committee A for further consideration.

American Society of Civil Engineers.

The specifications submitted as a majority report by the special committee on rail sections are as follows:

Process of Manufacture.—The entire process of manufacture and testing shall be in accordance with the best state of the art, and the following instructions shall be faithfully executed:

Ingots shall be kept in a vertical position in the pit heating furnaces until ready to be rolled, or until the metal in the interior has had time to solidify.

No bled ingots shall be used.

There shall be sheared from the end of the blooms formed from the top of the ingots, assuming that such blooms are about 8 by 8 in. square, at least 40 in., and if, from any cause, the steel does not then appear to be solid, the shearing shall continue until it does. If, by the use of any improvements in the process of making ingots, the defect known as piping shall be prevented, the above shearing requirements may be modified.

The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass, the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws, for a 33-ft. rail of 100-lb. section, of $6^{7}/_{16}$ in., and $^{1}/_{16}$ in. less for each 5-lb. decrease of section. These allowances to be decreased at the rate of $^{1}/_{90}$ in. for each second of time elapsed between the rail leaving the finishing rolls and being sawn. No artificial means of cooling the steel shall be used after the rails leave the rolls, nor shall they be held before sawing for the purpose of reducing their temperature.

Chemical Composition.—Rails of the various weights per yard specified below shall conform to the following limits in chemical composition:

	Percentage		
	70 to 79 lbs.	80 to 89 lbs.	90 to 100 lbs.
Carbon	0.50-0.60	0.53 0.63	0.55-0.65
Phosphorus shall not exceed	0.085	0.085	0.085
Silicon shall not exceed	0.20	0.20	0.20
Sulphur shall not exceed	0.075	0.075	0.075
Manganese	0.75-1.00	0.80-1.05	0.80-1.05

Drop Test.—One drop test shall be made on a piece of rail, not less than 4 ft. and not more than 6 ft. long, selected from each blow of steel. The test piece shall be taken from the top of the ingot. The rails shall be placed head upward on the supports, and the various sections shall be subjected to the following impact tests under a free falling weight:

70 to 79 lb. rails.....18 ft. 90 to 100-lb. rails.....22 ft.
80 to 89-lb. rails.....20 ft.

If any rail breaks, when subjected to the drop test, two additional tests may be made of other rails from the same blow of steel, also taken from the top of the ingots, and if either of these latter rails fail, all the rails of the blow which they represent will be rejected, but if both of these additional test pieces meet the requirements, all the rails of the blow which they represent will be accepted.

The drop-testing machine shall have a tup of 2,000 lbs. weight, the striking face of which shall have a radius of not more than 5 in., and the test rail shall be placed head upward on solid supports 3 ft. apart. The anvil block shall weigh at least 20,000 lbs., and the supports shall be part of, or firmly secured to, the anvil. The report of the drop test shall state the atmospheric temperature at the time the test was made.

Section.—Unless otherwise specified, the section of rail shall be the American Standard, recommended by the American Society of Civil Engineers, and shall conform, as accurately as possible, to the templet furnished by the railroad company, consistent with the paragraph relative to specified weight. A variation in height of $^{1}/_{64}$ in. less, or $^{1}/_{32}$ in. greater than the specified height, and $^{1}/_{16}$ in. in width will be permitted. The section of rail shall conform to the finishing dimensions.

Weight.—The weight of the rails will be maintained as nearly as possible, after complying with the preceding paragraph, to that specified in contract. A variation of one-half of 1 per cent. for an entire order will be allowed. Rails will be accepted and paid for according to actual weights.

Length.—The standard length of rails shall be 33 ft. Ten per cent. of the entire order will be accepted in shorter lengths, varying by even feet to 27 ft., and all No. 1 rails less than 33 ft. long shall be painted green on the ends. A variation of ¼ in. in length from that specified will be allowed.

Drilling.—Circular holes for splice-bars shall be drilled in accordance with the specifications of the purchaser. The holes shall conform accurately to the drawing and dimensions furnished, in every respect, and must be free from burrs.

Straightening.—Care must be taken in hot-straightening the rails, and it must result in their being left in such a condition that they shall not vary throughout their entire length more than 5 in. from a straight line in any direction, when delivered to the cold-straightening presses. Those which vary beyond that amount, or have short kinks, shall be classed as second-quality rails and be so stamped.

Rails shall be straight in line and surface when finished—the straightening being done while cold—smooth on head, sawed square at ends, variation to be not more than $^{1}/_{32}$ in., and, prior to shipment, shall have the burr occasioned by the saw cutting removed, and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds.

No. 2 rails shall be accepted up to 5 per cent. of the whole order. They shall not have flaws in their heads of more than ¼ in., or in the flange of more than ½ in. in depth, and, in the judgment of the inspector, these shall not be so numerous or of such a character as to render them unfit for recognized second-quality rail uses. The ends of No. 2 rails shall be painted white, and shall have two prick-punch marks on the side of the web near the heat number brand, and placed so as not to be covered by the splice-bars. Rails from heats which failed under the drop test shall not be accepted as No. 2 rails.

Branding.—The name of the maker, the weight of the rail, and the month and year of manufacture shall be rolled in raised letters on the side of the web; and the number of the blow shall be plainly stamped on each rail where it will not subsequently be covered by the splice-bars.

Inspection.—The inspector representing the purchaser shall have free entry to the works of the manufacturer at all times when the contract is being filled, and shall have all reasonable facilities afforded him by the manufacturer to satisfy him that the finished material is furnished in accordance with the terms of these specifications. All tests and inspection shall be made at the place of manufacture prior to shipment.

The manufacturer shall furnish the inspector, daily, with carbon determinations for each blow, and a complete chemical analysis every 24 hours, representing the average of the other elements contained in the steel, for each day and night turn. These analyses shall be made on drillings taken from small test ingots.

For Basic Open-Hearth Rails.—The specifications for rails made by the Basic Open-Hearth process shall be the same as for Bessemer rails, excepting that their chemical composition shall be:

	Percentage		
	70 to 79 lbs.	80 to 89 lbs.	90 to 100 lbs.
Carbon	0.53-0.63	0.58-0.68	0.65 0.75
Phosphorus shall not exceed	0.05	0.05	0.05
Silicon shall not exceed	0.20	0.20	0.20
Sulphur shall not exceed	0.06	0.06	0.06
Manganese	0.75-1.00	0.80-1.05	0.80-1.05

This report was received and the committee continued.

Italian Traffic Troubles.

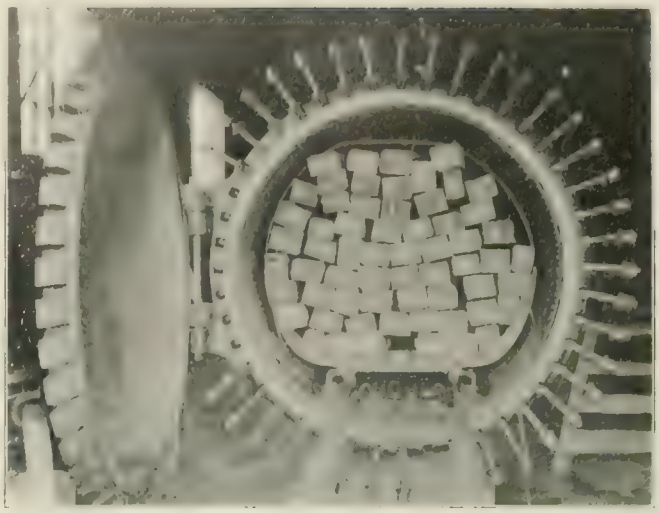
The Italian Minister of Public Works, Tedesco, in company with the General Manager of the State Railroads, visited various cities on the lines to put themselves into touch with the shippers and receivers of freight. At Milan, the Chicago of Italy, they met a gathering which included leading representatives of commerce and industry, who made their ears burn. They had stood all they could, they said. It had got to the point that goods were carted 60 miles or more because the railroad service was so bad. Since that time the Minister, Tedesco has gone out of office with the cabinet to which he belonged, and has been succeeded by a Signor Carmine, the third railroad minister since the state began working the railroads last July. Bianchi, the General Manager, made a good impression at the Milan gathering. It was intended that this office should be independent of parties and politics.

August von Borries.

Herr August von Borries, well known to American readers by his contributions to the design of railroad equipment, died at Marau in the Austrian Tyrol, Feb. 14, 1906, at the age of 54, as was briefly noted in the *Railroad Gazette*, March 2. His whole life had been devoted to the service of the German railroads. Beginning as an inspector he was later for a number of years in charge of the extensive shops of the Prussian State Railway near Hanover. Later he became a

Director of the Prussian State Railways (Regierungsrat) and continued as such until the time of his death. When, a few years ago, the Technical High School at Charlottenburg proposed to inaugurate an elaborate course of instruction in locomotive design, Herr von Borries was called to Berlin and appointed Professor in charge.

He has twice visited this country; first, as a member of an inspection party representing the German state railroads, and later, in 1893, as a member of the Jury of Awards in the transportation department of the Columbian Exposition at Chicago. He is perhaps best known in this country for his work in the development of the compound locomotive and for his extensive experiments designed to disclose the best proportions for locomotive stacks. The compound balanced German locomotive which was exhibited at the Louisiana Purchase Exposition by the Hanover Locomotive Works was largely of his design. Herr von Borries was an effective as well as an inveterate worker. While much concerned with matters of large moment, he never lost his interest for details. His contributions to the technical literature of his country have been numerous and valuable.



Charged Retort, Showing Door and Fastenings.

The Shirley Plant of the Columbia Creosoting Company.

The timber preserving plant of the Columbia Creosoting Company is located at Shirley, Ind., about 33 miles east of Indianapolis, at the junction of the P. & E. and Michigan divisions of the Big Four Railroad. Although comparatively small, being a two-retort plant with a yearly capacity of 2,000,000 ties, it is notable for a number of reasons and embodies advanced ideas in timber preserving practice in this country. Perhaps the most important of these is the absence of steaming the timber before injecting the preservative. Only air-seasoned timber is treated and the policy of the management is opposed to the exposure of the timber undergoing treatment to heat of any sort, whether dry or steam. Yet by the methods employed complete penetration of the timber with the use of a minimum volume of the preservative is obtained. The creosote used is the highest grade obtainable in America, the specifications requiring a boiling point of 220 deg. C., which insures the elimination before use of all light and volatile fractions.



General View of Columbia Creosoting Co.'s Plant Looking Toward Retort House.

The plant, which was completed about a year ago, is situated on a 17-acre tract north of the town, adjacent to the Michigan division of the Big Four. A good idea of its appearance and general arrangement is conveyed by the accompanying illustrations. It should be explained at the outset that the plant is designed to keep the air from the creosote as completely as possible to minimize evaporation. Also it is of interest to know that because of the construction of the plant and the methods employed, an insurance rate of ½ of 1 per cent. is allowed, from a base rate of 4½ per cent. Prevention of waste of the creosote was another of the objects sought and attained.

The retort building is 153 ft. by 33 ft. Its lower portion, including foundations, is in effect a large concrete pit 30 in. deep this feature being intended to guard against loss of the creosote in case of the breaking of a valve, for instance, allowing the oil to escape. This concrete pit has a capacity of 40,000 gals. The building superstructure is corrugated galvanized iron on a steel framework. The retorts are 7 ft. in diameter and 130 ft. long, back to back of rims. They are made of ¾-in. steel, with double-riveted circumferential seams and triple-riveted, double-butt longitudinal seams. The cylinders rest in cast-iron saddles bearing on cast-iron sole plates bolted to concrete foundations. Each cylinder is anchored at the middle, permitting expansion toward both ends. The retorts have doors at each end, though at present all of the charging is done from one end. The method of fastening the doors and absence of all leakage at same due to the gasket used is one of the special devices of the plant. As will be seen by one of the illustrations, the door is held by 46 bolts which are hinged to the retort rim (except at the door hinge) and swung forward into corresponding notches in the circumference of the door. The edge of the latter around which the washer moves is rounded, permitting a minimum movement of the nut for tightening and removal. When the nut has been set up by hand, one-quarter of a turn further with the wrench is all that is needed to prevent leakage under the maximum pressure to which the retort is subjected, namely, 180 lbs.

A specially devised friction wrench enables quick tightening and removal of the nuts. With an ordinary wrench it formerly took six men three hours to change a charge in a retore. Three men now do it in 25 minutes, it being possible with this friction wrench to loosen the door in eight minutes and tighten it up in 11 minutes, without special effort at speed by the men.

The cresote is received in tank cars, three of which may be seen in the general view of the yard looking toward the cylinder house. It is pumped from these cars into two 160,000-gal. storage



Electric Locomotive Withdrawing Charge from a Retort.



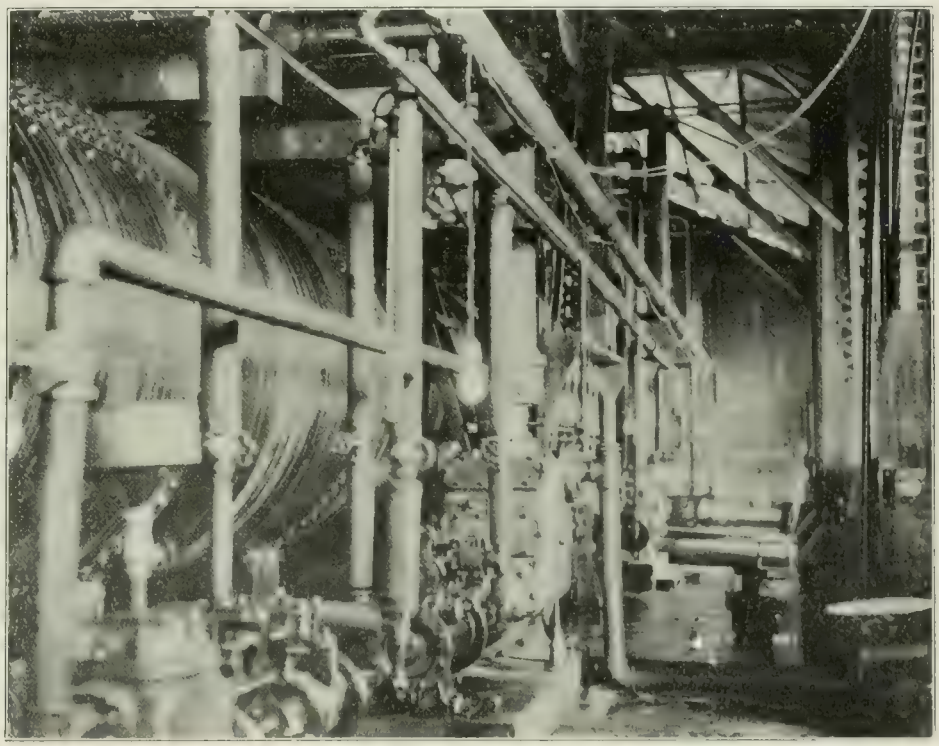
Loading Treated Ties Into Box Car.

tanks, one of which may be seen on the right in the picture. The second has been added since the view was made. The top of the brick pump house is just visible over the tops of the box cars, beyond the tank cars. From the storage tanks the oil is pumped to two 30,000-gal. overhead tanks projecting through the roof of the cylinder house, from which it passes to the retorts and from the latter by gravity to a 38-000-gal. underground tank outside of the cylinder house. From this latter tank it is again raised to the overhead tanks. A service pump in the cylinder house is so connected that it can take the creosote from any point—that is, from the cars, the storage tanks or the underground tank—and deliver it to the overhead tanks.

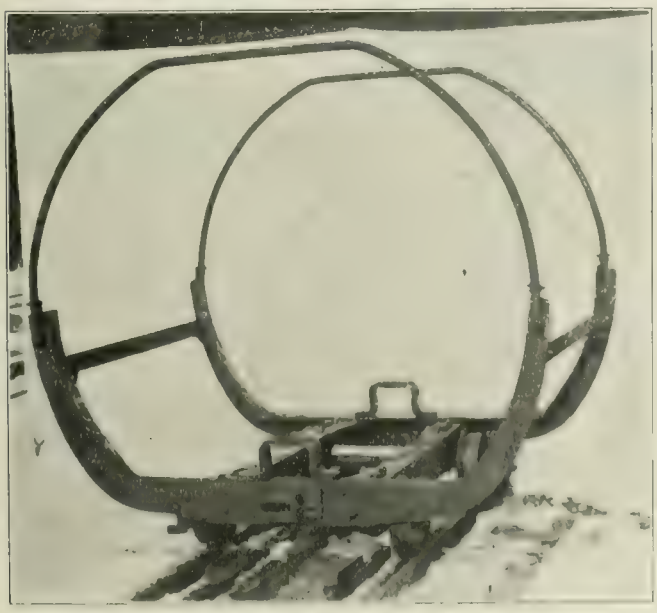
The pressure pump in the cylinder house is so connected as to be able to pump from either overhead tank to either retort. All pressure lines are made of double strength pipe, with extra heavy fittings. At every point where a valve is required, two instead of one have been put in as a safety feature, so that should one break the other will prevent any loss of oil. This doubling of the valves also prevents leakage. The cylinder is first filled with creosote by gravity from the overhead tanks. The pressure pump is then started and additional oil pumped in to give the requisite saturation, the pressure maintained, as already mentioned, being 180 lbs. The oil is then allowed to flow from the cylinder to the underground tank, after which the free oil in the timber is withdrawn by the creation of an almost instantaneous vacuum by a process which is one of the special features of the plant and by means of which the amount of oil left in a tie can be varied from 1½ gals. up. By this process a 20-in. vacuum can be obtained in 15 minutes and a 25-in. vacuum in 35 to 45 minutes, maintaining a temperature of 160 deg. F. in the retort meanwhile.

Each retort has a set of Bristol recording gages, including a pyrometer and a pressure and a vacuum gage. The temperature in the retort never exceeds 175 deg. F., which is the maximum temperature at which the oil is maintained to prevent crystallization. Much trouble has been experienced with these gages from the presence of the heavy creosote within their mechanism. The effect is to render them inaccurate, requiring them to be taken down every 30 days to be boiled out. They have to be renewed about once a year. A scheme has just been perfected at the plant for absolutely protecting these gages from the action of the oil, thereby saving the item of expense of annual renewal as well as the considerable annoyance of monthly cleaning and the constant possibility of inaccurate records.

To check the pyrometer readings a thermometer is inserted through the cylinder shell to take the internal temperature. The clearance between loaded train cars and shell is so small that if this thermometer occupied a fixed position at the distance the bulb needs to be thrust within the shell it would be broken off by the moving cars. Therefore a simple mechanical device for moving the thermometer and cage in and out has been applied to the shell of the retort.



Inside of Retort House. Partial View of Pumps and Piping.



Tram Car.

Another special device is an indicator by which the cylinder operator is kept informed with exactness of the movement of the oil to or from the overhead tank. This indicator resembles a large clock face with 20 large divisions corresponding to the height in feet of the 30,000-gal. overhead tank, and each large division is subdivided into 10 parts. Each of these small divisions is equivalent to 7.52 gals. For each complete revolution of the large hand of the indicator the small hand advances one large division (or foot), exactly as with a clock. The hands are actuated by a float in the tank, which connects by a copper wire over pulleys running in frictionless bearings, to an accurately turned drum back of the indicator face, also running in frictionless bearings.

One of the minor features indicating the care with which waste has been guarded against is the connection by pipe of the retort safety valves to the overhead tanks. Also, in order that such oil as drips on the concrete floor of the cylinder house will not be lost, this floor is given a side drop of six inches and along the lower side a small gutter leads to a sump. The oil is washed from the floor to the gutter with hot water and is carried to the sump. Being heavier than the water it gravitates to the bottom, from which it is raised by a pump. Apparently the only oil that is lost is the slight amount that drips from the ties and cars in the yard.

The car, a photographic view of which is shown, is notable for several features, chief of which are simplicity of design in combination with ample strength, the absence of chains and

provision of means for limiting the amount of timber that can be placed on the car and holding same when submerged, and simplified construction of retort track and guard rail fastenings, yielding greater head room. The wheels have roller bearings. Instead of chains, fixed bails are provided, which are 1⅜ in. in diameter and are therefore too stiff to spring. This prevents the workmen from forcing in a last extra tie, a practice that would be possible with lighter bails by springing them out of shape. As the cars are designed for only ¾ in. clearance in the cylinder, the need of rigidly limiting the load is apparent. Instead of a T-rail track in the cylinder, the track rails are angle iron, placed close to the bottom and giving the increased vertical room mentioned. As a result of this feature and the small clearance, a 30 per cent. greater load is possible for the car. To prevent side motion of the car in the cylinder and to hold it to the track during submergence, lugs on the under side of the angle end-sills run in angle-iron guides in the retort. The capacity of each car is from 52 to 56 ties and each retort will accommodate 15 cars.

The cars are moved into and out of the retorts and around the yard by an electric locomotive. The Morgan third-rail traction system is used, with a mining type locomotive which has gears which engage a rack-rail laid between the track rails. This rack-rail is also the conductor rail. This locomotive, which appears in one of the views, has a drawbar pull of 8,250 lbs. Current for its propulsion and also for lighting the plant and yard is furnished by a unit made up of a Fleming 75 h.p. engine and a Bullock 45 k.w., 250 volt, direct-current generator. It is housed in a brick lean-to alongside the cylinder house.

One view shows the method of transferring the ties from the tram cars to railroad cars. The fixed bail of the tram car having been removed, a rod is slipped through the holes by which it is secured to the arms and over this rod a skid is hooked, down which the ties are slid to the car. The loading and unloading of ties is done by piecework.

In addition to the parts already described, the plant includes a boiler plant using natural gas for fuel, a small blacksmith and machine shop, and a quite complete chemical laboratory where important investigations of interest and value in regard to preservation of timber by creosoting have been, and are being, conducted.

The primary reason for establishing the plant at Shirley was because of its favorable location for the discharge of a ten-year contract with the Big Four for creosoting a minimum of 600,000 ties a year. The Big Four specifications require that each tie shall contain 2½ gals., or 8 lbs. of oil per cubic foot. Complete saturation of the tie is assured with this amount. For red oak and beech, results at this plant show that about 4½ gals. are required originally for saturation and approximately the same for hard maple. Soft maple requires about a gallon more. This, it will be understood, is prior to the removal of the free oil by vacuum. Twenty-eight different timbers have been treated at the plant and the results recorded. In seasoning the timbers for treatment the best results are obtained from soft woods in from four to six months, red and black oaks in six to eight months, sugar tree and hickory in eight to ten months, and beech about a year.

As indicative of the economy of the plant and effectiveness and accuracy of the methods used, a report on work for the Big Four made January 20, is of interest, being as follows:

Oil received to Jan. 20, 1906		1,497,187 gals.
Used in treating lumber	9,831 gals.	
On hand Jan. 20, 1906	280,481 "	
	290,312 gals.	
Total oil used for ties		1,206,875 gals.
484,484 ties treated at 2½ gals.		1,211,210 "

On the justifiable assumption that the percentage of waste is negligible, the record shows the average impregnation per tie to have been within 0.36 of 1 per cent. of the specification.

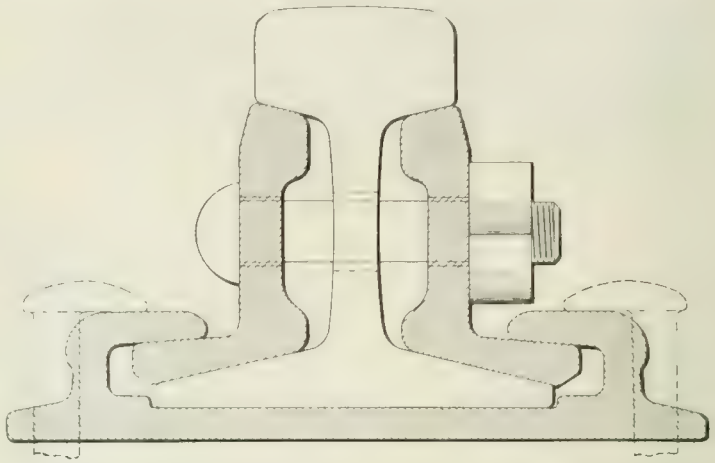
As might naturally be expected from the foregoing statements regarding this plant, and paramount in practical importance in the matter of results, the cost of creosoting ties has been greatly reduced by these methods. In Mr. Von Schrenk's report to the International Railway Congress last May the net cost to the Government for creosoting ties was given at 45 cents. The contract price with the Big Four at the Shirley plant is 30 cents a tie.

The officers of the Columbia Creosoting Company are A. T. Hert, President; L. T. Dickason, Vice-President; M. L. Gould, Secretary and Treasurer; C. B. Lowry, General Manager. The ideas embodied in the plant, as well as the special devices that have been referred to, are Mr. Lowry's and to him we are indebted for the information for this article.

The Prussian State Railroad management has assigned a government engineer, Gutbrod, heretofore the member of its Halle directory, expert in mechanical engineering, as an attaché of the German Consulate in New York. This is the only government, so far as we know, which maintains technical experts in foreign countries to keep abreast of changes in engineering practice; just as army and navy officers are attached to foreign embassies—a practice that might be imitated to advantage.

The Kohn "Solid Base" Rail Joint.

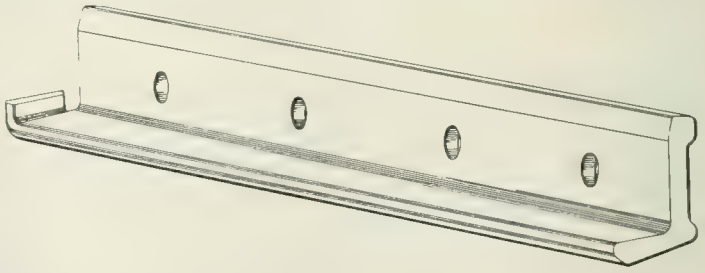
The accompanying drawings show a design of bridge rail joint for which a number of claims of superiority over other joints of similar character are claimed. It is simple, strong and not expensive to make. There are only three pieces, a base plate and two angle bars. In the process of manufacture no upsetting or bending of the joint base is required, the process being one of rolling entirely. The base plate, it will be seen, is formed with overhanging legs on each side, their under surface being at a 4-deg. angle with the horizontal. The rail seat is grooved to give a small shoulder half the thickness of the outer edges of the rail base to assist in resisting lateral thrust. The angle bars have a 13-deg. angle on the under surface of the bottom leg and a 4-deg. angle on the top surface. The bottom leg is extended beyond the vertical



Cross-Section Through Center of Kohn "Solid Base" Rail Joint.

leg at one end and a lip is turned up to assist in preventing creeping of the joint. To apply the joint the base is introduced under the rail ends from either side and the angle bars, which are interchangeable rights or lefts, are slipped in until the bolt holes are in line. When the bolts are tightened up the wredge-shaped bottom legs of the angle bars are drawn up in the contracted openings between the top of the base of rail and the overhanging legs of the base plate.

It is claimed that with this construction a perfect three-point fishing contact is obtained since the bottom legs of the angle bars come in contact with the base of rail and the overhanging legs of the base plate before the top surfaces of the angle bars come in contact with the under side of the rail head. Any irregularity of manufacture is overcome by the base plate shifting laterally during the tightening of the nuts. Owing to the small angle of 4 deg. on the under side of the overhanging leg, a powerful wedging action is obtained without distorting or bending up the overhang. The wedging action is obtained by tightening the joint bolts and not



Angle Bar for Kohn "Solid Base" Rail Joint.

by driving the angle bars in the direction of the length of the rail. It is claimed that perfect surface and alinement is obtained with this joint owing to the equal pressure on the two sides and the bottom surfaces of the rails. The base plate gives a solid base for the rail ends and the lateral thrust of the joint is carried by all the joint spikes, being transmitted to the base plate by the rail seat shoulder and the overhanging legs. The large bearing surfaces and the friction between them, it is claimed, practically eliminate creeping of the parts of the joint, but as an additional precaution the ends of the angle bars are turned up to engage with the end of the overhanging legs of the base plate. The joints can be applied without disturbing existing track standards. They can be made with spike holes punched, as shown in the drawing, or with the holes in the spike extension on the sides of the base plate.

Some experimental joints of this type were put in the main outbound passenger track of the New York Central near High Bridge, N. Y., on April 3, 1902. As no facilities for rolling the joints were

to be had they were made of cast-steel. These joints, after four years' service are still in track and show no signs of wear or distortion. The bolts have been tightened but twice in that time.

The joint has been designed and patented by Koby Kohn, 45 West 119th street, New York City.

Minor Shop Savings.*

The tendency of machine design is towards strength and massiveness and it is noticed that whenever a discussion centers about machine shop output, the common thought runs on the capacity of the individual machine to remove metal. The demand for heavy metal working machinery went from our shops to the tool makers, who have and are responding in no uncertain way. We are buying machines that in bulk, weight and working capacity are marvels. Machines of increased size to accommodate the cumbersome details of present day design are of course necessary; yet in the average run of railroad machine shop work the size of the average machine of ten years ago is large enough to-day. On that we will agree, but general exception will be taken to the capacity of machines but ten years old.

The machine of to-day aside from its inherent strength, is equipped with speed and feed adjustment attachments which are immensely valuable. These are no uncertain improvements tending to increased ease, accuracy and speed of output. I do not question the need of strength in the machine itself, but I do question the value of the results we get from a blind use of these machines. To be sure, if there is an excessive amount of stock to be removed from any piece to be finished the rational method is to crowd on power and get it off, but my contention is this: in the average run of railroad machine shop work the excessive stock for finishing should not be there. Excessive stock means unnecessary initial expense for castings or forgings. Excessive stock on castings indicates poor pattern design or the use of one pattern to fill several sizes needed at a consequent saving in pattern shop labor but a heavy increase in resultant net cost of output. It may indicate a lack of business perception in the machine shop superintendent; or it may indicate a pattern shop personel out of touch with present day demands or a force inadequate to properly take care of the work. Of all of the characteristics developed in the machinist working under premium or piece work methods, none should be more satisfactory to his foreman or master mechanic than his plea to get rid of a burdensome lot of stock on a certain casting. The machinist working in the usual day rate manner will pay very little attention to stock. If he has one of the large high powered machines he will take the feed and cut the foreman will set, with seldom ever a word as to the reasonableness of removing all the apparently unnecessary stock; but if that same workman adds to his pay check in direct proportion to his output and his machine power is limited, he will begin to scheme to save, for himself of course, but every time he gains an advantage for No. 1 he likewise gains for his company. When the workman in this manner builds his own pay check he puts himself in the position of one who must pay his own way. He must pay for the mistakes of others if the castings don't come in the very best shape. I have noticed that when we have to pay our own bills we watch the bills and we are a great deal more careful of amounts than when we simply O. K., and verify the extensions of bills of others. It is a patent fact that patterns for railroad shop use are not skinned to the limit demanded by manufacturing concerns whose chiefs are generally principal shareholders in all profits.

This sentiment may sound well but what is it when expressed in dollars and cents? Let us suppose your road purchases 50 locomotives, carrying 20-in. cylinders. The pattern shop in making ready to meet repairs with castings builds a piston head pattern, say, of the solid type. The foreman pattern maker knows the cylinders on these engines will wear larger and larger, hence prepares, in a way, for this by constructing a pattern which will finish for a 20⅜-in. cylinder. What has he done? For all engines so damaged as to require new cylinders, for all cylinders bushed during the life run of the engines, perhaps for 20 years, the machine shop will continue to finish the piston head to 20 in. Suppose the thickness of the piston is 5 in. Each time this stock is removed there are 25 lbs. of metal turned off which at a net loss of 1c. per pound, means a loss in metal of 25 cents. We all know it will cost more for labor to finish the piston head carrying this extra stock than were it reduced to a decent minimum. No matter on what machine this finishing of the piston head is done, the theory is the same. The needs of this particular lot of engines require at least two sizes of the patterns. These patterns are easily made and last well, the same core boxes will answer for as many sizes as are actually demanded. Simply because you have a machine capable of removing the stock in one cut, if necessary, gives no excuse for the 25c. loss in metal. As a pure machine operation it pleases the tool builder but costs you at least 35 cents each time it happens. A pattern maker in one day's time will enable you to reduce your loss 75 per cent. Perhaps also you believe the faces or ends of the piston should be smooth; ⅛ in. is a great plenty if this finishing is to be done in a lathe, that is ⅛ in. per face on the 20 in. piston. This total finishing of ¼ in. fine turnings represents an almost total loss of 20 lbs. of metal equal to 30 cents at least.

It is to be noted in working in cast-iron there is a usual loss of 15 per cent. of the turnings or borings. The iron dust is lost in every movement from tool to scrap bin. If the solid piston is of uniform thickness the sides can be quickly and easily finished on a wet grinder. When preparing the piston pattern for end finishing on the grinder absolutely no attention need be paid to stock, finish the pattern to size. The grinder will remove the sand, leave most of the hard scale and save you 30 cents worth of stock. It is thus possible to build patterns to suit the best laid plans of the machine shop. The pattern shop foreman should be as closely connected to the machine shop foreman as is usually the relationship of the machine to the erecting shop foreman. The proper construction of patterns when made is so important that there should be some intelligent member of the mechanical force daily in touch with the pattern shop, advising the pattern maker on all particulars of special importance to the finishing and erecting shops. Build your patterns as nearly right as you can in the first place.

In common with the gain obtained in cutting to a minimum the amount of finishing stock is that obtained in coring all possible holes. Actual practice determines that a hole can be properly reamed for one-half what it costs to drill; therefore if a hole must needs be exact in location and size first core it as large as practice will permit, then finish with a reamer. This will apply on castings which can be drilled from a jig. As said above, the labor cost is one-half and the metal of the hole is saved. Carrying out these ideas will enable any shop to turn out front cylinder heads finished for 35 cents. On quite a few castings which are to be finished we commonly add a flange or series of lugs to fasten it to a face plate. The metal in these lugs or flange is paid for at a new metal price and goes back to the foundry at a scrap price, a material loss of course. Instead of doing this over and over perhaps a thousand times a year, get your shop inventor to contrive some sort of a permanent chuck which will hold the casting in some other way and will save this waste. A chuck costing $5 will perhaps save $100 a year.

Particular attention should be given to steel castings as they are hard to finish. Brass is easily worked and enormous cuts and feeds may be taken on our heavy machines. I stood by a lathe hand recently in one of the largest and best shops of the country and saw the look of satisfaction on his face and that of his shop demonstrator as the machine tore the metal off a driving box brass. I inquired if such cuts were common and was told that they were. I found most of their patterns carried ⅜ in. to ½ in. finishing metal in the crown fit. No doubt this metal was removed as quickly as would only ¼ in. But did not that extra ¼ in. represent labor and material absolutely without a use in the production of a finished brass? There is not a great difference in price of new and scrap brass, but there is invariably a loss in weight, metal actually lost. A 10 in. x 12 in. driving box brass pattern with ¼ in. excess stock on the crown will weigh 14 lbs. more than it should and will represent a dead loss of at least 60 cents every time a new brass is put in a box. We have powerful machines for the work and the extra stock gives us so little trouble to remove that if perchance we should be told there was excess stock on the brass we would think or say there is not enough loss to count. But inspection does show a big loss, and a loss per day in some shops enough to pay the wages of a good machinist. Great stress is laid on the proper proportions of castings simply because castings are used in such quantities in our work. It isn't after all, the greatest feature of shop work to finish six or eight pairs of driving wheels per day, but it is a money making scheme to put the closest thought on the 200 or 300 other jobs which keep 25 other machines busy and which, because they are small, we pass by regularly as being unimportant. More money can be made for your company by following up the 100 small items than by putting the major thought on the ten larger items.

On finishing forgings the same general principle applies. Hammered or forged iron may cost 3 cents per pound, while the scrap turnings or borings will not net over ½ cent per pound. If the frame forge men will work carefully and keep the stock on a main frame within ¼ in. all over they will do their work as well as could be expected, but for every additional ¼ in. there will be a dead loss of $3 to $4. Thus it is not always a question of how cheaply you can plane frames but how best you can forge frames. Labor cost items are generally less than material cost items, therefore it behooves every man in authority in these matters to watch his rough material.

This idea is splendidly carried out in buying lumber for railroad shop use. The rough sizes are on the ragged edge of those

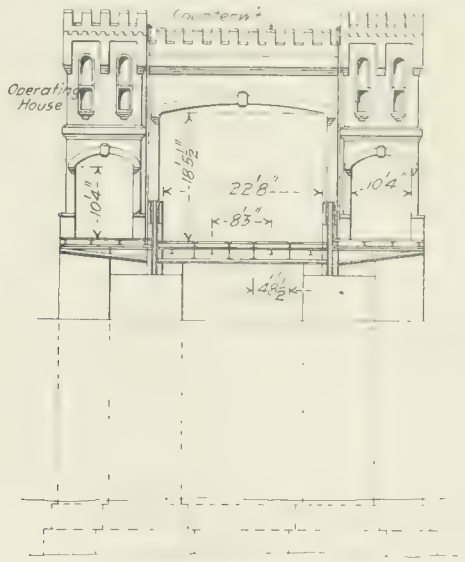
*A paper presented at the February meeting of the Western Railway Club by C. J. Crowley, Shop Demonstrator, C., B. & Q. Ry., West Burlington, Iowa.

which will yield dressed lumber of full size even when the lumber is green. Powerful machines are needed when they are needed, but their strength and utility is often used at a loss because some one has stopped thinking when he doesn't have to pay the bills.

Strauss Bascule Bridges.

Two designs of Strauss trunnion bascule bridges, prepared by Mr. J. B. Strauss, Chicago, are illustrated herewith. The Strauss bridge is the development of the fixed trunnion bridge. In it, not only does the bridge proper move on trunnions but the counterweight as well, substituting for the rigidly-attached counterweight mass moving with the leaf, a pivotally-connected counterweight mass moving independently of the leaf. This enables the counterweight to move horizontally as the bridge opens and therefore requires no pit; it also enables the counterweight to be so located and formed as to permit the use of concrete instead of pig iron, and permits the use of straight-line structural members throughout. Both designs shown herewith have overhead counterweights. There is another type having an underneath counterweight. The tail ends of the trusses of the moving leaf are carried under the floor of the fixed approach, where a structural steel box, usually hung centrally on pins in the tail ends, swings in the space embraced between these trusses, the approach floor and water line. This box holds the concrete counterweight (supplemented at times by pig iron) and generally is shallow, getting its volume from its width and length. By means of a pair of pin-connected links, it is kept from oscillating and is made to move parallel to itself through the entire range of motion.

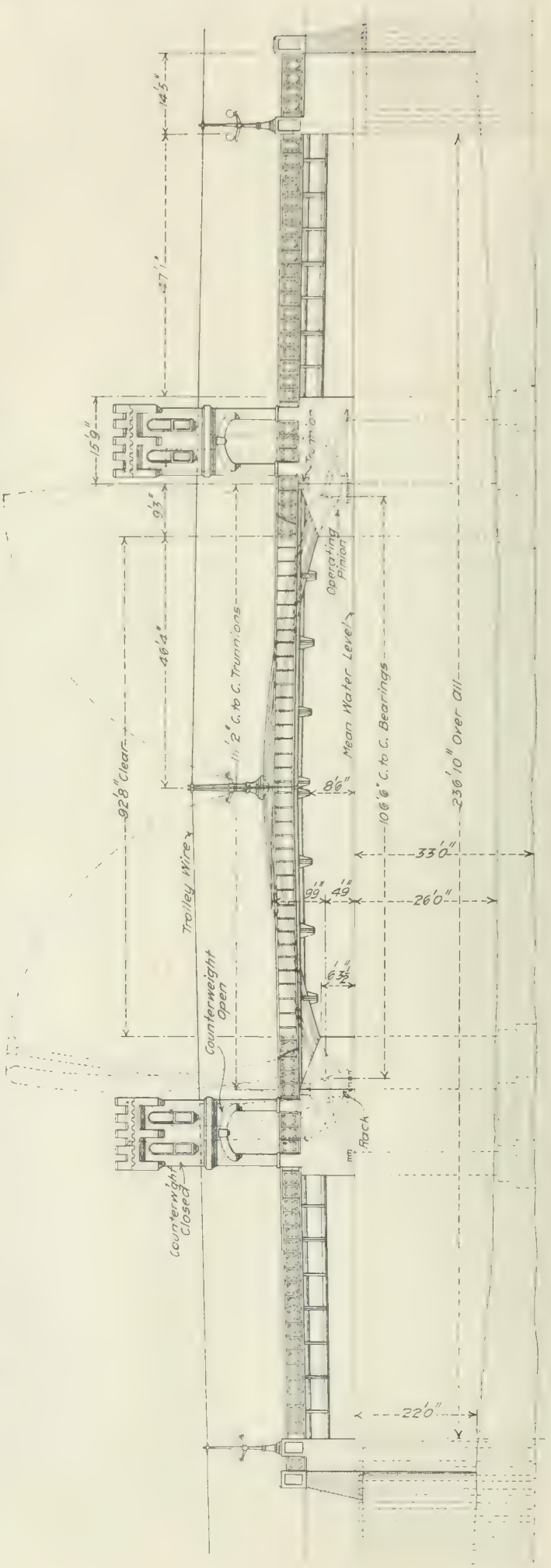
In the overhead counterweight type, the counterweight is carried in a box which is generally deeper and narrower, and eccentric with respect to the supporting tail-end pins, the connection to the pins being by means of a leg on either side. In the closed position this box is above the traffic clearance line, and in the open position it is just above the floor line. The parallel motion is obtained by means of a pair of braced links pin-connected to the box and to the tower forming the fixed support. Of these types, the latter is usually the more economical of the two. In highway bridges, the counterweight is generally placed centrally on the tail-end pins and designed as a portal, co-operating with the operating houses to form an ornamental gateway of pleasing effect.



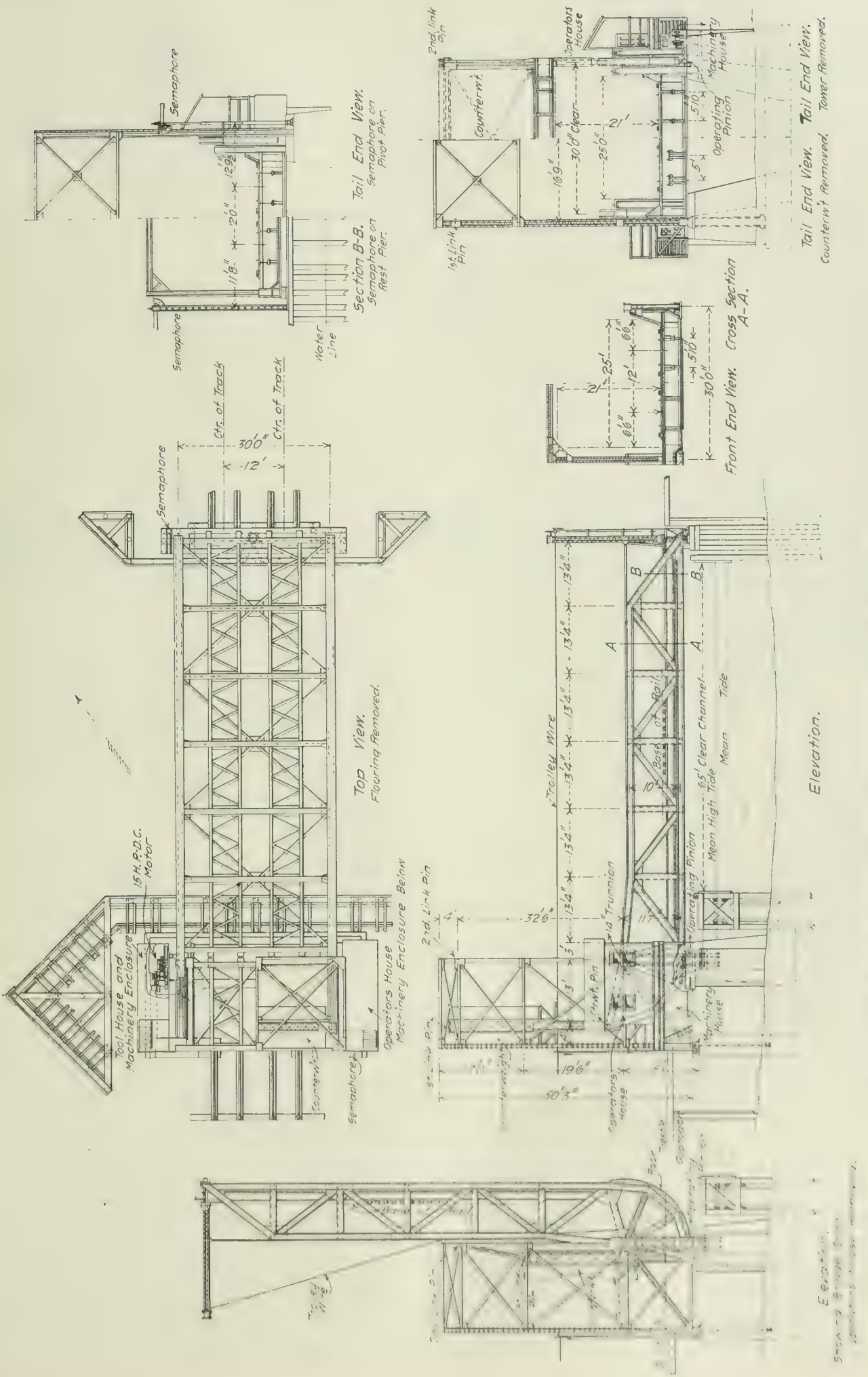
Cross Section, Copenhagen Bridge.

A feature for which special importance is claimed in the Strauss design is the concentration of all the load on one point on the foundation, the effect being the same as a fixed span. Another point is the matter of balance. By reason of the pin-connection for the counterweight, it is not only possible to locate the center of gravity of the leaf with exactness, but in the final adjustment counterweight may be added to or taken from any part of the box without changing the point of application. This secures a practically perfect balance and reduces the lost work to a minimum. The Wheeling & Lake Erie bridge at Cleveland, Ohio, built in 1904, stops at any point of its motion without the use of the brakes, it is said. There is no tendency either to open or close of its own accord, and no chance, therefore, of getting beyond control and coming down too hard on the foundations in closing, or against the bumper in opening.

The Rahway bridge of the illustrations is a double-track, single-leaf railroad bridge, designed for Cooper's E-35 loading. It carries the tracks of the New Jersey Short Line across the Rahway river.



General Plan of Strauss Trunnion Bascule Bridge for Knippel Bridge, Copenhagen, Denmark.



Details of the Strauss Trunnion Bascule Over the Rahway River for the New Jersey Short Line Railroad.

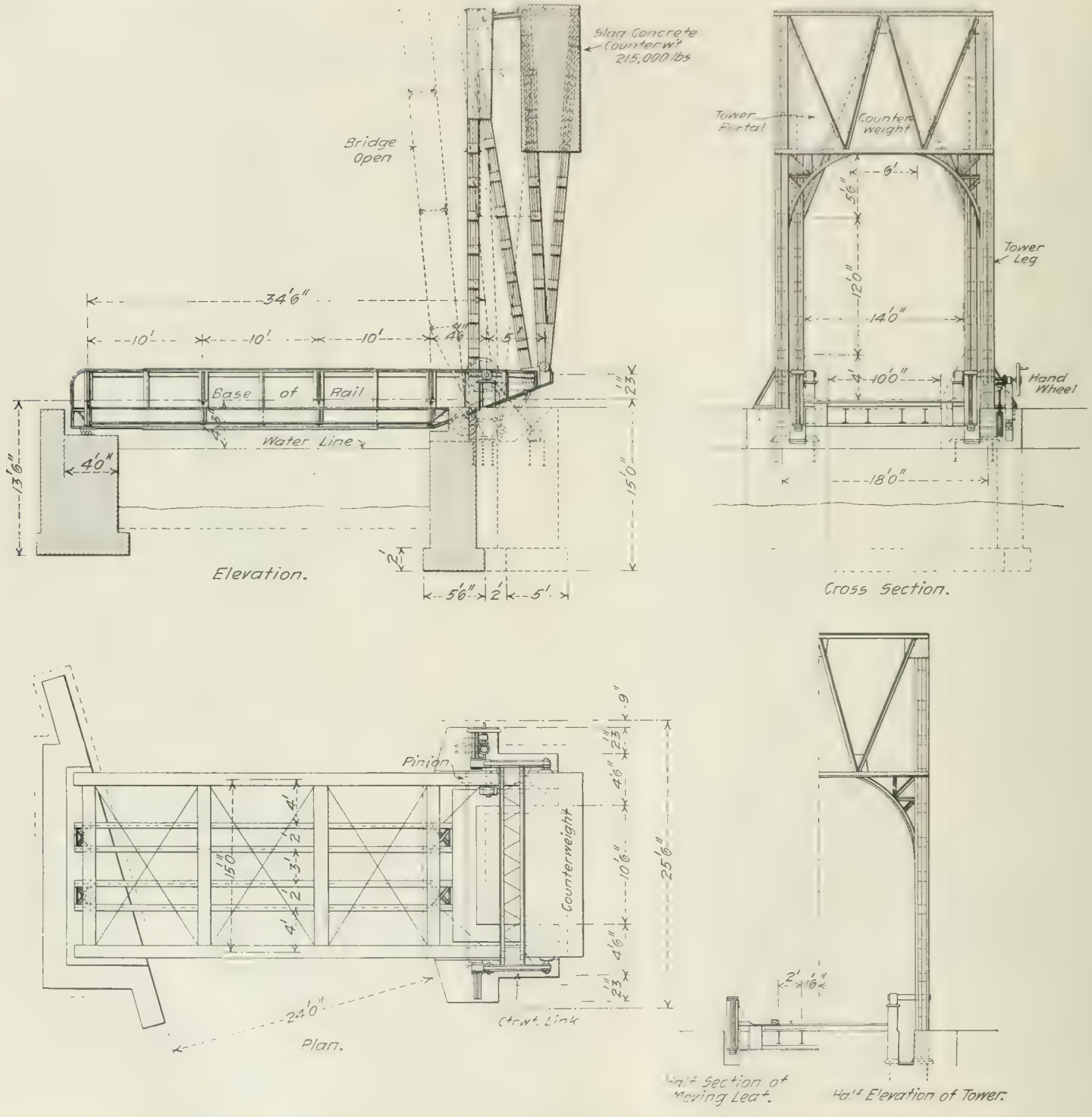
The clear span provided is 65 ft. and the length of the leaf is 83 ft. The trunnions are 14 in. in diameter, and the counterweight pins 8¾ in. The bridge is provided with air whistle, signals, semaphores, brakes, etc. All devices, including truss and rail locks, are controlled from the operator's house. Racks are used in place of operating struts, and all machinery is housed in machinery enclosures of ample size. Hand-power operation is also provided, the hand-power gearing being inside of the operator's house.

This bridge its designer considers a good example of medium span structure for either interurban or heavy railroad service. It is very stiff, and of substantial character throughout. Although the distance from the base or rail to water line is only 10½ ft., no pit is required. It is claimed that this design was as economical as a 150-ft. plate girder span, originally proposed for this crossing.

Of the other designs presented, one is of interest because of its extreme simplicity and low cost, its designer asserting that it is the most compact, direct and efficient movable bridge ever produced. It is particularly adapted for canal bridges which do not require frequent opening. It is operated by hand power and requires no maintenance, it is claimed.

A general plan of the Knippel bridge, plans for which are now under way for the city of Copenhagen, Denmark, is also shown. This bridge is of the overhead counterweight type, the counterweight being designed as a portal moving up and down as the leaf closes and opens. Two towers harmonize with the portal counterweight, the effect being that of an ornamental gateway at the entrance to the bascule. The operating houses are located in these towers. The bascule proper is designed to act as an arch under live load, the two channel piers being proportioned to take the arch thrust. The two approach spans are simple plate girder spans. These spans are paved with brick, while the bascule has a wooden floor. The operating power is electricity, direct current, and in place of an operating strut, as in the W. & L. E. bridge, there is a rack, so designed that all curvature comes in the rack castings, which are steel. The bridge is designed to be of a monumental character, and was selected in an international competition held by the city authorities of Copenhagen for this purpose. Its estimated cost is $230,000.

The Strauss Bascule & Concrete Bridge Company, Chicago, has recently acquired the patents of Mr. Strauss and will design and build the bridges bearing his name.



Strauss Hand Operated Bascule Bridge for Canals.

The Care of Air and Steam Heat Hose and Couplings.

It is the privilege and prerogative of the air-brake expert to look after and discuss the care of the air-brake generally, and the object of his work is to bring about greater efficiency in the working of a very important part of railroad equipment. His fundamental idea is to make money for the railroad company, recognizing the fact that money saved is money made. It is not my wish to encroach on the air-brake man's ground, but to draw attention to an opportunity of saving money that is to a great extent neglected by the larger railroad companies. I refer to the care of air and steam heat hose and couplings.

The first question to be considered is, are they worth the bother and expense of looking after them closely. Well, let us see how the figures look. Suppose we take a road of 2,000 miles with an average equipment, say, of 16,000 regular freight cars, 200 passenger cars, 200 other cars, vans, plows, 265 engines, and 265 engineers. This road would have in use the following air and steam hose and couplings:

32,400 air hose, complete, value	$57,024
1,195 steam heat hose and couplings	5,975
Making a cash value of	$62,999

Comparatively speaking, this is, of course, only a small sum, but I think you will agree with me that it is worth looking after.

Now one portion of this equipment is more perishable than the other, *i.e.*, the rubber hose, and when the hose is worn out, the whole thing must be removed and replaced by a new outfit. The cost of replacement could be $62,999, or it can be $33,834, and as this replacement must be made seven times per year, in the case of steam heat hose, and at least once every 18 months in the case of air hose it will make a considerable difference to a railroad company which figure it chooses.

In giving the above figures I use the maximum and minimum; in practice, each railroad hits a mean somewhere between these, depending on the attention it receives, but the choice is a wide one and there is room to lose or make considerable money.

If you will go over almost any large railroad to-day and make a thorough search, you will be surprised at the number of disordered air and steam hose couplings you will find that are going to waste by being allowed to rot. Don't give notice that you are coming, however, or you won't find them—there are ways of disposing of such things. I have in mind a case that happened at a divisional point on one of the big railroads of Canada. When word came along that there was to be an inspection in a few days, the boys started in to clean up and found many things, among them three barrels of air and steam hose couplings, with more or less worn out hose attached. When they were got together they looked like a good sized bunch of trouble for some one, and as the men in question were firm believers in the old saying that what you don't see won't hurt you, they packed them on the tender of an engine on a local train and dumped them into the first deep lake they came to. The money loss to the railroad in this case must have been some hundreds of dollars. How they disposed of these at other points on the road I am not in a position to say, but it is more than likely that the total quantity to be disposed of ahead of this particular inspection amounted to at least 50 barrels. I would be willing to take the money value of them for two years salary, anyway.

I merely use the above as an illustration of a thing that is going on more or less on all roads in America, and I don't want anyone to get the idea that this incident occurred on a road where things are run loosely; on the contrary the supply department of the road in question is above the average in efficiency, as can be easily proved. There is not much use in pointing out an evil if you are not prepared to suggest a remedy, and this I am prepared to do, and after due consideration I have concluded that a few facts from my own experience would help point the moral about as well as anything I could say.

Some years ago I was called on to take charge and organize the stores department on a certain railroad. I may say here that I was not altogether a green hand at railroad business, having had a somewhat extended experience in different lines of the work, and that I found all of my knowledge useful in my new position. I had not been very long keeping stores until there was brought forcibly to my notice the constant demand for the class of material I am attempting to deal with in this article, and these demands invariably necessitated the supplying of new material. As soon as I gave the matter special attention I made up my mind there was something wrong with our method of handling the business. As a first step toward reform I collected all of the second-hand air and steam heat couplings on the road, then took inventory of all the new stock made up and in the hands of men at terminals, divisional and junction points, and opened a debit and credit account with each man who handled this class of material. The next step was to put up a bench and vice in the general stores building, and start a man cleaning up and repairing old coupling heads and applying new hose, work which had been done in shops previously. You may judge of my surprise when I found we did not have to purchase anything in this line outside of hose, gaskets, and small bolts for nearly one year, coupler heads and nipples having been bought previously each month. The cost of refitting standard air hose amounted to 4 cents each while the steam heat hose cost 6 cents. The men at outside points now had to keep their account with me straight, that is, they had to return me one coupler head, nipple clamps and defective hose for each new one received, while the shop people simply brought to the store old outfit for exchange; the result was that you could not find a single item of the material laying round loose from one end of the road to the other, and the men were just as careful of it when it was disabled as when it was new and ready for service.

The next benefit derived under this arrangement came about in this way: As all of this material used on the road was handled in the stores building under my eye I noticed the large number of hose that had been pulled apart by trainmen failing to uncouple. I watched this for some time and found that it amounted to 20 per cent. of the whole. I also located the points where most of the hose came from, and then took the matter up with the trainmaster and superintendent. The number of torn hose received decreased at once, but some of the men fell short in their returns and in explanation stated that they found cars with everything gone, even the nipple, and so could not return what they did not have. I again called on trainmaster and superintendent and received back an explanation that did not explain anything nor produce the goods. Then I figured up the loss to date, and asked the superintendent whom in his department I should bill with $225. This seemed to wake up things all around, and the investigation that followed showed that yardmen when they destroyed a hose had been disposing of them in some dark corner or in the bottom of the river on the old plan. This made quite a little trouble for a few people, but the result was that we got the torn hose down to 5 per cent., below which I have not been able to bring it, but I am disposed to think that is not bad, when one poor fellow writes that his is 90 per cent.

Just as an instance to show how this scheme worked out, one of the joint car men at an important junction got ahead of his count 18 pieces, and when I asked for an explanation he informed me that the road we made connection with at that point had stored cars in our yard for a few days, and after they were taken out he found 18 hose and couplings on the ground where the train crew had thrown them while replacing with new equipment from the van. Since he was a joint man, and only one road called on him to return old hose he sent them to me. There was $15 worth of good material in this lot. If the road in question did business in this manner on the whole system, how much does it lose every year?

As to the cost of looking after this, I can say with a clear conscience that it has not cost our company one cent. Ten minutes per day of one clerk's time is all that is required to keep the accounts, and the time I devote to it does not count. How much have we saved per year? I do not know, as there are no figures obtainable, but with all the care we have given the matter, with every man who handles this material on the watch for our own and stealing from other roads to keep even with that account we lose $200 worth each year. How many thousands would we lose if it were not looked after?

STOREKEEPER.

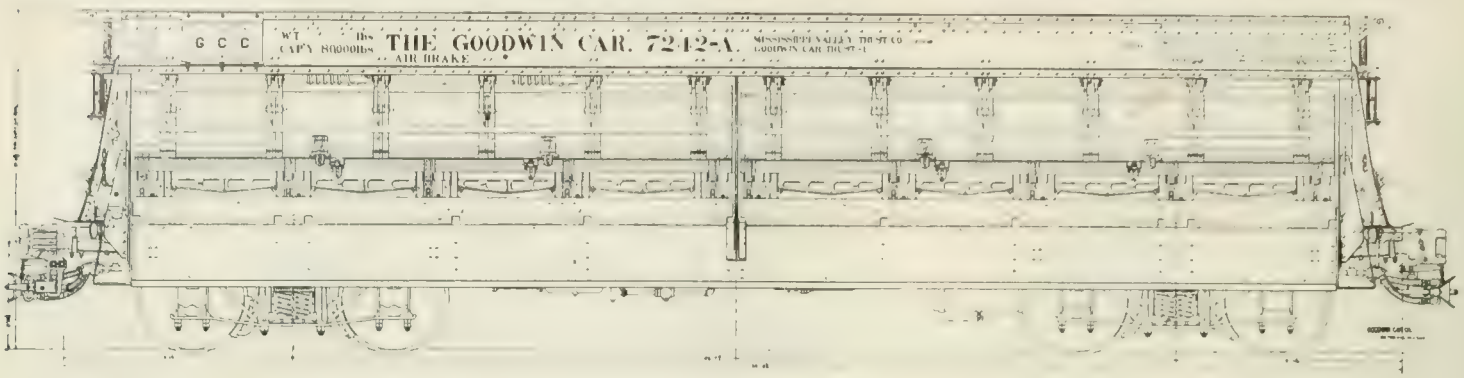
The Evolution of the Goodwin Car.

It is now something more than ten years ago that the first Goodwin steel dump car was built and put in service. The first design of car brought out was ahead of its time; many of its structural features were of a revolutionary nature in car building. This pioneer car was far from being perfect, but it did the work for which it was designed; and it was built to stand the racket. It was expensive and heavy but did not get out of order, nor was it easily made inoperative under the most severe conditions. The railroads were not then prepared to endorse and to buy such heavy cars, and few contractors, in whose work they were especially valuable, were in a position to invest in such expensive equipment, even if they fully appreciated the earning value of it. The policy of building and leasing cars early adopted by the Goodwin Car Co., was the natural outcome of the conditions existing when their cars were first introduced, and this policy of leasing only has been continued until recently. Quite a number of cars were built and put under lease for long and short terms to contractors, railroads, steel companies and others, and they have proved their perfect adaptability for handling any and every kind of dumpable material. Ballast, iron ore, coal, blast furnace slag, billet ends, pig iron and lime stone have been handled in these cars, loading by dropping from chutes twenty feet above the car, and then discharging under absolute control without manual labor of any kind. In railroad construction work, trestle filling, etc., the car is especially valuable.

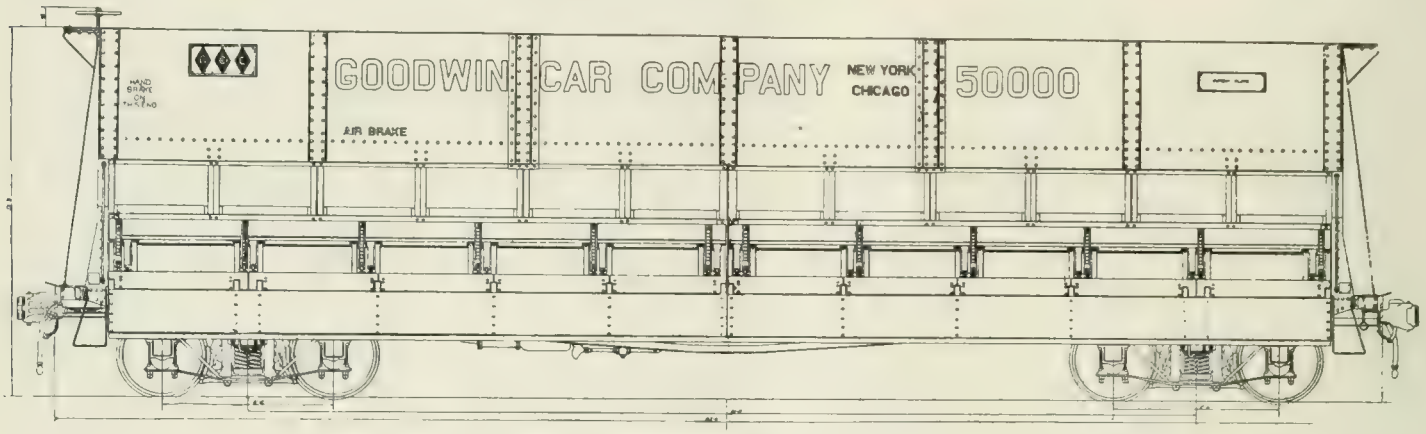
In 1903 Mr. Wm. H. Taylor of Scranton Pa., representing interests with large capital, became the president and general manager of the Goodwin Car Co. Mr. Taylor is a practical business man, and in addition to attending to affairs of this company is

also the President and Manager of the St. Clair Coal Co., one of the largest individual operators and shippers in the anthracite coal fields, and also conducts the operations of his three large machinery and supply houses located at Allentown, Hazelton and Scranton, Pa., and is also active as Director in New York banking institutions. The entire control of the company's interests was turned over to Mr. Taylor as President and General Manager, and he proceeded to put the company in a firm financial position and to enlarge its field of operation. With the able assistance of Mr. John M. Goodwin in charge of the engineering department and the hearty co-operation of a thoroughly capable and efficient organization, he has put the company on a dividend paying basis in the short time in which he has directed its operations. This speaks in itself for the new policy of management.

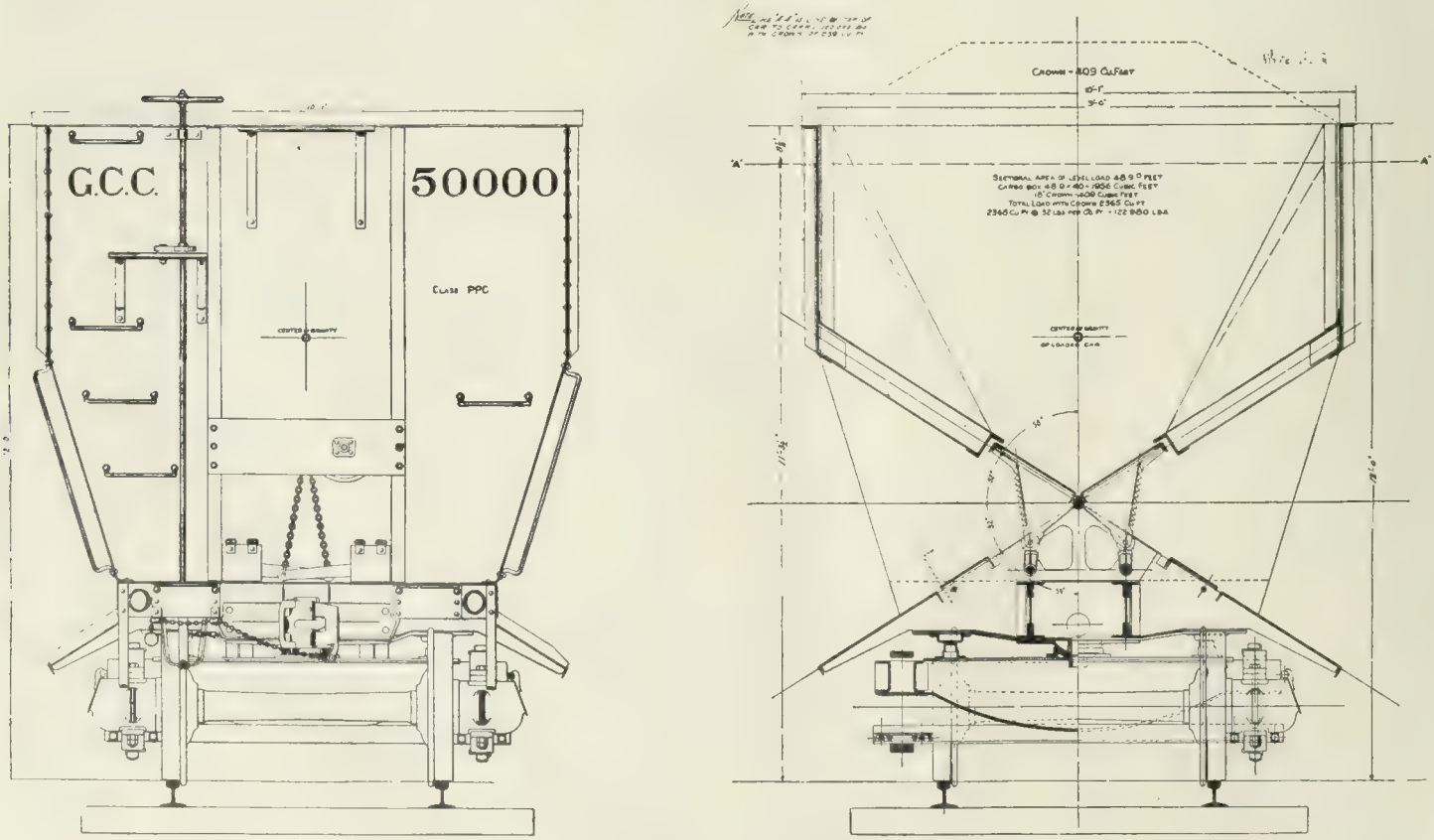
Successive modifications of the first Goodwin car produced the class "G" or special service car, with its air dumping apparatus. From this car (as in all types of Goodwin cars) the load can be discharged in any direction. This is the type to be seen to-day on many large pieces of construction work throughout the country. It weighs 50,000 lbs., has a capacity of 30 cubic yards level load, or 80,000 lbs., and is 36 ft. long. It is built to withstand the heavy shocks incident to steam shovel loading, and has all of the distinct-



Side Elevation of Class G Goodwin Car.



Side Elevation of Class PPC Goodwin Car for Coal, Ore and Limestone.



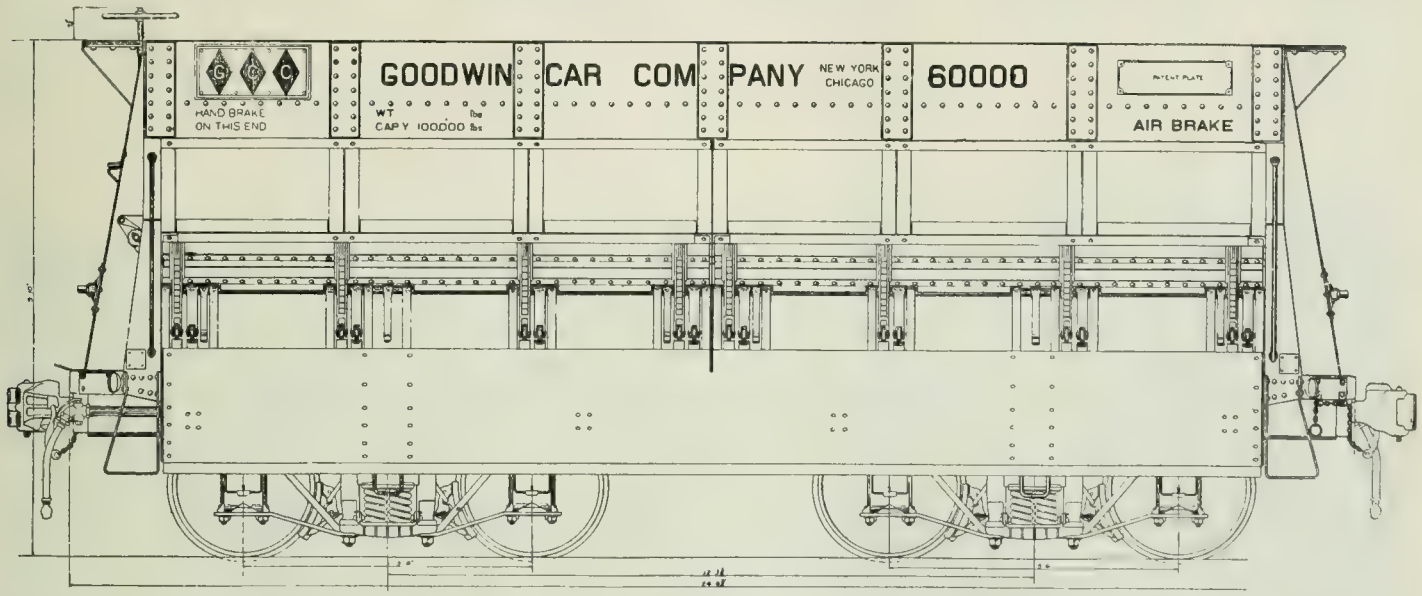
End Elevation and Cross-Section of Class PPC Goodwin Car.

ive features which have made Goodwin cars so widely and favorably known. This type of car, however, was too heavy and expensive for general service, and to meet the demand for a lighter and more simple car, having all the advantages of the Goodwin class "G" car, the company has designed and now offers its new type, class "P" car, patents of 1906. The aim has been to build a car conforming in every respect to standard freight car construction, but embodying the distinctive and desirable features of the Goodwin car. Two types of class "P" cars are shown in the illustrations. The "P P C" car is for carrying coal, lime stone or other bulk freight of similar character, and the "S P" car is a modified form intended for the ore-carrying roads. In the class "P" cars, the swing doors of the class "G" cars have been replaced by fixed sloping sheets, and the load is discharged through four doors which have a clear opening of 48 in., extending the entire length of the car on both sides. Any one, or all of these doors may be opened from the platform of the car by a single motion and the load discharged all on one side, or half on each side. In the "P P C" type the doors on the lower aprons may be raised and the load also discharged between the rails. This permits discharging the load on center-dump coal trestles, and into hoppers between the rails or discharging it over the side of trestles, or loading chutes. The bottom sheets of the body or box have a slope of 32 deg. in the "P P C" car, and 36 deg. in the "S P" car.

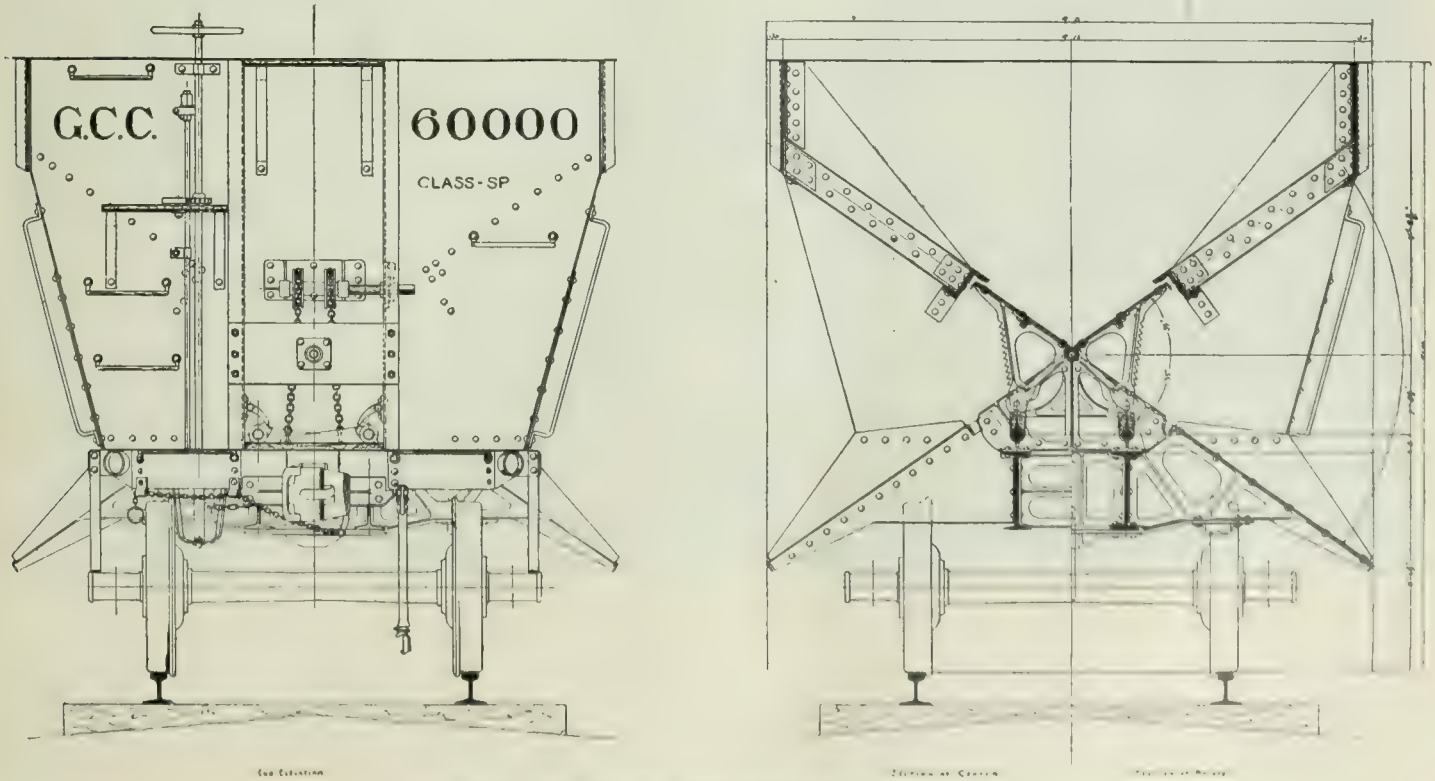
Under the class "P" cars, any standard truck and any standard equipment can be used, and the structural details have also been worked out with great care to avoid complicated or special shapes and sections and to reduce the amount of riveting to the minimum, all with the view of bringing the cost to the lowest possible limit, while retaining strength and efficiency. The Goodwin Car Co. now proposes to sell these types of cars as well as to continue to lease their type "G" construction cars.

Foreign Mail Service.

The report of the Superintendent of Foreign Mails, just issued for the fiscal year ended June 30, 1905, gives the comparative speed of mail steamers on both the Atlantic and Pacific. Many lines invited failed to report. There are shown the number of trips made, the average apparent time (in hours) of the trips, and the quickest trip made by each steamer of the steamship companies in conveying the United States mails from New York to London and to Paris. The number of hours stated does not indicate the time consumed in the sea voyage only, but the period elapsing between the actual receipt of the mails at the post office in New York and their delivery at the post office in London or Paris. The quickest Atlantic mail trips were made by the North German Lloyd, and the quickest Pacific trips by the Nippon Yusen Kaisha (Japan Mail



Side Elevation of Class SP Goodwin Car for Carrying Ore.



Elevation and Cross-Section of Class SP Goodwin Car.

Steamship Company). Both Atlantic and Pacific services showed great improvement during the year. The detailed statements follow:

Fiscal Year Ended June 30, 1905.

Trans Atlantic Fleet and steamer	No. of trips	To London Average time occupied per trip. hrs.	To London Quickest trip hrs.	To Paris No. of trips	To Paris Average time occupied per trip. hrs.	To Paris Quickest trip hrs.
North German Lloyd						
"Kaiser Wilhelm II"	9	149.5	144.1	9	162.1	155.0
"Kronprinz Wilhelm"	10	150.9	145.6	11	163.2	153.5
"Kaiser Wilhelm der Grosse"	11	152.5	146.3	11	165.2	153.5
Hamburg American:						
"Deutschland"	8	150.6	147.2	8	164.9	154.0
Cunard:						
"Campania"	12	167.6	163.4	1	179.0	179.0
"Lucania"	13	168.7	162.9			
"Etruria"	12	188.1	181.5	2	199.0	198.1
"Umbria"	12	191.1	183.5			
"Caronia"	2	198.4	197.8			
"Ivernia"	1	232.4	232.4			
White Star:						
"Oceanic"	11	175.9	165.1	1	184.5	184.5
"Majestic"	11	180.2	177.3	1	205.5	205.5
"Teutonic"	12	191.1	182.5			
"Cedric"	1	211.3	206.0			
"Germanic"	1	212.4	206.8	3	206.2	201.1
"Baltic"	13	212.5	207.0			
American*:						
"Philadelphia"	13	177.6	170.5	13	191.6	178.0
"St. Louis"	8	178.9	173.0	7	190.9	178.0
"New York"	12	179.8	171.9	10	192.9	179.7
"St. Paul"	12	181.5	176.2	12	197.4	189.0
General Transatlantic‡:						
"La Savoie"				11	173.8	164.5
"La Lorraine"				12	176.2	166.0
"La Touraine"				12	186.2	176.5
"La Champagne"				3	206.0	201.5
"La Bretagne"				8	207.1	201.1
"La Gascogne"				8	218.9	208.5

*New York to London via Southampton
†New York to London via Queenstown
‡New York to Paris via Havre.

The following statement shows similar facts about the Trans-Pacific service:

Pacific Fleet.

Trans Pacific Fleet and steamer	No. of trips	To Yokohama Average time occupied per trip. hrs.	To Yokohama Quickest trip hrs.	No. of trips	To Hong Kong Average time occupied per trip. hrs.	To Hong Kong Quickest trip hrs.
Pacific Mail:						
"Siberia"	4	414.7	401.6	4	750.8	664.1
"Korea"	4	415.3	403.2	5	740.9	648.0
"Mongolia"	4	418.5	402.0	5	797.7	728.2
"China"		427.8	404.6	5	712.6	646.1
"Manchuria"	4	417.4	429.2	2	821.0	785.0
Occidental & Oriental:						
"Coptic"	4	443.5	425.3	4	727.8	650.0
"Doric"	4	454.4	450.3	4	744.6	674.9
"Gaelic"	4	499.1	450.0	5	784.3	675.5
Japan Mail S. S. Co.						
Kanagawa Maru	6	417.0	388.0			
Iyo Maru	4	418.4	391.8			
Boston S. S. Co.						
"Tremont"	2	421.7	403.5			
"Shawmut"	2	443.8	421.5			
Great Northern S. S. Co.						
Minnesota	4	436.8	414.9			
Boston Tow Boat Co.						
"Lyra"	1	519.3	519.3			
"Hyades"	1	540.7	540.5			
"Pleiades"	1	583.5	583.5			

*San Francisco to Yokohama and Hong Kong.
†Seattle to Yokohama.

Both the Atlantic and Pacific services showed great improvement during the year.

Many German railroads in their efforts to prevent intemperance among employees have provided coffee and other beverages at very low prices. Last fall the Baden State Railroads provided hot coffee for all employees entirely free of charge. The result has been so satisfactory that in the estimates for the coming year an appropriation of $4,800 is asked for to pay for coffee.



The Progress of Steam.

Faugh, the filthy fellow, my dear, the wretch feeds his horse with common coal.

From a print published in London, January, 1828.

When the development of the locomotive was young, in the year 1827, Mr. H. Alken made an "Illustration of Modern Prophecy," which was engraved and printed in London in January, 1828. Aside from an interest which elderly persons may find in the female figures, this steam tricycle has indications of details worked out more than half a century later. The wheels are suggestive of pneumatic tires; the spokes are evidently designed for tensile strains only; the handle-bar and headlight are quite modern; but the chauffeur's costume has not yet been realized. The engraving is made from a print—a rare one—owned by Mr. W. Laycock, of Sheffield, England.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

CONTENTS

EDITORIAL:
Uniform Passenger Fares. 293
The Colorado Collision. 293
The Right to Route Your Freight..... 294
The Evolution of Railroad Taxes..... 295
United States Steel Corporation. 296
New Publications 296
Trade Catalogues. 296

ILLUSTRATED:
Santa Barbara Station of the Sou. Pac.. 298
Grade Separation at Cleveland, Ohio.... 299
Alternating Current Electric System for Heavy Railroad Service..... 302
All-Steel Drop Bottom Gondola Car for the Frisco System. 310
The "American" Electric Semaphore.... 312
The New Westinghouse "K" Triple Valve 314

CONTRIBUTIONS:
Shavings Cut from the Outer Rail..... 296
Experiment in Reduced Passenger Fares 297

MISCELLANEOUS:
Electric Locomotive for Simplon (Note) 297
Track Circuits in Place of Detector Bars 301
Revised Constitution for the Railway Signal Association. 302
Washington Correspondence 309
Wheeling & Lake Erie Earnings..... 310
Machine Shop Practice 313
Disastrous Collision at Adobe, Colo..... 315
Railway Signal Association..... 316
Temiskaming & Northern Ontario. 316

GENERAL NEWS SECTION:
Notes 85
Obituary 88
Meetings and Announcements 88
Elections and Appointments. 88
Locomotive Building 89
Car Building 89
Bridge Building 90
Railroad Construction 91
Railroad Corporation News. 92

VOL. XL., No. 12. FRIDAY, MARCH 23, 1906.

In the contributors' column this week there are two letters from correspondents about our editorial entitled "An Experiment in Reduced Passenger Fares," printed in the *Railroad Gazette* March 9. These letters are self-explanatory, and we think that our editorial also made its point of view clear; but, to remove any doubts, we wish to reiterate the statement we made at that time that it is obvious that there are a great many railroads which are physically unable to follow the example of the New York, Ontario & Western in making a uniform passenger rate. So far as the application to general practice is concerned, it seems most desirable, however, that fares should be as simple as possible. The passenger traffic manager is so accustomed to making his calculations to provide for diverse and complicated kinds of business that he does not always realize the feeling of helplessness with which the passenger tariff is apt to impress the passenger, particularly on western lines. We have at no time advocated a general adoption of a uniform rate of two cents per mile, or of any other sum per mile, throughout the railroads of the country; but we do believe that a simplification—even a radical simplification—of passenger tariffs would not only be possible, but would be very helpful in engendering a spirit of confidence and good feeling on the part of the traveler towards the railroad.

The disastrous butting collision of passenger trains last Friday morning near Adobe, Colorado, reported in another column of this paper, appears to have been due directly to over work of a telegraph operator, for which the public will hold the employer at least equally responsible with the operator; for the fact that the day man remained on duty at night without permission will not be a sufficient defense. The officer in charge will be judged responsible for not detecting and preventing such a risky proceeding. But though this is true, the reports indicate that the main and immediate cause was a moral delinquency of the operator. The trouble was not that he fell asleep, but that, when awake, he told the despatcher that No. 3 had not passed, when he did not know whether it had passed or not. Railroad managers have plenty of sins to answer for, but trusting sleepy operators to stop trains is not one of them; and those editors who predicate their censure on the allegation that "Operator Lively, while asleep, allowed a train to pass for which he held an order," should correct themselves. Lively did not have the order when No. 3 passed. If he had had it, his stop signal, which does not sleep, would have been displayed and would have stopped the train. The despatcher would not have sent the order until first assured that the signal was displayed; and the setting of the signal and giving the assurance would have been done in the regular and simple routine. The case is one more disheartening instance of a man who knows his duty, but lacks the moral courage to do it when doing it may involve a little censure. Rather than admit having been asleep, and by such admission risking the loss of a dollar, this operator risked—and lost—a score of lives. Getting operators with moral courage is not easy in the wilds of Colorado, and some railroad men will for that reason be lenient in their judgment of the man who appointed this operator. But there is a deeper question than that. Getting operators with strength of character is not easy, either East or West, on the plan usually employed. A better plan is needed. How many of your own operators can be trusted to frankly report irregularities for which they themselves are wholly or partly to blame? Only yesterday an officer of an eastern trunk line told us of continued difficulty in getting operators and signal men on his road. Not long ago a road in Pennsylvania deferred the adoption of the block system on certain lines because of the difficulty of getting reliable men who would work all day (or all night) in the woods, remote from civilization. Clearly, it will be necessary, if competent men are to be secured, not only to pay more money, but also to give the good treatment, vacations and careful instruction and counsel that competent men desire. And how about moral courage among superintendents and despatchers? Only a few months ago we had occasion to report an instance on an eastern road—another trunk line—of a signalman working 36 hours on a stretch. As we have said, going to sleep is not the greatest fault in the signal or telegraph service, for the rules, in a very simple way, provide against disastrous results from that kind of neglect; but how can a superintendent bear to be responsible even for the secondary cause of a collision? The Denver & Rio Grande apparently empowered despatchers to permit over work. Other roads do the same. Do we realize how very cautiously such power ought to be exercised?

Those who are working for the passage of compulsory block signal laws, whether in Congress at Washington or in the Massachusetts legislature at Boston, will have no lack of impressive arguments. The regular record, published by the Interstate Commerce Commission every three months, does indeed afford examples enough; but cases like Adobe, burning the bodies of a dozen victims beyond recognition, serve to more effectually arouse our hardened sensibilities. It should be carefully noted that the argument for the block system remains unshaken, notwithstanding the fact that, with the manual system, a sleepy operator may make trouble with the space interval as well as with the time interval and despatcher system. But, although a block signal operator by collusion with another operator, or through the coincident neglect of an engineman—can cause a collision by sleeping if the circumstances are favorable, the fact remains that such cases are rare. The difference in the routine is radical. With or without better moral character in the men, or better training, the block system is more practicable, sure and safe. It is operated by few and simple processes, requiring little time. Despatchers' orders are written, transmitted and made effective by numerous processes, requiring much time. These are to a large extent simple, when

viewed singly, but they become complicated when we take into consideration the details connected with the handling of numerous orders at the same station at the same time, or think of the exacting nature of the mental problems imposed on the despatcher. An efficient and reliable signalman, like an efficient and reliable telegraph operator, is the product of training, experience and moral qualities. Failures come about from a lack of any one of these three elements. The block system has the advantage of requiring less training, which is due to the simpler processes. The train despatching system is worked by a constant succession of exceptions to the rules; the block system by constantly following the rules, with very rare exceptions. A block-signal operator must have a regular habit of being awake for every train; under the despatching system the operator who desires to sleep is frequently finding occasions on which he can be off guard and no harm ensue. His reputation will be harmed if the despatcher finds him out, but frequently the despatcher is too busy to watch him. Thus we see that the block system puts a lighter tax on the moral as well as on the mental faculties. The block system in its crudest form is bound to improve the conditions when it is introduced on any road where the traffic necessitates placing much dependence on the despatching system; but why not have track-circuit control and thus still farther eliminate the puzzles and trials of mental and moral training? This is what the Southern Pacific is doing. If we had government investigation of accidents we might then have light thrown on the question whether such protection ought not have been provided on the Denver & Rio Grande.

THE RIGHT TO ROUTE YOUR FRIEGHT.

The decision of the United States Supreme Court in the California orange-routing cases, reversing the Circuit Court and the Interstate Commission, which was briefly noticed in the *Railroad Gazette* March 2 (General News Section, p. 66), is a fine example of Dutch justice; it is the unanimous decision of the nine justices, and is written by Justice Peckham. The acts charged against the railroads are not in terms prohibited by law, and, therefore, "a court is bound to consider the bearing which the result of its construction will have on the general purposes of the act." The Atchison and the Southern Pacific, by routing the enormous shipments of oranges and lemons for Eastern cities over such Eastern roads as they saw fit, succeeded in stopping the costly competition which those Eastern roads had indulged in (by means of secret, illegal rebates) and in that way resonable and undiscriminating rates were sustained and fair dealing promoted. The general result being for the public good, the technical difficulties of the law which a year or two ago guided the judges of the Circuit Court and four of the five Interstate Commerce Commissioners are now minified by the Supreme Court until they vanish from sight, and the railroads are justified. Some of the most refreshing judicial decisions that the courts give us are those in which they brush aside sophistries in order to make a statute press harder against an offender who has taken care to respect the letter while violating the spirit; here we seem to see the opposite. The spirit of the public tariff law and of the anti-pooling law were violated; but technically, Justice Peckham makes out that they were not violated.

It will be recalled that the Interstate Commerce Commission based its decision that the railroads were wrong mainly on the fact that the clause forbidding shippers the right to route their freight violated the law regulating the establishment of through routes. A through route and rate having been established, it should be open to all shippers and at all times, except as the tariffs might be modified after due notice and publication, as required by the law. Therefore, when the railroad reserved to itself the right to designate the route, it would be holding a route open to a given shipper at one moment and perhaps closing it to him the next moment. In pretending to give the shipper something in return for this privilege the road was making a false pretence, for the rate, as shown in the tariff, is guaranteed by the law, and the railroad cannot give any additional or greater guarantee. It is a contradiction to say that the tariffs create on the one hand many through lines, each open at all times to the initial carrier, while none is at any time open to the shipper except in the varying discretion of the initial carrier. Railroads have objected to the formation of through routes by the government because they might thereby be forced to make contracts with insolvent connections, but here they impose this condition on the shippers. Chairman Knapp filed a dissenting opinion, holding that, having given notice in the tariff that the through rates were conditional, the tariff was lawful. Roads are free to make or refuse to make through routes, and if they make them they may attach reasonable conditions; they may discontinue the through route and rate when they see fit; and Chairman Knapp is now sustained.*

Justice Peckham all through his decision emphasizes the fact that the shipper suffered no important detriment. Though the railroads reserved the right to route the oranges contrary to his wishes they seldom did so; they usually carried out his directions. The freight reached its destination as early as if routed by the shipper, and "in that event the particular route taken is not very important to the shipper." The freight was sent over the best roads in the country; those which were shut out were the roundabout roads. Witnesses gave no evidence as to any road being insolvent. The court must consider the possible evil results of an arbitrary application of the routing rule; but no such results were discovered. On the other hand, the railroads, by doing the routing themselves, stopped the rebating, which formerly had been flagrant among the Eastern roads. One shipper testified that in four years his company had received in rebates $174,000. This was done through the refrigerator car companies, yet it was a bald violation of the law, nevertheless. There is no pretence that the railroads discriminated between shippers.

The Circuit Court, in reviewing the order of the Interstate Commerce Commission (to abolish the conditional tariff) paid little or no attention to the arguments which were elaborated by the Commission and which are summarized above, but held that the routing rule was equivalent to a pool. It was agreed to between the initial carriers and the Eastern connections, and had the effect of stopping the competition between these Eastern connections. (The Circuit Court is justified by the Supreme Court in its placing of the emphasis on the question of pooling; the court is not bound to confine itself to the grounds specified by the Commission.) Justice Peckham then goes on to reverse the Circuit Court; and this mainly on the ground that although all of the good effects of a pool were produced, there was no actual agreement to pool. The Eastern roads simply were satisfied that it would be better to allow the initial lines to distribute the freight than to continue the practice of rebating; they believed that they would be fairly treated; and it was testified that not one of the Eastern companies knew what percentage of the business it received. They simply knew that rates were maintained. In short, there was no written pooling agreement, but there was a very effective "blind" pool. The Eastern roads trusted to the Southern Pacific and the Atchison to manage their pool for them satisfactorily, and the trust was not betrayed.

The Commission called this arrangement a tonnage pool, for the initial carriers certainly did divide the shipments with a view to giving each connecting road a proper share. The object was declared to be not so much to prevent rebates as to effect a tonnage division. Mr. Justice Peckham, on the other hand, holds that the main purpose was to break up the rebating, and therefore he decides that what was done was not repugnant to the anti-pooling law. He apparently couldn't see how these two things are inter-related. The rebates were the weapons in a fight for getting business; a pool when adopted or put in force is designed to secure business without having to fight for it. The essence of a pool is the peaceable division of competitive business, and the essence of this agreement was precisely the same.

Finally, Mr. Justice Peckham holds that the Eastern connections were not really competing roads. The initial carriers rightfully entered into agreements with the different Eastern lines for joint through rates, and could make any desired terms with any one of them, provided these were not in violation of other provisions of the act; and the only way that an Eastern connection could compete with another Eastern connection would be by violating the through tariff which had been made by the initial carrier and which the connection had agreed to. This, says Justice Peckham, would be unlawful; therefore, it could not properly be done; therefore the Eastern line could not compete with its rivals. The fact that the Eastern road *could* easily kick out of the traces; could, as often as found desirable, say every few days, call upon the initial carrier to change the tariff—change it according to law—does not occur

*The through tariffs, showing the rates over 183 different roads, contain a clause expressly stating that in guaranteeing the through rate the road reserves the absolute right to route the freight. Shippers are all the time diverting carloads of oranges to new destinations after they have made part of their journey. Shippers claim this privilege as a legal right; and to divert to advantage they must know where these cars are while on their way East. Usually the roads route cars as requested.

For seven years previous to 1900 all shippers received rebates of $15 to $25 a car; this was paid by the refrigerator car companies and by the eastern railroads. The California roads claim that their action in routing the freight (beginning Jan. 1, 1900) was necessary to stop this payment of rebates. It appears that the general eastbound tariff of the roads, covering all commodities, has the same clause denying shippers the privilege of routing their freight.

to Justice Peckham, apparently. He says that "all that would be needed for a total suppression of rate competition among the Eastern connections would be the honest fulfillment of their agreement as to joint through rates." If the law had required such agreements to be kept unchanged for a month or a year, this reasoning might hold water; but traffic men will not be able to see it in that light.

The complaining shipper will have to interpret this decision as holding that the right of a California shipper to decide what road he will patronize—say, between the Mississippi river and the Buffalo-Pittsburg dividing line—has in this matter been so very slightly infringed that he has no claim of any consequence for damage. Probably this is as near justice as we could expect. As the railroads are carrying the fruit at exceedingly low rates, and as the initial carriers themselves maintain a pretty vigorous competition (in facilities) it is probable that the decision works substantial justice; but to hear this kind of philosophy from hair-splitting and precedent-bound lawyers is an unfamiliar sound.

THE EVOLUTION OF RAILROAD TAXES.

The fact that the State of New Jersey has been passing through an "equal tax" contest with new and additional taxation of railroads in the foreground of the general issue is one of many reminders—in these days of rate bills and two-cent-a-mile statutes—of legislative activity in various railroad directions. Most of these measures can be summed up in the word "taxation," using that word in its very broadest sense. What, for example, in its final analysis, is the two-cent-a-mile proposition but a tax or impost upon the operating railroad corporation in the form of reduced rates to be distributed among passengers in proportion to distance traveled? And, on the tongues of economists and statists, equality of rates can be readily enough transmuted into equalization of a tax on transportation. The whole situation is rich in its emphasis on the subject of railroad taxation and its deep problems, whether those problems be considered historically or in the flickering lights of the future. We are now referring, however, to direct taxation of the railroad corporation by the state or municipality—not to the indirect forms of impost under the head of "regulation," though we are by no means sure that regulation may not at last reach the point where its contacts and collisions with normal forms of taxation may be serious.

Some years ago a New York railroad tax commission said in its report: "There is no method of taxation possible to be devised which is not at this time applied to railroad property in some part of this country." Not long ago we had a more personal illustration of railroad tax intricacies. Applying to the able head of a railroad commission in one of the oldest states of the Union for information as to the system of taxation of railroad bonds in his commonwealth, we were referred by him to the attorney-general of the state with the remark: "So complex are our railroad taxes that I don't understand them myself, and never did." Nevertheless, when one takes the wide and, so to speak, landscape view of railroad taxation in the United States, one can find some encouraging evolutions in the direction of scientific and harmonious methods. Order is coming out of chaos, but coming very slowly. It would have arrived more quickly if changes in the character of American communities on the one hand and of the physical conditions of railroad management on the other had themselves been less continuous and radical. The pioneer Western town once yearning for the railroad and willing to exempt it from taxation for a long term of years has since grown to the big city that wants to exact what taxes it can get. And the once isolated and independent railroad line has since become part of a great system with its fresh group of taxation problems imposed by interstate traffic if by nothing else. Taxation questions have thus been tangled by mutations both in the taxing power and the thing taxed.

The important forward step in railroad taxation during the last two decades has been the rapid transition from local to centralized taxation. From the varying systems of local appraisal, from the whimsical moods and tenses of municipal boards of assessors, and from habits and customs, dating some of them back to town or county organization, there has been throughout the country a progressive movement toward the centralizing of taxing power and functions in the state usually in some kind of a board. It is true that taxation of railroad property not directly used in operation is still in many states left to local authority. But essential justice is here generally reached by allowing the subtraction of such properties from state appraisals. If we are not mistaken only one state—Rhode Island—still holds with some persistency to the local system. The gain has been considerable. State tax commissions, with all their infirmities and under the evil impact of politics, have, nevertheless, been forced to consideration and study of principles in railroad taxation. Just as in New England the old district school system has had to yield almost universally to centralized control by municipal boards—higher as to intelligence and experience—so the change from local to state taxation of railroads marks the transfer to a higher order of taxing agency, and some coherency and uniformity have been substituted for the old local diversities. The fact that the state taxing agency often has the local distribution of the railroad tax receipts—in Eastern states among cities and towns, West and South in the counties—has no immediate bearing on the merits of the change.

Excluding those state taxation boards, which have been the temporary products of demagogism there has been, on the whole, in state taxation a discernible tendency to reach honest and equitable generalizations as tests of railroad values for a basis of taxation. It has taken a number of forms. Gross earnings is one, taxation of which, however, while plausible in theory, has not been very successful in practice, and has borne hard on struggling lines. Absolute appraisal, as though it were a piece of realty, of a railroad's whole plant within state bounds with apportionment of equipment to mileage, has been another pleasant theory that has proved infirm in practice. More successful and, on the whole, representing a growing tendency, is taxation of railroad debt—usually on a basis of par—and of stock on a basis of market values not always easy to ascertain. It has the merit—if just estimate is made as to values of interstate lines within the state—of reaching that market appraisal—including value of franchise—which is the common basic principle of public taxation of all kinds. But we are not going here *in extenso* into the relative merits and demerits, so often discussed, of the various tax systems. We are merely pointing out tendencies and the slow but steady drift toward scientific railroad taxation, the more encouraging because entangled by the rulings of the courts against state taxation of interstate traffic.

It is unfortunate that the progress toward general principles of taxation as between the public and the railroad corporations has not extended in the same degree to the individual holder of railroad securities. As a resident holder of securities of a domestic railroad corporation the resident owner of stocks and bonds is fairly protected. But, as a non-resident or as a holder of securities of a railroad outside the state, he is still overmuch a target of unjust taxation and the victim of some amazing anomalies very fruitful in tax dodging. Take but a single case: Under the Connecticut law the resident escapes all tax on bonds of Connecticut railroad corporations and of shares of outside railroad corporations. But, under a special and exceptional proviso, he is held for taxes on bonds of outside railroad corporations whether those bonds have been subjected—as a debt of the railroad corporation—to outside taxation or not. It is hardly strange that, under the circumstances, to abate tax dodging, Connecticut, some years ago, passed a law allowing such a bondholder to substitute for the municipal tax a lower bond tax to be paid to the state. This case is cited, in an old state where tax laws ought long ago to have passed their formative and plastic stage, to show what a large vacuum still remains for the redress of the double taxation of the ignored and victimized railroad security holder.

With state laws for railroad taxation still greatly lacking in uniformity, with legal principles of state taxation as yet much unsettled and with the swift growth of railroad consolidation bringing interstate complications to the front, there has been some tendency of late to discuss the question of federal taxation of railroads as a general substitute for taxes by the states—the assumption being that the receipts are to be redistributed to the states on a basis of their relative railroad interests. The proposition is speculative and academic, and cannot be described as a real tendency, though, in a broad way, suggested by recent federal activity in relation to railroad corporations. Even as a remote ultimate it seems very unlikely. As a form of redress, in the uncertain future, some railroad corporations may come to favor it so as to escape undue state exaction and irregularities of tax laws. But, saying nothing of obvious political dangers and the transfer to federal authority of a function so immense and so complex, the control in taxation of so vast an interest as that of the railroad is something we shall never see the states lightly yield. The idea belongs to that general appeal to federal paternalism just now popular with certain groups of Americans, but, in the near future, more likely to wane than to wax.

There remains for brief consideration the future tendencies and

ultimate shapes of taxation of the great and growing material interests represented by the street railways. The prognosis follows closely the analogy of the steam roads. At first, as localized institutions, local taxation modified in many states by a state collecting agency with redistribution to the municipality; later, as the local railroads extend, cross state lines and become freight carriers, a tendency toward uniformity of taxation and probably toward some diversion of tax revenues to the state treasuries; and, finally, under new mergers with old steam corporations the treatment, for purposes of taxation, of street railways as though they were integral parts of the steam system—perchance by that time itself electrified. The trolley is yet young, but in its rapid, if brief, life story it has already in so many aspects repeated the longer annals of the steam roads that its future in taxation can be, with reasonable certainty, foretold.

United States Steel Corporation.

The annual report for the year ended Dec. 31, 1905, shows gross sales and earnings of $585,331,736, an increase of more than $114,000,000 over 1904 and of $24,821,257 over 1902, when gross earnings were $560,510,479, the largest in the company's history. The net earnings of 1902—$133,308,764—still remain the largest on record. Last year's net earnings were $119,787,658, an increase of $46,611,136 over 1904. The surplus for the year was $17,065,815, an increase of over $12,000,000. The total surplus on December 31 stood at $84,738,451, a gain of over $23,000,000 above the figure a year earlier.

The following are extracts from the remarks of the President: "The production of pig iron, steel ingots and finished products for sale exceeded that of any previous year. It can be attributed largely to the liberal expenditures made during the last four years in improving and expanding the properties that it was possible to accomplish the record-breaking results in production and handling of business which resulted for the year, and consequently to realize the amount of net earnings shown. Although the capacity of the producing furnaces and mills at Chicago and vicinity has been materially increased from time to time, it has not kept pace with the increased and rapidly increasing consumption tributary to this location; and therefore a large percentage of this tonnage is now supplied from Eastern mills. In consequence, it has been decided to build a new plant on the south shore of Lake Michigan, in Calumet Township, Lake County, Indiana, and a large acreage of land has been bought for that purpose."

The following table shows the source of the company's production of iron ore and other facts about production for the past three years:

	Tons		
Iron Ore Mined.	1905.	1904.	1903.
From Marquette range	1,359,722	934,512	1,412,402
From Menominee range	1,871,979	1,186,104	2,106,443
From Gogebic range	1,671,747	1,271,831	1,867,856
From Vermilion range	1,578,626	1,056,430	1,918,584
From Mesaba range	12,004,482	6,054,210	8,058,070
Total	18,486,556	10,503,087	15,363,355
Coke manufactured	12,242,909	8,652,293	8,658,391
Coal mined	2,204,950	1,998,000	1,120,733
Limestone quarried	1,967,355	1,393,149	1,268,930
Blast Furnace Products.			
Pig iron	9,940,799	7,210,248	7,123,053
Spiegel	158,071	100,025	121,779
Ferro manganese and silicon	73,278	59,148	34,409
Total	10,172,148	7,369,421	7,279,241
Steel Ingot Production.			
Bessemer ingots	7,379,188	5,427,979	6,190,660
Open hearth ingots	4,616,051	2,978,399	2,976,500
Total	11,995,239	8,406,378	9,167,960
Finished Products.			
Steel rails	1,727,055	1,242,646	1,934,315
Blooms, billets, slabs, sh't & tin pite brs	1,253,682	932,029	493,292
Plates	780,717	404,422	519,713
Heavy structural shapes	484,048	313,779	362,765
Merchant st'l, skelp, hoopsbnds & cot ties	982,782	577,384	634,830
Tubing and pipe	911,346	710,765	710,555
Rods	84,049	84,934	101,699
Wire and products	1,283,943	1,226,610	1,126,605
Sheets: black, galvanized and tin plate	924,439	735,482	763,670
Finished structural work	404,732	357,488	469,692
Angle and splice bars and joints	150,265	72,470	138,709
Spikes, bolts, nuts and rivets	61,496	46,003	53,259
Axles	149,596	62,981	119,716
Sundry iron and steel products	28,236	25,787	30,059
Total	9,226,386	6,792,780	7,458,879

NEW PUBLICATIONS.

Building Code. Prepared by The National Board of Fire Underwriters, New York. Leather, 6x9½ in.; 263 pages.

This work has been prepared by the National Board of Fire Underwriters, through the Committee on Construction of Buildings, for the purpose of securing uniform building laws throughout the country. Every effort has been made to make it as complete and comprehensive as possible, and the committee has been assisted in its work by experts of the highest authority in the art of building construction. In the belief that good construction should be recognized as of the utmost importance in every city and town this work, as prepared and recommended, has been based upon broad principles, hoping to impress upon municipal authorities everywhere their grave responsibility in enacting and enforcing laws for the protection of life and property. The work is somewhat voluminous owing to the efforts of the committee to provide for conditions existing in towns as well as cities. It covers all matters concerning, affecting or relating to the construction, alteration, equipment, repair or removal of buildings or structures erected or to be erected. The work is nicely printed and is bound in a flexible cover. It contains an alphabetical index, as well as marginal subheads which will be found most useful for ready reference.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.	
Postal-card circulars	3¾ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Reinforced Concrete Construction.—A treatise on reinforced concrete construction has just been issued by the Northwestern Expanded Metal Company, Chicago. It deals with the value of expanded steel and its application to reinforced concrete in every form, giving tables and calculations for its use. It shows the comparative value of concrete and steel when used together, giving simple rules for determining their proper proportions and their easy and practical application to all classes and kinds of structural work. The principle and disposition of concrete and steel sections as laid down in this book demonstrate the value of expanded steel in the construction of beams, columns, girders, floor slabs, and, in fact, anything made of concrete. The book is a convenient size for the pocket and ready reference. Copies can be secured by writing the company at 790 Old Colony Building, Chicago.

CONTRIBUTIONS

Shavings Cut from the Outer Rail.

Roanoke, Va., March 18, 1906.

To the Editor of the Railroad Gazette:

In connection with the article by Mr. S. Whinery, and your comments thereon in your issue of March 16, 1906, relative to shavings cut from outer rail on curves by wheels of passing locomotives and cars:

I have on several occasions found shavings such as were described in the *Railroad Gazette* for April 4, 1905, on curves at outlying points on heavy grades where the outer rail was elevated for a high rate of speed. Trains on descending grade running at rate of about 45 miles per hour, the curvature being about 6 deg. On these curves the loaded movement is in the direction of the ascending grade. My explanation of excessive curve wear would be that with the very slow movement of the loaded trains, the high elevation of the outside rail throws a great preponderance of the load on the inner rail and holds the trucks rigidly in tangential position or possibly by reason of the wheel tread being coned and the inside wheels running on the larger diameter the tendency is to slew the truck in direction contrary to the direction of the curve. I think both have an influence and the result is that the flange of front wheel on each rigid wheel-base is held firmly against the outer rail at an angle which with a sharp flange causes shearing, and in any case causes excessive flange wear of rails.

Where it is necessary to maintain a considerable superelevation for high rate of speed in one direction only, it is at the expense of power and wear of rails in the opposite direction, and is a greater hardship where the loaded movement is in the direction of the ascending grade, and speed in that direction must necessarily be very slow. My practice has been to ameliorate the unfavorable conditions as much as practicable by elevating the outer rail as little as is compatible with maintaining fair riding track on descending grade, and to have trackmen give particular attention to maintaining the track rails in position at right angles with the plane of the ties. The constant tendency is to tilt both rails out and widen the gage on curves, and as the rails tilt the flange wear increases rapidly. The tilting is caused by the oscillation of both engines and cars and by the greater weight being borne by the outside base of rail. To remedy the defect it is necessary at intervals to pull spikes and adze ties so that the rails will have

firm bearing in proper position. I have found that close attention to this matter by trackmen will secure at least 20 per cent. longer life for the rails on curves.

G. W. MERRELL,
Assistant to General Superintendent, Norfolk & Western.

An Experiment in Reduced Passenger Fares.

March 16, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In connection with your editorial on "An Experiment in Reduced Passenger Fares," in your issue of March 9, I call your attention to a study of railroad passenger rates indicating the effect of low rates in increasing revenue, which appeared in your issue of Feb. 10, 1899. As one of the traveling public, and something of an observer of human nature, I am firmly convinced that almost every individual who travels at all will go twice for two cents against once for three cents. I think it is this peculiarity of human nature that is responsible for the largely increased revenue that almost invariably follows a reduction of rates. But I agree with you, also, that uniformity of the rate has much to do in encouraging travel. Of course no rate can be put below cost, and the old rule of what the traffic will bear seems to be the proper one to follow, the chief difficulty being in determining just what the traffic will bear, that is to say, just what rate will produce the maximum net revenue. In the study of rates referred to above, the fact that low rates do increase revenues seems to stand out clearly, although I am aware that there may be other local reasons for the apparent gains.

WM. G. RAYMOND,
Dean of the College of Applied Science, State University of Iowa.

An Experiment in Reduced Passenger Fares.

Philadelphia, March 16, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to article in your issue of March 9, "An Experiment in Reduced Passenger Fares," I want to take issue with some of the deductions you draw from your analysis of the situation on the New York, Ontario & Western—a line with little but local business, no heavy suburban traffic, and no expensive terminals to maintain—which found it desirable to reduce its passenger rate to two cents per mile.

The table you present shows an increase in gross passenger earnings of 72 per cent. from 1897 to 1905, and you attribute this increase to the reduced and uniform rate of fare. You must admit that all railroad earnings have largely increased during this period regardless of the rates charged. The gross passenger earnings of the New York Central & Hudson River, a two-cent-a-mile road, increased over 89 per cent.; the earnings of the New York, New Haven & Hartford, a two-and-one-half-cent-a-mile line, increased over 77 per cent., and the earnings of the Pennsylvania Railroad, a three-cent-a-mile road, increased over 94 per cent. These increases have been made without any change in the rates of fare charged. They prove, I think, that the increase on the New York, Ontario & Western has been only normal, and also that the general prosperity of the country and the activities of flourishing trade have had more to do with the increase than the reduction in fares, as the same result is shown on the three larger systems which have made no change in their varying rates.

Again, you fail to show the net increase in earnings. The increase in gross earnings from 1897 to 1905 has been accompanied by a corresponding increase in expenses, an increase on the Pennsylvania Railroad, for instance, of more than 98 per cent. The actual increase in net earnings on the New York, Ontario & Western, therefore, becomes an interesting question.

You have failed to mention an important consideration in the passenger business—the service provided. While none of the standard railroads has reduced its fares during the period covered by your article, it is well-known that marked improvements have been made in the service, and this is virtually a concession to the passenger, because he gets that much more for his money. Roadbeds have been bettered; a larger proportion has been rock-ballasted. Safety appliances have been perfected; the equipment has been greatly improved. More parlor and dining cars (which seldom pay) have been provided. Coaches have been made more comfortabel. Commodious and expensive terminals have been constructed. More frequent and faster trains have been added. It is not a general rule of business to reduce the charge when by large expenditures the service is improved. On the contrary the charge is usually raised.

The improvements in the service, representing an increase in the expense of performing it, have been equivalent to a reduction in fares. And it is here that the "contented mental state" is produced; for while the passenger naturally wants to pay as little fare as he has to, he always expects the best in the way of service. The progressive road is, therefore, constantly improving its service and attracting travel by this means. Compared with the service performed, I think you will find that the rates on the standard railroads of the country are as low as those which charge a flat two cent a mile rate. In fact, you will find that the average rate per mile on the principal trunk lines does not exceed two cents. It is simply adjusted to satisfy the various classes of patrons—it is made flexible rather than arbitrary. The flat two cent a mile rate is an advantage to the occasional traveler, but it would be a disadvantage and a hardship to the commuter and the frequent traveler.

I note your suggestion that "simplification of passenger charges to the extent that a man can go up to a ticket window anywhere on a road with the assurance that it will cost him (say) two cents a mile—no more and no less—to travel, and that the next man is paying as much as he and no less, has no small influence in increasing passenger earnings." This may be true, although it has never been tried, but I believe from experience that nothing would produce greater irritation and dissatisfaction among the traveling public generally than to charge everybody the same rate per mile.

The man who rides daily to and from his office insists upon having a lower rate than he who rides only once a week; the commercial traveler who rides frequently insists upon a lower rate than the occasional traveler, and the man who makes the round trip between one point and another within a limited period insists that he should have a lower rate than the man who goes and comes when he pleases; and every passenger man in the country knows that large movements are created only by a substantial reduction in rates.

Everything is comparative in this world, and passenger fares are no exception to the rule, and if a rate of two cents a mile were adopted on all the railroads in this country, the demand would very soon arise for a reduction below that figure. As an illustration, a bill has been introduced in one legislature this winter for a rate of one and one-half cents to apply in a territory where a two cent rate obtains very generally. If the price of a ticket is to be measured by the frequency of the trip taken by the purchaser, the restrictions which you criticise are unfortunately necessary to insure the observance of the contract of ticket by the purchaser, thus protecting the forms of transportation sold at higher rates.

We find that a "contented mental state" for the passenger is when he gets a better rate than some of his fellows, and it does not take a passenger long to find out that there is a round trip rate or a commutation rate by means of which a reduction from the standard fare may be secured.

The experience of the passenger agent is that a reduction in rates stimulates travel for a short period, but that the novelty soon wears off and the volume of traffic falls back to its normal condition. I think it is not well understood by those who write upon such questions that a large proportion of the business of the great railroads to-day is carried at reduced rates; and these reductions on special occasions are a great stimulus to travel. This stimulus is lost the moment a flat rate is established.

It is true that the electric lines have created travel in a great many instances, but the beginning of their prosperity resulted from underselling the competing steam roads, and the opportunities they have of using the highways and passing the door of the passenger at frequent intervals. The cheapness of the rates, of course, has much to do with this increase, but it will be found, if a careful analysis of the question is made, that the frequency of movement is also a most important factor, next to that of the lower rate, in taking from the competing steam road, with its less frequent service, the short travel. Where the electric lines have to pay their own right of way, and run in competition with steam railroads outside of the suburban territory adjacent to large cities, it will be found that many of them are not formidable competitors.

I think most of the men who have charge of the passenger traffic of the country would hail with delight the opportunity to make one rate, say two cents a mile, for everybody, but there are so many special rates for conventions, special occasions and excursions of various kinds, and commutation rates, demanded by the passenger interests that those in charge of the passenger traffic would be loath to endorse a reduction in the maximum fare.

The railroads in Ohio, having had their maximum fares reduced, are endeavoring to apply the flat rate to all classes of travel, but we observe that already they are being severely criticised for it, and are threatened with reprisals by municipal authorities through adverse and hampering legislation.

AN OLD RAILROADER.

Brown, Boveri & Co. have completed one of the electric locomotives which are to haul the trains through the Simplon tunnel. It is a 10 wheeled engine, 40 ft. 6 in. from buffer to buffer, weighing 68 tons, capable of developing 900 h.p. ordinarily and 2,300 at a pinch, and intended to run 21 miles an hour with freight, or 42 miles with passenger trains.

Santa Barbara Station of the Southern Pacific.

The Southern Pacific has recently completed at Santa Barbara, Cal., a very attractive passenger station in the Old Mission style of architecture, views of which are shown herewith. The walls are concrete, 14 in. thick, the concrete being composed of sand, fine gravel, crushed rock and German cement, and being faintly buff tinted wherever it shows either inside or outside of the building. The roof covering is full-sized, red, Old Mission tiles. The platform, including the portions under the baggage shelter, arcade and passenger shelter, is of bituminous rock laid on concrete. The arcade extends around the waiting room and office portion of the building, with an extra width at the passenger end affording large, out-door passenger waiting space and being supplemented by a porte cochere in the rear of the building, opposite the women's waiting room entrance. The baggage room is in the one-story part of the building and has a wooden floor and tongued, grooved and beaded side and top ceiling, with the usual baggage protection wainscoting; the baggage room being supplemented by an arcade baggage shelter at the end of the building. The private and public office rooms have wooden floors and quartered oak wainscoting and picture molding, the remainder of the walls and the ceiling being sand-finish plastering, buff tinted. Three ticket windows open from the office into the general waiting room.



Street Side of New Station at Santa Barbara, Cal., Southern Pacific.



Fireplace in Ladies' Waiting Room.

The lavatory floors are ceramic mosaic, the wainscoting and partitions are of Italian veined marble, and the remainder of the walls and the top ceiling sand-finish plastering, buff tinted.

The general waiting room is in the two-story portion of the building and extends the entire height of the two stories. It has a ceramic mosaic floor with enameled tile wainscoting to the height of the doors with base of Tennessee marble, top molding and picture molding of quartered oak, sand-finish plastering, buff tinted, on remainder of walls, and a high open roof timber ceiling, antique-oak stained. The women's waiting room is in the one-story portion of the building surrounded by the arcade. It has a high open roof-timber ceiling, antique-oak stained, like the general waiting room, and the finish is the same as the latter.

All seats and other depot furniture are of quartered oak. The electric light fixtures were specially designed to correspond to the general style of the building, and all electric light, telephone and telegraph wires enter the building through conduits. The mantels around the fireplaces in the women's waiting room and general waiting room are of concrete, with buff sandstone fireplaces, and the over mantels are ornamented with plaster of paris plaques, bronze painted.

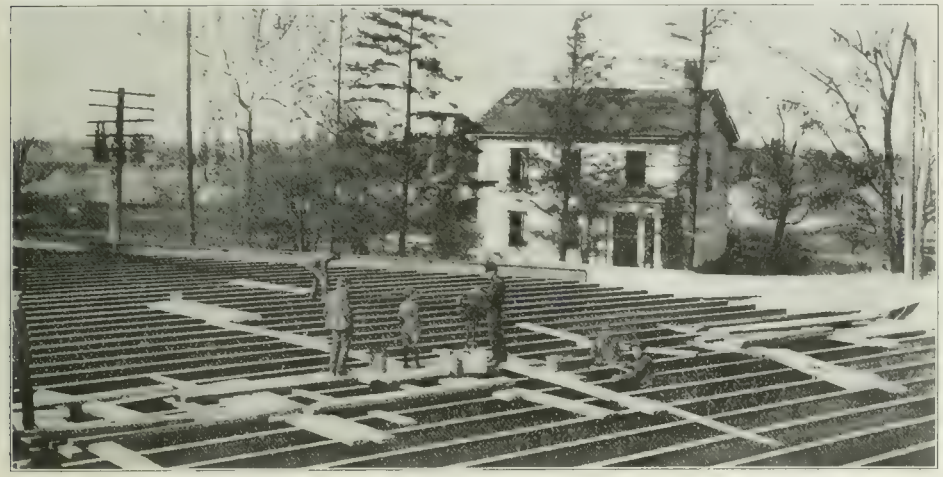


Track Side of New Station at Santa Barbara, Cal., Southern Pacific.

Grade Separation at Cleveland, Ohio.

BY GEO. H. TINKER,
Assistant Engineer, New York, Chicago & St. Louis.

The city of Cleveland, in common with other large cities, has realized the necessity of eliminating the grade crossings of steam railroads and city streets. The inception of work of this character dates back a number of years and its progress has in general been marked by a broad and public spirited consideration by the city authorities and the officials of the various railroads interested, as well as by a deep interest on the part of the citizens. In some instances, with a foresight not always in evidence, franchises have been granted to railroads with the condition that certain specified crossings should be separated at some future date when the interests of the city should require it, at the sole expense of the railroad. In the majority of cases the work has been done by the city and railroad jointly, each bearing half of the total expense. In all cases work has been taken up only as part of a comprehensive plan embracing the improvement of an entire section of the city or all the crossings on a single railroad, it being the intention that eventually all the grade crossings within the city limits shall be eliminated.



Showing I-Beam Floor—Detroit Street and Nickel Plate Grade Separation.

At the present time work is in progress at several different crossings. During 1904 Detroit street was taken under the Lake Shore & Michigan Southern tracks, the railroad being carried on a through plate girder bridge with solid ballasted floor. The city required a clear span the entire width of the street, necessitating a girder 102 ft. 5 in. long. The surface of the street was depressed 20 ft. 6 in., the subway grades being 4 per cent. At Wilson avenue a similar plan was adopted for eliminating the crossing with the Erie Railroad. In this case the span of the girders was shortened by placing bents at the curb line. The street surface was depressed 18 ft., and the subway grades are 4 per cent. This work will be completed during the present season. At the crossing of Broadway and the Pennsylvania Railroad also, the street is depressed and the railroad carried overhead. This work was begun in the fall of 1905.

In the three cases mentioned the general plan is the same. The street surface is depressed and the railroad carried overhead. At the crossing of the New York, Chicago & St. Louis Railroad and Detroit street the topography favored an opposite solution. The tracks of the railroad were depresesd about 4 ft. and the street surface raised about 15 ft., giving an approach grade from the east of 4 per cent. and from the west of 0.6 per cent. This is the first crossing to be treated in this manner. As the work of crossing elimination progresses there will be many others that will admit of a similar solution and it is possible that the type of structure adopted here will be more or less closely followed in other cases.

The abutments are of concrete founded on shale rock at a depth of a few feet below the subgrade excavation. These are extended to form retaining walls for the street approaches. In the construction of these walls vertical expansion joints were left every 30 ft. The concrete was machine mixed and dumped in the forms from a drop-bottom bucket designed by the contractor. Between the tracks were built three piers, each consisting of steel columns spaced 8 ft. 2 in. center to center and resting on concrete pedestals. These columns support cross-beams of 15-in. 42-lb. I-beams, and on these cross-beams and the abutments are the floor stringers of 15-in. 42-lb. I-beams spaced 3 ft. center to center. At each street line is a light fascia girder carried by the cross-beams and abutments. The floor stringers are placed perpendicular to the center line of the cross-beams and arranged to break joints. As the crossing is on a skew, as shown in the illustration, this brings the stringers at an angle with the street line. The short ends are riveted to the fascia girders.



Track Depression in Detroit Street and Nickel Plate Grade Separation.



Concrete Curtain Walls Completed and Columns Encased in Concrete—Temporary Floor and Railing for Use During Winter—Detroit Street and Nickel Plate Grade Separation.

Supported by the floor stringers is a slab of reinforced concrete 9 in. thick at the crown and 3 in. thick at the curb line. The reinforcement consists of 1 in. by ⅜ in. flat bars. This carries the regular street pavement and two street railway tracks. The two 11 ft. sidewalks are of 5 in. slabs of concrete not reinforced. The fascia girders carry a solid railing of reinforced concrete molded in place, as shown in the detail.

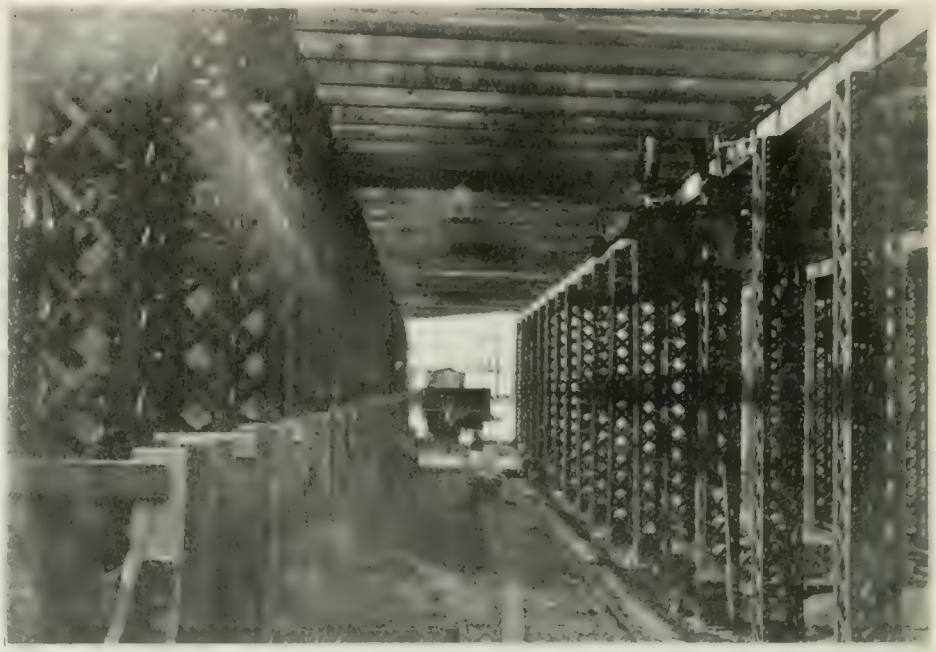
The entire structure is encased in concrete as a protection to the steel. Expanded metal and concrete covers the web and bottom flanges of the I beams and fascia girders. Between the columns of the piers an 18 in. curtain wall of solid concrete is carried up to a height of 5 ft. above the rail. Above this elevation the columns only are encased. The object of this curtain wall is to lessen the damage by a derailed car.

Construction was begun in the fall of 1904

by building as much of the retaining walls as could be built without obstructing the street. The work was then stopped until the spring of 1905, when the street was closed to traffic, the street cars detoured around the work, and the abutments were completed. Railroad traffic was then abandoned on the north half of the right-of-way and the work of track depression begun. A 65-ton steam shovel was used loading into dump wagons. The excavated material was used to fill the street approaches, the average haul being 750 ft. The average day's work for the steam shovel was about 400 cu. yds. The railroad company forces followed the steam shovel with ballast, and relaid the track which they had removed ahead of the steam shovel.

When one-half of the right-of-way had been excavated and the track relaid, traffic was diverted to that side and the shovel moved to the south side. Upon the completion of the excavation the pedestals for the columns in the piers between the tracks were built and the steel work erected. Concrete for the pedestals was hand mixed. These pedestals are founded on hard blue clay and shale at a depth of one to five feet below subgrade. There is in Detroit street a 6-ft. sewer built in tunnel, during the excavation of which the roof had caved where the sewer crosses the railroad. In excavating for the pedestals six of the pits penetrated the caved-in tunnel roof. Some old I-beams were secured and placed across the tunnel so as to insure that the weight of the bridge will not come upon the sewer but be carried by the undisturbed rock at the sides of the tunnel.

As soon as the steel work was erected and riveted the placing of the concrete metal protection was begun by concreting the columns and curtain walls. This work was completed to the level of the cross-beams in November, 1905, and there stopped for the season as it was not deemed advisable to continue this work in freezing weather. The half-tone illustrations show the work at different stages. The features of the steel work and the appearance of the piers with the concrete metal protection in place are clearly shown.

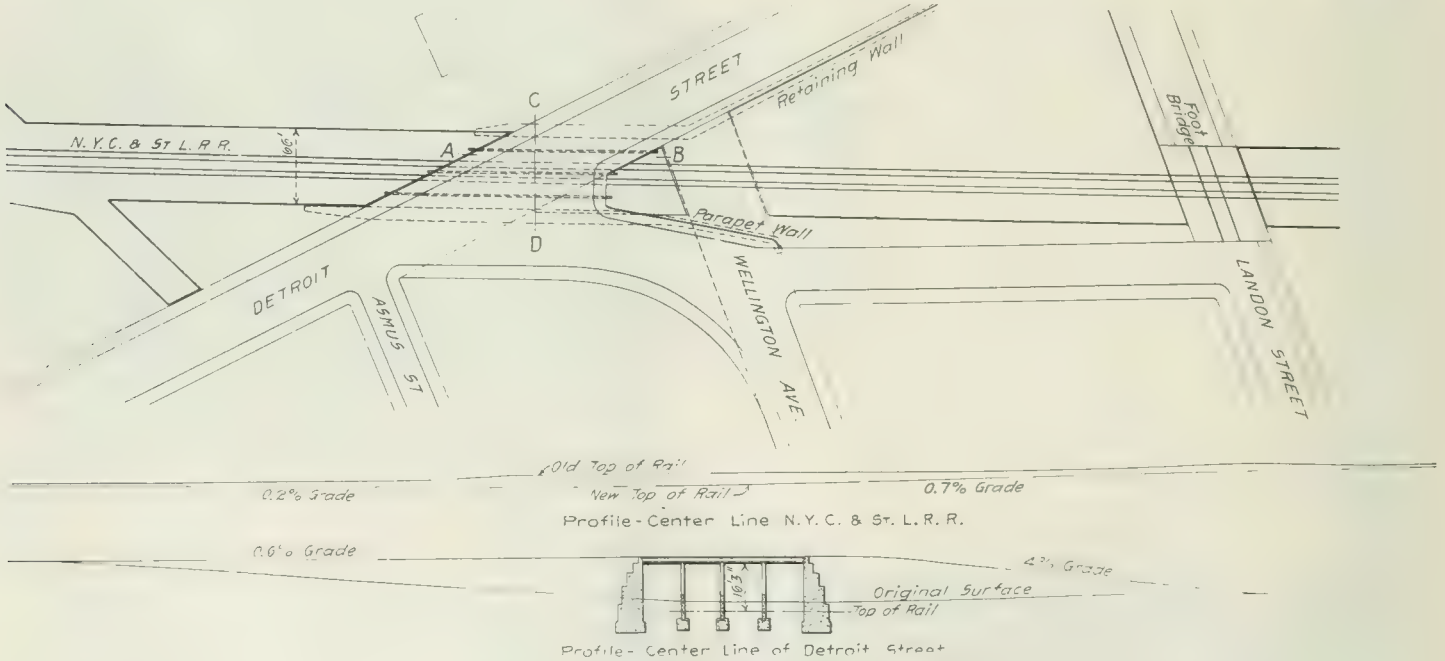


Showing Steel Columns in Piers and Forms in Place for Concreting Curtain Walls —Detroit Street and Nickel Plate Grade Separation.

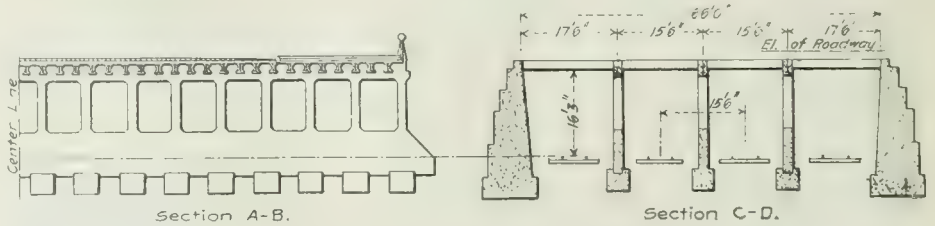
The total amount of material excavated was 25,100 cu. yds. The total amount of material filled into approaches was 28,600 cu. yds., of which about 1,500 cu. yds. came from outside sources. This would indicate that the excavated material, which ranged from sand to hard blue clay, swelled about 8 per cent.

There were in the foundations 3,537 cu. yds. of concrete. This was all mixed under the supervision of an inspector employed by the city. The proportions are 1 part Portland cement, 2½ parts sand and 5 parts stone. The stone is limestone from ½ in. to 2 in. in size. A sack of cement was assumed to measure 1 cu. ft. A careful tally of the number of sacks used each day showed exactly five sacks, or 1¼ barrels of cement per cu. yd. of concrete. The labor cost of concreting was about $1.40 per cu. yd., distributed as follows: Unloading materials, 13½ per cent., forms 21½ per cent., placing concrete 65 per cent.; wages were 15 cents and 17½ cents per hr.

There are 132 tons of steel in the structure. The labor for erecting cost about $4.25 per ton, distributed as follows: Handling plant 26½ per cent., unloading material 7½ per cent., raising steel



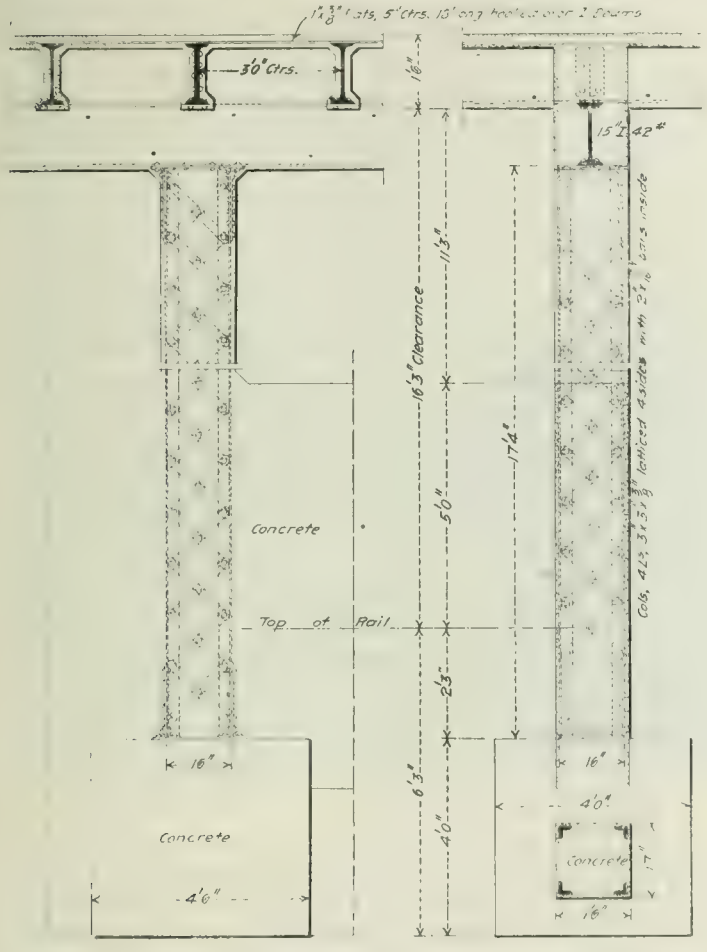
General Plan and Profile of the Detroit Street and Nickel Plate Grade Separation.



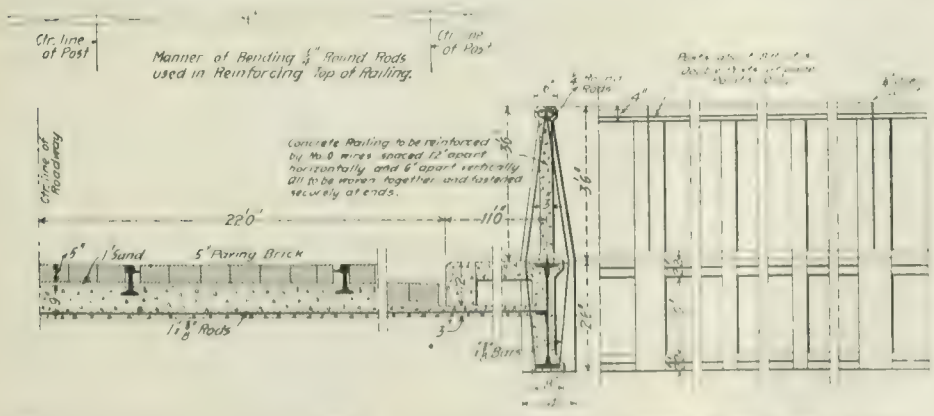
Sections Through Masonry—Detroit Street and Nickel Plate Grade Separation.



Steel Erected and Concreting of Curtain Walls in Progress —Detroit Street and Nickel Plate Grade Separation.



Details of Concrete Steel Columns and Connections—Detroit Street and Nickel Plate Grade Separation.



Details of Floor and Reinforced Concrete Railings—Detroit Street and Nickel Plate Grade Separation.

36 per cent., riveting 30 per cent. All rivets are of ¾ in. diameter soft steel, and were hand-driven. The average day's work for a gang of four men was 162 rivets. The cost was 10.3 cents per rivet. The proportion of defective rivets was 3.14 per cent. Wages were 50 cents per hour.

The contractors for the grading and masonry was The Williams Bros. & Morse Co., of Cleveland. This part of the work was sublet to J. H. Bard & Co., of Toledo. The contractor for the superstructure was the Van Dorn Iron Works Co., of Cleveland. The concrete metal protection was sublet to Masters & Mullen, of Cleveland. The work was done under the supervision of W. J. Carter, City Engineer, and F. D. Richards, Bridge Engineer, of Cleveland, and E. E. Hart, Chief Engineer, and A. J. Himes, Bridge Engineer of the N. Y. C. & St. L. R. R.

Track Circuits in Place of Detector Bars.*

In running circuits through switches it is impossible to force the current to flow through every foot of rail, and the bonding to cross-overs and fouling points must be made as perfect as possible. Jumpers should be used for both positive and negative rails. Examination of track circuits through many interlockings indicates that signal workmen are apt to get lost in wiring through switches. A great number of bond wires are put on, but through failure to trace the circuits, wires at some one or two points are left off, making the continuity of one side or other depend on the contacts between switch points or switch plates and the stock rail or through the parts of frogs. It is equally important that a reliable person should take entire care of the bonding through switches, as the situations are too complicated to be left to the trackmen.

Where, to avoid putting in short pieces of rail, it is necessary to have a dead space, this should be as short as possible; always shorter than the wheel base of a four-wheeled caboose. Track circuits should be inspected and tested every day. This can be done by raising the latches of the levers controlling various switches when trains are moving over them and noting whether the locks pick up. One hand should be placed in front of the lever while trying it with the other so that if the lock is not holding, the lever cannot be moved far enough to throw the switch. These tests should especially be made with light engines or cabins on the circuits so that a momentary picking up of the relay might be detected. A fraction of the labor and expense required to keep detector bars in reasonably good order will unquestionably keep the electric locking working with practically absolute reliability. The attention required will be no burden to the repairman, and negligence due to the fact that failures are few should not be tolerated.

The repair man should be cautioned against the mistake of imagining that the only failures to be looked for are those which would keep the lever locked. When failures locking the levers up occur, the releasing, with few exceptions, should be left to the repairman. This can be done either by an application of battery at the lock terminal or by lifting the indication latch by hand. The circuits are usually short and as a general thing very little time is required in locating the trouble. As a mater of fact there are few instances throughout the use of elctric locking that switches must be operated any length of time without its protection.

Through Altoona yard there are six electro-pneumatic interlockings with a total of 68 working switch levers equipped throughout with electric locking. The results from its use at three of the larger plants and where the movement is heaviest are as follows: At the east end of the yard, a point where all traffic passes and where all westbound freight, with the exception of high-class trains, is taken into the yard, there are 11 working switch levers. During 1905 there were three failures on the safe side and one on the wrong side. This failure was caused by just enough dead space in a circuit to allow a momentary picking up of the relay while a cabin was being pushed through the circuit by trainmen. As the dead space was just a foot longer than that required for the wheels of a cabin to stand in, we can clearly understand to what degree the electric locking is depended on by the levermen to do its work. At the west end of the yard where all trains are carried through and where the eastbound passenger trains cross the westbound freight, there are 12 working switch levers with [illegible] crossing and two double slips. From April 18

*Read before the [illegible] Association, at [illegible], March 19

1905, or when the entire interlocking was electrically locked, to Dec. 31, 1905, there were seven failures on the safe side and none on the other. The situation at the third interlocking, where there are 23 working switch levers, is particularly interesting. The plant was put in operation Dec. 17, 1905, and controls the movement to a receiving yard built from two ladders. At least 30 per cent. of the movements are made by swinging trains, which requires that after the engines have been cut lose and have run far enough to clear the locking circuits, the signals and switches must be changed, the trains allowed to run into the yard, the switches again changed and the cabins allowed to follow the engines. During the 48 days of service no failures of circuits were reported.

Revised Constitution for the Railway Signal Association.

At the Chicago meeting of this association, March 19, a committee consisting of J. A. Peabody, W. M. Camp and C. C. Anthony reported a revised constitution which, if approved, will go into effect, we suppose, next October. The new constitution consists of ten articles and embraces also those subjects usually put in a separate class and called by-laws. Provision is made for temporary changes where necessary. This constitution has evidently been prepared with great care and it embodies many improvements over that now in force. It is proposed to divide the active members into two classes. Railroad signal officers, including inspectors, supervisors and assistant supervisors, are called senior members, and all other active members "junior." Questions of standard practice are to be decided by a two-thirds vote of the senior members voting, though never at a meeting where less than 20 senior members are present. An honorary member shall be a person whose connection with the association may promote its welfare or a person of established reputation who has ceased to be actively engaged in signal work. Provision is made for expelling, at annual meetings, members who are guilty of dishonorable or unbecoming conduct, but an expulsion is not to be recorded in the published Proceedings. Dues are payable in the first three months of the calendar year for that year. The executive committee is to consist of the president, an eastern and a western vice-president, the secretary-treasurer, two executive members and the three latest living past presidents who are active members. Officers are to be elected separately by ballot, without nomination, and a majority is necessary to elect. The dividing line between the East and the West runs from Buffalo to Pittsburg and thence down the river to the Gulf of Mexico. A president shall not be eligible for re-election until five years after his first incumbency, and vice-presidents not until after one full term (two years). All terms are one year except those of the vice-presidents. No meeting except the annual meeting can approve expenditures or appropriations. The regular meetings are to be the annual meeting in October; meetings in January and May in New York, and in March and September in Chicago; but the executive committee may change the times and places of the last four.

Alternating Current Electric Systems for Heavy Railroad Service.*

BY B. G. LAMME.

In attempting to solve any new and difficult problem in the engineering field it is natural that it should be first attacked with methods and tools already at hand. The results obtained in this manner are in many cases as good as could be expected, but it is usually found that afterward new methods and tools are developed especially adapted for obtaining the best results.

In the problem of heavy electric traction the method of procedure has been very much the same as in other engineering undertakings. The first and most natural means used was that which had shown such remarkable results in light traction work, namely, the direct current system. In the application of this to heavy work, however, the necessities of the problem led to the development of a number of adjuncts, such as the rotary converter or motor generator sub-station for transforming from alternating to direct current, the use of the third rail instead of the overhead trolley on account of difficulty in collecting current, and other features of lesser importance.

As the purely direct current system developed, both in the extent of territory covered and in the size of the equipments handled, it soon became evident that the usual 550 volts was not sufficient for transmission to any great distance if much power was to be transmitted, or large equipments were to be handled. This led naturally to the transmission of the power at high voltage as alternating current, with sub-stations at suitable points for transforming to direct current for the trolley system. In this way one of the first serious limitations of the D. C. system was apparently removed, but at the expense of moving machinery of a capacity practically equal to the total car service, this machinery performing practically no other function than merely to transform from one kind of current to another. Furthermore, the transformation in these sub-stations is a two-fold, and sometimes a three-fold, one. If, for instance, rotary converters are used, the high tension alternating current voltage is first transformed to low tension in the "step down" or lowering transformers. The current at low tension is then fed into the rotary converter and is transformed to direct current. Part of the energy of the alternating current circuit passes directly into the direct current circuit, while part is transformed into mechanical energy, and is then converted into direct current energy, except that part required for overcoming the friction and certain other losses in the machine. In the case of a motor generator the energy of the alternating circuit is all transformed to mechanical energy by the motor. Mechanical power is transmitted to the generator through the shaft, and is transformed to direct current energy in the generator. Necessarily not all the alternating current energy can thus be transformed, for each change exacts its price or commission.

Further, if the alternating transmission voltage is very high, then in the case of the motor generator method it may be necessary to transform or "step down" the line voltage to a voltage suitable for the motor. This means three energy transformations in this case. However, the loss in transforming from the higher to lower alternating voltage does not involve much additional waste of energy, for the alternating voltage transformer, in general, is the most efficient known method of transforming energy, as but 2 per cent. to 3 per cent. is lost in well-designed apparatus.

On the other hand, transformation of energy by rotating machinery is much less efficient, and change from electrical to mechanical form, or the reverse, is generally less efficient than transforming directly from one electrical form to another. This indicates, in a general way, why a rotary converter sub-station has been given preference over the motor generator method in a majority of cases.

After the sub-station adjunct was developed the way seemed to be clear for a while, but as the size of the car equipments was increased it was found that another difficulty had been encountered, namely, the limited amount of current which could be taken from the overhead trolley wire. This determined the amount of power which could be delivered to the apparatus on the car. This led to the development of the present well-known third-rail system, which has been used very extensively where the power consumption for individual direct current equipments has been very heavy.

Even with the above two vital modifications of the direct current system, it is found, as heavy railway conditions are approached, that one of the weakest links in the system is the voltage drop between the transforming sub-stations and the car or locomotive. This is due primarily to the enormous currents which must be handled wtih the usual 550 to 650-volt direct current system. Suggestions have been made by prominent engineers that this difficulty should be overcome by increasing the direct current voltage to 1,000 or 1,500 volts. However, this solution has not been pushed extensively by the principal manufacturers of electric apparatus, as it is felt that this would be only a partial step in the solution of the problem, like the transforming sub-station and the third rail, and also because there are certain inherent tendencies for trouble in the present 600-volt apparatus, which would be greatly exaggerated at much higher voltages.

While the above development was being carried on, the problem was being considered in other ways. Many engineers objected to the third rail for general use, believing that a live conductor should not be located so near the ground, and that the place for the trolley wire is overhead. Recognizing that high voltage for transmission is necessary, but that, after transformation to direct current, there remains the difficulty of collecting large currents from an overhead wire, it occurred to many that a more suitable solution of the problem could be obtained by supplying the high voltage alternating current directly to the trolley wire and then utilizing it, either directly or indirectly, for propulsion of the car or locomotive.

PORTABLE SUB-STATION SYSTEM.

Keeping in view the above trend of direct current development, the most evident of such methods would be to put the rotary converters or motor generator sub-station on the locomotive itself. However, as the ordinary electric car, even of large size, has practically no place for such a transforming sub-station, this method has not been given serious consideration for such equipment. However, in the case of heavy locomotives it becomes a possible one. In theory it presents some very good points, but in practice a considerable objection is found in the size, weight and cost of the sub-station which must be carried by the locomotive. It has been suggested that this sub-station be placed upon a tender equivalent to the present tender of a locomotive, and it has also been proposed that it be placed directly on the locomotive itself.

The type of sub-station which is feasible on a locomotive or tender is much more limited than in the case of a stationary sub-station. For simplicity there should be but one overhead wire,

*From a paper presented before the New York Railroad Club, March 16, 1906.

and therefore the supply system should be single-phase alternating current. This practically limits the transforming equipment to a single-phase motor generator unit. There are two types of single-phase motors having suitable speed characteristics for driving the generator, namely, the synchronous type and the induction or non-synchronous type. The synchronous type must hold rigidly in step with the frequency of the supply system, and when carrying heavy load it can be thrown out of step by a momentary break in the supply circuit. As such breaks are not uncommon in railway service, this type of motor is considered unsuitable. There remains, then, the single-phase induction type motor for driving the generator.

Assuming, therefore, the use of a single-phase induction motor for driving the generator, it should be wound preferably for the full trolley voltage in order to avoid the additional weight of a step down transformer. This motor must have a capacity sufficient for the maximum power of the locomotive, plus all the electrical and mechanical losses other than those in the motor itself. It is self-evident that in order to reduce the weight of the motor as much as possible, it must be run at very high speed.

It may be well to look a little closer into this motor generator transforming set. Considering, first, the motor, it may be said that the single-phase induction type motor in its simple form is one of the least effective types of electric machines which we have. It is non-starting, or starts very uneconomically as a distorted polyphase motor. Its power factor, or the ratio of its true power to the apparent power supplied it or the current and volts supplied, is not nearly as good as that of a polyphase motor of the same dimensions. Its output is only about half that of a good polyphase motor built on the same frame. It is, therefore, heavy in proportion to its output. It takes a fairly large current from the line at no load. On account of its poor starting characteristics, it would preferably be kept running when the power is shut off from the car motors, and it would, therefore, take considerable current from the line when the locomotive proper is running empty, or is at a standstill for a short time. On account of its magnetic losses and the high speed at which it should be operated, this motor would have appreciable losses, even when running empty, and would, therefore, be drawing energy from the line when the locomotive is coasting or is at a standstill. On a 25-cycle alternating system such a motor could be built with two poles for 1,500 r. p. m., or with four poles for 750 r. p. m., the number of poles necessary being a multiple of two. The lower speed machine would be somewhat heavier than the higher speed one, but its losses when running empty would probably be no greater, and could even be less.

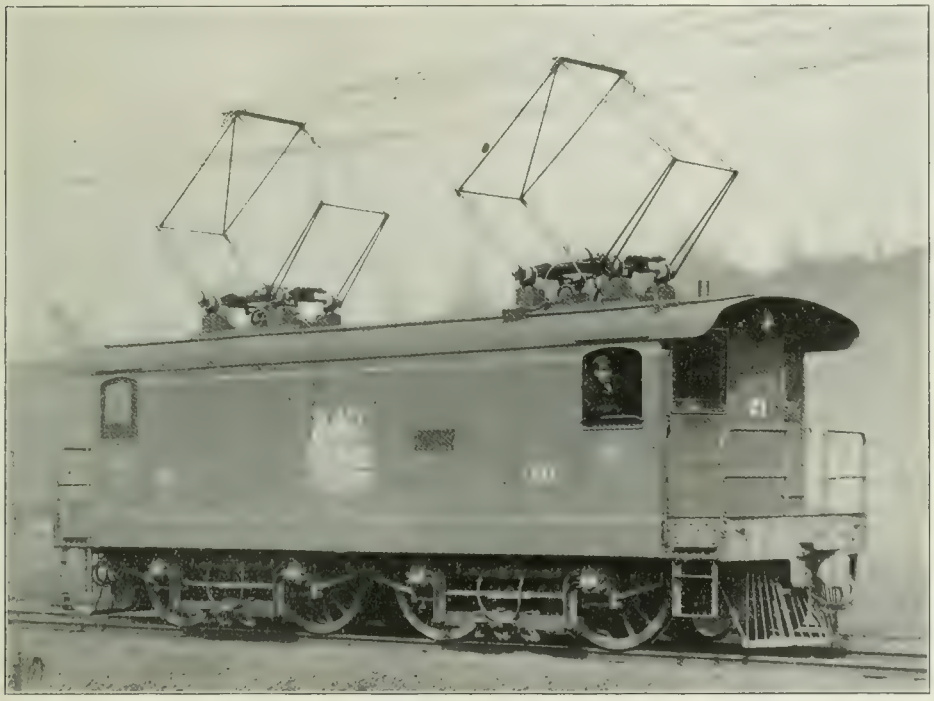
Taking up next the direct current generator driven by the above motor, it is seen from the above that it will be run at either 1,500 r. p. m., or at 750 r. p. m., corresponding to the above motor speeds as it would preferably be direct driven. The higher speed generator, being the lighter one, would naturally be chosen if this speed is not too high to permit the construction of a first-class generator of the required output. Taking, for instance, an electric locomotive of the above type, and corresponding in capacity to those being built for the New York, New Haven & Hartford Railroad, it would be necessary at times that the generator deliver an output of 1,500 kilowatts (2,000 h. p.) or more. Moreover, the load fluctuations would be violent and, therefore, a machine of first-class commutating ability is required. I do not consider that any direct current machine now built, with the above capacity and with a speed of 1,500 r. p. m. is sufficiently good for such service. This, therefore, implies a generator of questionable characteristics, or the choice of a speed of 750 r. p. m. At this lower speed the size of motor generator of the above capacity may be too great to be placed on the locomotive itself, although the weight and cost may not be much greater than for the higher speed unit.

For the purpose of comparison motor generator units corresponding to the above New Haven locomotive conditions were worked out some time ago. The approximate results are as follows, both for the 1,500 r. p. m. and 750 r. p. m. outfits:

Speed	1,500 r.p.m.	750 r.p.m.
Approximate weight	47,000 lbs.	54,000 lbs.
No. load losses	65 h. p.	65 h. p.
Combined effi., at 750 K. W.*	90 per cent.	90 per cent.
Loss at 750 K. W.	110 h. p.	110 h. p.

*1,000 h. p.

The above weights include starting apparatus, exciter, etc., but do not include the massive base plate which is usual with stationary motor generator sets, as it is assumed that the frame of the locomotive could be made stiff enough to serve for the base. The locomotive structure might require some additional weight, which should also be charged against the portable sub-station outfit.



New York, New Haven & Hartford A. C.—D. C. Locomotive.

However, the 1,500 r.p.m. unit was not considered a practicable outfit, from the operating standpoint.

Assuming, however, that such a motor generator set could be used it would permit some very neat features as regards operation of the locomotive. In case it is to be on an alternating current trolley circuit exclusively, so that the motor generator set is always used, then the ordinary direct current control apparatus can be almost entirely eliminated, for the speed of the car motors can be controlled by varying the direct current voltage delivered by the motor generator in the manner proposed by Leonard, namely, by varying the field excitation of the generator. In this way any speed within the range of the apparatus may be obtained efficiently, as there are no armature rheostatic losses and the power supplied is practically in proportion to the load. However, with this method of control a separate exciter is required for the D. C. generator, as a self-exciting machine could not be controlled over a sufficiently wide range.

If, however, the equipment must operate on both alternating and direct current as in the case of New Haven electric locomotives, then a complete complement of D. C. controlling apparatus must also be used, as the motor generator will be out of service when the locomotive is on the D. C. trolley.

In addition to the efficiency of speed control, this motor generator scheme possesses another feature which may be of value in special cases. This is its ability to feed energy back into the high voltage A. C. line by suitably exciting and controlling the car motors so that they can be made to operate in a stable manner as generators of power, such power being fed into the motor generator set and transformed and returned to the line, minus the usual commission, of course. This may be of considerable advantage in letting trains down long grades. In ordinary braking, however, it is a question whether it is worth the complication, as it means that special provision must be made for exciting and regulating the fields of the car motors.

In general, it may be said that the disadvantages of the motor generator scheme are found in the size, weight and cost of the apparatus and the relatively high continuous losses; also, there are objections, from the mechanical standpoint, to carrying a motor generator operating at high speed. The advantages of this scheme lie in the efficient speed variation, simplified control and the ability to return energy to the high voltage line, however, at the price of additional complication.

THE POLYPHASE SYSTEM

Another method of solving this railway problem based on using existing methods and means, is that in which the well-known polyphase alternating motor is used. The polyphase induction motor has long been used in stationary work in connection with high voltage transmission circuits. At first glance, it would appear as if this motor should also furnish a solution of the railway problem where high trolley voltage is required. Many of the manufacturers of electric railway apparatus have given this method care

ful study, and a number have [illegible] a commercial test on a more or less extended scale. Some of those manufacturers who at first advocated it have [illegible] it, while others, particularly the Ganz Company, of Budapest, are still very favorable to it.

Various reasons are given for the attitude of those who have discarded or [illegible] adopted this system. The most obvious of these [illegible] are as follows:

At least two overhead trolley wires.

The [illegible] characteristics of the induction type motor, prevent[illegible] speed variation.

General structural features of the induction motor at the usual commercial frequencies.

Taking the first point, it may be said that the use of two overhead wires with a high difference of potential between them is considered very objectionable by many engineers. Those advocating this system have usually talked moderate trolley voltages such as 3,300 volts. While higher voltages may be possible there is no question but that the trolley problem becomes increasingly difficult with increased voltage, and the current collecting devices, switches, cross-overs, overhead equipment of the yards, etc., present serious problems.

The constant speed characteristics of the induction type of motor have come in for much criticism when used for railway work. One law of the induction motor is that it requires a given amount of power to develop a given torque or turning effect, regardless of the speed at which it is running. At full speed the power supplied to the motor appears as useful output, with the exception of the losses in the motor itself. At one-half speed the same power applied gives but one-half full output, the remaining power being wasted in heat. At one-tenth speed, nine-tenths the power is wasted. The reduction in speed is, therefore, obtained with this motor in the same way as a corresponding reduction could be obtained with a friction clutch, namely, by wasting part of the power as heat. With an induction motor, therefore, there is no such condition as power consumption in proportion to the speed, but the power consumption is constant, regardless of the speed. It is evident, therefore, that the induction motor, in its usual form, is an inefficient piece of apparatus where the speed must be varied. This difficulty is overcome to a certain extent by using two or more motors arranged in the so-called "cascade" or "tandem" connection. With this connection a part of the power which would be wasted at lower speed in the case of a single motor is, instead, fed into a second motor and utilized to a greater or less extent. However, there is but one speed at which these two motors, connected in tandem, can operate efficiently, and below this speed the power is again wasted. The two motors in tandem act as if a single motor had been geared for lower speed. The result is the same as if one constant speed motor had been used with a high and a low gear, to give two changes in speed. These two speeds correspond to the efficient running conditions. By the addition of a friction clutch for intermediate conditions and the use of gears with two speed ratios with a single motor, we approximate closely the conditions of operation, as regards economy, that would be obtained with two induction motors arranged to be operated singly and in "tandem."

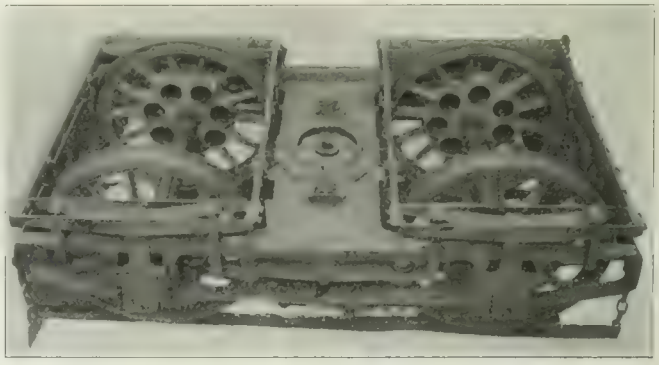
Normally the induction motor, in comparatively large sizes, closely approximates a constant speed between no load and full load. The variation in speed within these limits will usually be less than 2 per cent. Two such motors rigidly connected to the same load must have the same speeds or they will not divide the load equally. Assuming that the normal speed variation in the motor is 2 per cent. and that one pair of car wheels or drivers is 2 per cent. smaller than the other, then one motor will tend to run 2 per cent. faster than the other at all times. They will, however, automatically adjust for equal speeds by unbalancing their loads. At no load one would tend to take half its rated load as a motor and thus drop 1 per cent. below synchronous speed, while the other would tend to raise 1 per cent. above synchronous speed, and carry half load as a generator. The resultant would be equal to no load, but each motor would be carrying half load. Again, at half the rated load of the two motors, one would tend to carry no load and the other full load. In the same way at full load for the two motors, one would carry half load and the other one and one-half loads. The difference in load between the two motors in this case is always equal to that load on one motor which would be required to give a drop in speed equal to the difference in speed between the car wheels or drivers. With 4 per cent. difference between the drivers the unbalancing would correspond to the load required to drop one motor 4 per cent. in speed, or about double load on the basis of a drop of 2 per cent. at full load.

This difficulty can be overcome in a single locomotive by keeping all drivers of the same diameter or by the use of side rods, but this is not feasible when a number of separate locomotives are to drive the same load. When it is borne in mind that the drivers of different locomotives may have as much as 6 per cent. or 7 per cent. difference between the diameters of their drivers it is evident that the unbalancing of the load between two locomotives may amount to much more than their normal rated capacity unless the slip of the drivers equalizes them.

One method of equalizing the loads would be to drop the speed of all of the locomotives to that of the lowest one by connecting suitable resistances into their motor circuits. This would be effective for one given load, but would not give suitable equalization for other loads. For example, with 6 per cent. difference in diameter of drivers of two locomotives, one would tend, when running empty, to carry one and a half times load, receiving power from the line, while the other locomotive coupled to it would carry one and a half times load as a generator feeding back into the line. The use of resistance would lessen this extreme unbalancing but could not eliminate it entirely, as there must be some load on the motors in order that the equalizing resistances may become effective. It is thus evident from the above that only an average equalization of load would be practicable.

Taking up the structural features, it may be said that the induction motor is not particularly well adapted for railway work at the usual frequencies of alternating current circuits, but the reasons for this are somewhat too technical for the scope of this paper. However, the Ganz Company, of Budapest, has avoided, to a greater or less extent, a number of the structural limitations by reducing the frequency of the supply system to 15 cycles per second instead of 25 cycles, the lowest in general commercial service in the country. This low frequency presents no particular disadvantages at the generator station except in the case of small steam turbines, which can have a maximum speed of only 900 r. p. m. The frequency of 15 cycles per second is equal to 1,800 alternations per minute, which is equal to the number of generator poles multiplied by the revolutions per minute. As the least number of poles is 2, the highest possible number of revolutions is 900. This speed is lower than desired for steam turbines, except those of large capacity.

In the transmission line, however, the use of this low frequency in itself is advantageous, as it gives less line drop and loss than with 25 cycles. All transformers, however, become somewhat heavier. The real gain with this frequency, is in the motor, which can be given better proportions and characteristics.



New Haven Locomotive—One of the Trucks.

Among the advantages claimed for this system is its ability to return power to the line under certain conditions. When the induction motor is run above its synchronous speed it acts as a generator and returns power to the line. If a car equipped with such motors be started down grade with the power on, it will speed up until the motors run above the synchronous speed. Below synchronous speed the induction motor acts as a motor. At synchronous speed it does no work. Above synchronous speed it acts as a generator, but it cannot deliver power efficiently, except when running but slightly above synchronous speed. If it is desired to run much above synchronous speed, then resistance must be connected in circuit just as in the case of the motor when running much below speed and the efficiency in returning power to the line is affected by the rheostat in the same way as its efficiency as a motor is affected by the use of resistance. When running 50 per cent. above synchronism, a considerable amount of power is wasted, just as when running 50 per cent. below speed.

In this and in the preceding cases where mention has been made in regard to returning power to the line, it must be kept in mind that there must be some load connected to the line which can absorb this power. A single locomotive on the line cannot return power advantageously because there is no load except the normal light load losses in the line and transformers. Therefore, the return of energy would possess no particular advantages as the practical way to get the additional load would be to connect a rheostat across the line and thus waste the power returned to the line. However, in a system where there would always be a number of locomotives in operation with a considerable portion of them taking power from the line, there would be some advantage in restoring power.

ARNOLD'S ELECTRO-PNEUMATIC SYSTEM.

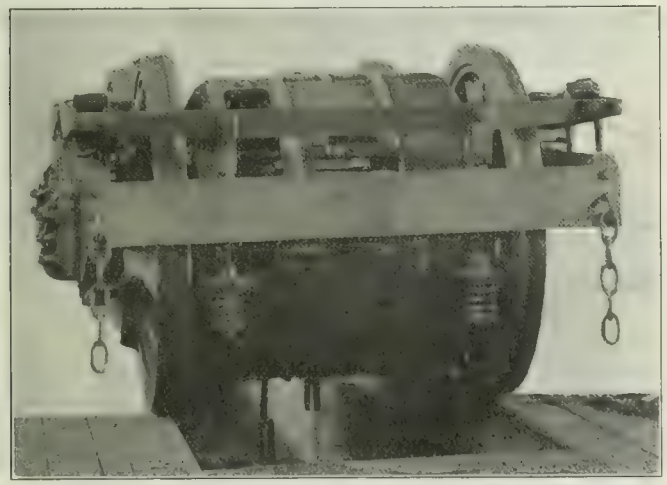
Another method of solving this railway problem with high voltage trolley was that proposed and tried by Mr. B. J. Arnold. He recognized at an early period the advantages that could be obtained with high voltage and a single trolley wire, and he, therefore, adopted single-phase alternating current for his supply system. However, it was again attempted to carry out the work with tools at hand, and the only motor available at that time for use on his single-phase trolley system was the single-phase induction motor. As already mentioned in connection with the motor generator method, this motor has very bad characteristics in regard to starting, overload capacity, etc., and Mr. Arnold, therefore, proposed to supplement the single-phase motor with certain compressed air appliances which would furnish the characteristics lacking in the motor itself. The motor was intended to run at or near its normal load most of the time, while the air apparatus was to do the starting and was to assist in taking care of abnormal conditions. Variable speed operation was also to be obtained by means of the air apparatus. This system differs from the preceding ones, and one notable feature was that the electrical apparatus was in reality a minor feature of the scheme, many of the desired locomotive characteristics being obtained by mechanical means, as distinguished from electrical.

SINGLE-PHASE SYSTEM.

By this time the problem was becoming better understood and at this stage another system was brought forward which was specifically designed to meet the varied conditions of heavy traction service. This system contains the following features:

1st. Alternating current is used on account of its facilities for transformation.

2d. One trolley wire only is used, by adopting single-phase alternating current.



Truck Showing Motors in Place.

3d. With alternating current and one trolley wire only, any desirable voltage can be used on the trolley line.

4th. By using alternating current an efficient means for varying the voltage to the motors is obtained. With single-phase there is one only supply circuit to be handled, and the variable voltage apparatus can be given the simplest and most efficient form.

5th. A type of motor was developed which can have its speed varied by varying the voltage supplied to it, and which uses power practically in proportion to the load, when operated in connection with the above variable voltage supply circuit.

6th. The motor is preferably wound for low voltage and the same transformer which is used for stepping down from the trolley voltage to the motor voltage can also be used for obtaining the desired voltage variation, for varying the speed, and the power in proportion to the speed.

7th. The motor is inherently of a variable speed type and can automatically adjust its speed to that of other motors driving the same load, with but very small unbalancing of the loads on the individual motors.

8th. The type of motor developed is one which can be used on direct current also.

The above covers the principal features of what is now known as the single-phase railway system. It may be noted that most of these appear in one form or another in the preceding systems, which have been described. It is intended to cover practically all the best features of the other systems. It is, in fact, a tool especially designed to do a particular piece of work, and is not primarily an adaptation of existing apparatus to a new condition. The single-phase system may be described briefly as follows:

Single-phase alternating current is fed either directly from the power house into the trolley line, or from a high-voltage transmission circuit by step-down transformers, into the trolley system. A high-voltage trolley current is carried into the car or locomotive and is stepped down to a suitable voltage to be applied directly to the motors themselves. At the same time the step-down transformer is provided with variable voltage connections whereby the voltage supplied to the motor can be varied up or down over any desired range. The type of motor used is one in which the speed varies directly as the voltage applied to it is varied. Speed control is thus obtained without wasting energy other than that in the motor itself. It, therefore, permits efficient speed control over any range desired by simply varying the voltage over the necessary range. There is but one transformation of energy between the high-voltage trolley wire and the motors which is that of the step-down transformer, and as stated before, the alternating voltage transformer is our most efficient device for transforming energy. At the same time this transformer serves the double purpose of transformation and regulation, as mentioned above.

This method of varying the speed by varying the voltage supplied to the motor is not limited to this particular type of motor, for the ordinary D. C. railway motor can have its speed varied in the same manner. However, with direct current, no simple means has yet been devised for varying the voltage efficiently.

The control of the speed and power by varying the voltage may be roughly compared with the control of a steam locomotive by varying the steam pressure. Throttling varies the pressure applied at the cylinders and thus varies the speed and power. However, the equivalent of the variable cut off is not found in the motor, but it may be said that voltage control in the motor is the equivalent of combined throttling and variable cut off in the steam engine.

There are several variations in the types of single-phase motors used by the different manufacturers, but the principal features of the system are common to all. In its characteristics of variable speed over any desired range, and consumption of power in proportion to the load, the single-phase equipment is on much the same footing as the steam locomotive, as just indicated above. The equipment also possesses the ability to operate at increased speed by increasing the voltage above the normal and can thus make up for lost time, when desired.

As mentioned before, it is important that under certain conditions an electric locomotive should be able to act as a brake, or to return energy to the line, as when taking loads down grade, for instance. There is but one way in which the car equipment can act as a brake, namely, by reversing the function of the motors and converting them into generators of power, the driving power being furnished by the train in movement. In acting as generators there are two ways in which an electric equipment can expand its power: First, by wasting it in resistance as heat, and, second, by feeding it back into the line in case there is any other load on the line which can absorb the power.

The motors of the single-phase system can readily meet the first of these conditions, namely, that of feeding power into a resistance. As the motors are of the commutator type, and are, in reality, first-class direct-current machines, they will readily pick up as D. C. generators and can feed power into a suitably proportioned resistance. This method of braking is perfectly feasible, provided the controlling apparatus and car circuits are arranged for this purpose.

Consider, next, the case of feeding power back into the line and controlling it. It would appear when looking at the problem broadly, that a motor which could have its speed and power varied so economically over a wide range, should also be capable of reversing its functions and becoming a generator of power with an economical control over a wide speed range; and it has been determined in an extended series of shop tests, that the single-phase type of railway motor does possess this property under certain conditions. A number of ways of doing this in a more or less successful manner have been tried. Some of these methods are very effective, and permit practically perfect control of the power and speed during braking, or when returning energy to the line. Such an arrangement would probably not be advisable for merely stopping trains. Its true field would be in letting a train down a grade of such length that the power is returned to the line for a long enough period to represent a fair proportion of the total time of operation. Both this method and that where the power is absorbed in a rheostat, are valuable in relieving the wear of the brake shoes, which is a very important item on very long grades.

The resistance method of braking, although not as efficient as the other, has one advantage, in that it is independent of the supply system. Therefore, in case the power goes off when the train is descending a grade the resistance method of braking would still be effective.

In the past few months two contracts have been taken by the Westinghouse Electric & Manufacturing Company for single-phase railway equipment involving locomotives of steam railway size. These are for the equipment of part of the New York, New Haven & Hartford Railway system and for the electrification of the St. Clair

or Sarnia tunnel, under the Detroit river, on the Grand Trunk Railway. The former equipment will operate under high speed passenger service conditions, while the latter approximates freight locomotive conditions. A brief description of these two proposed installations may be of interest.

THE NEW HAVEN SINGLE-PHASE EQUIPMENT.

In this case the problem is somewhat complicated by the fact that the locomotives must operate on direct current over the New York Central part of the New Haven system, and on alternating current on its own part of the line. However, this complication is not nearly as great as would appear at first thought, for the type of locomotive chosen is one which adapts itself well to both classes of service. However, there is necessarily some duplication of parts on the locomotive, such as the collecting devices, certain details of the controllers, wiring, etc. On the other hand, it is surprising how many parts are common to both classes of service.

As 11,000 volts will be applied directly to an overhead trolley and as the trolley system will span from four to six tracks, it is evident that a very substantial overhead construction must be used. The construction of this overhead system is one of the most interesting features in this whole electrical system.

The trolley system is to be suspended from steel bridges which span from four to six tracks normally, and even a greater number at special points. These bridges are placed at intervals of about 300 feet, and at points about two miles apart heavier structures, called anchor bridges, are placed.

The steel cables which support the trolley wire proper are supported by massive insulators on the bridges. Two cables are used for each wire, and form a double catenary suspension carrying the trolley wire by means of triangular supports. The double system of suspension gives increased stiffness to the trolley construction. The triangular supports are placed about 10 ft. apart. The steel cables have a total sag of about 6 ft., while the trolley wire itself is maintained in a practically horizontal position.

At points corresponding to the anchor bridges, that is, about two miles apart, each trolley wire is broken by section insulators and is connected to the other trolley wires and to two feeder wires through automatic circuit breakers. Otherwise each trolley wire, with its cables and supports, is insulated from the adjacent wires. In this way each wire is sectioned and a short circuit on any one section can cut it out without putting the neighboring wires out of service. The two feeder wires just mentioned are carried the whole length of the alternating system, and by means of these and the arrangement of automatic switches, any entire section of four or more trolleys could be cut out of service and the sections beyond can be kept in service.

The trolley wire has a nominal height of 22 ft. above the track. This height will vary a few inches up or down with wide variations in temperature. The pantagraph type of trolley used on the locomotives has an effective range of about 8½ ft. and therefore a very considerable variation in the height of trolley is permissible.

The overhead system is designed to be amply safe under abnormal conditions, such as high wind or heavy coating of ice. The stresses in the supporting cables with a load of ice ½ in. thick or 1 in. total, each side, on the cables, hangers, etc., will be about 1/6 of the ultimate. The stresses in the structure due to wind have been figured on a basis of 16 2/3 lbs. per square foot, projected surface for the cables and 25 lbs. per square foot normal surface for flat surfaces. This is on a basis of the cables being covered with ice as given above. Allowance is made for double these pressures in summer when there is higher wind velocities, but under this condition the cables will be of much smaller diameter in the absence of ice.

As 11,000 volts is used on the trolley system, no transforming stations are necessary on the part which is now to be installed. The high voltage trolley system will extend about 19 miles in one direction from the power house and about three miles in the opposite direction to Stamford. This system could be extended in the latter direction approximately 20 miles further, if desired, without transforming sub-stations. Therefore, about 40 miles of the trolley system can be supplied directly from the main power house. With a locomotive load representing 4,000 k.w. about 19 miles from the power house and a corresponding load 15 miles away, or four miles from the power house, the drop at the end of the line will be about 13 per cent. This drop is on the basis of feeding into the load from one direction only. If there were a transforming sub-station about 40 miles away from the power house, feeding into the same trolley system, then the drop at a point 20 miles away would not be 13 per cent. but would be considerably less, as power would be supplied from both directions. It is apparent, therefore, that with sub-stations along the line feeding into a common trolley system, such sub-stations could be possibly 60 miles apart. For example, if a transforming sub-station were placed in New Haven about 40 miles away from the power house, the drop at the midway point between the sub-station and power house would be equivalent to a load on the present system at 10 to 15 miles from the power house. However, the above distances between sub-stations are so great that it might prove inadvisable to feed more than one or two sub-stations from a given plant, two or more power plants being installed on a very long system.

THE LOCOMOTIVE.

This is the part of the electrical equipment which will doubtless excite the most interest, principally because it is a newcomer in an old field. From the standpoint of the designer the generating system and overhead construction may present just as interesting features, but to the layman in the electrical field there is but little with which to make comparison; but when it comes to the locomotive the general problem is much better understood.

The frame, trucks and cab of this locomotive were built by the Baldwin Locomotive Company, on designs developed after many conferences between the New Haven Railway Company, the Baldwin Locomotive Company and the Westinghouse Electric and Manufacturing Company. The design adopted was partially determined by the fact that the motor equipment must be suitable for use on both alternating and direct current. This to a certain extent controlled the number and size of the motors and thus affected the construction of the trucks and other parts. The results have turned out so well, however, that there is every reason to believe that this type of locomotive will be used in future even where alternating current alone is used.

The mechanical construction of the locomotive presents many novel and interesting features which deserve special consideration. The running gear consists of two trucks, each mounted on four 62-in. driving wheels. The length of wheelbase is 8 ft. The side frames are of forged steel and to them are bolted and riveted the pressed steel bolster carrying the center plate. The weight on the journal boxes is carried by semi-elliptic springs with auxiliary coiled springs under the ends of the equalizer bars, to assist in restoring equilibrium. The bolsters are 30 in. wide at the center plate, and are widened, where bolted to the side frames, to nearly double this amount, thus giving a very strong construction without excessive weight. The center plate which transmits the tractive effort to the frame is 18 in. in diameter, and will be lubricated to permit a perfectly free motion in curving. The truck centers are 14 ft. 6 in. apart.

Owing to the fact that the entire space between the wheels is occupied by the motors, it was impossible to transmit the draw-



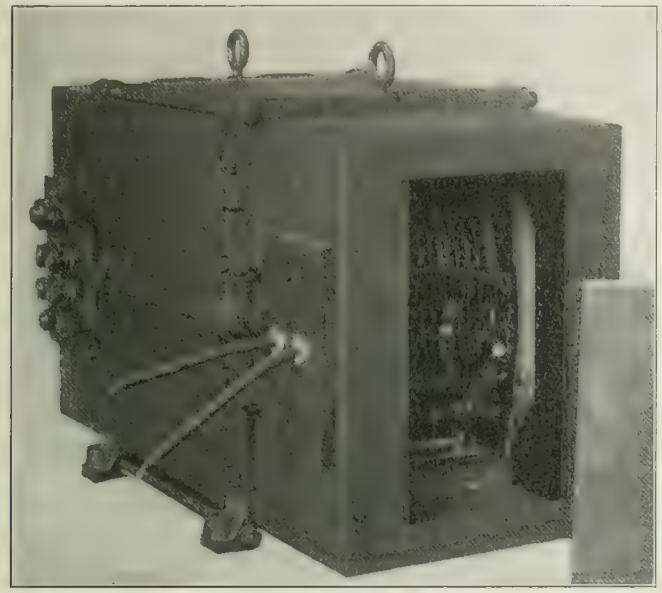
Driving Wheel With Caps Removed to Show Pockets for Driving Pins on Quill.

bar pull through the center line of the locomotive in the usual way. Instead of this, strong plate girders heavily cross braced are carried outside of the wheels and the entire strain of the drawbar is carried to these through strong box girders having top and bottom plates 42 in. wide. Directly underneath the girder at each end is a Westinghouse Friction Draft gear to which the drawbar is attached. The entire design lends itself to a very strong construction without great weight. The cab is built up of sheet steel on a framework of "Z" bars. The apparatus inside the cab is carried on a framework of structural steel which is built into the cab and firmly anchored to floor and ceiling. Over each motor is a large trap door which permits easy access to motor bearings, brushes, etc.

The motors are four in number, each of 250 h.p. nominal

capacity, but with a continuous capacity of over 200 h.p. each, or over 800 h.p. total. The motors are of the gearless type, and are wound for a normal full load speed of about 225 r.p.m. They are connected permanently in pairs and require about 450 volts at the terminals on alternating current and 550 to 600 volts on direct current.

The frame and field of each motor are split horizontally, and can be removed in halves in order to give access to the inside of the field or to the armature. The armature is not placed directly on a shaft, but is built up on a quill through which the car axle



New Haven Locomotive—One of the Two Step-Down Transformers.

passes with about 5/8 in. clearance all around. On this quill, at each end, are placed bearings which carry the field frame.

At each end of the quill is a flange from which projects seven round pins, parallel to the shaft, into corresponding pockets in the hub of the wheel. Around each pin is placed a coiled spring wound with the turns progressively eccentric. These springs are contained between two steel bushings, the smaller of which slips over the pin, and the larger fits in the pocket in the wheel. These springs are amply strong to carry the entire weight of the motor, but are normally required to transmit only the torque of the motor and to keep the motor axis parallel to the axle. They allow a total vertical movement of about ¾ in. The end play of the motor, instead of coming directly on the wheels, is taken by strong coiled springs inside of the driving pins which press against covers in the outer ends of the spring pockets in the wheels. The torque on the motor frame is taken by heavy parallel rods which anchor the frame to the truck above and below the axle. These rods permit vertical or side motion of the motor, but prevent excessive bumping strains from coming on the motor-driving spring. The entire weight of the motor is normally carried on springs supported from a steel frame surrounding the motor and resting on the journal boxes.

The motors are internally of the same general type which the Westinghouse company has been building for some time for interurban service. However, due to the relatively low speed of the motors, the maximum commutator speed is very low, being less than 3,000 ft. per minute when the locomotive is making 60 miles per hour. This may be compared with 5,000 to 7,000 ft. commutator speeds which are frequently attained in both D. C. and A. C. high-speed service with fairly large motors.

One interesting feature in these motors is the method of cooling. As a blower is used in the locomotive for cooling the lower transformers, it was decided to extend this method of cooling to the motors also. In the floor of the cab is an air conduit of considerable size from which air is piped to each motor. This method of cooling improves the continuous capacity of the motors, as evidenced by the above figures, which show that the continuous rating is almost equal to the one-hour rating. A further very great advantage in this method of cooling lies in the fact that the motors can be kept very clean in this manner, as the inside of the motor is kept under partial pressure at all times, tending to keep out dust and dirt, as all air flow is outward. The air furnished to the motor, being taken from the inside of the cab, can be kept relatively clean and dry.

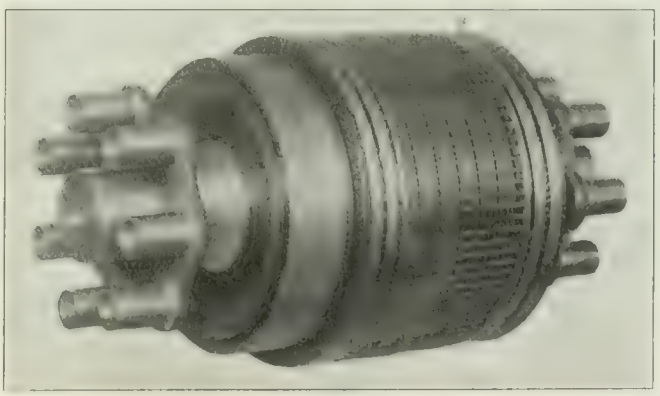
On the direct current part of the line, current is taken from the third-rail system, except in the case of some short sections at cross-overs fed from an overhead trolley on direct current. The motors are controlled in the usual series parallel method in combination with resistance, as in ordinary D. C. practice.

On alternating current the motors are not operated in series parallel as on D. C., but are connected permanently in a given manner and the supply voltage is varied. This gives an equivalent of the series parallel, except that the number of efficient operating steps is much greater. On A. C. operation no resistance is used in regular running, but a slight amount is used in passing from one working step to the next, this being in the nature of a preventive device to diminish the short-circuiting effect when passing from one transformer tap to another. There are six operative voltages, or running points, on the A. C., corresponding to six taps on the lowering transformer, while there are a small number of intermediate steps which are used only in passing from one working point to another. Experience has shown that the number of steps on A. C. required to give a smooth acceleration is considerably smaller than required on D. C. In consequence the controller is so arranged that on A. C. about half as many steps are used as on D. C. The tests have shown that the acceleration on both A. C. and D. C. is very smooth.

There is one feature in the D. C. control which is not generally found at the present time on direct current equipments, namely, shunting the field for higher speeds. On the series position on D. C. the motors have an efficient running point. It is usual railway practice to pass from the series to multiple position by introduction of resistance, there being no intermediate efficient running speed. On the New Haven equipments, however, the type of motor used is one which permits an almost indefinite shunting of the field without affecting the commutation or operation otherwise, and advantage is taken of this to obtain several higher speeds by shunting the fields before passing into multiple. In this way several efficient running points are obtained between the series and multiple. The tests have shown that these motors will operate in a perfectly satisfactory manner on direct current with their fields shunted down to much less than half their normal strength.

When operated on direct current, as stated before, the current is fed directly to the motors. On alternating current, however, step down transformers must be used, as the A. C. trolley voltage is 11,000. The step down transformers are two in number, one on each side of the cab, in order to balance the weight in the cab. It must be borne in mind that these transformers are the heaviest single pieces in the cab and there would be considerable difficulty in placing a single transformer to advantage. A further reason for two transformers is that an injury to one would not entirely disable the locomotive. The transformers are connected in parallel across the high voltage, but on the low voltage side each transformer feeds one pair of motors, through a separate control unit. This means that the controller when operated on A. C. consists of two normally independent units.

The main controllers are of the well-known Westinghouse electro-pneumatic unit switch type. The design, however, differs somewhat from the straight D. C. type, due to the fact that switches, blow-outs, etc., must operate on both alternating and direct current



Armature Complete, With Quill.

as many parts of the controller are common to both. It may be mentioned also that the reversing switches are of the unit switch type.

The main controllers are operated from master controllers at each end of the cab. The controller system is arranged for multiple unit operation so that two or more locomotives may be coupled to the same load.

In addition to the controlling and transforming apparatus there are a number of auxiliary parts, such as two air compressors driven by motors which can be operated on either A. C. or D. C., two blowers driven by similar motors, for furnishing air to the transformer and motors, and to the D. C. rheostat. It may be mentioned that the air which passes through the transformers is also sent through the rheostats. When operating on A. C. the transformer is heating the air which passes through, and this air would

not be very effective in cooling the rheostat. However, when running on D. C. the transformer is idle, and the air passing through becomes effective in the rheostat.

The locomotive is equipped with devices for collecting both alternating and direct current. For the latter there are eight collecting shoes, four on each side of the locomotive, arranged in pairs of two each. There are, of course, two pairs on each side, one at each end, for the purpose of bridging such gaps as are necessary in the third rail system. There must be shoes on each side, as the locomotive must be able to make contact with the third rail when turned end about. These D. C. contact shoes must also be able to work on two forms of third rail, one in which the shoe runs under the rail and the other where the shoe runs on top of the rail. The locomotive is provided with a pantagraph low tension overhead D. C. trolley to conform with certain New York Central requirements.

For collecting alternating current the locomotive is provided with two pantagraph type high tension bow trolleys. Each trolley has a capacity to carry the total line current under average conditions, but two are provided to insure reserve capacity.

Each of these locomotives is to be able to handle a 200-ton train in local service on a schedule of 26 miles per hour, with stops averaging about two miles apart. In order to make this average speed the maximum speed will be about 45 miles per hour.

One locomotive will also be able to handle a 250-ton train on through service. For heavier trains than this it is intended to couple two locomotives together and operate them in multiple. This presents no difficulties, for, as stated before, the locomotives are fitted up for the multiple unit system of control.

It is evident from the above description that the engineers of the New Haven Railway Company have had in view the adoption of an electric system which is particularly well adapted for future extensions. If the electrification were to stop at Stamford, then the full advantage of the alternating system would not be obtained. However, the section which will be electrified with alternating current is of sufficient length to enable the New Haven Railway engineers to determine the advantages and possibilities for future extension, and it is safe to predict that such extensions will be made in a comparatively short time.

SARNIA TUNNEL.

This equipment is to be on a relatively small scale as compared with the New Haven, as there are to be five locomotives of 750 h.p., which can be operated singly or in multiple as desired. These locomotives are to be of comparatively low speed, developing their rated horse-power at 10 to 12 miles per hour. The service is very intermittent.

On account of the low speed of these locomotives the motors are geared to the axles. As the normal axle speed is about 60 r.p.m., it is impracticable to get a motor of the required capacity into the available space, if made of the gearless type. The motors are therefore designed for a speed of about five times that of the axle.

Except for the fact that they are of the single reduction type instead of gearless, the motors are very similar in general features of construction to the New Haven motors. The whole equipment, however, is simplified somewhat by the fact that alternating current only will be used.

On account of the limited height of the tunnel it is found advisable to use only 3,300 volts on the trolley wire. However, as the length of the electric part of the system is comparatively small, this does not impose any very severe conditions. It is probable, however, that in case the electric zone at either end of the tunnel should be greatly extended, it would be advisable to use 6,600 volts on the additional sections, with transformers on the locomotives, so arranged that they could be switched from a 3,300 volt connection to 6,600 volt connection, or vice versa.

As this system as a whole has been very fully described in various technical journals it is not necessary to go into it more fully at the present time.

DISCUSSION.

Mr. W. J. Wilgus, Vice-President, N. Y. C. & H. R. R. R.—The motives in the minds of steam railroad men when considering a change of motive power from steam to electricity, in the majority of instances, are based upon one or both of the following conditions:

(a) The desire or necessity to abate smoke nuisances in tunnels or terminals in large cities; or

(b) The improvement of passenger service to attract an increased patronage by the public.

In other words, steam railroad companies at the present stage of the development of electricity as a motive power, do not consider its use from motives of economy but from those of necessity or from the broader policy of improving public service. To accomplish these objects, safety, reliability and earning capacity should be borne in mind, as follows:

SAFETY.

Whichever electric system is adopted, full consideration must be given to the question of safety to the employees of the company and to the public. Of decreased dangers from collisions with the use of electricity there is little to be said at this discussion, but increased dangers from working conductors involves the selection between the third rail working conductor with D. C. current, and the overhead construction with A. C. current. Both forms of construction have their disadvantages but, properly installed, neither offer any more cause for apprehension on the part of railroad men or the public than elements of danger that exist with ordinary steam railroad equipment, as for instance, boilers carrying heavy pressures and fires on steam locomotives. As between these two forms of construction, however, there has been more or less heated discussion and as a rule the impression seems to have gone forth that the third rail is dangerous and that the overhead construction is absolutely safe.

I would not like to be considered as condemning either as I feel that there will always be local conditions that will require the use of either or both. I think, however, that it is only fair that the advantages and disadvantages of both should be made plain to those who are contemplating the future change from steam to electricity.

Properly designed and protected, the third rail may be said to have the following disadvantages:

(a) Hindrance to ordinary maintenance of track.

(b) Danger from derailments.

Other objections have been made as, for instance, troubles with snow and sleet, complications at frogs and switches, difficulties of current collection and great danger to employees and trespassers. Extended experiments under my direction have proven the fallacy of these objections, provided the rail is properly designed and protected. Objection has also been made to the use of third rail because of interference with the clearance lines of equipment, but inasmuch as several trunk line railroads have already adopted third rail so as to fix the standard outlines of equipment, other railroads must naturally adjust the outlines of their equipment to the clearance diagram that has already been adopted to fit third rail conditions in order that traffic may be interchanged.

Overhead construction has the following disadvantages:

(a) Inelasticity of construction which prevents the laying of additional tracks or changes of grade and alinement without requiring radical expensive alterations in the permanent overhead structures. For instance, it has recently been necessary in the electrification of about 50 miles of double-track on the West Shore Railroad to decide in favor of third rail because by so doing $400,000 was saved that otherwise must have been spent for the increased cost of the overhead construction designed for anticipated future conditions that might not become necessary for between five and ten years.

(b) Danger to trainmen on the tops of freight cars.

(c) Danger to the public at overhead street and highway bridges.

(d) Danger to trains in tunnels and at other places with restricted clearances, owing to the possibility of rearing cars in cases of collision or derailment making contact with the highly charged conductor.

(e) Danger from derailments knocking down a supporting structure which would affect not only the track upon which the derailment occurs, but also all tracks on, for instance, a four-track railroad, with the possibility of accident to more than one train.

(f) Danger to trains where the overhead conductor carrying, for instance 11,000 volts, is within two or three feet of moving cars. In the city of New York, for instance, the public authorities have even taken a decided stand against wires carrying high voltages on transmission lines remote from the track.

(g) Corrosion due to freight locomotive gases.

On the question of safety it may therefore be concluded that properly designed working conductors, either third rail or overhead, offer as much safety as is now enjoyed with present steam railroad equipment, that both types of working conductors are necessary for the full development of the art, and that as between D. C. systems with third rail and A. C. systems with overhead construction a selection of either may be made to properly fit local conditions, with the preference from a non-electrical standpoint in favor of third rail.

RELIABILITY.

One of the arguments urged by the steam railroad men against the adoption of electricity for heavy railway service is the superior reliability from the fact that the breaking down of one unit still leaves unaffected other units on the system; whereas with electricity, the failure of the power station or line brings all units to a standstill.

To meet this argument it seems imperative that those charged with the responsibility of changing motive power from steam to electricity must reduce to a minimum the chances for a wholesale interruption of traffic. This object can be attained as follows:

(a) Power stations may be constructed in duplicate so that in case of the failure of one the other, by utilizing its overload capacity and spare units, will permit the entire system to be oper-

ated, although possibly with some reduction of efficiency. The New York Central & Hudson River Railroad has adopted the two power station idea, either one of which under above conditions, can operate its system with full efficiency.

The first impulse may be to criticize this policy as expensive, but it should be borne in mind that by so doing the requirement of reliability is obtained, and moreover, as those operating the system become expert in preventing troubles, the surplus power may be utilized for taking care of the expanding traffic of the company. Already we see ahead the necessity for the use of this surplus energy and in the meantime we are amply protected against the usual troubles in starting a new system.

(b) The transmission line should, where possible, be in duplicate, and the working conductor should be such in fact as well as in name and not utilized for transmission purposes. In other words, the working conductor should be sectionalized so that in case of breaks of any kind the trouble will be confined to the section in question, leaving the remainder of the road to be operated without delay to trains. The system described by Mr. Lamme appears to omit a consideration of this feature so that in case of a breakage of the overhead construction not only will the working conductor be out of service at the point of trouble, but the entire system will be at a standstill. In other words, should a derailment or any other occurrence cause the collapse of the supporting members of the overhead construction as proposed by Mr. Lamme, not only will the trolley wires but also the feeder wires be broken and all power will be cut off from trains.

(c) In order to guard against interruption of service batteries have been considered a necessity on trunk line railroads. This has been urged not only by the advocates of D. C. current but by some of those most prominent in the A. C. field, and it is therefore somewhat surprising that those who have been the most urgent in their advocacy of batteries for D. C. installation should now consider them unnecessary where they are advising the use of A. C. current. Certainly conservative railroading on trunk lines carrying frequent passenger, mail and express trains should leave no stone unturned to guard against interruption of traffic and thus meet one of the strongest arguments that has been raised by those believing that steam railroad practice with independent units is far superior to electric traction. If this is conceded, the cost of batteries is just as legitimate a charge against the use of A. C. electric systems for heavy railway service as for the D. C. system, and even more so if but one power station is used as contemplated in the system described by Mr. Lamme. I merely bring out this point in fairness to both systems.

(d) *Locomotives.*—The relative technical advantages of A. C. and D. C. systems for heavy railway service I will leave to those who are far better qualified to discuss them, merely calling attention to the wisdom on the part of the steam railroad men to adopt the system not only best suited to local needs, but, moreover, the one which by long experience or careful experiment is proven to be worthy of adoption in such a revolutionary step as the change from the long tried steam locomotive to electric motive power in districts where a failure would be disastrous. In other words, the responsibility on the steam railroad men of the change from one kind of power to another is sufficiently heavy without adding to it the use of untried systems.

EARNING CAPACITY.

To secure increased earning capacity in making a change from steam to electricity a change must also be made in the operating conditions that by long experience are known to bring about the creation of a new remunerative traffic. We all know that when the change from horse cars to electric cars was first proposed many arguments pro and con were made as to the relative cost of operation and therefore the effect upon earnings. Almost, immediately, however, the question of comparative cost of operation disappeared because it was discovered that the improved conditions, entirely apart from the cost of operation, created enormous increase of traffic that made the advantages from the use of electricity self-evident.

The causes of these benefits alike to the public and to the railroads were:

(a) Increased speed, which was obviously attractive to the public and which increased the capacity of the railroads.

(b) More frequent stops without corresponding loss of speed, because of quicker acceleration.

(c) More frequent units.

When a steam railroad finds it desirable to change its motive power on its through trains which must be handled by locomotives, should it not at the same time follow in the footsteps of urban railroads and adopt the same flexible system of train units for its suburban traffic? By so doing trains made up of a desired number of cars may be run with the frequency best suited to the volume of traffic at different times of the day without in any manner affecting acceleration, which in turn is largely the measure of the capacity of the road. For instance, with the multiple unit system at certain hours of the day trains of three cars will be sufficient whereas at the rush hours trains a few minutes apart may be made up of as many as 10 or 12 cars.

With multiple unit operation the power of the train is always proportioned to the load and there is therefore a uniform acceleration; whereas with locomotive operation the larger the number of cars the slower the locomotive is in starting. Moreover, in congested terminals the use of multiple unit self-moving cars dispenses with switching, flying movements and duplicate interferences across the throat of the yard.

Therefore the more frequent trains possible with multiple unit operation, quicker acceleration and higher uniform speeds, all combine to make attractive to the public the territory along the railroad adopting that system; whereas a mere change from steam to electric locomotive practice, whether of the A. C. or D. C. system, brings to the railroad none of the increased earning capacity which it should secure when incurring this large expense.

SUMMARY.

Admitting that the purpose of a change of motive power for heavy railroad service from steam to electricity is to abate the smoke nuisance and improve the passenger service so as to make travel more attractive, the electric system that is adopted, whether direct current or alternating current, must employ the safest appliances known to the art, must have all possible safeguards against interruptions due to troubles in the power station and on the line, must employ well tried apparatus that has passed beyond the experimental stage, and must be thoroughly flexible so as to afford the traveling public the advantages that are denied with steam operation. The use of any system which does not possess these qualities will burden the corporation adopting it with a heavy expense, for which there is no adequate return. Whether this system shall be A. C. or D. C. depends entirely on the development of the art from a practical standpoint and the local conditions. The more congested the traffic the more necessary the adoption of the system that will be least in danger of failure and best adapted to public demands.

Washington Correspondence.

Washington, March 20.—It is becoming apparent that Senator Bailey will not be able to command the support of all the Democratic Senators for his proposition to amend the Hepburn railroad rate bill so as to provide for review by the courts of orders issued by the Commission with a provision restricting the right of the courts to suspend an order pending its review. The break in the Democratic ranks increases the probability that the Senate will adopt a review amendment that will not impose any restrictions on the power of the courts to enjoin the enforcement of an order of the Interstate Commerce Commission pending review with a provision requiring the difference between the challenged rate and that made by the Commission to be deposited in escrow subject to the order of the court on the final determination of the case. Republican Senators who favor such an amendment are confident that it will meet with the approval of President Roosevelt, whose views on the subject of suspension seem to have undergone considerable modification.

The proposition to require the impounding of the amount in controversy rather than to require the roads to give bond for the reimbursement of shippers is favored on the ground that, under a bond provision, it might be necessary for shippers who had paid the old rates pending review to institute suit to recover the amounts due them. On the other hand, if the money is held in escrow subject to the order of the court, it would be paid out in accordance with the directions of the court, and if the order of the Commission should be sustained it would be returned to the shippers who had paid it at once. This proposition is also favored on the ground that it would tend to prevent roads from instituting review proceedings merely for the sake of delay. It is contended that, under such a provision, the officers and attorneys of a railroad would be deterred from filing an application for review unless they were convinced that the order of the Commission was illegal and would be set aside by the court. Otherwise, they would have nothing to gain and would lose the costs of the case in court. It is also argued by the advocates of this proposition that it would tend to reduce the time occupied by review proceedings for the reason that a road instituting such proceedings with the belief that the order was illegal would have a substantial financial interest in having the case decided as soon as possible so that the money impounded subject to the order of the court could be paid into the treasury of the road without delay.

Senator Simmons, of North Carolina, stated more clearly than any other Senator who has yet spoken the real ground on which the advocacy of denying to the court the right to suspend pending review is based. He argued that the enforcement of the order would work an irreparable wrong either to the railroad or to the complaining shippers, and he preferred to take the chance of injuring the road. This argument is being met by pointing out that the complaining shippers would be fully protected by the deposit

of the amount in controversy in escrow, while, if the order should not be suspended, there would be no way of preventing the possibility of irreparable money being done to the railroad and to those shippers who would be injured by the change that the order would make in the relation of rates affecting rival communities.

One of the grounds on which it is contended that there should be no restriction on the power of the courts to review the orders of the Commission is that such review is more necessary to prevent the issuance of illegal orders than to correct them after they have been issued. It is contended that the inferior courts of the states and of the United States are made careful and kept free from the suspicion of corruption by the fact that their decisions are subject to review, and it is argued that it is still more important that the administrative orders of a political commission should be subject to review by the courts to prevent the members of that body from undertaking to institute and enforce fantastic theories as to the government of the transportation business of the country by making decisions in accordance with their ideas as to what the law ought to be rather than in accordance with the manifest intention of Congress. The history of the Commission in the past is cited to show that it has been overruled by the courts so frequently for the reason that it has attempted to read into the Interstate Commerce act provisions of law that were not put there by Congress.

J. C. W.

Wheeling & Lake Erie Earnings.

The gross earnings of the Wheeling & Lake Erie for the seven months ended Jan. 31, 1906, were $3,350,618, an increase of $709,253; net earnings, $968,735, an increase of $467,993. The surplus after charges was $133,118, which compares with a deficit of $139,945 for the corresponding period of the previous year. Maintenance of equipment and general expenses increased in about the same ratio as gross earnings, while conducting transportation shows less increase and maintenance of way shows a slight decrease. The operating ratio was 71 per cent., a decrease of 10. The average revenue train load increased from 426 tons to 560 tons.

All-Steel Drop Bottom General Service Gondola Car for the Frisco System.

The Frisco System is now receiving a lot of 200 all-steel drop bottom general service gondola cars, 100 for the Chicago & Eastern Illinois and 100 for the Kansas City, Fort Scott & Memphis, which embody a number of new points in design. They might properly be termed a 99 per cent. flat bottom dump car in that, although the floor of the car is flat with the doors closed and is to all appearances an ordinary flat bottom gondola car without hoppers, when the doors are open it will discharge its lading to an even greater extent than 99 per cent. without shoveling. The cars are of 100,000 lbs. capacity and were designed and built by the Pressed Steel Car Co., of Pittsburg.



General Service Drop Bottom Gondola Car—K. C., F. S. & M.



General Service Drop Bottom Gondola Car Discharging Load Through Four Doors.

Through the courtesy of the National Tube Co. a test was made of one of these cars at their works at McKeesport, Pa., on March 7 by officers of the Pressed Steel Car Co., to demonstrate the rapidity with which the car clears itself in dumping, and several photographs were taken which are reproduced in the accompanying engravings.

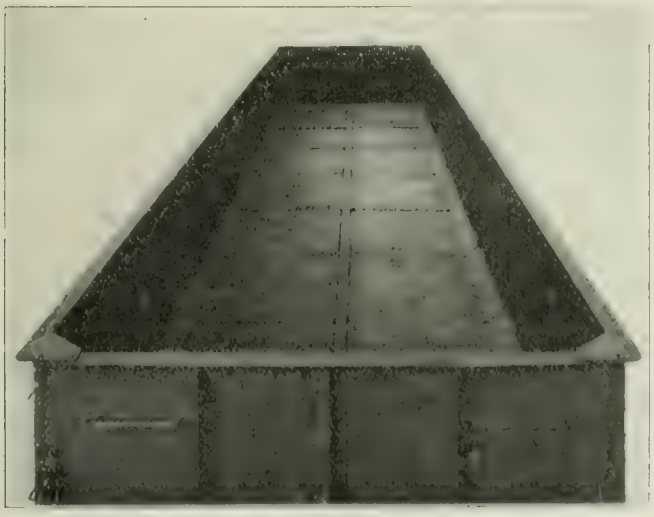
The first of these shows a general view of the car before dumping its load of 99,300 lbs. of run-of-mine coal. This is somewhat less than the capacity of the car level-full and therefore the coal in the car is not visible in the photograph. The second illustration shows the car as one-half of the load is being dumped from the

approach to the ore-trestle of the National Tube Works. The third photograph is an interior view of the car after dumping the whole load, and shows distinctly the self-clearing nature of the car. It will be seen that one end of the car was on a curve, the elevation of which decreased the angle of inclination of two doors immediately over the truck, thus retaining a small portion of the load which would have otherwise dumped. The illustration shows more coal retained at that point than at any other. The car was not weighed after dumping, but it was estimated by several of those present that not over 600 to 700 lbs. of coal remained in the car. It may safely be said, therefore, that not more than 1 per cent. of the load will be retained and the greater portion of this will run out when the car is jarred to any extent, such as the coupling of an engine or slight shifting. The time required for dumping is about six seconds for each half of the car, and the time consumed in closing the doors about one-half minute for each of the four sections. Such a car can be placed, dumped and the doors closed to form a flat bottom gondola car by two workmen in four minutes or less. The fourth illustration shows the interior of these cars with the doors closed.

The car is built entirely of steel and has 16 drop doors so that practically the whole bottom of the car drops. The eight doors over the trucks drop to a clear opening of 23 in., while the eight doors in the center of the car have a 26-in. clear opening. The center sills are pressed to form an inverted V at the top and are rivetted to a T-shape which has a 4-in. top, and are reinforced with angles at the lower edges. The center ridge of the car is only 4 in. wide. The body transoms are built up of plates and angles which give a 7-in. space, while the cross-bearers are of pressed steel shapes and have a top surface only 3 in. wide.



General Service Drop Bottom Gondola Car After Load Was Discharged by Gravity, No Shoveling.



Arranged as Flat Bottom Gondola with Doors Up.

The doors are operated by a so-called "creeping shaft" mechanism which is carried in slots by the cross-bearers and bolsters, and while the doors are closed by chains attached to these shafts, the latter are automatically moved over underneath the doors when fully closed and the load is thus securely supported and accidental discharge is impossible.

The general dimensions of the car are

Length over end sills	[illegible]
Length inside of body	[illegible]
Width over stakes	[illegible]
Width inside	[illegible]
Depth of body to top of sides	[illegible]
Length of doors in clear	[illegible]
Width of doors in clear	[illegible]
Height of floor from top of rail	[illegible]
Truck centers	[illegible]

The name, general service gondola ca[illegible] of the usefulness of a car of this type. It may not [illegible] for coal, ore, gravel and all kinds of materials that do not require dumping either from trestles or to the ground but on account of its flat features, free of hoppers or any other [illegible] can be shoveled out without effort where dumping is not [illegible]. As a flat bottom gondola car it can be used for loading [illegible] brick, sewer pipe or any materials of that kind which cannot conveniently be loaded in hopper cars and this type of car is therefore of interest not only to railroads but to shippers.

The "American" Electric Semaphore.

The signal here described has been developed in the past two years, and possesses important merits. The spectacle casting and blade are pulled to the proceed position instead of pushed, as in the ordinary designs. The electric motor is of high electrical efficiency and excellent mechanical design. The shaft is of tool steel, ground to gage; the bearings are of phosphor bronze, needing no lubrication, and the commutator is built exactly like the commutators of large electric generators—of drop forged copper segments, insulated with mica. The whole motor is enclosed and dust proof. The commutator and brushes are protected by a glass covering which can be removed to permit inspection. In the base of the motor, directly back of the name plate, there is a copper pan which can be filled with calcium chloride, or other suitable chemical, or with lime, to absorb any moisture which may collect on the glass, the commutator or the brushes. By filling this pan once in every three or four weeks it is hoped to do away with the trouble now so frequently experienced from frost. From this pan a hole is cored to and under the glass covering, so that the commutator will have the benefit of the absorbent while yet the fumes of the chemical cannot reach or injure the insulation on the armature winding.

This signal can be moved from the stop to the proceed position in 7½ seconds on 10 volts and 2¼ amperes. With eight volts a current of three amperes is required to clear the signal in 10 seconds. The blade can be readily moved from any position that the blade, is supported by the square semaphore shaft, *S*, Fig. 2. The chain is attached to the top part of the quadrant sheave while the blade is at stop. It passes around the sheave, lying in the groove; and thence through a square hole in the lock dog, *D*, which is provided with rollers to prevent friction between the chain and the dog. As shown in Fig. 2 the lug on this dog is under the lower edge of the sheave and the chain has been forced in toward the semaphore shaft so that it does not hang in a straight line. In this position it will be noted that the blade could not be depressed on account of the lug on this dog. When power is applied to the chain it is drawn taut, and this throws the dog and its lug clear of the sheave. The sheave is then pulled down and the blade brought to the clear or proceed position. This locking device is made to operate in the same way whether the blade is moved to "proceed" by elevating or by depressing the arm.

The sheaves, *c*, Fig. 3, are cast iron, and fitted on tubular shafts. These shafts meet in the center of the machine but are of course independent of each other. The sheaves are each made from a single piece of metal and the tube is flanged at one end for the gear *d*, Fig. 4. The outer ends of these tubes have bearings bushed with phosphor bronze. There is an oil cup about midway between the flanged end of the tube and the sheave into which oil may be poured to lubricate the bearings. The lubrication will last for months. The sheave, tubes and gear revolve together. Fig. 3 shows two sheaves, the machine being for a two-arm signal.

The vertical phosphor bronze rod connecting the mechanism

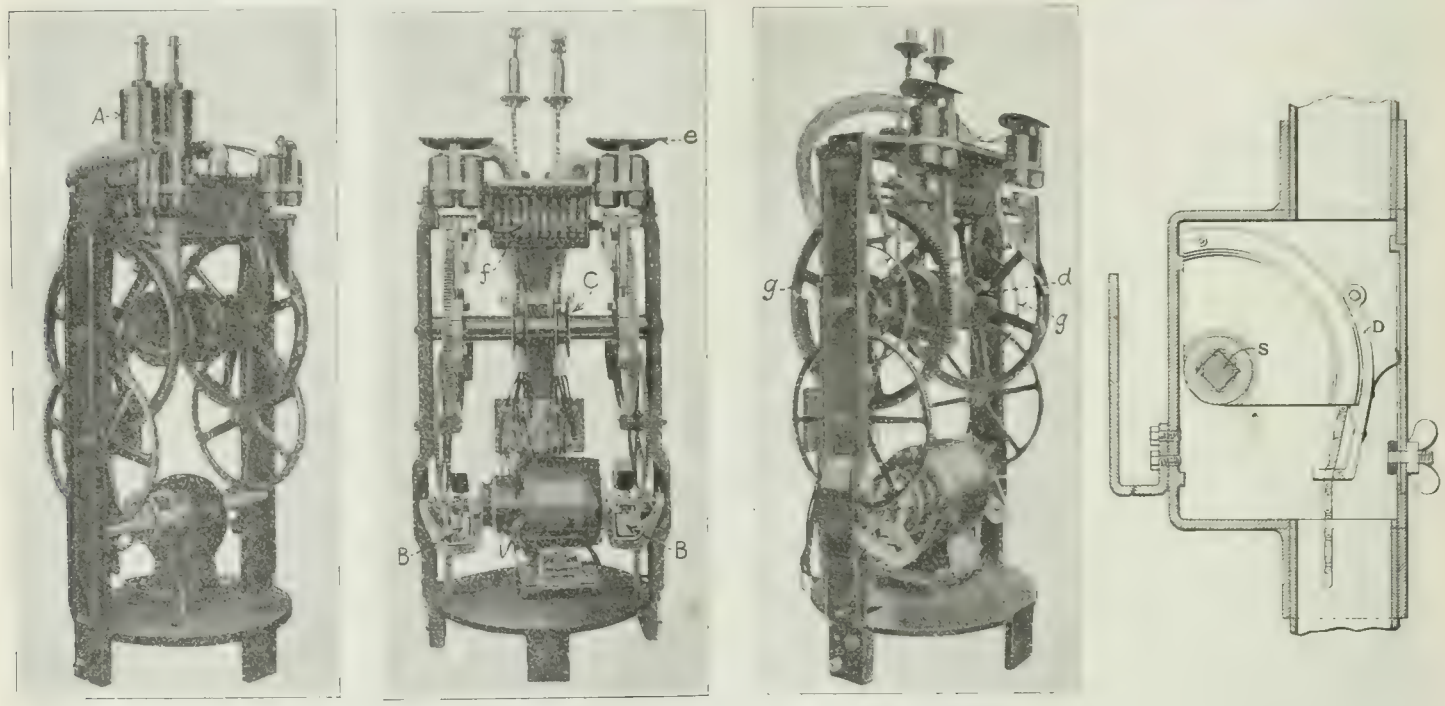


Fig. 1 Model B. Fig. 3 Model C. Fig. 4 Model C Fig. 2

Motor and Connections for the Electric Semaphore of the American Railway Signal Company.

motor may stop in. The figures just given are computed from the instant the circuit is closed (not, as is customary, when the load is thrown on the motor) and are based on the use of a 90-deg. semaphore casting, counterweighted to raise a 6-lb. weight on the end of a 4-ft. blade. It will be noted that this requires a counterweight of considerable size when depressing the blade to the proceed position. It is possible to operate one blade for two positions, or one blade for three positions; two blades for two positions, or two blades for three positions, all without making any changes other than of the wires leading to the circuit controller. This can be done in 20 minutes.

Figure 1 represents the mechanism equipped with a dash pot *A* to act as a cushion when the arm returns to the stop position, as is the general custom. But as dash pots have peculiarities, the designer has substituted something simpler and more satisfactory, the fan, *B*, shown in Figures 3 and 4. This fan is worked in connection with clutch. It is supported by an independent bearing and causes no friction on the motor shaft. When the motor is engaged by the clutch the fan is disengaged, and vice versa.

The clutch is operated by a solenoid which is in series with the motor. It is enclosed in a watertight iron case, and bolted to the underside of the plate supporting the motor. It acts through the vertical rods seen at each side in Fig. 3 projecting through the base plate.

The blades, when in either the stop or proceed position, are mechanically locked and it is impossible to move them except by operating the mechanism enclosed within the post. The sheave, at the top of the post, carrying the bicycle chain for operating the with the blade is ¼ in. diameter, straight and hard drawn. No guides are required no matter what the length of post, as there is no compression strain and hence no buckling. Should the rod break there can be no improper indication given, as there is no obstruction on which the casting could catch. The tensile strength of the rod is 2,100 lbs.

A bicycle chain connection is used at both ends. The lower one is fastened to a funnel shaped flange to prevent water or moisture reaching the chain.

The covering for the slot magnets *e*, Fig. 3, is to protect them against dripping water. The only moisture that can accumulate on the slot magnets is what may condense from the atmosphere. The armature is not liable to freeze to the slot coils, as the armature with its bar weighs about five pounds, and all the moisture that could collect on these coils would hardly hold that weight. There is about one 200th of an inch clearance between the armature and the cores of the magnets.

With this mechanism the blade can be stopped at any angle and immediately returned to the proceed position, without first returning it to the full stop position. This is a very desirable quality as not infrequently momentary interruptions to the track circuit allow the blade to move toward the stop position. The mechanism can, of course, be used to move the arm either up or down from the horizontal. If a road which is using the downward indication when a signal is installed desires to change, all that is required is the new blade grip casting; then by giving the head casting on the post a half turn the signal is ready for service.

The mechanism can be used to operate two blades separately

or both at the same time, with the same motor. The slot or lock coils can be wound to 800 ohms; and then with 10 volts the signal will at all times be under perfect control, because these coils are at no time required to hold more or less weight than the armature and its bar. The weight of these is sufficient to break away from the coils when a current of five volts or less is used. From this explanation it will be seen that the weight of the blade at no time adds to the work to be done; and there is no necessity of a delicate system of adjustment between these coils and the weighted semaphore. The weight of the armature bar when released from the coil is sufficient to release the signal under the most adverse conditions. It has been known to work successfully with 250 lbs. of added weight, which is many times in excess of any ordinary accumulation of ice or snow.

The circuit controller *f* is enclosed in a water-tight case, keeping the rubbing contacts free from dust and moisture. This controller is operated by a rim *g* on the large bronze gear and the construction and operation are such that at no time can the circuits be shifted except through the operation of the gear. The wires leading from this controller are run through fibre bushings and rubber tubes to a duplicate board from which the lead-out is made. Phosphor bronze is used in all gears. This not only precludes the possibilty of rust, but insures a long life, great strength and little wear; and no oil is needed. All moving parts are bushed with bronze.

Signals of this design have been in use over a year, and one, a two-arm signal, three-position, working each blade separately and independent of each other, has been in operation since the first of November, subject to all kinds of weather, and thus far has not failed. The fan with which the new model (Figs. 3 and 4) is fitted serves to prevent the formation of frost and ice on the gears and moving parts, by keeping the air in circulation. The fan is thus used for two distinct purposes, for enabling the signal to be returned to the stop position without the use of a dash pot, and for circulating the air.

This apparatus is designed and manufactured by the American Railway Signal Company, of Cleveland, Ohio.

Machine Shop Practice.*

Good machine shop practice may be said to be the arriving at the desired result at the lowest cost. Whatever can be done to cheapen production is a step forward. Very much might be said about rules and procedure for maintaining discipline, for the systematizing of output, for the installation of the piece-work system or the many modifications thereto, and many other points; these, however, will be but briefly touched on. Attention will be directed chiefly to the equipment of the shops to indicate how very much can be done in the way of cheapening output.

The general management of a large machine shop is a subject in itself. The control over the shop should be very complete, and as much a one-man control as possible, not that one man should actually supervise the shop but that he should control every department through competent assistants, each assistant or foreman having trusted foreman or sub-foreman under him. The utmost care should be taken to have all the work performed systematically, so that the time lost in handling work is reduced to a minimum. Again, the utmost care should be taken to turn out good work, for in the end any concern doing poor work is doomed to failure; not only should the workmanship be good, but the parts turned out should all be to gage within a predetermined limit of error, the allowable error being determined by means of limit gages.

The general scheme of handling the men, whether by day work, piece work, premium or other systems, is also a subject in itself. Each system has advantages and disadvantages. The men should be under careful supervision, but at the same time not watched as if they were trying to cheat the company. A speed foreman or a man whose duty it is to speed up the tools to the proper point is generally obnoxious to the men unless he has exceptional tact. The work can be done by a sub-foreman without the special title. The good will of the men should, as far as possible, be obtained by making the surroundings comfortable and healthy and paying a good wage to keep good men.

An efficient tool room is a requisite of a good shop. In it the tools should be kept in some good system and should be kept always in the best of condition. The machines in this department should be high class, otherwise their imperfections will be reproduced in the tools. In the larger shops it is the duty of the tool room to not only see that certain tools are on hand for doing the work but to see what jigs or other fixtures could be made to cheapen production, and to consider in general the best way to handle any special job.

The general stores department is of great importance, for on it depends very much the profit or loss that the company will incur. The only possible way to prevent shortage, to reduce stock to a minimum, to keep an exact inventory of material on hand, to make certain that all outgoing material is charged to the right account and to prevent delays in the manufacturing department by having ready to deliver the proper material at the required time, is to create a general store-keeping department for finished and unfinished material in charge of a good general storekeeper and under him a sufficiency of clerks.

General management, tool supply rooms, general stores department, accounting departments are classed as non-productive, though of course without efficient service in these departments no works can pay. But the works themselves, the machines and men doing the actual labor, are where the money comes from, and it is there that the greatest reduction in cost must be made. In general it will be found that as the productiveness of the shops increase the non-productive labor will also increase. The great cost in all shops is the labor. Anything to cut down the relative cost of labor is a step in the direction of greater profit for the manufacturer, not necessarily to cut down the rate of wages, but rather the reverse, but to still further increase the output per man. The means for increasing the output may be taken up under these heads:

1st. Multiplying tools.
2d. Multiplying machines.
3d. Improving the quality of the cutting tool.
4th. Increasing the speed and ease of handling the machines.

"One machine—one tool—one man," was the old rule since the operation of the first machine, and if some shortsighted trades' unions had their way, would still be in force. But such is no longer the case in live machine shops. Many single spindled drills are, for special work, replaced by multiple spindled drills, so that with one operation half a dozen or more holes are drilled, gaining very greatly in time and also in having the output absolutely interchangeable, a point of the very highest value. Single-headed planers are now the exception except in small sizes; planers cutting on both the forward and return stroke have been used but are not generally approved; plate edge planing machines cut both ways with entire satisfaction. Lathes also have multiple cutting tools. With locomotive driving-wheel lathes, for example, the two wheels and the two bearings are in some cases machined simultaneously. Shafting lathes have usually three tools operating, gun lathes, four, etc. Vertical boring mills have usually two heads. Turret lathes in their many modifications are a slightly different example of multiplying tools. The different tools are contained in one machine, but usually one tool operates at a time, the saving in time being effected by the extreme ease of changing from one tool to another. Screw cutting machines with multiple spindles are now universal, so that the price per operation is reduced to a minimum—what a difference between the time when every screw was cut in the lathe or by hand dies and present day practice, when, for example, the operator has to thread 15,000 half-inch bolts in a day to make a living wage, as is the case in a Pittsburg shop! The milling machine is another example of duplicating tools, though in a slightly different sense. The milling cutter may have 20 to 30 cutting edges, each doing its fair share of work and each is as distinctly an individual tool as the cutters in a boring bar, for example. Besides this a milling machine may have several heads. Milling machines have been productive of immense economy in the machine shop, not only in the decrease in time for the operation but also in facilities offered for milling any kind of profile. The multiplying of cutting tools in a machine will always be more of special than general application. The tendency of engineering practice is towards specialization, which is eminently favorable to the multiplication of tools.

Many non-automatic manually controlled machines can be replaced by semi-automatic ones, so that one man can attend to two, three or more of these machines; and, one step farther, many non-automatic or semi-automatic machines can be replaced by automatic ones, for which the only attention required is the intermittent feeding of a new bar from which the screws, nuts, bolts, etc., are automatically turned out. But, in addition, besides the economy in it, there is the advantage of obtaining uniformity of product and greater degree of accuracy. It is quite possible, however, to overstep the mark in installing automatic or semi-automatic machines, especially the former. They are only a paying investment when the number of pieces of one kind is large, so that the time taken to set the mechanism is small compared to the time the machine will be in operation. It is the balancing of capital and interest against saving in attendance.

Hand chipping should be replaced by pneumatic chippers, hand riveting by pneumatic or hydraulic riveters, hand filing by emery wheels or portable electric grinders, portable drills to replace the old ratchet. Planers should be supplemented by milling machines to cut down the number of operations, lathes should be supplemented by grinding machines. Portable tools are usually thought of as being small and light, and the majority of them are but sometimes the work is so large that it cannot be taken to the machines, and consequently the machine has to be taken to the work, necessitating large and heavy portable planers, drills, etc., such, for example, as were used in the shops of the Westinghouse Electric & Manufacturing Co. at East Pittsburg in machining large

*Paper by G. M. Campbell, read before the Mechanical Section of the Engineers' Society of Western Pennsylvania.

generator frames, some of these frames being laid out by means of a transit as the ordinary method of straight edge, square and level, were insufficient. In [illegible] duplicating pieces by the thousand, such, for example as [illegible], sewing machines, standard lathes and a thousand and one small articles of every description, the general practice [illegible] special machines for every individual operation, was [illegible] the result of cheapening cost.

Another important addition to all up-to-date machine shops is the traveling crane, which may be considered under the head of multiplying machines. Its value can hardly be overestimated, as the time and labor saved by its use pays for its installation many times over. Practically all traveling cranes are electrically operated, and they are usually so equipped that there is motion in three planes at once. The use of the electric magnet for lifting in connection with these cranes should be made with reserve. It is, however, of much service in some places where the crane travel is small. Small electric or pneumatic jib cranes or suspended hoists should be installed wherever there is much lifting in one particular spot.

The discovery of the value of certain steel alloys is one of the greatest of the age in regard to machine shop practice. Its value is far-reaching, not only in greatly decreasing the time required for an operation but also in leading machine shop men to investigate all connecting problems, such as the strength and better design of machines, the time required for handling and chucking the work, etc. If, under old conditions, a certain operation in a machine required three hours time and one hour for chucking and handling, the idle time of the machine would be only 25 per cent. of the total, if the time of the operation were reduced by the use of high-speed steels to one hour then the idle time would be 50 per cent., and some endeavor would undoubtedly be made to decrease time of chucking. There is a large amount of literature on the subject of these high speed steels, and some of the showings are little short of marvelous compared with former practice. This is especially the case under favorable conditions in experimental demonstrations. Under ordinary conditions the results are less startling, for the problem is not one of speed alone. High speed steel may not always be a paying investment; for example, a light job requiring relatively little time for cutting compared to time required for preparing and chucking; or, again, suppose, under ordinary conditions, a man has all he can do attending to two machines, the cutting time of one being just sufficient for the chucking time on the other, then any decrease in cutting time would be of small advantage. In general, the new steels cannot be used to the limit, first, because the present machines will not stand it and the general tendency is to retain present tools, working them to the limit instead of at once scrapping them, and, second, much of the work will not stand it on account of special shapes. The old carbon steels give better results, as far as service is concerned, on very light finishing cuts. But on the larger work, shafting, guns, wheel turning, big planing operations, etc., the advantages to be gained by the use of high speed steel are considerable. These steels have increased the output of railroad shop machines 25 to 100 per cent., and in some cases even 200 per cent. There is still considerable experimental data to be obtained before the best results are obtainable from these steels, as the speed bears some relation to the depth of cut and the feed. The highest speed does not necessarily remove the greatest amount of metal in a given time. In general, a slower speed and heavier cut and feed is more efficient.

As a sample of what may be done in general practice there is given a table of results, obtained at the Union Pacific shops, under new and old conditions in turning a pair of locomotive tires. These are average results and are not for a particular instance. They were reported in the Proceedings of the American Railway Master Mechanics' Association for 1904.

Comparative Time of Output of One Pair of Driving Wheels.

Operation	Carbon. Hrs.	Min.	Tool steel — Air hardening. Hrs.	Min.	High speed Hrs.	Min.
Setting tool, etc., throughout [illegible]	1	30	1	00	0	36
Grinding rough tool	1	30	1	00	0	20
Grinding flanging tool	1	30	1	00	0	04
Roughing cut	8	00	5	00	1	00
Finishing cut	5	00	2	30	0	30
Flanging cut	2	30	1	30	0	30
Total labor	20	00	12	00	3	00

As a parallel to this, the average total time in the shops of the Pittsburg & Lake Erie Railroad Co. per pair of wheels, under old conditions, using air-hardening steel, was eight hours; under new conditions four pairs per day, or 2½ hours per pair. This is not meant for a comparison of the two shops, as conditions may not be the same. But not the whole of this improvement is due to the tool steel. Much of it is due to better methods of driving and better facilities for handling the wheels. Many similar examples could be given. Later on in this paper reference will be made to some other results obtained in the P. & L. E. R. R. shops.

From the old hand driven or foot power tools to the line shaft belt driven shop was an immense stride, and as the machines themselves were improved so that some were all but human, it would seem that the limit had been reached. This was, of course, not true, even of the machine, and very much less so of the method of drive. The large belt driven shops had become a perfect network of shafts, countershafts and miles of belting. These interfered greatly with the lighting and general cleanliness. Another great drawback was the lack of speed variation. The cone pulleys and back gearing, or its equivalent, could give as wide a total speed change as was desired, but the steps were too coarse. The average increase of speed by means of the cone pulley was 50 per cent. It may be assumed the average loss of speed would be 25 per cent., that is, one half the speed increment. If now it were possible to decide, within 10 per cent., the speed a tool will stand, and if a method of control were put in to give that speed increment, then the loss of speed would average only 5 per cent. The advantage in favor of a close speed range would thus be 20 per cent., and if the average time the machines were running were 50 per cent. of the workman's time, then the net savings would be 10 per cent. If the mechanic's wages were $3 a day, the saving would be 30c. a day, or $100 a year per man.

(To be continued.)

The New Westinghouse "K" Triple Valve.

This valve, which was first publicly introduced at the West Seneca Tests on the Lake Shore & Michigan Southern Railway last October, is new more in designation than in detail, since it consists of an ordinary Westinghouse quick action freight triple valve with a small addition and slight modification in the ports of the valve body and slide valve, designed to meet those conditions existing in the long-train service of the present day, which are not met with entire satisfaction by any present standard triple valve. Any Westinghouse freight triple valve can be made over into the "K" type with very little expense and during the usual time required for general repairs.

The principal advantages gained by such modification are:

(1.) Quick Action in Service Applications.—This is obtained by venting a certain amount of brake-pipe air to the brake cylinder at each triple valve during the service applications in a way similar to the emergency applications of the old triple valves, with less danger of undesired emergency applications, and with a greater degree of sensitiveness of graduation than can be obtained in the present standard valves.

(2.) Retarded Release of Brakes on the Forward Part of the Train.—This extremely desirable result is accomplished through an arrangement of ports in connection with a spring affecting the movement of the piston and slide valve in the release position in such a way that either a full or restricted exhaust port can be obtained as the position of the car in the train requires.

(3.) Even Recharge of Auxiliary Reservoirs Throughout the Train.—The "feed port" is so changed in relation to the triple-valve piston that its opening is reduced on such triple valves as are in the "restricted-exhaust" position, while those having the full exhaust opening also have the full recharging opening. This provides that all the brakes in the train may be recharged in about the same length of time. These very desirable results have long been sought after but never before obtained in a practicable shape. The quick-service feature insures a much more rapid response to service applications of the brakes on all lengths of trains. With the old triple valve on a 50-car freight train, it is necessary, in order to be sure that all brakes will apply, to make not less than a 7-lb. brake-pipe reduction. With the "K" triple valves under such conditions, a 5-lb. reduction will readily apply all brakes, thus materially reducing the loss of air from the brake pipe during an application. More than that, a reduction of pressure such as will insure the application of all the brakes on a 50-car train with the old style of triple valve develops only a small cylinder pressure on the rear cars of the train, while the new valve causes a pressure which is approximately equal on all the cars.

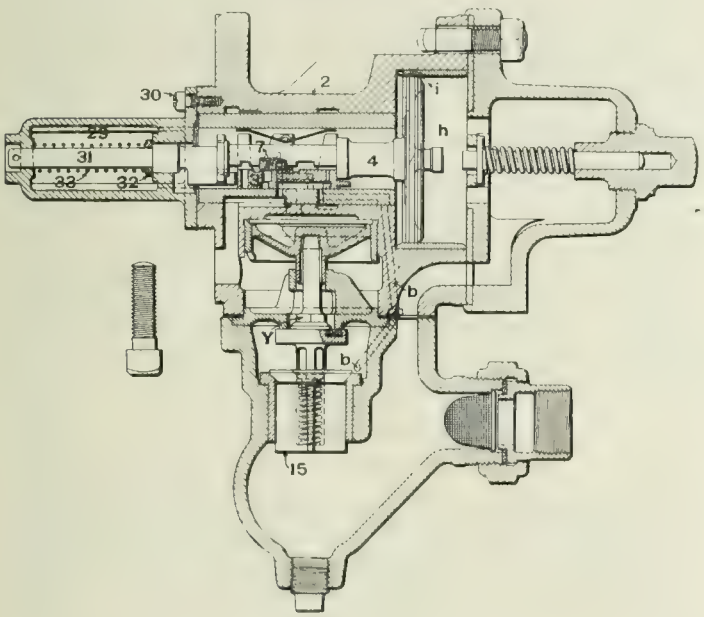
On a 100-car freight train it is, impossible, with any present make of triple valve, to apply all the brakes with any service application. This applies even where the triple valves are all in first-class condition. With the "K" triple valve, however, no trouble is experienced in applying all of the brakes on this or even a greater length of train. With the ordinary triple valve on such a train, a 15-lb. brake-pipe reduction will apply from 76 to 81 brakes if Westinghouse triple valves are used; and from 50 to 61 if New York triple valves are used, referring to equipment with 8-in. x 12-in. brake cylinders in both cases. With the 10-in. x 12-in. brake-cylinder equipment, the number of brakes that will apply under similar conditions is considerably less than with the 8-in. With the "K" triple valve and its quick-service feature, however, a means of applying all the brakes is afforded with lighter brake-pipe reductions than are required with the old triple valve giving the unsatisfactory results above mentioned.

This retarded-release feature provides a means by which the brakes can be released at slow speeds without any danger of train partings. With the present equipment it is often necessary to bring

freight trains to a standstill before releasing the brakes if the speed has been reduced to ten miles an hour or less, and under certain conditions this speed limit is even greater. In many cases it is not practicable to release at slow speeds even when the engine has the independent straight-air brake to control the slack of the train. By proper manipulation of the brake-valve handle, this retarded-release feature puts into the hands of the engineer a means of (1) releasing the brakes at the rear end of the train first; (2) releasing those at the head end first, or (3) releasing the brakes throughout the train all at the same time.

The restricted recharging of the brakes on the forward cars causes the air pressure to rise more rapidly throughout the entire brake-pipe and makes more air available in a shorter time for releasing and recharging the rear brakes. This effectually obviates the tendency of the rear brakes to stick, because this tendency is due to the auxiliary reservoirs on the forward end absorbing so much of the air while recharging that the rear cars do not get the pressure required to promptly release their brakes. It also prevents re-application on the head end after release, due to the brake-pipe pressure there being lowered through the rear brakes still recharging after the forward ones are fully charged.

This feature also permits of the brake-valve handle being allowed to remain in the release position longer without overcharging the head of the train, thus more quickly building up the brake-pipe pressure, and, consequently, recharging the auxiliary reservoirs. Since those brakes at the rear of the train are charged in about the same time as those at the head end, a more evenly distributed braking power is obtained, causing each brake to do its



Westinghouse "K-1" Triple Valve.

share of the work, and avoiding the overheating of some of the wheels.

A 50-car freight train equipped with the new valve and running at a speed of 20 miles per hour will be brought to a standstill by a 5-lb. brake-pipe reduction in about 400 ft. shorter distance than with the old type, due to the more prompt application, higher average cylinder pressure and more positive action of the brakes. It requires a 20-lb. reduction with the old triple valves to stop in the same distance as the 5-lb. reduction just mentioned. More than this, the amount of free air saved on a 50-car train with 10-in. brake equipment, due to the lighter brake-pipe reductions and quick-service feature, is about 25 cu. ft. for every full application. And a full application with the new valve stops the train in 35 per cent. less distance than required with the standard valve.

The present standard Westinghouse freight triple valve may be transformed into the improved type by a simple change, preserving all the old parts except the body, slide valve, slide-valve bush and graduating valve. This can be done when these valves are sent to the brake works for heavy repairs. Thus the cost of re-standardizing is reduced to a minimum, the time required will not exceed that allowed for ordinary repair work, and the railroads will get the advantage of using the parts of their own triple valves.

The accompanying illustration is a central vertical section through the "K" triple valve, from which the changes required to convert the old standard valve into this type will be readily understood. These changes are: A new body, 2; a new slide valve, 3, a new graduating valve, 7, of the slide-valve type, the necessary modifications in the piston stem, 4, required by the new type of graduating valve, the new slide-valve bush with proper rearrangement of ports to suit the new slide valve, and the addition of the retarded-release feature, 29, which in the ordinary freight equipment protrudes into the auxiliary reservoir volume. Besides this, the port *b* is drilled through the body and check-valve case in such a manner as to connect the chamber *Y* above the check valve to a port in the slide-valve seat. In the release position of the valve when used with the 10-in. brake equipment, this port *b* communicates through a port in the slide valve with the slide-valve chamber, and thus with the auxiliary reservoir, permitting air from the brake-pipe to raise the check valve 15 and pass through port *b* to the auxiliary reservoir. This is in addition to the supply that passes through the ordinary feed groove *i* around the piston, so that in full release position the auxiliary reservoirs will charge very rapidly. But if the valve is in the retarded-release position, port *b* connects with a much smaller port through the slide valve, while the piston fits closely against the ends of the slide-valve bush, cutting off any supply through feed groove *i*, thus greatly reducing the rate of recharge. This also applies to the valve when arranged for an 8-in. equipment except that communication between port *b* and the slide-valve chamber is broken during the full release, all the air for recharging then coming through the feed groove; while during the retarded release the port in the slide valve which opens *b* to the slide-valve chamber is about half the area of the feed groove. This difference exists because of the different volumes of air that have to be handled, while the feed grooves in both valves are the same size.

The retarded-release feature is made possible through the supplementary portion 29, which consists of a brass frame casting open on both sides and attached to the triple-valve body by means of three screws, 30; the stem, 31, acts as a stop for the triple-valve piston when moving to the release position. Since it is held to its position by the spring 33, and collar 32, it will readily be seen that by properly proportioning this spring, the stem 31 can be made to compress the spring or not, depending on the rate of increase of the brake-pipe pressure in chamber *h*. If the triple valve is on the head end of the train, where the brake-pipe pressure builds up rapidly, spring 33 will be somewhat compressed by the piston when going to the release position, thus allowing the slide valve 3 to pass beyond full release position and partly close the exhaust port. As the brake-pipe pressure equalizes throughout the train, and feeds through into the auxiliary reservoirs, the difference of pressures on the two sides of the piston becomes less, and the slide valve is gradually forced back to the full exhaust opening.

Quick-Service Feature.—When the slide valve goes to the service-application position, its arrangement of ports is such that the chamber *Y* is connected through port *b* to the brake cylinders. These ports are so restricted that the resulting flow of air from the brake-pipe to the brake-cylinder through port *b* is not sufficient to cause an emergency application, but will materially hasten the brake-pipe reduction throughout the train. It is for this reason that a much smaller reduction is required at the brake valve to obtain a given brake-cylinder pressure than would be the case with the old type of triple valve. This is true not only because of less air exhausted to the atmosphere at the brake valve, but also because of the additional pressure derived from the air entering the brake cylinders from the brake pipe and thereby causing a higher brake-cylinder pressure.

In all other respects the operation of this valve is practically that of the present F 36 or H 49 triple valves. Its outward appearance, when attached to the auxiliary reservoir, is so much like those valves that, to distinguish it, a thin lug is cast on the top of the body in a position easily seen from the side of the valve; and its designation "K-1" or "K-2" is also cast on the side of the body, the former replacing the F 36 and the latter the H 49 standard valves.

A large number of these valves are already in service giving results that are in every way satisfactory. The serious problems brought forward by the rapidly changing conditions of freight service have made it absolutely necessary to increase the power and flexibility of the air-brake. Yet the adoption of any new device would entail such an immense amount of expense and inconvenience that the arrangement above outlined whereby the valves now in service can be utilized and transformed to give the required results with only a slight addition to the number of parts and with little expense, will prove to be one of the most important improvements yet brought out in connection with air brake equipment.

Disastrous Collision at Adobe, Colo.

In a butting collision of passenger trains on the Denver & Rio Grande, about 2 o'clock on the morning of Friday, March 16, near Adobe, about 25 miles west of Pueblo, Colorado, twenty-two persons, nearly all passengers, were killed outright or died soon after, and 72 were injured. Westbound passenger train No. 5, drawn by two engines, moving up grade at moderate speed, collided with eastbound passenger train No. 16, piling up the two engines and the forward cars of the trains in a bad wreck, which took fire almost instantly

The fire seems to have started from the coals in the fire boxes of the locomotives, but there was an explosion of illuminating gas which appears to have spread the flames. The collision occurred on a curve where an engineman has a view of an opposing train for only a few hundred feet; and, moreover, the track of the Atchison, Topeka & Santa Fe runs parallel to the Rio Grande track, making it easy to assume that an opposing train is on another track. There was a blinding snowstorm at the time, and the weather was so cold that the passengers suffered much from this cause. The reports indicate that the collision was due to a false report sent to the train despatcher by the operator at Swallows, a station east of Adobe. This operator had been asleep on duty, and when asked if train No. 3 had passed replied that it had not, whereas it had gone by while he was asleep. As a result of this misinformation, the despatcher issued an order to No. 16 based on his supposed ability to hold No. 3 at Swallows.

The following statement is published as from A. C. Ridgway, general manager of the company: "No 3, leaving Pueblo, had orders to meet No. 16 at Adobe. On account of delay in getting out of Pueblo after the train had left the order was changed to make the meeting point Beaver in place of Adobe. The despatcher had 'O. K.' from Florence and Swallows, the operator at Swallows stating that No. 3 had not gone by. He had been asleep beyond question; did not hear No. 3 go by and 'O. K.'d' despatcher's order, and is the sole cause of the collision. This was the day operator, and he was doing duty for the night man, as the night man had gone to Pueblo to cash pay checks without asking permission from the Pueblo office. Our standing rule is that day operators are not to relieve night operators and work overtime unless permission is asked and granted by the chief despatcher."

Railway Signal Association.

This association held its regular March meeting at the Great Northern Hotel, Chicago, March 19. Vice-President J. A. Peabody (C. & N. W.) presided. About 75 persons were in attendance at the two sessions, and 40 new members were elected. The revised constitution as published in the notice of the meeting was discussed, and a number of changes made. It was recommended that with these corrections it be presented at the New York meeting in May for adoption. The Committee on Standard Specifications for Mechanical Interlocking presented the following substitute for paragraph No. 74 of the specifications, which were referred back to the committee at the October meeting.

Specifications for Signal Poles.—All straight poles must be of lap-welded iron steam pipe in sections of 4 ft., 5 ft. and 6 ft., with swedged joints; the swedging to be 18 in. length and the male section inserted 16 in. The swedged ends must be hammer caulked. The total weight of 32-ft. poles, which must be set in concrete, shall be not less than 526 lbs.; for 38-ft. poles, 639 lbs. One-arm poles, set in base castings, must be 26 ft. long and weigh not less than 413 lbs. Two-arm poles must be 32 ft. long and weigh not less than 526 lbs. All these weights apply to poles without fittings.

Weights and lengths of pipe are fixed as follows: 4-in. section, 9 ft. 4 in. in length, to weigh 10.665 lbs. per foot; 5-in. section, 11 ft. 4 in. in length, to weigh 14.502 lbs. per foot; pipe of 6-in. section for poles set in the ground to weigh 18.762 lbs. per foot; for one-arm signals to be 14 ft. long; for two-arm, 20 ft. long; 6-in. section for one-arm poles set in base castings to be 8 ft. in length; 6-in. section for two-arm poles set in base castings to be 14 ft. long.

Concrete Foundations for Signal Poles.—Poles which are set in the ground must be reinforced by concrete not less than 12 in. by 12 in. by 6 ft. deep, and the pole filled with cement mortar 2 in. above concrete; and there must be a ¾-in. drain hole through the wall of the pipe at the top of the filling. Concrete foundations for base castings must be 30 in. by 30 in. at the top, and be not less than 5 ft. deep, with 1-in. slope per foot on the sides. Anchor bolts are to be 1 in. in diameter, and extended to within 12 in. of bottom of foundation.

These paragraphs were adopted and will be incorporated in the Standard Specifications printed in the 1905 proceedings as paragraph No. 124.

The paper by Mr. Spangler* on "Substituting Track Circuits for Detector Bars" evoked quite a lively discussion, and brought out the following points: The substitution of track circuits necessarily increases the number of insulated joints in and around switch points, which, from a track maintenance point, is undesirable. The relays used on the circuits release too slowly; to meet this condition about 60 ft. instead of the customary 45 ft. to 50 ft. should be allowed. Many of the speakers favored the retention of detector bars, and argued that they are giving full protection under all conditions, except with 100 lb. rails. Evidence was given to show that it cost a great deal less to maintain interlocking where track circuits are used, particularly during snow and sleet storms, when bars must often be disconnected. Mr. Sperry observed that the fundamental principle of the detector bar is wrong; a failure to come in contact with the wheel will cause an improper indication. This is not true of the track circuit, with which a failure will invariably give the desired protection by maintaining the route.

Mr. W. A. D. Short, Signal Engineer of the Illinois Central, presented a paper on power distant signals. He said that those roads in the Middle West which a few years ago thought the gas signal was the best for this purpose have found that the regulating mechanism of the gas signal is too delicate, especially where the signals cannot be inspected every day; and the electric motor is now being generally adopted. Mr. Short has secured information from 19 railroads representing 100,000 miles of road, and he finds that "five years ago the average distance of the distant signal from the home signal at interlocking plants was 1,444.44 ft., and from the interlocking machine it was 1,750 ft. To-day the average distance from the home signal to the distant is 3,745.64 ft., and of the distant signal from the interlocking machine 4,025 ft." Just what data were taken in computing these averages is not stated. Mr. Short says that where a power signal is used there should be an electric lock on the back latch of the home signal lever to absolutely ensure the distant signal being in the caution position before the home signal lever can be unlatched to be put in the normal position.

The discussion on this subject showed in a striking way what a change has come over signalmen's minds with reference to the use of the power distant signal. The recommendations of this Association in its favor, adopted two years ago, are now being followed by most of the important roads. There is a difference of opinion among members as to whether the power distant signal shall in all cases be controlled by a separate lever or shall be operated automatically. The latter method seems most likely to be generally adopted. With this, approach locking between the distant and home signals is easy and cheap. The matter of locking the home signal at "proceed" when the distant is at proceed, either mechanically or electrically, received some consideration, and the majority inclined to the opinion that some arrangement should be made whereby the home signal shall at all times be in such a condition that it can be set to the stop position quickly.

Switch signals came up for discussion under this head; and it developed that on many roads electric locking and time-interval locking is receiving considerable consideration. Members recognize the need of anticipating open switches, and the opening of switches in the face of trains.

* A report of Mr. Spangler's paper, and a notice of the revised constitution, as submitted by the committee, will be found elsewhere. A paper on Storage Battery Practice by Mr. F. B. Corey, is deferred to a future issue.

Temiskaming & Northern Ontario.

Ottawa, March 12, 1906.

This road, the new Ontario Government Railway into New Ontario, running north from North Bay to Liskeard, 113 miles, and passing through the Cobalt mining regions, was a distinct financial success last year, the first in which it was operated to its present terminus. The prospects for the coming year are that earning power will be greatly increased. The silver discoveries at Cobalt proved a silver mine indeed for this example of government ownership. Both passenger and freight traffic were largely increased, the latter both in ore coming out from the mines and machinery, building material, supplies and settlers' effects going in. Both kinds of traffic were hampered by lack of rolling stock. The passenger trains—one each way daily—afforded standing room only, and freight was often two or three weeks on the road from Toronto and Ottawa to Cobalt, which is 103 miles from the southern terminus of the Temiskaming road. In the coming season the equipment of the road will be even more severely tested. It is estimated that nearly 100,000 people will make for the new mining region this spring. The Provincial Commission, which manages the road, is taking steps to increase the equipment before next month, and to be ready to supplement it if necessary. A score of mines already shipping ore and a prospect that the number may be doubled, an influx of settlers into the clay belt which will soon become productive, the demands of business resulting from the opening of many stores in the new towns along the line—all these promise to add largely to the permanent earning power of the new road. Last year its net earnings were $113,000—$1,000 a mile. It is not unlikely that they will be three times that amount this year. There are 100 miles northward from Liskeard under construction and work is practically completed to within 35 miles of a junction with the projected line of the new National Transcontinental Railroad, the eastern end of the Grand Trunk Pacific. This is to be at a point about 142 miles north of Liskeard. With the construction of the new transcontinental, the Temiskaming & Northern Ontario would become both an important feeder and an outlet to the trunk line. In any case, as long as the prosperity of the mines continues, the road will be prosperous and to that extent will be a fine object lesson of the success of the principle of government ownership of railroads. J. A. M.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Brooks Adams on Government Regulation 317
- Correspondence Schools 317
- A Phase of Railroad Bonding..... 318
- Electric Systems for Heavy R. R. Service 318
- February Accidents 319
- Grade Crossings in Massachusetts. 319
- Another English Automatic Signal Overrun. 319
- Delaware & Hudson 320
- Michigan Central 320
- Wheeling & Lake Erie 321
- Trade Catalogues 321

ILLUSTRATED:
- Rebuilding the Housatonic River Bridge; N.Y., N.H. & H., at Sandy Hook, Conn. 323
- Interlocking on Lackawanna at Roseville 330
- The Engineering and Maintenance of Way Association Convention. 332
- Automatic Signals for the Union and Southern Pacific 343

CONTRIBUTION:
- Cab Arrangements on Electric Trains... 321
- Shavings Cut from the Rail. 322

MISCELLANEOUS:
- President Mellen on the Hepburn Bill. 322
- Washington Correspondence 323
- Alternating Current Electric Systems for Heavy Railroad Service..... 327
- Iowa Vermont and Prussia 329
- Exhibits at the M.-of-W. Convention.... 341
- Investigation of Concrete Materials Under National Board on Fuels and Structural Materials 342
- Standard Locomotives for India 342
- Train Accidents in the U. S. in February 343
- The Hungarian Railroad Strike (Note).. 344

GENERAL NEWS SECTION:
- Notes 93
- Obituary 95
- Meetings and Announcements..... 95
- Elections and Appointments 95
- Locomotive Building. 96
- Car Building 96
- Bridge Building 97
- Railroad Construction 98
- Railroad Corporation News. 100

VOL. XL., No. 13. FRIDAY, MARCH 30, 1906.

A rigid long-and-short haul rule and a law to prevent stock-watering are the two principal elements in the remedy for railroad evils proposed by Mr. Brooks Adams in the *Boston Transcript.* Like Dr. Hadley, Mr. Adams states his position rather briefly, not giving all his reasons and not touching on all of the difficulties, but, like Dr. Hadley, he also takes a calm view, recognizing that compromise is necessary—and not only necessary but exigent. He shows in very clear terms how the courts have uniformly taken that position which favors vested interests, while the Commission has as uniformly taken an opposite one; has tried to make progress by dealing out justice even at the expense of costly departures from traditional practices—which sufficiently explains the strenuous endeavors of most capitalistic interests to keep all questions within the hands of the courts as far as possible. "Stock-watering" is used as a broad term to include stock-fattening as well. In other words, Mr. Adams would forbid stock dividends and other devices by which the earning power of a railroad is concealed from all except experts until ownerships have been so juggled that the public finds itself powerless to prevent exorbitant profit taking to pay unreasonably high dividends. By compelling a railroad to pay its profits to the stockholders in dividends, or else to show the public where the money is put, or what is being done with it, he would endeavor to keep the public so well informed that excessive rates would be readily discoverable. At present it is usually impossible to know whether rates are exorbitant or not until it is too late to give the public any adequate relief by legislation or other state action. Mr. Adams' plan is not without reasonableness. With intelligent management it would undoubtedly aid in hastening that practical degree of publicity that all fair-minded students and critics desire. The enforcement of the long-and-short haul rule everywhere would, of course, work much injustice, at least for a time; but Mr. Adams could plausibly claim that the change only shifted the burden from the oppressed to the oppressor. Nobody, however, could devise such a law which would not have to be subject to exceptions; and there's the rub: Where is the wise and powerful body to supervise the allowance of exceptions?

While Mr. Adams' article is neither conclusive nor novel, it is valuable for the clear insight manifested, and therefore we give it this notice. It is too solid to be abstracted; it must be read. It is also of interest from its local viewpoint. Being a New Englander, the author gently reminds his neighbors that they have been too short sighted and provincial. They have not exercised the commercial common sense which would have dictated an appeal to Congress for the remedy now suggested. Instead of being commercial, New England is—capitalistic, though Mr. Adams does not directly say so. The railroad investors, rather than the shippers and manufacturers, control public sentiment there. Finally, Mr. Adams gives a clarifying view of the "court review" perplexity. On this he says:

> As the vested interests resisted all relief, the President had to do what he could, not what he would. The Hepburn bill is confessedly imperfect, but all men can understand a proposal to erect a tribunal which shall have power to correct an unjust rate, while the intricacies of the automatic system of the long-and-short haul are popularly inexplicable. Furthermore, the vested interests clearly prefer to take their chances with a new statute which the Supreme Court may emasculate. . . . All lawyers know that a court can emasculate any new statute at pleasure, but courts are usually careful not to exasperate society at large. To do so would be fatal to themselves. The Hepburn bill presents an alternative. Either it purports to prevent a judicial review of the Commission's decisions, or it does not. If it cuts off review it may be held unconstitutional for depriving citizens of their property without due process of law; if it does not, it would be impossible to limit the extent of the review against the will of the judiciary. Take, for example, the plea of confiscation. Ames vs. Union Pacific has established that any reduction, however small, in gross receipts, which carried out logically might impair dividends and thereby injure values, may be confiscation; while Calloway's case decided that rates calculated to return 6 per cent. on actual investment, and 6 per cent. on water 12 per cent in all—beside a surplus, had in them nothing intrinsically unreasonable. Hence it might be inferred that any equalization which tended to reduce dividends below a 12 per cent. basis would unreasonably diminish the value of the property, and be confiscation. To determine this fact the Court would be obliged to consider both law and evidence. . . . Few lawyers assume that a constitutional act of Congress can certainly bar a judicial review. A statute which should unconditionally subordinate all the functions of the Commission to court review would be assumed to be an approval of the law as it now stands. Under such a statute the judiciary would feel itself strengthened, and no relief would follow. The privileges of vested interests would be maintained or even extended. Conversely, an enactment which purported to limit the judicial review, and to place responsibility on the Commission in preference to the Court, would be interpreted as disapproval of the attitude of the Supreme Bench, and an expression of a demand for a more perfect equalization of the transportation tax. . . .

"The Character of Correspondence School Teaching" was the subject of a recent editorial in the columns of a contemporary, wherein, in answer to many inquiries regarding the character of such instruction, and also because of a tendency in some quarters to ridicule the same, the excellence of the work done by the high-grade schools was pointed out, particular reference being made to the high character of the text books, prepared by recognized authorities on the subjects. The weak points, the drawbacks, existing in the best of such courses were likewise pointed out in detail, simply as a matter of information, it being understood that most of these are unavoidable in the nature of things. In all that was said in this article we heartily concur. The opportunity afforded by these schools to the ambitious among the masses who, as a rule, cannot afford a technical course in a college is valuable and far reaching

in its influence, and to one appreciates it more thoroughly or admits it more readily than the collegebred engineer. Nevertheless, there is one practice of some of these schools—not all—which we have heard condemned by members of the engineering professions, and with justice it must be admitted. In many of the advertisements of these courses, by making it appear that the engineering professions are easily and quickly learned and by listing them indiscriminately with the variety of trades or occupations now covered by the larger of these schools, the impression which is conveyed regarding these professions is undeniably one of inferiority. For example, we have before us one such advertisement in which the interested person is asked to indicate in the heterogeneous list given, running from show card writer to civil engineer, which "occupation" he prefers, promising to show him that it is "not only possible but actually easy" for him to enter that occupation. It is not surprising that the members of the high and difficult calling of the civil engineer, for instance, should consider that such a presentment is a reflection on the dignity and superiority of their profession, lowering its standard in the eyes of the public. It is also misleading to the student, actual and prospective. In view of the great and valuable work these schools are doing we feel that they owe it to themselves as well as to these splendid professions in which they give instructions to modify a practice which tends to cast discredit thereon.

A PHASE OF RAILROAD BONDING.

During the last year we have had occasion more than once to point out the "bond period" into which, as regards their broader operations in finance, the railroad corporations of the country have entered. Its most impressive index is the increase of the bonded debt of American railroads from $32,494 a mile to $35,418 a mile (about nine per cent.) during the year 1904, while, during the same year, capital stock per mile decreased from $30,719 per mile to $30,686 per mile; and when the returns for 1905 are fully made up we have little doubt that a similar, if not larger, bond increase will be shown in view of the size of bonding issues during the last few months. Historically, bond periods in our railroad development have been generally periods of railroad prosperity and good health, and such is the case now. Some of the fiscal phenomena of the present great standing harvest of railroad bonds are, however, unique and striking, and especially so is a new relation of investors to such bonds as a sequel of the rapid progress of railroad consolidation. While it is a fact which cannot be measured in exact figures, it is one which railroad financiers have begun to encounter, especially in those regions and centers where single great railroad systems have their special spheres of fiscal influence and look for markets for their securities.

Forty years ago the independent railroad corporations of the country were many. Now they are relatively few. Each independent company, whether large or small, had its stock—sometimes of two or three classes—and its mortgage debt represented by from one to several groups of outstanding bonds. The mortgage security was specific and localized. It covered a railroad property usually simple in character, not interstate, often small in size, easily visible, and its annual report readily analyzed with gross earnings, seldom going beyond six figures in dollars and not infrequently falling to five. The great mergers and consolidations have changed all that, and with the absorption have, of course, gone many of the separate and small bond issues with their specific local mortgage security. The one-time bondholder of the small road now finds himself the owner of bonds often by the process of exchange—of a different bond of a bigger road. What is more to the point, he often finds also that, by the same process, from being an investing bondholder in several comparatively localized lines—with a moderate investment in each—he is become a large holder of the securities of the great absorbent corporation, and that not by original volition but by the compulsion of railroad events. The same truism holds if his local railroad stocks have been guaranteed by the big company; and if he hunts new railroad investment he must go pretty far afield to a new financial center and rely upon investment opinion secondary, derivative and often misliked by the ultra-conservative security holder.

There has thus been reached in many cases a situation following the great railroad mergers in which the investor finds himself overloaded with the securities of the dominating railroad system. He has—or, what amounts to almost the same thing, thinks he has—in the rural phrase, "too many eggs in one basket"; and this condition affects considerable areas of the country with large investment capital, and bears also on considerable groups of conservative investors. The situation presents one anomaly. Large issues of bonds of the big system have supplanted the smaller mortgages of the subsidiary and annexed lines. But these larger issues, averaged for their security, undoubtedly rank higher than the average of the smaller mortgages which they have superseded. They cover larger properties, they identify themselves with a great system, and are usually protected by valuable equities in junior interests, including the railroad's share capital. There have been, in fact, during the last twelvemonth very few issues of new bonds of great railroad corporations which have not been of a high grade, and offered at a 4 per cent. basis or below. But this does not affect much the sentimental scruple of the bondholder whom railroad consolidation has overloaded with securities bearing the title head of one corporation. If a trustee who must render an account, he hates to be found with, say, half or two-thirds of his trust held in one corporation. Savings banks considerably, trust companies somewhat less, are under stress of the same argument, and even the man who invests his own funds generally prefers the distributive to a centralized policy.

The case has now begun to expand beyond the steam railroad system. Thus the holder of a trolley railway bond in the Hudson river or Mohawk valley or in Connecticut or Massachusetts a year or two ago deemed himself the owner of a street railway bond pure and simple. He now finds himself, while still the holder of the same bond, a dependent of the New York Central or New Haven corporations, which have bought up the trolley systems. The security is not decreased in value by the change—on the contrary, it is apt to be decidedly enhanced. But if the trolley bondholder, before the trolley sale, was already a large holder of the steam company's securities, the sentimental disposition to unload a part, at least, of his holdings becomes a force in his investment policy.

At a period when centralization is the resonant keynote of railroad policy, every new phase of it is of interest and significance. Among its fiscal phenomena this overloading of the investor is not a fact to be despised simply because it thus far seems to have gone almost unnoticed. Indeed, unless we are greatly mistaken, it is already beginning to be felt in that law of supply and demand which affects even the best types of new railroad bonds—in this case tending to increase the supply and considerably lower prices in the market. To illustrate the situation we could name here at least one great railroad corporation that prolongs the corporate existence of strong subsidiary lines as a basis for separate mortgage security and higher prices for new bond issues. In seeking a measure of the size of this "overloading" and its psychological influence on investment, three or four points in the market quotations of certain large groups of bonds is probably fair and, by some, may be considered excessive. But, as the tidal flood of railroad bonds—competing with, for example, new industrial and telephone securities—rises, and, along with it, railroad mergers proceed, the results of the overload of the investor is a thing to be watched with interest. That, for instance, it is one of the obscure but genuine forces in the expanding device of the convertible railroad bond can hardly be disputed.

ELECTRIC SYSTEMS FOR HEAVY RAILROAD SERVICE.

Among railroad officers there are many to whom electrification is a live question, but there are few railroads whose staff includes an engineer who has followed the subject so closely as to even understand the nomenclature of the new science and discuss it intelligently with the electrical companies' engineers. Fewer still have any confidence in their own judgment of the comparative safety, reliability, original cost and cost of operation of a.c. and d.c. current systems. This is not censurable. For these it is not written in the Good Book: "Even a fool, when he holdeth his peace, is counted wise." The knowledge is not necessary until its time comes, and meanwhile the different systems are being tried out by discussion, experiments and actual use in comparatively light service; and we shall not need to wait long for the results of working of the alternating-current locomotives and motors on the New Haven road under like conditions and side by side with the direct-current locomotives and motors of the New York Central.

Nevertheless, there is a present value to every operating officer in reading the discussions before the New York Railroad Club, of which the substance is reprinted in last week's and in the present issue of this paper. Much of this is technical, some of it is historical, but there is a remainder of clear statement of the economics

of the proposition. Even where the change is compulsory, as it is with the Central and New Haven terminals in New York City, there is a chance to make it profitable. Mr. Wilgus says:

"To secure increased earning capacity in making a change from steam to electricity a change must also be made in the operating conditions that by long experience are known to bring about the creation of a new remunerative traffic. We all know that when the change from horse cars to electric cars was first proposed many arguments pro and con were made as to the relative cost of operation and therefore the effect upon earnings. Almost, immediately, however, the question of comparative cost of operation disappeared because it was discovered that the improved conditions, entirely apart from the cost of operation, created enormous increase of traffic that made the advantages from the use of electricity self evident."

There is no reason to expect any such proportional increase of receipts, in a change from steam to electricity, as was obtained by the change from horse power to trolley, except by suburban and some local trains. It has been difficult for most of us to see an advantage in electrically-operated express trains or freight trains, but Mr. Townley indicates some possibilities, in that the electric locomotive has available unlimited power, while the steam locomotive is limited to the power generated in its own boiler. This means that the size and weight of freight trains, or the speed of express trains, will not be limited by the present strength of track and bridges, or by weight on driving axles. Enough electric locomotives can be coupled up and worked by the multiple unit system to move anything at any speed, if the draft gear is strong enough. This feature, combined with the economic divisibility—more frequent small trains at an approximately proportional cost per car mile—makes a basis for considering the revolutionary proposition to abandon the well-developed and nearly-perfected steam locomotive.

Mr. Townley, alone among those who took part in the discussion, said: "The track capacity of any given road can be materially increased by the substitution of electric traction for steam." This is important if it can be shown to be true. We have in mind one railroad, with a congested line, and the problem before it of additional tracks, or additional "track capacity," to be secured by electrification. After careful study, the engineer of one of our great electric companies was not able to demonstrate any material increase. This was during the past year, and the chance is still open.

In one respect the New Haven road gives the best possible opportunity for demonstrating the advantages of electrification for the public benefit, for an increase in revenue and for possible economy. It is an interlaced, complicated system, largely for local services; an inevitable combination due to the force of circumstances, rather than a consolidation of the modern type. It owns 240 miles of electric trolley lines, and its problem is to make these trolleys, working in harmony with its own lines, earn more money and give better public service. Here, if anywhere in the world, electrification of the main lines and branches, at any cost within reason, should be profitable, as it enables the company's trolley cars in city streets to pick up passengers and run through to destination; and there appears no reason why this extension of service is not alike applicable to freight. For the carrying out of this scheme the alternating-current locomotives and motors with overhead conductors seem best adapted to involve the least possible complication.

It is out of place here to discuss the estimated comparative costs of installation and operation of the a.c. and d.c. systems. It is a matter of fact rather than of opinion, and the electric companies will soon develop the facts. Mr. Wilgus, with an evident desire to be fair-minded in his dignified contribution to the discussion, seems to be in conflict with himself in prophesying the comparative safety of the two systems. He admits the dangers of the use of the third-rail conductor, proved by many ghastly catastrophies; assumes that his protected, under-contact, rail conductor is safe, although it has never been tried, even experimentally, in actual service; and, nevertheless, in his summary makes it axiomatic that companies "must employ well-tried apparatus that has passed beyond the experimental stage." His protected conductor rail is promising, but we have no evidence that a derailed train may not plow it up or tip it over, with a result of holocausts the like of which have already occurred. His fear of derailed trains knocking down the supporting members of overhead construction used in single-phase operation is more reasonable in theory. It is something like the danger of knocking down the trusses of through bridges; but the record of such accidents is small, indeed, in modern times, and if this objection holds against overhead construction for electric power it is logical that through bridges should be eliminated. But we need not theorize about this, for the record of safe use at high speed of overhead conductors is long and satisfactory.

In this paper for May 12, 1905, page 475, there was published a selected list of then existing trolley runs at high speed longer than 20 miles. This showed 14 trolley services, 50 to 188 mile runs at average speeds of from 20 to 30 miles per hour. These average speeds necessitate occasional running at 60 miles per hour. The operation is safe. Admitting that local conditions will often govern, the fact that the two great electric companies have contracts for over 500 miles of single-phase alternating-current electrification is by so much indicative.

February Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of February, printed in another column, contains accounts of 26 collisions, 17 derailments and two other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

Feb.		Killed.	Injured
3d	Duran, N. Mex.	0	15
5th	Helena, Mont.	4	1
14th	Janesville, Wis.	5	10
14th	Columbus, Kan.	3	2
15th	Boston, Mass.	1	8
18th	Swannanoa, N. C.	2	3
25th	Enterprise, Miss.	1	12

The most prominent accident in this list, the collision due to a runaway near Helena, Mont., apparently escaped being a great holocaust only by the fact that the passenger train carried but few passengers. The only explanation of the cause is that near Austin the engine of the freight train was detached from the cars to take water and "by some means the cars got started down the hill." It was in August, 1901, that 34 passengers were killed in the same state (at Nyack) by a collision due to a similar runaway. Are steep grades specially dangerous in Montana? Or was the lesson of 1901 poorly learned?

The collision at Boston on the 15th resembles the Montana case in that a chief element in it was a feature which is known to be dangerous and which has been exemplified in other collisions quite recently. The car in which the passenger was killed was a light car placed in a train between heavy cars. The case was exactly like that at Sheffield, Mo., in October last, when 13 persons were killed. It raises the query whether the lessons of collisions, as related to the make-up of passenger trains, will have to be separately exemplified on each railroad before the danger of mixing heavy and light cars in the same train shall be duly appreciated.

The number of electric car accidents reported in the newspapers of the United States in the month of February was eight, in which eight persons were killed and 63 were injured.

Massachusetts is very far ahead of any other American state in the intelligence and energy with which she has tackled the grade crossing problem, but even in Massachusetts some of the most pressing local problems have been found very hard to deal with and are still unsettled; and there is a persistent demand that things be made to move faster. A bill has been introduced in the legislature to empower each special commission—one of which is appointed to deal with each local problem—to decide how soon its orders shall be carried out. Reciting that human lives continue to be sacrificed and that more speedy action is a necessity, the proposed bill aims to take the matter out of the hands of the railroad commission. It seems likely, however, that nothing can be done, for the causes of delay are by no means trifling. In some cities, the interests of conflicting parties and the great cost have made action seemingly impossible for the time being. The city of Boston is particularly opposed to a change in the law just at present, because of the great expense that might be thrown on the city for work in the Charlestown district which must be done in the near future. Again, a special commission never knows, until it takes up a case, what obstacles are going to be encountered. For interminable and unavoidable "delays of the law" the grade crossing problems of the great cities afford examples scarcely less striking than those afforded by the interstate freight rate problem. The progressive citizens of Massachusetts are, indeed, to be commiserated. But those of them who are inclined to despair should look for a moment at their neighboring state of New York. If Massachusetts is slow, New York is, in comparison, dead.

A second rear collision has occurred on an English road which uses automatic block signals and like the first it was on an electric line. Can it be that our British cousins, in adopting those two American "features," automatic signals and electric propulsion, have also adopted a third characteristic American product, and have thus given themselves a larger collision record? This second accident occurred at North Elmore on the Metropolitan District, the runner of a work-car, without any destination, ran past a stop signal, so as to try the automatic stop, but the stop did not prevent the collision, and the question on this point engaged most of the inspector's attention. The stop acted, but the speed was not such

ciently checked. There was an overlap of 424 ft., and the grade was such that the car should have been stopped in 300 ft., but it struck the car ahead with much force and seven persons were injured. The inspector concludes that the motorman under-estimated his speed and that the work-car, having two pairs of motor armatures, instead of the four pair usually found on passenger cars, had more momentum than the motorman had calculated on. The principal moral to be drawn is, therefore, that for such vehicles, with such a short overlap, the present speed limit at automatic signals (30 miles an hour) should be made lower. The inspector also finds that the use of sand has been neglected, for the reason that somebody believes that by it the track circuits would be interfered with. The inspector rejects this argument, as well he may; but he modestly contents himself with the conclusion that "the subject [of sand] is one on which the views of the company should be obtained."

Delaware & Hudson.

In common with the other anthracite carriers, the Delaware & Hudson has had a year of very marked prosperity. Under the present agreement between operators and miners, which expires April 1, anthracite coal, the main source of profit and traffic of the company, has been produced in larger quantity than ever before. General prosperity has at the same time helped to enlarge passenger and merchandise freight traffic. It was, of course, to be expected that in the year following the strike, earnings would attain record figures, but it could not have been expected that the high records of 1903 would be surpassed in each of the two succeeding years. The earnings of the Delaware & Hudson Company come from two sources—the mining and sale of coal and the operation of its line of railroad extending from Wilkesbarre, Pa., northeast through Albany and Saratoga, N. Y., to a Montreal connection at Rouse's Point, on the international boundary.

In 1902, the strike year, gross earnings from all departments were $22,500,000, a decrease of $7,000,000 from the previous year. Railroad earnings were $11,000,000, a falling off of over $1,000,000 from 1901. The year after the strike (1903) saw railroad earnings rise to $13,600,000, a gain of over $2,500,000, and gross earnings to $34,000,000, an increase of $11,500,000. The next year's earnings not only kept pace with these enormous increases, but in 1904 railroad earnings were $15,000,000, an increase of nearly $1,500,000, and gross earnings were $34,600,000, an increase of nearly $500,000. Following this nominally slight but, in reality, striking increase in gross earnings over the increase of $11,500,000 following the year of the strike, gross earnings have taken another upward move of more than $2,600,000. At the same time, railroad earnings increased last year $1,300,000 over the 1904 figure. This surely is a record of progressive corporate well being.

Of the $37,331,629 gross earnings from all departments, 73 per cent. came from coal. Of this amount $20,000,000 came direct from the sales department, and $6,889,764 of the $16,382,074 total gross railroad earnings from the transportation of coal. Total net earnings were $7,695,923, less interest and rentals of $3,016,328, leaving $4,679,594 as the total net income for the year after all charges, being 11.14 per cent. on the $42,000,000 capital stock. Dividends of $2,869,300 were paid; $1,303,643 was charged to profit and loss and credited, $800,000 to mining plant and $503,643 to equipment, and the net income balance of $188,908 was credited to profit and loss.

The road is operated in four divisions—the Pennsylvania, Susquehanna, Saratoga and Champlain divisions, following in this order from the Wyoming valley north to the Canada line. On the two southern divisions carriage of coal is much the most important business. Pennsylvania division earnings from coal were $3,326,968, which is 74 per cent. of the division's total freight revenue of $4,521,609. On the Susquehanna division, coal earnings were $2,794,761, 52 per cent. of the total freight revenue of $5,344,375. Coal traffic on the two northern divisions is a much smaller share of the total, being in each case 23 per cent. of total freight earnings of $2,125,701 on the Saratoga, and $1,242,269 on the Champlain division. On both of these northern divisions, passenger earnings were considerably larger than earnings from coal, amounting to more than one-third of total earnings; whereas on the two southern divisions passenger earnings were only about one-tenth of the total.

Gross passenger earnings were $3,014,839, of which the Pennsylvania, Susquehanna and Champlain divisions, aggregating 594 miles, earned $1,828,809, against $1,186,030 on the 249 miles of the Saratoga division. The importance of the passenger traffic on this division and the necessity for protecting it are shown by the acquisition during the year of a half interest in the Schenectady Railway (electric), and also, though not mentioned in the report, of a half interest in the United Traction Company, which controls the street railway systems within the cities of Albany and Troy.

The main line mileage was 843 miles, the same as in 1904. This makes it easy to compare operations for the two years. Maintenance of way figures out at $1,731 per mile of main track, against $2,101 in 1904 and $1,922 in 1903. A decrease in a year of $370 a mile, or 18 per cent. in cost of maintenance of way would, in the case of many roads, mean skimping the property; but the Delaware & Hudson's expenditures on the line are so liberal that this merely brings the figure down more nearly to the general average. Large expenditures on the line in preceding years must have been largely responsible for the reduction.

Under maintenance of equipment, repairs of locomotives cost $1,886 per locomotive, against $1,744 in 1904 and $1,186 in 1903. Repairs of passenger cars cost $377 per car, against $381 in 1904 and $321 in 1903, and repairs of freight cars cost $58 per car, against $43 in 1904 and $41 in 1903. Twenty-two locomotives, six baggage cars, four combination cars, 131 coal cars, 12 milk cars and 15 service cars were purchased or built during the year.

Conducting transportation cost $7,230 per mile, against $6,145 per mile in 1904 and $5,560 in 1903—an increase for 1905 over 1904 of $1,085 per mile, due to the largely increased traffic handled by the road. Gross earnings of the railroad department were $19,433 per mile in 1905, against $17,878 in 1904 and $16,617 in 1903, an increase of $2,816 per mile in two years. Expenses were $12,081 per mile, against $10,908 in 1904. Net earnings were $7,352 per mile in 1905 and $6,970 in 1904, an increase of $382 per mile following an increase of $303 per mile in 1904. These are notable earnings' increases.

Traffic and mileage statistics show 6,965,154 more passengers carried one mile than in 1904, and 325,059,477 more tons of freight carried one mile than in that year. The passenger miles were 120,840,369, or 143,364 passengers one mile per mile of road; and the ton miles 2,107,422,372, or 2,500,234 tons one mile per mile of road. This is an increase of 385,649 tons in freight density. The rate received per unit of both passenger and freight traffic was slightly lower than in 1904. Total freight earnings increased from $14,346 per mile of road in 1904 to $15,700 in 1905. The train load showed an increase for the year of 35 tons. It was 393 tons in 1903, 420 tons in 1904, and in 1905, 455 tons. Anthracite coal furnished more than one-half of the total freight tonnage of 18,021,300 tons, and nearly half of the increase for the year of 2,409,137 tons. The tonnage of bituminous coal increased 20 per cent., and of coke over 200 per cent., probably partly as a result of closer interchange relations with the Pennsylvania Railroad (Sunbury division) at Wilkesbarre.

Financial operations of the year consisted in refunding $10,000,000 first mortgage bonds of the Albany & Susquehanna Railroad, a subsidiary company. The Albany & Susquehanna has issued new bonds at a lower rate of interest, which were offered to stockholders of the Delaware & Hudson to the amount of 25 per cent. of their stock. These bonds have, for 10 years subsequent to their issue, the privilege of conversion into stock of the Delaware & Hudson at the rate of five shares of stock for each $1,000 bond. An increase of $5,000,000 in Delaware & Hudson stock has consequently been authorized.

One important element of the Delaware & Hudson's strength lies in its large appropriations out of income for betterments and depreciation. During the past year $1,821,573 was appropriated from current earnings and profit and loss for betterments, and $2,347,126, written off various accounts for depreciation, a total appropriation of $4,168,699. Depreciation charges included $826,000 charged off railroad equipment, and $800,000 charged off mining plant, washeries, etc., which cancels this item as an asset on the balance sheet. This is an extreme case of conservatism in valuing tangible property, an extensive mining plant being now carried on the books at no valuation whatever. The sinking fund, amounting to five cents a ton on coal produced, was $250,260. In accordance with its provisions, 500 shares of the company's stock were bought for $92,513 and retired, and on April 1st, 2,285 shares of stock, to be obtained by exchanging $457,000 in Albany & Susquehanna new bonds, not taken up by stockholders but purchased for the sinking fund, will be similarly canceled.

The principal figures for the year's operation follow:

	1905.	1904.
Mileage worked	843	843
Freight earnings	$13,233,954	$12,092,269
Passenger earnings	3,014,839	2,842,962
Gross railroad earnings	16,382,074	15,071,124
Maint. of way and struc.	1,459,345	1,724,931
Maint. of equipment	1,884,725	1,574,874
Conducting transportation	6,094,763	5,180,335
Railroad operating expenses	10,183,960	9,195,281
Gross earnings from all depts.	37,331,629	34,655,113
Net earnings from all depts.	7,695,923	7,452,479

Michigan Central.

The report for the year ending Dec. 31, 1905, reflects the prosperous conditions of the rest of the Vanderbilt system. The mileage was increased from 1,653 to 1,745 during the year, principally by assuming operation of the Detroit, Toledo & Milwaukee Railroad from Homer to Allegan, 66 miles. Gross earnings increased $1,790,924 to a total of $23,283,868, and although operating expenses, chiefly owing to liberal charges for maintenance of equipment, increased even faster than earnings, a good gain was shown in gross income after the deduction of expenses due to the

increase of $252,341 in the item "other income," arising principally from increased revenue from securities held and interest on advances. After paying dividends, which aggregated 8 per cent. during the year and which consumed $749,520, a surplus for the year of $223,934 was carried forward, as against $123,255 in 1904. The Michigan Central carries a good deal less coal in proportion to other commodities than is the case on most of the railroads of the country, and it carried a little less this year than it did last. Anthracite and bituminous together amounted to only 26 per cent. of the total tonnage. The freight traffic of the road is unusually well diversified, with a large movement of grain, of forest products and of general manufactures. As a result, the road gets a good ton mile rate, averaging .615 cent; and at the same time manages to get an average revenue train load of 418 tons. This has been very greatly increased during the past year. In 1904 the average revenue load was 371 tons.

It is interesting to see that earnings from passenger and express traffic have been increasing even more rapidly in proportion than have earnings from freight traffic. The proportion of increase in freight traffic during the year amounted to 6 per cent., while passenger and express traffic together increased over 12 per cent. This is quite an extraordinary showing in a year which indicates no special reasons for such a growth. The increases were due to both local and interline business and indicate a very healthy state of affairs in the company's prospects. The following table gives the principal statistics of the year's operation:

	1905.	1904.
Mileage worked	1,745	1,653
Freight earnings	$16,255,481	$15,273,012
Passenger earnings	5,225,528	4,818,764
Gross earnings	23,283,868	21,492,945
Maint. of way and struc..	3,418,740	3,135,125
Maint. of equipment	4,386,927	3,261,044
Conducting transportation.	10,518,814	10,130,382
General expenses	541,435	514,464
Operating expenses	18,865,916	17,041,015
Net earnings	4,417,952	4,451,930
Gross income	4,733,764	4,515,401
Net income	973,454	872,775
Surplus after dividend	223,934	123,255

Wheeling & Lake Erie.

The report at hand for the year ending June 30, 1905, is the sixth which the company has made, and the first full-year statement to be signed by President F. A. Delano. It will be recalled that the Wheeling & Lake Erie is now controlled by the Wabash-Pittsburg Terminal Company through ownership of 51.73 per cent. of its capital stock, while the Wabash-Pittsburg Terminal Company also controls the Pittsburg Terminal Railway & Coal Company through ownership of its entire capital stock, and is itself controlled by the Wabash Railroad through a similar entire stock ownership. The Wheeling & Lake Erie and the Wabash-Pittsburg Terminal Railway together furnish the Wabash entrance into Pittsburg and supply it with highly important traffic connections at Cleveland, Wheeling and Toledo. The Gould management has realized the importance of having at least this portion of the system in thoroughly able hands, and it is safe to say that no unit in the Gould group of roads is better worked at the present time than the Wheeling & Lake Erie, with F. A. Delano as President and B. A. Worthington as First Vice-President and General Manager. The brief statement of President Delano, which heads the report, explains that the difficulty heretofore has been that the road was too poor to adequately supply itself with equipment or to make the necessary improvements to take care of the business at hand. Last spring 62 locomotives, contracted for in the summer of 1904, were received, and these have proved of great service. Two thousand cars have also been added to the equipment since the close of the fiscal year under review, and the increased business handled with this equipment has fully justified the expenditure. The Wheeling & Lake Erie has not yet begun to receive any considerable benefit from the Wabash-Pittsburg terminal, and the benefits of the Pittsburg extension will probably not begin to show until the latter part of the fiscal year; but it is fully expected that by the summer of 1906 there will be a very material increase in the business derived from this source.

The road started off under its new management handicapped by a number of unfavorable circumstances, beside the shortage in equipment and in general facilities. For example, the cost of operating was materially increased by the necessity of putting on a number of fast non-paying passenger trains for World's Fair business. The company also encountered a severe drought which lasted from October to February, which still further reduced the usefulness of the road's equipment, already insufficient to take care of the business. The average earnings per mile of road for the entire fiscal year amounted to $10,393. For the six months ended Dec. 31, 1905, the average earnings were at the rate of $13,118 per mile, and the company believes that it could easily have increased the earnings 50 per cent. if it had then had the track facilities and the equipment necessary to handle the business. Mr. Worthington says in his report that the future of the property is dependent wholly upon this development of facilities, and he believes that the business that can be obtained along its lines should enable it greatly to multiply its earnings per mile of road.

In the income account, earnings from coal carried are separated from the general total of gross earnings and are shown to constitute 36 per cent. of the total. Except for this separation, however, the report does not show a classification of the freight carried, and such a classification would be interesting. Besides the coal traffic, iron and steel of course constitute an important part of the tonnage, though just how important cannot be stated. It will be recollected that the Carnegie Company has contracted to give the Gould roads 25 per cent. of its Pittsburg tonnage, though this arrangement is now pending the completion of the West Side Belt Railroad to the works; a link which is expected to be in operation by summer.

The company is capitalized at the rate of $83,666 per mile, stock, and $33,079 per mile, bonds, exclusive of equipment trust obligations. This makes a pretty good load to carry, as with all the Gould properties, but the funded debt, at least, is low. Net earnings for the current year fell almost $2,000,000 short of meeting interest, taxes, rentals and discount, but it seems reasonable to suppose that the new Pittsburg traffic, new equipment and facilities and good management will be able to put quite a different aspect on the statement next year. The following table shows the principal operating statistics for the year ending June 30, 1905.

	1905.	1904.
Mileage worked	442	442
Freight earnings	$3,812,461	$3,535,879
Passenger earnings	534,410	493,748
Gross earnings	4,595,607	4,325,282
Maint. of way and struc..	732,228	687,119
Maint. of equipment	763,899	717,459
Conducting transportation	2,015,119	1,750,710
General expenses	127,889	120,011
Operating expenses	3,639,135	3,275,299
Net earnings	956,471	1,049,983
Surplus	193,360 (deficit)	63,654

TRADE CATALOGUES.

"In the Maine Woods," an annual publication of the Bangor & Aroostook Railroad, is in size, interest, quality of engraving and descriptive writing, easily the peer of the first-class magazines. Editorially, it has but one objective: To make known the charms of out of door life in northern Maine. This it does in 130 pages, with a series of descriptive articles and 118 engravings of incidents and ways of living in the woods. These show how easy it has been made to live with absolute physical comfort, surrounded by chances to fish, hunt, photograph and study nature. This magazine is a fine example of method in creating new railroad business, but it is only one of the several activities of this company in pioneering. On its northern lines, primarily supported by lumber industries, it has won population and an enduring source of revenue by making known its agricultural and manufacturing possibilities. It is a marked instance of successful pioneering by a transportation company.

Dump Cars.—Two new types of Goodwin steel dump cars are shown in the 1906 catalogue of the Goodwin Car Co., New York. These two types are designated Class P P C for coal, ore, limestone and other bulk freight and Class S P O for ore. The essential features of the Goodwin general service dump car Class G have been retained, but these two types are much simplified in every detail. The weight has been reduced without sacrificing strength and the capacity has been increased to 120,000 lbs. of bituminous coal for the Class P P C cars and 120,000 lbs. of ore for the Class S P O cars.

Locomotives.—The Baldwin Locomotive Works, Philadelphia, Pa., has just issued its "Record of Recent Construction," No. 54. It contains half-tone illustrations and specifications for upwards of 15 locomotives built by the company for foreign roads, including locomotives for use in Porto Rico, Brazil, Japan, Chile, etc.

CONTRIBUTIONS

Cab Arrangements on Electric Trains.

Newark, N. J., March 22, 1906.

To the Editor of the Railroad Gazette:

As an engineman on one of the railroads which in the near future will in part be equipped with electricity, I should like to ask why there is so little attention paid to the cab arrangement of the new cars for this service. The cab door arrangement in use on the Long Island Railroad and also to be used on the new cars for the New York Central, by which the cab door of the vestibule is fastened in position half way open, is a very poor arrangement from the motorman's standpoint, as it helps to chill the vestibule in cold weather, and in case the motorman wishes to look back

at his train it is very unhandy as a window. The cab of a car for this service should be built with a drop sash in the side door, if no regular side window can be had, and the controlling apparatus so placed that the motorman can use the window without leaving his seat, very much the same as the cab seat and window of the steam locomotive. A look at one of the cars of either the Manhattan elevated or Brooklyn elevated roads will show how much in favor the side window seat is with the motorman. W. P. N.

Shavings Cut from the Rail.

New York, March 20, 1906.

To the Editor of the Railroad Gazette:

I note your editorial comment on my communication in *The Railroad Gazette* of March 16, relating to the shearing of shavings from the outer rail on very sharp curves under certain conditions.

Referring to my expressed opinion that the coning of the wheels is the principal cause of this shearing, you say: "Perhaps there is an error in this," and proceed to show that the present standard coning is so small that it could have very little appreciable effect.

The action of the wheels of a car truck upon curved track has been observed more or less, and has been theorized about a great deal. It is not a simple problem to investigate theoretically, and scarcely any two writers seem to agree in conclusions. My own study led me to the conclusion I have roughly stated in the communication, but to undertake to demonstrate it would take up too much of your space, and would bore most of your readers if they undertook to read it at all. Small as is the coning of standard wheels, it seems to be sufficient to produce the results observed.

It will be found, I think, that whittling of the rails occurs only with new wheels where the coning is not yet worn away. In the cases I have observed it occurs mostly where the gauge on curves has been originally, or has been widened, so that the front outer wheel may impinge at a considerable angle against the rail. Whatever may be the pressure, the flange of the wheel and the edge of the rail must stand at a certain angle with each other before actual shearing of the softer metal will take place, just as in a planer the edge of the tool must make a certain angle with the surface to be planed before it will take hold of the metal. The coning of the wheels not only tends to produce the necessary pressure, but to increase the normal angle between wheel and rail.

However, the principal object of my communication was to suggest a remedy for this shearing action, and I hope that some of your other readers who may have had experience in similar cases will favor us with their observations. S. WHINERY.

President Mellen on the Hepburn Bill.

The following extracts are taken from an address recently delivered at Hartford, Conn., by Charles S. Mellen:

Any legislation along lines that will accomplish the practical elimination of preferences and discriminations (and the present laws have nearly acomplished their purpose in these respects); amendments to existing laws requiring the frequent examination of books, records and accounts, as in the case of national banks, with the fullest returns and their publication and accessibility—will do more good to the public (and be without harm to the carriers) than any such legislation as is now pending before the United States Senate.

Under existing laws, amended to include car companies and other carriers not now subject to the Interstate Commerce Act, and with power to examine books and accounts and give such measure of publicity to the operations of the carriers as might be adjudged necessary, I would myself undertake to stamp out and hold in restraint the payment of all rebates and the practice of discrimination as completely and effectually as are murder and other crime against persons and property in all well-organized, well-disposed and law-abiding communities. More than this is impossible, and such a bill as this is unnecessary to eradicate the only evils of railroad management of which complaint has been made, or which are claimed to be existing, and would appear to be an attempt to obtain doubtful legal powers for an ulterior purpose not frankly disclosed.

It is easy to incite, it is exhilarating to lead, it is pleasing to be applauded; but the man is yet to come forward who can satisfy and control the mob, and it is well for the sober, successful citizen to think whether or no he should wait until his own particular interest is attacked before he rises to defend from such attack an interest so large, so important, so far-reaching as the railroad interest of this country, for the precedent established, his own interest will stand next in line waiting for the same disposition to interfere and manage it to his detriment.

To attempt in the short time at my disposal a thorough analysis of the Hepburn bill is impossible; but I will refer to one or two sections that have received but little attention by the press, and which seem to me to be open to most serious objection as being dictated by no public interest, and unnecessary unless there may be some ulterior object, and certainly giving such a grand chance for graft as to render a position upon the Commission one of the finest opportunities in the speculative world.

So much has been said about review by the courts (and the arguments for and against have been without number) that I much fear other important objections may be overlooked, and I will only say upon that particular branch of the subject that you should view with suspicion, and visit with your condemnation, any man or set of men who solicit to render you service but are wary of review by the courts until it is too late to be of any good. Their main interest is less your advantage than to secure power for themselves.

One would naturally suppose a measure drafted to protect the interests of the public against abuses on the part of railroad management would confine its attention to matters in which the public is interested, and why I believe there is some ulterior purpose not frankly disclosed in the present bill is because it is so drafted that it was plainly the intent of its framers to interfere in the relations of the carriers between themselves, in matters wherein the public has no interest.

The bill contains provisions intended to force the carriers to contract among themselves for through lines or routes, to compel artificial persons created by the states to do that which their charter requirements do not contemplate, to amend their charters, in fact, putting additional burdens upon them without their consent, and all this by a power that had no part in their original being or creation.

The carriers are compelled by their charters to carry persons and property at reasonable rates, and they have spent their money to put themselves in position thus to do; but they are under no obligations beyond their own lines, and I do not believe there is any warrant in equity or justice in attempting to make them assume a liability beyond their charter limits, and if they do their service within the limits of the territory they are chartered to serve there should be no power (outside the power to alter, amend or repeal, possessed by their original creator) to compel them to go beyond those limits to perform another service elsewhere without their consent.

Under Section 15 the power attempted to be conferred upon the Commission is such that our company, having a line partly by rail and partly by water over steamboat lines wholly owned and controlled by it, it is possible, if another party should establish a nondescript steamboat line in competition, for the Interstate Commerce Commission to order us to establish a through route with that line, and prescribe the rates and the divisions of those rates that shall obtain, thus diverting from our own line our own business, dividing our revenue, reducing values and consequently impairing the service—and for no advantage whatsoever to the public (unless it be to force a compromise or purchase), for such temporary reductions of rates as are the result of such a policy are more often a curse than a benefit, in that they are unstable, and a cause for discontent when all either do not or cannot participate. A policy like this is simply a case of robbing one carrier to benefit another, and offers the widest possible chance for speculation in reducing the value of the securities of one carrier and enhancing the value of those of another, with no possible advantage accruing to the public; and unprincipled men will be quick enough to see and take advantage of the same—and such, you know, are occasionally found in the service of the Government. The railroads have no monopoly of them.

Under Section 20, power is given to prescribe the accounts, records or memoranda to be kept by the carriers. This is right and proper; the carriers should keep all accounts, records or memoranda prescribed by the Commission, and the Commission should have the fullest power to use the same in any way in which the public interest may be promoted; but in this same section it is provided that any carrier who keeps any other books, accounts or memoranda than prescribed by the Commission is guilty of a misdemeanor and subject to fine or imprisonment, or both, in the discretion of the court. Of what possible advantage is it to the public that a carrier should be prohibited from keeping such accounts, records and memoranda of its business as may appeal to its officers as an advantage in keeping a check upon and record of its operation, so long as all records are kept that the Commission may desire?

Why should I be subject to fine or imprisonment, or both, if the Commission does not prescribe data and memoranda that I need to keep a check upon my business, and I supplement the records it does require by such additional records as I may need for my own convenience and information? Such a law as this would cover with shame the Czar of Russia or the Sultan of Turkey, and is wholly out of place under any enlightened system of popular government.

The warrant, I am told, for all this is that the Commissioners, at times, have been confounded by information supplied by the

carriers in controverting the misleading conclusions they have drawn from accounts kept in their own offices, and they do not propose to have a carrier appear before them with any data or information other than that in their possession, from which conclusions may be drawn contrary to their own; in other words, that no man shall plead in his own case any information drawn from accounts, records or memoranda other than those on file in the office of the Commissioners, for fear that their own misleading results may in the future, as in the past, be proved to their confusion.

To have accomplished the result aimed at, it would have been better to have prescribed (for it would have been much more effectual, although as hard to have controlled) that in any controversy no carrier should appear before the Commission with any accounts, records or memoranda, or with any more brains than possessed by the Commissioners who hear the case.

Washington Correspondence.

WASHINGTON, March 27.—Senator Tillman, in charge of the Hepburn railroad rate bill in the Senate, has made his first move in the direction of pressing for an agreement upon a time for the final vote on the bill, and Senator Dolliver has expressed the opinion that the bill may be passed in 10 days or two weeks, but the end of the debate is not in sight, and it is certain that it will be much more than two weeks before a vote can be had. There is no disposition on the part of any Senators to prolong the discussion unduly or to delay final action, but there are so many points upon which there are radical differences of opinion among Senators that an extension of the debate for some weeks may be necessary to give time for all of the arguments that will be submitted. It is expected that nearly every member of the Senate will make at least one set speech. Senator Lodge has already made two, and men like Senator Foraker and Senator Bailey may be counted upon to make several before the final vote is reached.

While other subjects are receiving more or less attention in the debate, it is apparent that the point around which all of the discussion centers, and over which the principal contest is to take place, is the question whether or not a reviewing court is to be permitted to suspend an order of the Interstate Commerce Commission pending judicial review. There is no longer any practical doubt as to the adoption of an amendment providing expressly for review, but there is much doubt as to whether the amendment shall prohibit the suspension of an order as is proposed by Senator Bailey. Senator Spooner's speech, in which he drew a distinction between the authority of Congress to confer jurisdiction on the inferior courts of the United States or to withhold such jurisdiction, and the power of Congress to restrict the general judicial power of a court when once jurisdiction has been given it, has aroused much doubt as to the constitutionality of the Bailey amendment, and has convinced some Senators that its adoption would add another to the many grave doubts that exist as to the constitutionality of the Hepburn bill.

An argument that is now being brought forward is that if this amendment should be adopted and the courts should be prevented from suspending, pending review, the operation of the provision imposing a fine of $5,000 a day for failure to put an order of the Commission into effect, it would make the bill unconstitutional under the provision of the Eighth Amendment to the Constitution of the United States, which provides that "excessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted." It is contended that the courts would probably hold this to be unconstitutional on the ground that it proposed to impose an excessive fine, and on the ground that it would be an attempt to deprive the carriers of the right to have an order reviewed on constitutional grounds, by presenting the alternative of having their property confiscated by the operation of the order or taking the risk of having it confiscated by the imposition of the fine.

The advocates of giving to the courts broad powers of review and leaving them free to exercise the right of enjoining the enforcement of an order so as to prevent the possibility of irreparable wrong being done seem to be gaining ground, but they are not yet ready to claim that they have a clear majority of the Senate. A great deal will depend on the success that Mr. Bailey may have in securing votes for his proposition on the Democratic side of the Senate. It is certain that he will not have the unanimous support of his Democratic colleagues, but the Republicans are also divided, and so many of their votes on this proposition are in doubt as to make it unsafe to predict what the outcome will be.

Senator Foraker intends to press his court proposition and ask the Senate to incorporate it in the bill as an alternative method of procedure, leaving the Interstate Commerce Commission free to proceed with the hearing of a case and issue an order or go into court and ask for an injunction against an illegal charge, as it may prefer. He will contend that even the most ardent advocate of giving the Commission power to make rates cannot object to this, and that it would afford a guarantee of effective legislation being left on the statute books if the rate-making proposition should be found to be unconstitutional. J. C. W.

Rebuilding the Housatonic River Bridge of the New York, New Haven & Hartford at Sandy Hook, Conn.

Speed of construction, as illustrated in the methods employed in replacing Bridge No. 105 on the Highland division of the New York, New Haven & Hartford at Sandy Hook, Conn., which was destroyed by fire, was recently discussed by Mr. A. H. Terry, Division Engineer, before the Connecticut Society of Civil Engineers. The progress of the work is shown in the accompanying photographs.

This bridge was originally a deck wooden truss of three spans, total length 500 ft., and 70 ft. from base of rail to low water level. It crossed the Housatonic river running east and west. The fire which destroyed it was caused by a live clinker which dropped from a locomotive and lodged on the northwest corner of the bridge seat just under the junction of the end post and the bottom chord. The fire was discovered at 10.45 a.m. Sunday, November 19th. There was a strong wind blowing from the northwest and the timber was very dry after a long continued drought. All efforts to check the fire were unsuccessful, and at 11.55 a.m., one hour and ten minutes after its discovery, the bridge was totally destroyed and in the river.

Word was immediately sent to New Haven and by 6 o'clock in the afternoon of the same day, under the direction of Mr. Edward Gagel, Chief Engineer of the road, Mr. W. H. Moore, Bridge Engineer, and Mr. W. J. Black, Engineer Maintenance of Way, the main features of a combination pile and frame trestle with openings for ice way had been designed. Meanwhile word had been sent to all bridge supervisors in the Western district (west of New London and Willimantic) to forward at once to Sandy Hook all timbers and piles which they had in stock of the various sizes needed. At the same time work trains were despatched to each end of the bridge to clear away the wreckage. A small water pile driver with float in three sections, the property of the road, was also ordered to Sandy Hook at once.

After arriving on the ground Monday morning, November 20th, it was decided to pile the center and east spans so far as possible, and to build the west span of frame construction. This last was made necessary on the west span by the fact that the bottom of the river in this span was rock ledge. The trestle as designed was to be built in three tiers with four ice ways, one in the east and one in the west span and two in the center span to be one tier in height and to be each spanned by four girders. These girders were to be placed one under each rail and one under each batter post of the intermediate tier.

Monday, Tuesday and Wednesday (November 20th-22nd) were employed in clearing the wreck and unloading plant and material. Thursday, November 23rd, saw the work actually started. The plan employed the first week was as follows: On the east side there were at work a land pile driver, a water driver, and for two or three days a steam wrecking derrick which was used to lower the heavier portions of the plant to the river bank. This does not count two work trains which were used to bring material, clear away wreckage, etc. On the west side there was a small derrick car and a stationary hoister which was set up on the west abutment. There was also a switch engine to handle the derrick car and bring material to the bridge and a work train for bringing material. After the first week, a patent car pile driver was used for power on the east side and the American Bridge Company's derrick car No. 204 on the west side. This derrick had a 50 ft boom and capacity of 50 tons, with boom at 30 deg. The force at work after November 24th, consisted of about 100 carpenters and 100 laborers, equally divided between the two sides of the river. This force was in large part brought in daily by trains from Bridgeport, Waterbury, Danbury, and one gang of 35 laborers from East Hartford. Only about 70 men could be boarded at Sandy Hook. These were all bridge carpenters. Most of the work was done between 6 a.m. and 5 p.m. (daylight to dark), although pile driving went on night and day until completed. Such other work as could be done at night was done whenever it was possible to thus expedite the work of the following day.

The trestle, as mentioned above, was built in three tiers. The top tier was a 4 post frame bent with vertical posts 24 ft. long. The intermediate tier was a six post frame bent with vertical posts 20 ft. long except where bents came on top of girder span. The bottom tier was a combination of pile bents, frame bent and girder spans. The frame bent west of each pier arch and the pile bents of nine piles each. All bents were spaced 12 ft. centers except in the case of the girder spans and one bent of 60 deg. The girders had their bearings in the case of the east and west openings, in a double bent, at either end. In the center openings where two girder spans came together the bearing at the ends was the same as in the east and west spans. The center bearing, however, was a triple pile bent.

The west span was built as follows. First the sill was bedded



Nov. 21st. At foot of east abutment. Debris on left is rock scaled off abutment by heat of the fire.



Looking west from east abutment. Wreck of old bridge lying in river on the right. This wreckage lay in the line of the bridge and had to be pulled out of the way before the new bridge could be started.



Looking east from the west side of the river.



View from up stream. West pier still smoking. Wreckage around west pier and between east pier and east abutment.



View of east abutment from the river side.

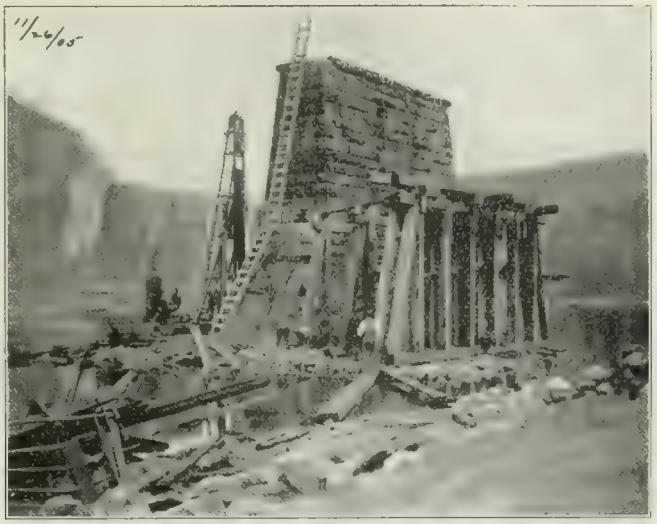


Nov. 24th. Temporary trestle in the west span fairly started, showing method of erecting in stepped tiers. The horses were framed flat and ended up with block and fall from hoisting engine on top of abutment.

Rebuilding Housatonic River Bridge of the New York, New Haven & Hartford at Sandy Hook, Conn.; November 21st to 24th Inclusive.



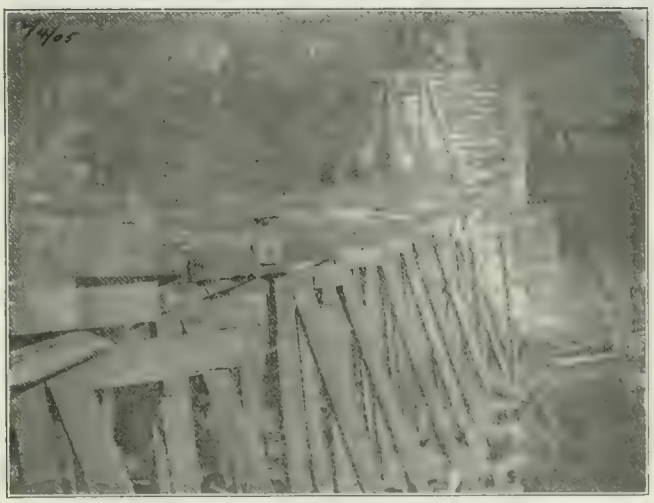
Nov. 26th. Temporary trestle two days later. Men working on runway on which girders for iceway were carried into place.



Construction at west pier showing frame bents erected on rip rap on the west side and pile-driver at work on piles for center span bent. The bottom was rock ledge on the west side of the pier so that piles could not be driven there. Wreckage in foreground at the left.



Dec. 2d. Looking west. Derrick car placing an 8 ton girder in center iceway



Dec. 4th. East span looking east. First ten tiers of horses are in place; the top two being put, to be ended up by patent pile driver. This tier of four ten horses was put together and ended up in thirteen hours.



Looking west from east pier. [illegible]



Dec. 4th. Looking south.

Rebuilding Housatonic River Bridge of the New York, New Haven & Hartford at Sandy Hook, Conn.; November 26th to December 4th Inclusive.

then the posts erected, then the cap placed and the whole ended up by block and fall, power being furnished by the hoister set on the west abutment. When the sills came in the water the bottom was first levelled off with small stone. The higher tiers were put together on the tier next lower and ended up in the same way. To do this it was necessary that each of the two lower tiers should be kept two bents ahead of the one next higher. All timber was cut on the track level and lowered into position by the car derrick until the arrival of the American Bridge Company's derrick. The girders for the west span were unloaded by hand and taken in skids to their resting place, power being applied through block



Afternoon of Dec. 4th. Placing last girder in east span. Derrick car in center span. Ready to end up top tier of east span.



Morning of Dec. 5th. East span complete. Derrick car ready to move to west side.

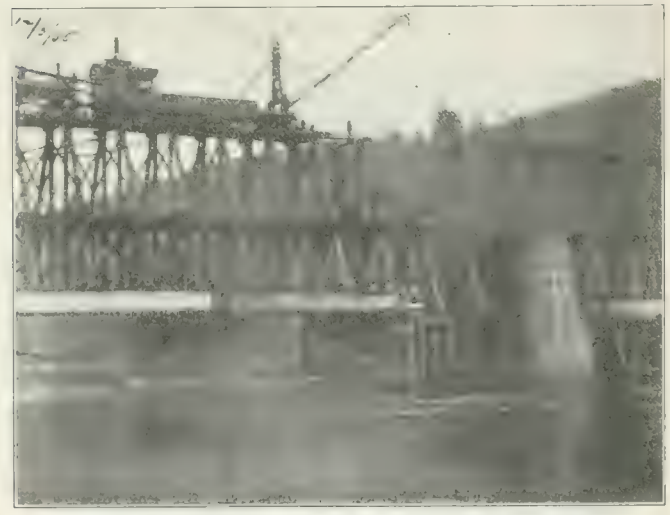
Rebuilding Housatonic River Bridge of the New Haven Road at Sandy Hook, Conn.; December 4th and 5th.

and fall from the hoister. These girders were 55 ft. long and 4 ft. 6 in. deep. The center pair came riveted together and were placed without cutting them apart. After the arrival of the derrick all bents were put together ashore and carried out by the derrick and placed bodily. The iron of the center span was placed by the derrick. The girders of these spans were 55 ft. and 46 ft. long, respectively. The west span and the two higher tiers of the center span, including girders, were built by the force on the west side.

On the east side the construction and method were both different. All except five bents of the bottom course were pile bents. The 46-ft. girders were lowered to the river bank by the steam

next bent was then framed and hauled into position with its top resting on the first bent and so on. When the entire tier was thus in place, each bent, beginning with the one nearest the abutment, was ended up and stayed in position, after which the rangers were telegraphed into position and doweled down. The top course was placed in the same manner. On this tier, after the timbers had been cut, 14 horses were carried to their destination piecemeal, put together, and erected in 13 hours.

Each bent of the entire structure was braced traversely by a single X brace of 3 in. x 10 in. pine spiked with ½ in. x 8 in. boat spike. The structure was braced longitudinally by a triple row of



Morning of Dec. 6th and Dec. 5th. Derrick car placing rangers on top of intermediate tier. Five horses in use.



Dec. 7th, 2 p. m. Patent pile driver crossing bridge to take siding and clear for first train to cross.

Rebuilding Housatonic River Bridge of the New Haven Road at Sandy Hook, Conn.; December 6th and 7th.

rangers between the intermediate and bottom tiers and a double row of rangers between the intermediate and top tiers. In addition to this, there was a single row of X bracing placed longitudinally for the two highest tiers. No dowels were used except for the rangers and track stringers and no mortise joints at all. All joints were made by spiking a plaster of 3-in. plank to cap and post and sill and post. On the west side the track stringers, ties and rails were carried out with the top tier, two methods being employed: Before the arrival of the large derrick car the stringers, ties and rail were carried out by the small derrick car and placed piecemeal; after the big derrick car came, a panel of track 36 ft. long was put together

wrecking derrick and hauled into position by block and fall, the land driver furnishing the power. This gave a level surface to work on. All the bents of the next course were framed together lying flat on the course beneath, before a bent was raised. All the timber on the east side was cut on the river bank just south of the bridge and from there carried to the foot of the abutment, from which point each stick was telegraphed to its destination by a fall running from the patent driver on top of the abutment to the east pier. The bent nearest the pier and farthest from the driver was put together first and hauled into position with its sill resting on its bearing on the rangers of the tier below. The

ashore, carried out as a whole and placed bodily. On the east side the top tier was complete before any of the stringers were placed. Here the stringers were all framed on the river bank and hauled into position by the patent driver, after which the track forces placed the ties and rails.

The total amount of square timber was 270,000 ft. (board measure) exclusive of waste, which was small. Of this amount 90,000 ft. was in stock at the time of the fire and the remainder was bought in the market and forwarded to the work as required. There was practically no delay to the work on account of lack of material. The first regular train crossed the new structure Decem-

ber 7th at 2.46 p.m., just 18 days and 4 hours from the discovery of the fire, and about 14½ days from the time the first timber was framed.

Alternating Current Electric Systems for Heavy Railroad Service.

[In the *Railroad Gazette* last week was published on pages 302 to 309 an abstract of a paper on this subject, read before the New York Railroad Club, by Mr. B. G. Lamme, of the Westinghouse Electric & Mfg. Co., together with a comment by Mr. W. J. Wilgus, Vice Prest., N. Y. C. & H. R. R. R. An abstract of the further discussion by Mr. Calvert Townley, N. Y., N. H. & H. R. R., and Mr. Frank J. Sprague, of the New York Central Electric Commission, is given here.]

Mr. Townley.—I think too much credit cannot be given Mr. Lamme for his persistent and long continued effort in developing and pushing forward to its present position the alternating current system. Some one has got to get behind every new development and put his entire energy into it before it is successful, and as you very well know that is generally a thankless task.

Interesting comparisons between electric and steam operation have been made, the cost of installing and the operation of various systems have been discussed, and the results obtained by the use of any of the electrical systems have been compared with those obtained by the use of modern steam locomotives. It seems to me that, valuable as is all this discussion, in a sense it is misleading. The electric locomotive, however much we may admire it, is a very new baby; the steam locomotive has been through years of development, and with all its complicated mechanism it has been perfected to a high degree. No one expects or claims that the electric locomotive as it appears to-day will be the electric locomotive of ten years hence. All that can be said of it, is that it is the best available now, and that best seems good enough to try. Further, the chances are in favor of a decreased first cost, and of reduced operation and maintenance charges as time goes on, so that any comparison neglecting these probabilities is consequently incomplete and faulty. Further, from a much broader standpoint, a comparison between electric and steam locomotives is in many respects like a comparison between their prototypes—the trolley car and the gasolene motor car, or any of the self-propelled and self-contained vehicles, that is to say, the self-contained unit has only available the power generated by and within itself, and it is, therefore, absolutely limited in the amount of work which it can do. The power limitations of the steam locomotive have existed from its beginning, and as they have had to be reckoned with, the road-bed, bridges, rolling stock and train operation, all have been arranged accordingly.

It is not surprising, therefore, that even the contemplation of a service readjusted to take advantage of the removal of this limitation requires a complete mental revolution, which the mind of the steam railroad engineer finds it difficult to make. To illustrate this point, we may consider that the electric locomotive is, in fact, the equivalent of a steam locomotive with its boiler removed and set up some distance away, and that a system equipped with electric locomotives, or with multiple unit cars, is the equivalent of a large number of steam locomotives, with all their boilers removed, rolled into one and placed some distance away. The electric system is simply the connecting link between these boilers and the driving wheels of the several engines on the road. This means that for the power developed by any one locomotive, instead of the limitation of the amount of coal one fireman can shovel into its one firebox, or by the amount of steam which that locomotive's cylinders will take, there is available at the drivers of each machine practically all the power generated in the entire power house boilers, that is to say, a steaming power represented by the amount of coal which all the firemen on all the locomotives can shovel into all of their several fireboxes. This statement of the case is, of course, not literally true in the last analysis, but it is so in principle, because of the fact that the electric system being a means of transmission only will attempt to transmit all the power supplied to it by the prime mover, and that it further has the ability to perform for considerable periods of time very far in excess of its normal capacity.

In handling heavy freight traffic, or even high grade passenger traffic, instead of having to keep down the length and weight of trains in order to obtain the necessary speed, instead of being limited to a certain maximum locomotive weight by the strength of bridges and other structures, instead of being hampered by the consideration of maximum sized wheel base and the maximum weight per driving axle, by using two or more locomotives, connected together by the multiple unit system, it becomes feasible to get practically any amount of speed and any amount of tractive power that is needed to perform a given service. It follows that the size of train units, whether passenger or freight, can be increased up to any extent desired, and be limited only by the strength of the draft gear of the rolling stock.

The track capacity of any given road can be materially increased by the substitution of electric traction for steam, and without the expenditure of one dollar for new rights of way for the construction of additional tracks, and for the strengthening of expensive bridges, trestles, etc. I see no escape from this conclusion. The value of this increased track capacity is difficult to appreciate. Take, for example, a community whose business growth depends upon its railroad facilities. When those facilities have been outgrown it often is a long and a difficult, if not an impossible task, to expand them, that is to say, to procure rights of way for additional tracks through a congested district where they are badly needed, is frequently so difficult and expensive an undertaking that such tracks are never provided, and a further growth of that community is, in consequence, correspondingly hampered.

If my logic is correct, and by the substitution of electricity for steam it becomes feasible to materially expand the traffic capacity of a choked up and congested section of railway by a material percentage, this consideration far outweighs in importance any comparison of the relative costs of the engine mile of steam and electricity. I do not mean by this that the cost of the engine mile is not important, nor that we do not expect to obtain a material reduced cost by the substitution of electric locomotives, but I want to emphasize what I regard to be the far more important side of this question than that which has heretofore been given greatest prominence.

If any of you will study for a short time the railroad map of southern New England, you will be impressed at once with two prominent facts; first, that the New Haven system is not a single line stretching across the country, but is a more or less complete network of lines ramifying among the numerous manufacturing towns throughout the states of Connecticut, Rhode Island and Massachusetts. This fact naturally means many short distance runs, and a comparatively large number of trains in a given district. Two conditions to meet which electric traction is particularly well adapted. You will also see that for a considerable part of the distance, tide water is reasonably near; in fact, within easy electrical reaching distance. This condition, and the fact that there are numerous water powers throughout the New England hills, affords ample opportunity for the cheap generation of power. If, therefore, with short hauls and congested traffic, and if with an abundance of cheap power, the New Haven system is not especially designed and located for operation by electricity, I doubt if you will find a large railroad system anywhere that is.

Bearing in mind, then, the numerous possibilities of complete electrification, and the favorable conditions of the New Haven road, which we have just named, it was absolutely essential that, in considering the question of initial electrification, there should be borne in mind not only the immediate requirements, but also the possible future duty which this road would have to meet, and to select an electric system suitable thereto, and which would impose as few handicaps on future expansion as possible. It is our view that in selecting a method of operating by electricity, first consideration should be given to reliability, including safety, and second to first cost and low operating charges. From this point of view you will note that in the system which we have adopted, and which has been described by Mr. Lamme (single phase alternating current) our selection has been particularly happy.

Starting from the power house bus-bar, there will be but one link in the transmission of energy to the locomotive, namely, an 11,000 volt trolley wire. Had we adopted a system of high tension transmission, with rotary converter substations, there would have been no less than eight links, instead of one, that is to say, 1st an 11,000 volt, three-phase transmission line; 2d, a high tension substation switch board; 3d, a set of step-down static transformers; 4th, a rotary converter; 5th, a D. C. switchboard, 6th, a storage battery, 7th, a system of direct current feeders, and 8th, a 600 volt third rail.

None of these links are bad in themselves, but it must be admitted that there is a greater danger of interruption to service, and a greater opportunity for misfits in the eight opportunities for trouble as against one.

It might be possible, of course that opportunities for trouble on a high tension trolley line, such as is proposed would be so great as to offset the apparent disadvantage just cited, but such an assumption is not warranted by any logic based on existing alternating current transmission practice, or past experience in the operation of single-phase motors.

On the ground of first cost, the single-phase alternating current system is far in the lead, in fact, it is doubtful if electrification on a large scale would be warranted at all if no other method than that of continuous current with rotary substations were available.

The electrification of the New York division, 61 miles, from Woodlawn Junction to New Haven, and the possible future extension to New London, Hartford, Springfield, Providence and Boston, must provide both for a suburban service and for through traffic. The latter comprises heavy trains, and the train intervals are as infrequent as compared with the intervals ordinarily prevailing in trolley service. On this account the maximum drafts of power are very greatly in excess of the average consumption and it will be these maximum drafts and not the average consumption which

must determine the capacity of each part of the distribution system. This means that the alternating current transmission system, with rotary converters at sub-stations must be placed close together, and the capacity of each station made abnormally large, with the consequent first cost becomes alarming, if not prohibitive.

With the single-phase current, 11,000-volt trolley on the other hand, a single trolley wire over each of four tracks has ample electrical capacity for the heaviest demands that are likely to be made upon it. I think it needs no further argument to demonstrate the enormous advantage in the matter of first cost of the system which we have adopted.

In operating charges, it is noted that the single-phase alternating current system eliminates at once all the labor and other expenses connected with sub-station operation, and it is, of course, relieved, likewise, from the heavy fixed charge due to investment in those stations. It is further relieved of the constant losses of transformation, and of the loss due to the very considerable drop in the 600 volt secondary distributing system. This will mean a saving in power output averaging at least 10 per cent., this being, if anything, an under rather than an over statement of the facts.

It was supposed a year ago that possibly the single-phase system would be handicapped by a very heavy and a very expensive locomotive, which would be subject to a further disability of design, in that the motors must be geared to the driving axles, instead of being direct connected. These objections, it is now known, have disappeared. The motors are made of the gearless type, and judging by factory tests of our first locomotive, the other imaginary disabilities have also vanished.

A further important consideration to us has been the flexibility with which the electric system might be extended in the future to branch lines. It is likely that we may be called upon at any time to reach out a considerable distance and handle, by electricity, a limited and infrequent service. This can be accomplished by the use of the 11,000 volt single-phase trolley, at a very moderate construction expense for an overhead structure, and with no fixed operation and maintenance charge such as would be necessary were a rotary sub-station required.

Considering the advantages which I have enumerated, and I have by no means stated them all, simply referring to the most important ones, I do not see that the engineers of the New Haven road had any alternative but to select the system which has been chosen. The only difficulty which presented itself was the necessity for operating on the continuous current system between Woodlawn and the Grand Central station, but when it was found that the single-phase locomotive, with but slight additional complication and expense, could be made to operate with equal facility on either the continuous or alternating current, this remaining difficulty promptly disappeared. I desire here to call attention to one fact, which, although we all know it, remains so frequently unsaid as to be sometimes forgotten in a comparison such as I have drawn. I refer to the fact that the alternating current single-phase system, while it can be used at any desired tension on overhead trolley where the continuous current cannot, it can also be used on a third rail or any other form of conductor, and at any tension, low or high, that may be best adapted for the service. That is to say, in passing through a city or town, or under bridges or tunnels with insufficient clearance, it is always possible to step down the high trolley voltage and run for such distance as may be necessary at any other selected voltage, the current being collected either from a third rail or otherwise. It is obvious that a system which lends itself to practically any form of transmission, and any form of current collectors, and that may be used with any other system, cannot be charged with weaknesses attending the use of a particular type of conductor. I regard this flexibility as a very valuable feature of the single-phase system.

Mr. Wilgus criticises Mr. Lamme's description of the overhead construction as failing to provide for operation in case any section of a line should be disabled. If you will refer to Mr. Lamme's paper you will find that this criticism is not well founded, as provision has been made for a continuous feeder running the whole length of the overhead structure, which feeder is so arranged that by means of automatic cut out switches any section of track may be entirely cut out of service, and the sections beyond remain undisturbed. I might also point out that each individual trolley wire is likewise protected at the end of each two mile section, so that one, two or more of the four tracks in any section may be cut out of service and the remaining ones be undisturbed.

The New Haven road also has a somewhat different problem of electrification because, through the Consolidated Railway Company, the New Haven road owns and operates several trolley properties adjacent to its steam lines. It is not unlikely that a number of branches heretofore operated by steam may be electrically equipped and operated in connection with one or more of the trolley lines, affording a frequent intercommunication between adjacent centers not feasible in steam railroading, and at a moderate expense. By equipping such lines with the single-phase trolley system, and providing rolling stock that may operate either on that system or over the continuous current trolley systems referred to it becomes possible to take advantage of the opportunities just described and at the same time to maintain a uniform method of electrification adapted alike to sparsely settled and to congested districts. I believe that this plan if carried out will result in great benefit to the communities served, and will be no small factor in the commercial development of southern New England.

Mr. Sprague said: Referring to Mr. Lamme's general description of the three principal methods of operation, each was practicable and had certain specific advantages, but he must condemn the assumption that past practice measured the limit of potential in d.c. operation. He had projected raising the direct current standard for some classes of work to at least 1,500 volts, and wished to repeat without reserve that not only was this increase possible with modified forms of construction, but it made practicable the resuscitation and adaptation for locomotive use of early and effective methods of variable speed control.

It had been incorrectly stated at a former meeting of the club that a continuous current locomotive had but two economic speeds. In the ordinary two-motor d.c. equipment the motors were given two impressed electromotive forces, half and full, by the series parallel control, and with a four-motor equipment there were three impressed electromotive forces; in each combination there was for any definite current and torque a certain speed, but with each the entire range of speed after leaving the resistance control was an economic one.

Since it had been stated that the power to make up time was one of two factors which alone would be sufficient reason for adoption of single-phase operation, it was of special interest to note that Mr. Lamme emphasized the fact that even with the plain series motor there is possible a wide range of economic speed control by field variation alone while maintaining a constant torque. Hence this assumed advantage seems to have already largely disappeared.

The special improvements which had been referred to made possible a range of several hundred per cent. in economic speed at will, with any desired gradation, and a like range of return of current to the line where such was advisable. These developments contained the promise of effective results in certain difficult classes of railroad operation.

It had been stated that the storage battery as a reserve was available to the single-phase a.c. system, but of course the only possibility was by the introduction at sub-stations of rotating machinery, held to be such a bugbear in d.c. operation, and then only under conditions of serious energy losses, as illustrated in the plans of a certain western road. There a polyphase synchronous a.c. motor is to drive a single-phase generator, and to the same shaft is coupled a direct-current machine which with light line loads will charge the storage battery, and when the line load increases, with consequent slowing down of the synchronous motor, it will reverse its function, and taking current from the battery help drive the single-phase generator. About half of the electric energy, after leaving the original power station, will undergo six transformations, and the other half ten transformations before reaching the motors on the car.

Much had been said on the subject of electrolysis, which trouble had been held as individual to the d.c. system. That such has taken place was undeniable, but largely because of local conditions. Most electric railways in the localities instanced had their tracks laid in intimate contact with the earth. They ramified in all directions on streets filled with leaky sewer, gas and water pipes. The ground was at times saturated with rain and other liquids—with resulting conditions especially favorable to electrolysis. On a trunk line railway conditions were essentialy different. Heavy traffic rails of enormous current capacity were carried on wooden sleepers embedded in well drained broken stone ballast. Being on a reserved right of way they were well removed from gas and water pipes, and little apprehension need be felt. In this connection he quoted some recent remarks by Mr. A. P. Trotter, the electrical expert of the British Board of Trade, under whose jurisdiction all electric railway installations in England were now made, as they appeared in the February, 1906, issue of the *Transactions of the Faraday Society*, of which Lord Kelvin is President.

Mr. Sprague said that it is not the volume of current on the rail that determines the amount of electrolysis, but the difference and character of potential which exists in the different parts of the track and the facility offered to the flow of current because of that difference of potential to other metal conductors. But the single-phase a.c. system had a special difficulty of its own. When using pressures as high as 11,000 volts, even with only 5 per cent. loss on the rails there would be a mean difference of potential on the tracks of 550 volts, with a maximum of nearly 800 volts. Leaving out the question of electrolysis, which there is good reason for believing will take place, there were possibilities of serious interference with lightly insulated telephone and grounded telegraph serv-

ices, the latter operating with phantom circuits in the duplex and quadruplex systems.

Referring to the economic advantages of high tension operation, he reminded his hearers that he had always been the advocate of higher potentials, and believed that whether with a.c. or d.c. currents it would be necessary on occasion to go to the highest permissible limits, but here again came up a new point for consideration, for the higher the potential the greater the necessity for concentrating motor equipments in a single unit, whether it be a car or locomotive, for we could not view without apprehension the project of introducing into the several cars of a passenger train made up wholly or partly of motor cars of the very high potentials contemplated in long distance infrequent locomotive service. It is therefore quite possible that different standards of potential would be adopted on different parts of the same line.

In discussing pressures, conductor capacity and costs, some elemental facts should be borne in mind. When subjected to single-phase currents all conductors labored under some of the same disadvantages as does a motor, and an iron track rail especially so. Under average conditions as to size, frequency and power factor a copper trolley wire will offer about one and a half times, and a steel rail about six and a half times as much total apparent resistance to a single-phase alternating current as the same conductors will offer to a direct current of like volume.

Comparing the actual capacity of tracks and conductors as to be installed on the New York Central and on the New Haven, the total apparent resistance per mile of the latter will be about six and a half times as much as that of the former to like volumes of the two currents. This practically meant that if the two roads had sub-stations the same distance apart then with the same loads and line losses the mean pressures required on an a.c. system would be over two and a half times as much as on the d.c., and the maximum pressure over three and a half times. For example, operation with a direct current at 1,500 volts would give the same line losses as operation with a single-phase a.c. at a mean pressure of about 3,800 volts and a maximum of 5,400.

Mr. Townley had stated that in place of the normal high tension overhead trolley a low pressure third rail could be installed wherever along the line limited tunnel and road crossing clearances will not permit the former, and also that terminal yards could be similarly equipped. Momentary shiftings from high to low pressures and vice versa are not enviable operating conditions. With a tunnel of some length and in yards an a.c. third rail is possible, but only and with special construction. Single-phase operation is essentially a high pressure and copper conductor proposition, and the ordinary steel third rail is practically barred to it. The mean a.c. pressure can only be about seven-tenths of that allowable on the d.c. system, with resultant current increase irrespective of how it is transformed. On account of the high rail impedance the result is very much as if on a d.c. system the pressure were reduced a third, and with the increased current a 10 or 15-lb. rail were generally adopted. A copper conductor should therefore be used, and even then the low power factor, the greatly increased currents, the extra resistance of the equivalent copper conductor and the high impedance of the traffic rails would constitute serious operating limitations.

Statements as to the cost of working conductors were misleading. The constant tendency of the times is to require the abolition of grade crossings, and when established in congested districts they cannot be changed save at great expense and risk. Even in the country the tendency is to make the clearances as small as possible to avoid unnecessary grades on either the railroad or the street, and when the railroad is the lower the changes necessary to insure reasonably safe conditions for carrying a high potential a.c. trolley wire by present methods are necessarily costly, and must be added to the capital account chargeable against electric equipment on this plan. Changes in levels and alinement of tracks, as well as the addition of sidings and running tracks, must also be anticipated.

Single-phase, polyphase and continuous current motors have different characteristics. The first gives an intermittent drawbar pull, the others a continuous one. In a 25-cycle single-phase machine for 50 times a second the torque produced by the reversible and variable current rises from zero to a maximum of nearly half as much as the mean, while in the continuous current and the polyphase motors the maximum torque is practically the mean for any given conditions. The result is two-fold; first, the latter machines, since they receive a continuous instead of an intermittent delivery of energy, are not only lighter but more economical; and second, for equal drawbar pull it would seem that the actual weight on the drivers of a single-phase locomotive must necessarily be considerably in excess of that required for the others, or else when pushed to the limit there would be a periodic slip.

A comparison of two locomotives appeared to bear out this contention. The New York Central d.c. machine has about 70 tons weight on the drivers, its motors measured on the hour rating and without special ventilation aggregate 2,200 h.p. capacity, and is guaranteed to handle trains having a total weight of from 400 to 550 tons, according to schedule required. The New Haven a.c. locomotive is reported to have 72 tons on the drivers, to have an hour rating without ventilation of only 1,000 h.p., and is intended to handle trains of 200 to 250 tons.

It has been popularly stated that while cars equipped with single-phase a.c. motors cannot accelerate as rapidly as those equipped with like capacity of d.c. motors this is not a matter of importance when dealing with locomotive drawn trains making infrequent stops. Whatever disadvantage there may be in this respect it is equally present whether a single-phase motor be used under a car or in a locomotive, for in either case it will probably be operated up to the slipping point of the wheels, and the gist of the criticism, of course, is that there is required a greater ratio of weight on the drivers to get equal acceleration, and the heating of the motors is more pronounced. This is a matter of considerable importance when attempting the quick accelerations which are necessary for high schedules with frequent station stops, and it is pertinent to operation on the New Haven road, where within the district to be operated by single-phase current the station stops and the schedules are practically the same as those of the New York underground railroad, on which d.c. motors are used and 43 per cent. of the weight of the train is carried on the drivers.

Mr. Sprague held that the polyphase motor, admirable a machine as it was, has but limited possibilities in railway service, and was largely confined to single units. For multiple unit operation it was impracticable under the ordinary conditions of railway operation because of the small air gaps and the difference of duty with varying wheel diameters.

Comparing the direct current and single-phase motors simply as machines, he said that the former with equal development must always be the better, for it is of simpler construction, is lighter and more economical, has a larger air gap and runs at a slower speed. It has from a half to a sixth of as many sets of brushes, can always have a series winding for the armatures, can be operated at a higher individual potential, and sparking at the commutator can be more readily eliminated. Heating is less, for the transformer action is absent, and the torque is constant instead of intermittent. The claim that a motor built for successful operation on single-phase currents must necessarily be the best kind of machine for d.c. operation was not borne out in theory or in practice. If so there would be no valid excuse for maintaining dual manufacture.

Iowa, Vermont and Prussia.*

The apprehensions of my friends seem to cluster about the idea that if this law passes, New England will suffer from the incubus of what are termed "commission rates"; that we shall be afflicted with a touch of "Government rate making." While there is not the slightest foundation for any assertion of this sort, I want to inquire for just a moment whether if this were possible it would necessarily be an unmitigated evil for New England?

The State of Iowa is about the size of all New England combined. It was one of the first states to create a commission with power. For the last thirty years the maximum rates of Iowa have been fixed by its Commission. While there was objection at the outset that these rates were too low, there is little or no claim of that sort to-day. Its railroads are prosperous, and its railroad service excellent. Taking New England as a whole and considering all conditions of construction and operation, we ought to enjoy as favorable freight rates as Iowa.

The State of Prussia, which, as you know, is the largest in the German Empire, is about twice the size of New England. It owns and operates nearly or quite all its railways at the present time, and prescribes the absolute rate for railway transportation. I live at Newport, in the northern part of Vermont, and I have had the curiosity to compare some of the rates which we pay with those which are made by the Commission of Iowa and the Government of Prussia.

Potatoes are a commodity extensively raised and shipped to market in New England. The rate from Newport, Vermont, to Boston, a distance of 250 miles, is 19 cents. In Iowa the rate for a similar distance is 12½ cents; in Germany, 9.6 cents. The great potato-raising section of New England is Aroostook County, Maine, an average distance of 100 miles from Boston and 600 miles from New York, the rate being 21 cents to Boston and 29½ cents to New York. The Iowa tariff for 400 miles is 29 cents. They have no distance as great as 600 miles. The Prussian tariff is 13½ cents for 100 miles and 18½ cents for 600 miles.

Another article in which the farmers of northern Vermont are largely interested is hay, which is cost [illegible] 15 cents per 100 lbs. to send in carloads from Newport to Boston. In the State of Iowa the same service would be [illegible] for 11 cents, while in Prussia it would cost [illegible] cents. We are also manufacturers

* From a paper by [illegible] Vermont Interstate Commerce Commission, read before the [illegible] State Board of Trade, Boston.



Fig. 1 Switches and Signals at Roseville Avenue, Newark, N. J., Delaware, Lackawanna & Western.

A part of the Bloomfield Branch (signals 1 to 7) is cut off and shown by itself.

of butter, upon which the rate in carloads from Newport to Boston is 46 cents. In Iowa the tariff for a corresponding distance is 26 cents and in Prussia 36 cents. Our principal industry at Newport is lumber, upon which we pay a rate to Boston of 10⅔ cents; to Hartford, Conn., 256 miles, 15 cents. The Iowa lumber rate for 240 miles is 9¼ cents; for 256 miles, 9⅔ cents. The Prussian tariff for 250 miles is 6.4 cents.

Going now in the other direction, I find that the rate on sugar in carloads from Boston to Newport is 15 cents; that the Iowa tariff for a corresponding distance is 17.1 cents, while in Prussia the charge is 10.9 cents. Fertilizers in carloads take a rate from Boston to Newport of 17 cents, in Iowa the distance tariff is 9⅓ cents; in Prussia, from 7.7 to 9.8 cents.

It is possible that rates can be found which are lower for corresponding distances in New England than they are in either Iowa or Prussia. I know of none. These figures fairly show that the rates of Iowa are materially lower than those of New England, and that those of Prussia are lower still. I would be glad to have some of these gentlemen who stand horrified when you talk of a commission rate or a Government rate make plain just how it is that the payment of these charges from 10 to 33⅓ per cent. higher is of such enormous benefit to the people and the industries of New England.



Fig. 3 Slip Switches and "Double-Deck" Signal Rod Lines.

Interlocking on the Lackawanna at Roseville.

The signal department of the Delaware, Lackawanna & Western has lately finished an interlocking plant of 49 levers at Roseville avenue, Newark, N. J., in which a number of interesting details have had to be designed especially for the location, and some of these details are here described. Roseville avenue is the junction of the main line of the Morris & Essex division with the Bloomfield branch, leading to Montclair. The grades of both the main line and the branch have lately been depressed, so that the whole of the roadway shown in the drawing, Fig. 1, lies in a narrow cut between vertical concrete walls. That part of the drawing showing the signals on the branch has been separated from the part showing the main line in order to bring it within the space of a page. All of these branch signals (Nos. 1, 2, 3, 4, 5, 6 and 7) are entirely hidden from the cabin. Both main and branch lines are equipped with automatic block signals, and therefore no distant signals are shown in the plan, all of these being at the farther ends of the



Fig. 4—Leadout, Looking East.



Fig. 2—Roseville Avenue Signal Cabin, Looking West.

block sections terminating at signals 4, 20, 48 and 52. The main passenger-station building is between the main line and the branch, close to the intersection of the tracks. The tracks farthest from the station, both on the main line and on the branch, have separate platforms and stairways on the farther side.

The front of the signal cabin, a frame building, facing the track is flush with the wall of the cut, as shown in Fig. 2, and its main floor, 23 ft. above the tracks, is entered directly from the street which crosses the railroad on a bridge. The three overhead bridges crossing the main line and one on the branch are shown in dotted lines in Fig. 1. The machine has room for 52 levers, three of the spaces being spare. Of the 49 working levers, 25 are for signals, nine for switches, 13 for locks and bars, and two for movable point frogs.

The lower story of this building is virtually a chamber in the retaining wall, and it is used for a storage room and repair shop. The interlocking machine, which was furnished by the Union Switch & Signal Company, is a Johnson, with vertical locking. The Johnson pattern, with a few modifications, is standard on the Lackawanna, the principal modification being the provision of slots for locking the tappets in both the normal and the reverse positions. These are added in order to insure the proper stroke of the tappets in case the machine becomes worn. The electrical apparatus, referred to below, was also furnished by the Union company.

Of the three tracks in the main line, the middle one is signaled so as to be usable either eastbound or westbound. In the morning it can be used for express trains toward New York (Hoboken), and in the afternoon for the same class of trains from Hoboken westward. The cross-overs have number 12 frogs, enabling trains to pass from one track to the other at 30 or 40 miles an hour. Signal 52 is for a westbound movement on the right-hand main line track, signal 51 for a main line movement to the branch, signal 50 for a movement to the middle track westbound, and signal 49 for any other movement from westbound main track through the junction.

Elaborate electric locking and indicating apparatus is provided. There are repeaters in the tower for all hidden signals, train indicators to give automatic notice of the approach of trains, and a train "describer," worked by the signalman at Newark, by which full information is received concerning all trains from the east. Telephones connect with the adjacent stations.

As shown in Figs. 3 and 4, the gas pipe rods to switches and signals for each direction from the cabin are arranged in two groups, one above the other, making a "double-deck" line. The arms on the rocker shafts are 7½ in. and 9 in. The 7½-in. arms operate the rods for the lower deck, and the 9-in. arms those for the upper deck. In order to maintain the established 7½-in. stroke the levers

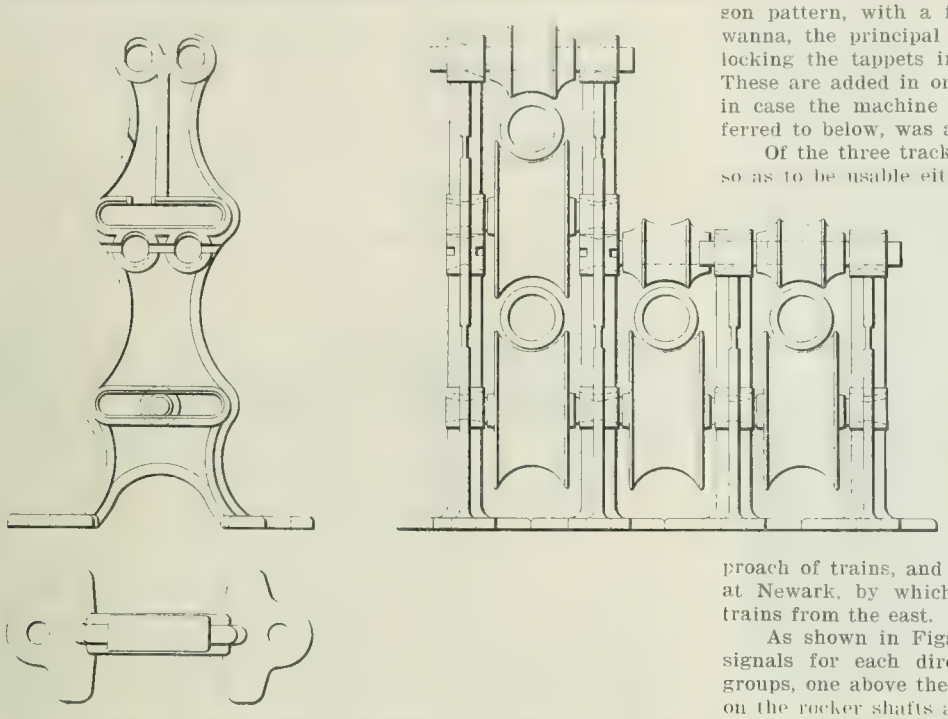


Fig. 5—Pipe Carriers for Single-Deck or Double-Deck Lines.

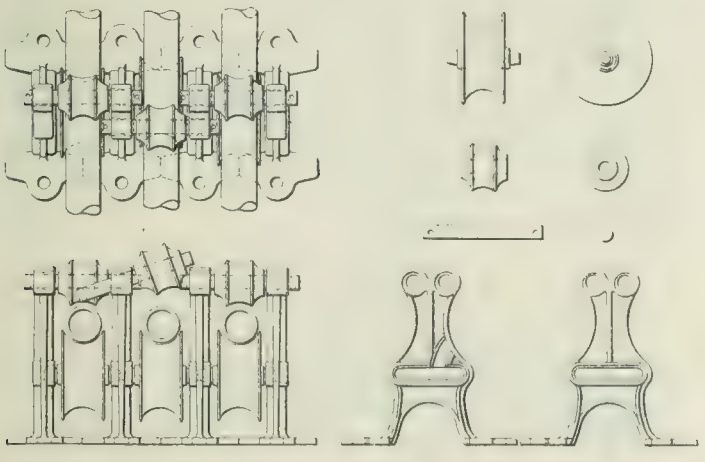


Fig. 6—Details of Pipe Carrier.



Fig. 7 Signal Rod (Pipe) Line and Fence, Showing Deflector Bars.

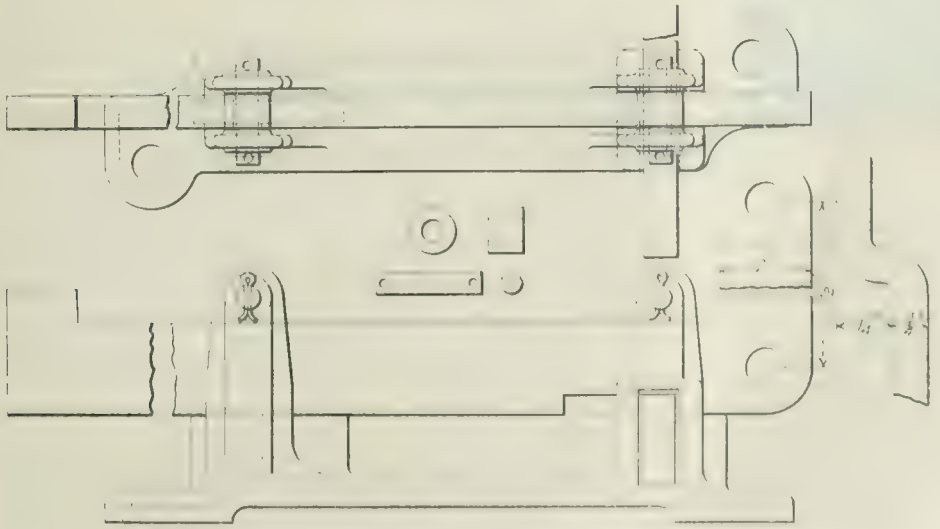


Fig. 8—Bolt Lock.



Fig. 9 Stockdill Deflector Bar

operating the lower deck, both the up and down rods, are placed at 8½ in. throw on the tail levers.

The pipe carriers, illustrated in Figs. 5 and 6, are of malleable iron, and have been designed for the double-deck arrangement. The foundations for the pipe carriers have iron uprights with wood tops. All other foundations, including those for cranks, compensators, bolt locks and wheels, are malleable iron piers imbedded in concrete. Owing to the lack of room on the Bloomfield branch, the pipe line had to be put part on one side and part on the other of the fence between the eastbound and westbound tracks, as shown in



Fig. 10—Main Line East of Junction; Looking West.

Fig. 7. It will be noticed that the pipe line is in no way connected to the fence proper, though it is secured to the same foundations. The pipe used in the pipe line is of 1-X wrought iron, and weighs 217 lbs. per 100 ft.

Starting east from the cabin, there are 14 leads on the upper deck and 15 leads on the lower deck; and there are 10 leads on the lower deck and 8 leads on the upper deck running west from the tower, making 47 leads in all. As the switches are successively

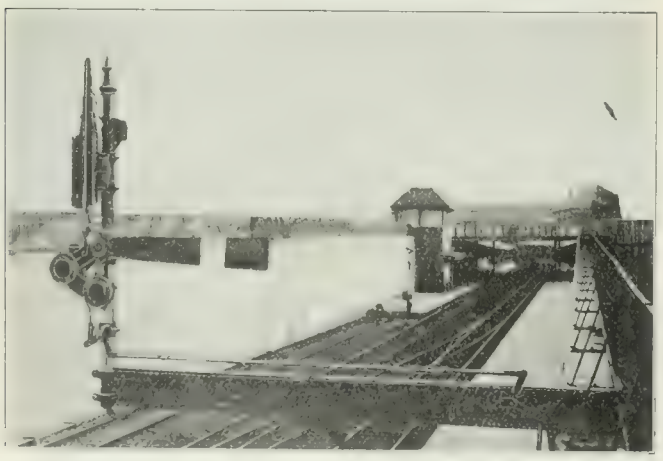


Fig. 11—Signal No. 4.

reached, the lower pipes are dropped out, one after another, and the upper pipes are brought down to take their places, as is clearly shown in Fig. 3.

All front rods and head rods are adjustable, and the head rods are also provided with gages so that overthrow can be provided for. All of the main line signals are slotted, and they bolt-lock all switches through which they give right to move. The detector bars are 50 ft. long, and each has 14 Kelloway patent detector-bar clips.

The deflector bars which appear in Fig. 7 are shown in detail in Fig. 9. These bars slide between fixed rollers, and when kept thoroughly lubricated are said to give satisfactory results.

In Fig. 8 is shown a bolt lock made with a vertical arm to fit it for use where the pipe lines are arranged in two "decks." To keep the rod clear of the pipe line there is an offset, as shown.

Fig. 10, looking west, shows, on the right-hand post, signals 50, 51 and 52. The signals for the eastbound tracks on this bridge are automatic.

The distant signals connected with this plant are fitted with electric locks to insure to a train a route which it has once accepted. For example, home signal 52, when cleared, automatically clears distant signal 85. The distant, when it reaches the clear position, opens a circuit breaker, which has the effect of locking the latch of 52, and keeping it locked until the train has passed the home signal, and till the distant arm (85) goes back to the horizontal position. The locking of the latch of 52 prevents putting that lever home, and therefore prevents the signalman from clearing any conflicting route; though he is not prevented from throwing arm 52 to the stop position in case an emergency should make that desirable.

For information concerning this plant we are indebted to Signal Engineer M. E. Smith and General Foreman of Interlocking C. J. Kelloway.

The Engineering and Maintenance of Way Association Convention

The seventh annual convention of the American Railway Engineering and Maintenance of Way Association was held in the Auditorium Hotel, Chicago, March 20, 21 and 22. It was the largest meeting the association has yet had, the attendance being over 200 out of a total membership of 528. New members admitted during the year were 102; dropped from the roll, 37; net gain, 65. The cash balance in the treasury was $9,949. The 1904 amendment to the constitution made the term of office of president and vice-president two years; but First Vice-President James Dun (A., T. & S. F.) having resigned, Second Vice-President A. W. Johnston (N., C. & St. L.) was elected First Vice-President and Walter G. Berg (L. V.), Second Vice-President. The other officers elected for the ensuing year were: Secretary, E. H. Fritch; Treasurer, W. S. Dawley (re-elected); Directors for three years, W. C. Cushing and J. P. Snow.

President H. G. Kelley called the convention to order at 10 o'clock, March 20. His address reviewed briefly the past year and contained suggestions for the present year. Reference was made to the representation of the association by invitation of the President of the United States, on a national advisory board on fuels and structural materials. The membership of many managing officers is a cause of gratification and also emphasizes the principle of the association that its work must be marked with conservatism and its recommendations adopted only after most thorough consideration. After reviewing the important committee work, reference was made to the publication of the first volume of the association's Manual of Recommended Practice, an event of considerable importance in the history of the association. Progress toward partial electrification of steam roads was touched on, and the fact that the new conditions arising will in the immediate future require the attention of the association.

Committee Reports.

Ties.

This committee has met twice by itself and also has met with the track committee. With the last named an attempt was made to prepare a formula to show, for three types of track, the right lengths of ties and right spacing, but it was found impossible to formulate any rule which would be of value. One member, however, has made a study of the theory of spacing, which the committee prints in an appendix. The committee resubmits, with corrections, the specifications for ties presented last year. The use of dating nails in ties has been the subject of considerable discussion. Copper nails are stolen and steel corrodes. It is suggested that experiments should be made with iron and steel wire boiled in oil and also the same galvanized, with a view to determining the best material.

Everything that the committee has learned during the past year concerning preservative treatment of ties confirms the favorable opinions before expressed. The committee believes that preservatives should be more generally used; but many roads refuse to do anything when the price of ties is low, and then again refuse when it is high because they are unwilling to buy large stocks at the high prices. The report gives some results of the experimental track of the Gulf, Colorado & Santa Fe. The committee recommends for adoption a code of specifications for ties, another of definitions and specifications for a dating nail; also rules for keping tie records. It is recommended that the standard tie be 7 in. x 8 in. x 8 ft. To the report is appended also a code of specifications for tie treatment, which the association is asked to discuss. These are confined to forms of treatment which are neither secret nor patented. Another appendix to the report gives interesting notes from Mr. Kruttschnitt, of the Southern Pacific, and Mr. Faulkner, of the Santa Fe, concerning their experiences in tie treatment. An essay on a proposed standard method for analysis of coal tar creosote and zinc chloride, by Mr. J. E. Moore, of the

Canadian Pacific, which was published in Bulletin 65, is now republished along with the present report in Bulletin 72.

BALLASTING.

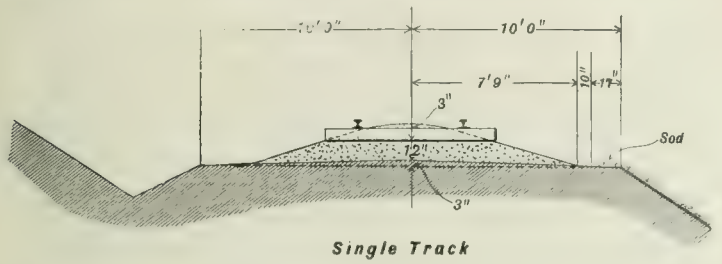
The committee on ballasting offers the following definition of disintegrated granite, a material which is being used to a considerable extent in the West:

"*Disintegrated Granite.*—A natural deposit of granite formation, which, on removal from its bed by blasting or otherwise, breaks into particles of size suitable for ballast."

The following notes prepared last spring by Mr. J. B. Berry, at that time Chief Engineer of the Union Pacific, are submitted:

In the Rocky Mountains disintegrated granite is usually in mass and very compact, with occasional dikes of hard granite sticking up through it to the surface.

The bulk of it may be taken out by a very heavy steam shovel, but we have found it much cheaper to do some blasting. When blasted and picked up, it crumbles into small cubes about the size of peas. The dikes of granite are solid material, and have to be blasted out and thrown to one side or



Single Track

Section for Chert and Cementing Gravel Ballast.

used for riprap. We have been able to load with a steam shovel having a three-yard dipper about 2,000 cu. yds. a day.

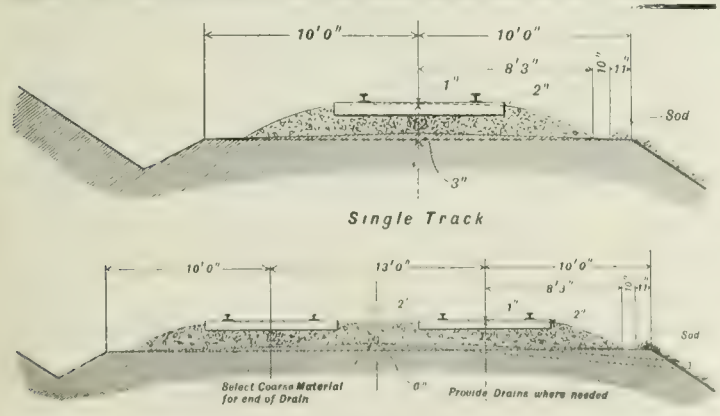
Disintegrated granite runs very easily out of the cars, is of a good size to ballast track, is easily handled under all conditions, becomes quite compact when in the track with little or no dust, will stand hard tamping with tamping bar, is one of the best ballasts to shed water I have ever seen, and we find it more economical, especially in renewals of ties, than any other kind of ballast.

We have used about a million yards of disintegrated granite for ballast within the last three years and can report as follows:

	Average cost, per cu. yd.
Cost loaded on cars at pit	9.19 cents
Labor unloading from center dump cars and putting under trk	13.37 "
Tools, engineering and miscellaneous expenses	0.76 "
Total	23.32 cents.

Weight of ballast, 3,000 lbs. to cubic yard.

This cost includes everything except haul, and each company must decide for itself what it costs to haul ballast per cubic yard. The items I have given included tools and their repairs, powder and fuses, steam drills, wages of pit employees, labor putting ballast under track, repairs to cars, wages of locomotive engineer, fireman and trainmen who spot cars at the pit, roundhouse expenses, water supply, oil and waste for locomotives and steam shovel, fuel, rental of locomotive and steam shovel and rental of outfit cars.



Sections for Crushed Rock, Slag, Gravel, Burnt Clay, Chats, Cinders, Disintegrated Granite and Sand Ballast.

In other words it includes every expense connected with the handling of this ballast except the haul.

While we did not meet with any granite boulders in our gravel pits, we found a good many seams or dikes of the solid granite throughout the pit and were obliged to shoot these. The loading of these after shooting was done by steam shovel and at times was a little slow, but nevertheless was the most economical method of handling them. The material that was too large for ballast was used for riprap. The expense of this shooting and loading was included in the figures given for cost of ballast, but the yardage is not included.

It probably would be more expensive shooting boulders, as we are able to put holes down the depth of entire face of work. We find it economic to use powder in loosening the face of entire work for the shovel.

Ballast Cross-Sections.—Last year's report showed two sets of ballast cross-sections, a majority and a minority report. These were referred back with instructions to try to reconcile the differences. The members of the ballasting committee agreed on a set of sections, which afterward, with slight modifications, were agreed upon at a joint meeting with the track committee. The sections are shown in the accompanying illustrations.

These sections are in the nature of a compromise between the different sets of sections proposed last year. It was the general opinion that some surface drainage was desirable, if not absolutely necessary, even with such material as crushed rock and slag. This requirement is met by the slight rounding of the surface between ties, the distance to top of ballast at end of tie being one inch lower than at center, and space being left under the rail to allow passage of water. It was also the general opinion that a large body of ballast is necessary around the end of the tie to give support to that part of the material which is directly under the tie. Without this support, the ballast works out and allows the tie to drop. This requirement is met by allowing the ballast to come well up on the end of tie and providing a flat slope from there to the foot. It was thought that a steep slope, equal to the natural angle of repose of the material, had practically no resistance to a disturbing force and that the ballast should, therefore, be put at such an angle as would resist a disturbing force from the start.

Where the ballast contains clay, or material which makes it practically impervious to water, the latter must be carried away on the surface entirely. The importance of a steep slope, in this case, is greater than that of support at the ends of the ties, and a section is provided accordingly. This is shown for cementing gravel and chert. Ballast sections shown are for first-class track only. It was not thought proper to provide for different classes of track until the Association had taken some action on classification. A double track section for cementing gravel was not shown because it seemed probable that a double-track road would use a better ballast.

The report is signed by John V. Hanna, Chairman; C. A. Paquette, Vice-Chairman; C. H. Byers, A. O. Campbell, M. P. Cotton, L. F. Goodale, G. D. Hicks, B. C. Milner, J. O. Osgood, F. W. Ranno, Samuel Rockwell, A. F. Rust, G. M. Walker, Jr.

RECORDS, REPORTS AND ACCOUNTS.

The committee on this subject found itself widely scattered, and the different subjects were therefore referred to sub-committees. These committees report on ledger accounts for individual pieces of work, system for office records of bridges, conventional signs for right of way maps and proposed standard progress profiles and track charts. The standard requirements for drawings of the Pennsylvania Lines West of Pittsburg are given in full; also data on this subject from the Illinois Central, the Nashville, Chattanooga & St. Louis, the Central of New Jersey, the New York Central, the Norfolk & Western, and the Canadian Pacific. The committee submits a standard progress profile and a standard track chart. It holds that ledger accounts with individual pieces of work are essential, and recommends for adoption the definitions which it has formulated and the charts which it has mentioned; but the conventional signs are offered only for discussion.

TRACK.

The committee on track believes that the A. S. C. E. rail section might be improved by increasing the proportion of metal in the base and reducing that in the head. This view is based on reports of frequent breakages which start in the base. The committee recommends the appointment of a committee to confer with the Master Mechanics' Association as to the amount that the gage of track should be widened on curves, with a view to deciding how much the widening should be for different wheel bases and different curves. It is becoming customary to have flanges made on all wheels, and wheel bases are being made longer. The committee desires a full discussion of standard drilling for rails. Easement curves are discussed at length, and a formula is submitted for approval, also rules for the maintenance of gage and the inspection of track.

CLASSIFICATION OF TRACK.

The special committee on Classification of Track recommends that when a district of a railroad has reached the conditions of traffic hereinafter specified it shall be placed in one of the following classes:

Class "A" shall include all districts of a railroad having more than one main track, or those districts having a single main track with a traffic that equals or exceeds the following: Freight car mileage passing over district per year per mile 1,000,000; passenger car mileage per year per mile of district 50,000, with maximum speed of passenger trains of 60 miles per hour.

Class "B" shall include all districts having a single main track with a traffic that equals or exceeds the following: Freight car mileage passing over district per year per mile 500,000, or, pas

senger car mileage per year per mile of district, 5,000, with maximum speed of passenger trains of 40 miles per hour.

Class "C" shall include all districts of a railroad not meeting the traffic requirements of Classes "A" or "B."

These conclusions were made from statistics collected by the committee.

The report is signed by Chas. S. Churchill, Chairman; W. M. Camp, Vice-Chairman; C. H. Ackert, D. D. Carothers, W. C. Cushing, W. A. Gardner, W. J. Harahan, Wm. Hunter, J. Kruttschnitt, Wm. Michel, C. A. Wilson and H. R. Williams.

ROADWAY.

This committee presents a long report on the proper wording of the overhaul clause in contracts, dealing with the manner of payment and the method of computing overhaul, but no conclusion could be reached and the reader is left to digest the conflicting views as best he can. This matter fills about 90 pages. There is a tabular abstract showing the present practice of members of the association, but aside from this the most encouraging paragraph that we find on the subject is one quoted from a correspondent of the *Engineering News* in 1888, who concluded that "in view of the difficulty of the subject the best way out is to guess at the quantities of earth to be hauled" and leave it to the contractor to make his esimates as best he may. Make no computations of the allowance for the overhaul, but say to the contractor, Here is the work, what will you do it for?

SIGNS, FENCES, CROSSINGS AND CATTLE-GUARDS.

This committee, No. 9, submits specifications for standard right of way fences, describing three classes. Galvanized wire fencing is discussed at length. The committee believes that the rapid deterioration of woven galvanized fence wire is due to the thinness and unevenness of the zinc coating. It is held that woven fence should have a second coat of zinc after it is manufactured. The committee proposes to print the report of the investigation of this subject which was made by Dr. A. S. Cushman of the United States Department of Agriculture (Farmers' Bulletin No. 239). The committee recommends that its specifications for fences be adopted as good practice and that the longitudinal wire for fences should be No. 9, with ultimate tensile strength of 1,800 lbs. to 2,200 lbs.

SIGNALLING AND INTERLOCKING.

This committee presents its seventh annual report. It recommends that, for single track, lock and block, with track circuit control, be used, and train orders (meaning, presumably, the present system of recording and repeating train orders) be abandoned. Automatic signals should be used to make intermediate blocks for following movements only. Diagrams are given of the best arrangements of block signals at stations, and the committee recommends that these diagrams be adopted as good practice. The specifications for mechanical interlocking adopted by the Railway Signal Association are printed, and the committee proposes that they be endorsed as good practice. The committee submits a code of conventional symbols and of definitions, both of which the association is asked to approve. The diagrams of automatic signal locations include representations of upwardly inclined signals. Reports are given of letter ballots on the question of the proper angle travel of semaphore arms and on the question of the upwardly inclined arm.

MASONRY.

This committee discusses failures of concrete structures, waterproofing of masonry and waterways for culverts. Many failures of concrete structures have been reported, both of plain and reinforced, due to improper design, premature or improper loading and improper materials or workmanship. The committee has considerable information, but is not yet ready to make a report. The subject of waterproofing is held over until next year. The subcommittee on waterways for culverts has not met, but the chairman has prepared an article which is to be published.

This report is supplemented by a code of specifications for stone masonry and another of definitions. The committee recommends that the specifications be adopted as good practice, and that the definitions be approved.

BUILDINGS.

The report of this committee is under three heads:

1. Relative advantages and disadvantages of circular, square or other special designs of roundhouses, and recommended general practice.

2. Smoke jacks—various designs and material, life, cost and recommended practice.

3. Roundhouse doors descriptions and sketches of various designs and recommended practice.

Roundhouses.

Advantages of the circular roundhouse:

(a) It is the logical shape when a turntable is used.

(b) Ordinarily it is the most economical design for ground space.

(c) It requires only one "jack" per stall.

(d) The cost of handling locomotives in and out, and of turning them, is a minimum.

(e) The circular shape allows good command of the work in the house by the foreman.

(f) It gives the best facilities for furnishing natural light around the engine end of the locomotive.

(g) Artificial light can be provided at least cost.

(h) It affords better facilities for locating benches and lockers.

(i) It gives maximum room at the engine end and economizes space at the tender end of the locomotive.

(j) With equal facilities for work, and ventilation, the cubical capacity per stall in a circular house is comparatively small; consequently heating is more economical.

(k) At the expense of roofing over the turntable, the loss of heat by open doors may be reduced to a minimum.

(l) One operator and one power equipment can handle all engines going in and out.

Disadvantages:

(a) Locomotives are tied up when the turntable is out of service.

(b) Loss of heat from open doors, one outside door per stall being usually used.

(c) Difficulty in increasing the length of the stalls after they are built.

Rectangular houses are classed under two heads: through rectangular houses and transverse table houses.

The through rectangular house consists of a series of parallel tracks running lengthwise of the house with a system of lead tracks and switches at each end outside of the house and a system of double slip switch crossovers in the house, to be used in running engines around one another. The advantages and disadvantages following do not apply to the small rectangular house, open at one end only, with capacity for two to four locomotives.

Advantages of the through rectangular house:

(a) It may fit some particular location or shape of property where length but not width can be had.

(b) Provided that in case of emergency there is no confusion in operating the double slip switches and no derailment occurs at them, locomotives can be readily handled.

(c) Locomotive standing room can be increased for longer machines by changing the location of the pits and also of the crossover track system, or by increasing the length of the house and readjusting the tracks at the end.

Disadvantages:

(a) Assuming that all locomotives will enter at one end and depart at the other, it will be necessary to turn at least one-half of them before they are put into the house, and the same number again after they go out, in order to save the use of two jacks per engine stall throughout the house.

(b) Either two turntables or "Y" tracks, one at each end, will have to be used or the locomotive will have to be run from end to end outside to be turned before and after going to the house.

(c) Loss of heat from doors in opposite ends of the house being open at one time will be very great.

(d) There is no space for work benches, or for storming parts of engines temporarily, without blocking the running space for other locomotives.

(e) Locomotives cannot be required to arrive at one end and depart at the other without materially cutting down the capacity of the house by keeping several of the tracks open.

(f) If crossover clearances are maintained, and tracks are kept open for running, there will be a large amount of space in the house per effective stall, consequently the cost of heating and of lighting will be comparatively large.

The transverse table house consists of a series of parallel engine pits, usually running crosswise of the house, the locomotives being handled to and from them by means of a transverse table, located either inside or outside of the building, as determined by conditions and requirements.

Advantages of the transverse table house:

(a) The capacity of the house can be readily increased by extensions and additions of other transfer tables on the same depressed tracks.

(b) Cranes can be used to advantage if necessary.

(c) The design is favorable for use in connection with a machine shop or an erection shop, where the transfer table or tables can be used in common for both.

(d) When the transfer table is covered, heat may be saved. One door, however, will have to be opened many times instead of each of many doors occasionally. There will, in this case, be an economy in the smaller number of doors needed.

(e) Adaptability for some special locations.

Disadvantages:

(a) On account of the necessity for the use of a turntable as well as a transfer table, the cost of operation and of maintenance

will be high; the turntable will have to be used for about one-half the engines when coming in as well as when going out.

(b) Increased time for handling locomotives when the turntable work is included.

(c) The arrangement of parallel tracks in an engine house does not give the best disposition of the floor space, for when the spacing is made to suit the requirements around the engine end there will be room to spare at the tender end.

The Committee makes the following conclusions, and recommends as general principles of practice that:

The circular form of an engine house is, in general, the preferable design, with possibly the following exceptions:

(a) At branch terminals, or similar points, where not more than three or four locomotives are housed at one time and where it is more economical to provide a "Y" track than a turntable, or where it is not necessary to turn the locomotives, a through rectangular house, with switches at one end only, may be desirable, or

(b) At shops where a transfer table is used and an engine house is to be added, and at special locations, the transfer table house may be desirable.

Smoke Jacks.

The design and construction of jacks is at the present time in a state of rapid transition from the small diameter, adjustable, cast-iron form to a fixed jack of large size, with a large size flue and a damper, made of various materials. These large jacks were at first made of wood, but are now being made more and more of cast-iron, asbestos board and other non-corrosive and non-combustible materials, as fast as manufacturers are able to adjust construction to the new designs. Arguments in favor of the large fixed jacks are:

The modern large locomotive requires larger jacks to take care of the smoke, particularly from green fires.

Necessity for quick service in the roundhouse makes frequent adjustment of the location of the locomotive desirable to facilitate inspection and repairs. These movements frequently result in the separation of the stack from the jack. This difficulty is overcome by the use of the large jack.

A saving in labor is secured, as there is no work to be done in adjusting the jacks to the stacks each time a locomotive enters the house. This saving, and the general better atmospheric conditions prevailing, offset the loss of the increased draught caused by the small jacks acting as extensions of the stacks.

The life of the jacks is determined by the kind of material used, and there are no reasons why the same material cannot be used in the large as has been used in the small jacks. The cost will increase with the size, but advantages in favor of the larger size are so great that cost should not be a determining factor.

Cast-iron jacks with bottom openings 3½ to 4 ft. wide and from 10 to 12 or more ft. long, tapering gradually upward to a flue of a reasonable length, and 3½ to 4 ft. in diameter, with a damper, cost from $175 to $225 each, erected.

The Committee recommends that the engine house smoke jack should be fived, the bottom opening should be not less than 42 in. wide, and long enough to receive the smoke from the stack at its limiting positions, due to adjustment of the driving wheels to bring the side rods in proper position for repairs. The bottom of the jack should be as low as the engines served will allow, and it should be furnished with a drip trough. The slope upward should be gradual to the flue; the size of the flue for the largest locomotives should be not less than 42 in. in diameter; a damper should be provided in the flue—easily adjusted from the floor, and the material used should be non-combustible and non-corrosive.

Roundhouse Doors.

Designs of roundhouse doors include the following: Swinging, rolling, folding, lifting and sliding doors.

(a) Swinging Doors.—Have the advantage of being:
Comparatively cheap in first cost.
Glass can be used in them.
Small doors can be built in the larger ones.
They are, however, exposed to the wind, and liable to be blown against a locomotive and damaged.
If struck, they are liable to serious damage.

(b) Rolling Doors.—Are now made of wood slats or of metal
Cost about 60 cents per square foot erected.
Small doors or glass are not placed in the large doors
Are not exposed to damage by wind.
If struck, the damaged slats are easily repaired.
They fit snugly along the sides and at the bottom

(c) Folding Doors.—Are made of wood.
Glass and small doors can be used in them.
Are not exposed to damage by wind.
If struck, they are liable to serious damage.

(d) Lifting Doors.—Are made of wood.
Glass and small doors can be used in them.
Are not exposed to damage by wind.
If struck, they are liable to serious damage

(e) Sliding Doors.—Do not fit tightly; the hangers rust and fail.
Glass and small doors can be used in the large ones.
One-half of the doors are necessarily closed all the time.
Are not exposed to damage by wind.
If struck, they are liable to serious damage.

The Committee recommends that roundhouse doors should be made of non-corrosive material; they should be easily operated, fit snugly, be easily reuaired and maintained, and should not be exposed to damage by wind, directly or indirectly, and should admit of the use of small doors. The particular kind of door that will suit a given case can be determined only by giving proper value to the different factors enumerated above.

The report is signed by A. R. Raymer, Chairman; E. D. B. Brown, Vice-Chairman; G. F. Bristol, M. Coburn, H. M. Cryder, B. C. Gowen, E. C. Macy and H. M. Steele.

WATER SERVICE.

Following its reports for the two years previous, which covered in detail the subject of water softening for locomotive boilers, this committee has confined itself for the past year to collecting information from railroads which have installed water softening plants. This follows in detail by roads:

Atchison, Topeka & Santa Fe.—Nearly all kinds of water are embraced in the general boiler water supply. Sixty-five plants in operation. The oldest of these has been in service for two years and six months. Capacity of plants varies from 40,000 gals. per 24 hours for the lowest, to 450,000 gals. per 24 hours for the highest. The average capacity is given as 50,000 gals. per 24 hours. The cost of softening water at these plants varies from 0.7 of a cent to 14 cents per 1,000 gals., the average cost being 3.5 cents per 1,000 gals. Among the beneficial results from the use of softened water there is reported a very decided decrease in engine failures due to boiler troubles, resulting in reduction in payrolls of boilermakers and helpers; reduction in the number of flues used; increase in time between shoppings (about 100 per cent.), and increased ton mileage of locomotives. Some of the districts where water is softened now show but from one to three engine failures per month from boiler troubles, where before softening the water they had this many failures every 24 hours.

Baltimore & Ohio.—Boiler water supply is, generally speaking, good, though in the coal and oil regions the waters contain large amounts of corrosive solids and some free sulphuric acid. Two plants in operation. One of these has a capacity of 20,000 gals., and the other 10,000 gals. per hour. These plants have been in operation about two months. The cost of softening is 0.7 of a cent per 1,000 gals., but the raw water was then in the best condition. The cost will increase in dry seasons. They report that the scale is falling off of the flues of the boilers that are using the softened water. Also they notice absence of foaming and pitting since the plants were started.

Buffalo, Rochester & Pittsburg.—There is one water-softening plant with a capacity of 600,000 gals. a day, which has been in service two years. An improvement is noticed in the condition of boilers using this water.

Central Railroad of New Jersey.—General character of the boiler water supply poor. One water-softening plant, which has been in service since Sept. 1, 1904. Capacity per day is 240,000 gals. The use of softened water in their locomotive boilers eliminates a considerable amount of incrusting solids, and improves operation of the locomotives.

Chesapeake & Ohio.—One water-softening plant in operation which has been in service one year. Capacity 5,000 gals. per hour. Cost of softening water is 4.10 cents per 1,000 gals. The use of softened water has reduced leaky flues and boiler seams to a minimum.

Chicago & Eastern Illinois.—Ten water-softening plants in operation and three in process of construction. The character of the boiler water supply is very poor. The cost of softening runs from one to three cents per 1,000 gals., with an average of two cents. Capacity of plants varies from 10,000 gals. per hour to 25,000 gals. per hour, averaging 15,000 gals. The oldest of the plants has been in operation about two months, so that the beneficial results of using treated water are not yet demonstrated.

Chicago & North-Western.—Water supply varies from very good to very bad. Many of the waters contain a large quantity of scale-forming matter, and some of them, taken from running streams, contain mud and other matter in suspension at certain seasons. Twenty-five water-softening plants in operation, the oldest of which has been in service three and three-quarters years. Capacity of the plants varies from 120,000 to 800,000 gals. per 24 hours, the average being 300,000 gals. Cost of softening water at these plants is 0.8 of a cent for the lowest, to 3.4 cents for the highest, the average being 1.8 cents per 1,000 gals. Chemical analyses of the waters, before and after treatment, show that incrusting solids are reduced so that the quantity left in the softened water is approximately from three to five grains per gallon. Some of these waters before treatment contain approximately 40 to 50 grains per gallon of scale making material. The officers of the Mechanical Department, who have charge of the locomotives on the divisions where the water

softening plants are located as well as the superintendents of these divisions, say that the use of the softened water has been of great benefit in the economical handling of trains and maintenance of locomotives. Statistics showing the cost of operation in the districts where the plants are installed indicate that they have been the direct cause of saving in the cost of repairs to locomotive boilers.

Chicago, Indianapolis & Louisville.—Water supply varies between wide limits. Five water-softening plants in operation, the oldest of which has been in service four years. Capacity of plants ranges from 8,000 to 30,000 gals. per hour, averaging 15,000 gals. The cost of softening is 1.2 cents per 1,000 gals. for the lowest, 2.6 cents per 1,000 gals. for the highest, an average of 1.7 cents per 1,000 gals. There has been a decrease in boiler failures on road, decrease in flue work, and some decrease in washing, due to the use of softened water.

Chicago, Milwaukee & St. Paul.—Character of the boiler water supply varies from very good to very bad. Both alkali and incrusting waters are found. One water-softening plant in operation, which has a capacity of 4,000 gals. per hour. Cost of treatment is 13.6 cents per 1,000 gals. Benefits are derived from the use of softened water, as illustrated in the case of an engine which required work on flues each week before the installation of water-softening plant. This engine was after erection of plant supplied with soft water exclusively and ran for six weeks without any work on flues.

Chicago, Rock Island & Pacific.—Character of boiler water supply variable, the solid matter dissolved in the waters ranging from 6 to 150 grains per gallon. Fifteen water-softening plants, the oldest of which has been in service 21 months. Capacity varies from 4,200 gals. per hour for the lowest, to 15,000 gals. per hour for the highest, with an average of 8,400 gals. per hour. The cost of softening varies from 3.1 to 14.9 cents per 1,000 gals., the average being 12.2 cents per 1,000 gals. The use of softened water has increased the engine miles between washings, reduced engine failures on account of leaky flues and staybolts, and materially reduced the cost of repairs to locomotives.

Chicago, St. Paul, Minneapolis & Omaha.—Water ranges from very good to very bad. Nine water-softening plants in operation, the oldest of which has been in service four years. The cost of softening water varies from 1.3 cents per 1,000 gals. to 3.9 cents, the average being 2.1 cents per 1,000 gals. There has been a decrease in repairs to boilers, and a marked improvement in the handling of trains in the district where the plants are in operation.

Delaware, Lackawanna & Western.—Five water-softening plants, the oldest of which has been in operation three years. Average capacity 286,000 gals. per 24 hours. The lowest is 240,000 gals. and the highest 350,000 gals. per 24 hours. The cost of softening is lowest, .9 of a cent; highest, 1.1 cents, average 1 cent per 1,000 gals. There has been a reduction in scale-forming matter in locomotive boilers, resulting in greater efficiency of engines, as evidenced by greater mileage for every tube reset. Previous to using treated water, boilers needed more frequent washing out, and scale-forming sediment made it necessary to repair boiler tubes often.

Detroit, Toledo & Ironton.—Water poor. Two water-softening plants in operation and one under construction. The oldest plant has been in operation nine months. Cost of softening: lowest, 1 cent; highest, 2.7 cents, with an average of 1.8 cents per 1,000 gals. Capacity of plants 100,000 and 160,000 gals. for 24 hours—averaging 130,000 gals. Considerable benefit received from less boiler work and maintenance. Locomotives using treated water give less trouble with flue and firebox leakage. Roundhouse boiler work estimated to be 50 per cent. less since the installation of water-softening plants, and 20 per cent. reduction in fuel expense.

Erie.—One water-softening plant which has been in operation for six months. The capacity of this plant is 12,000 gals. per hour.

El Paso & Southwestern System—Eastern Division.—Eight water-softening plants, the oldest of which has been in operation a little over two years. General character of water supply poor. The water from several of their wells contain 170 or more grains per gallon of incrusting solids. Capacity of plants varies from 2,000 gals. to 10,000 gals. per hour—averaging 5,000 gals. per hour. The cost for softening water on this road is 7 cents at the lowest, and 28.5 cents at the highest, with an average of 18 cents per 1,000 gals. Before the installation of water-softening plants it was almost impossible to get an engine over the division between Alamogordo and Santa Rosa without boiler trouble. Since the plants were started, the use of softened water has lessened their trouble.

Hocking Valley and Toledo & Ohio Central.—Water poor. Three water-softening plants in service, the oldest of which has been in operation three years. Plants have a capacity of from 100,000 to 650,000 gals. per 24 hours. Their cost for softening is two cents per 1,000 gals. The use of softened water results in the removal of scale-forming matter, prolongs the life of the boiler, and saves fuel.

Illinois Central.—Character of boiler water supply varies on different parts of the line. Six water-softening plants in operation. The oldest has been in operation 16 months. Each plant has a capacity of 10,000 gals. per hour. Have resulted in great reduction in cost of repairs to locomotives, as well as doing away with engine failures on account of hard water.

Lake Erie & Western.—Character of boiler water supply variable. At two of the stations where softening plants are located the waters contain about 25 grains of incrusting matter per gallon. At the other two stations the waters sometimes contain 60 grains of incrusting matter per gallon, with also a large amount of alkali part of the time. Four plants in service. One of these has been operating for 21 months, and the other three for eight months. They have a capacity of from 175,000 to 275,000 gals. per 24 hours—averaging 206,000 gals. The cost of chemicals used for softening water is 2.1 cents per 1,000 gals for the lowest, 3 cents per 1,000 gals. for the highest, with an average of 2.5 cents per 1,000 gals. The benefits derived from the use of softened water in locomotive boilers have been removal of incrusting solids (part of which were also corrosive), large reduction in engine failures due to leaking boilers, and decreasing running repairs to boilers.

Lehigh Valley.—Four water-softening plants, the oldest in operation for two years. Capacities are: lowest, 100,000 gals. per 24 hours; highest, 300,000 gals. per 24 hours, averaging 225,000 gals. Three of the plants have been in operation for only nine months, and figures showing benefits due to the use of softened water have not yet been ascertained.

Missouri Pacific.—General character of water supply poor. Three water-softening plants in service, all of which have been in operation for nine months. The capacity of each plant is 250,000 gals. per 24 hours. The average cost of softening water on this road is 2.4 cents per 1,000 gals., ranging from 1.2 cents per 1,000 gals. for the lowest, to 4.3 cents per 1,000 gals. for the highest. The number of engine failures due to water troubles has been greatly reduced by softening the water. A master mechanic states that a saving of several hundred dollars per month has been effected through the use of softened water.

New York, Ontario & Western.—One water-softening plant in operation, which was installed in 1901. Capacity 5,000 gals. per hour. Cost averages 2.5 cents per 1,000 gals. Engines are out of service less time on account of boiler washings and flue repairs than they were before commencing to soften water; also flues last longer.

Norfolk & Western.—Water variable. On about one-half of the line the water is fair. On about one-fourth it needs filtering to remove mud and suspended matter. On about one-fourth it contains much scale-forming material. One water-softening plant in service, which has been in operation one year. Five plants in course of construction. Cost of treatment is 3 cents per 1,000 gals. Capacity of all the plants ranges from 100,000 to 250,000 gals. per 24 hours. The one plant which has been in operation for the past year has proved a great success. The water untreated contains 36 grains per gallon of incrusting solids. After treatment it contains only four grains. After 30 days' use of the treated water in a stationary boiler, no scale was deposited in it.

Pennsylvania Lines West—Southwest System.—General character of boiler water supply varies—part good and part very bad. Four water-softening plants in operation, the oldest of which has been in service for one and a half years. Cost for treatment varies from 2 cents to 3 cents per 1,000 gals., with an average of 2¼ cents per 1,000 gals. Capacity of plants varies from 10,000 to 20,000 gals. per hour—averaging 15,000 gals. per hour. The installation of these water-softening plants has done away with cracked firebox sheets; reduced number of leaky flues; made less boiler work; no trains given up on account of leaky engines; less roundhouse labor; less fuel consumed, and engines are gotten ready more quickly for trains.

Pittsburg & Lake Erie.—Water poor, containing carbonates and sulphates of lime, also at times sulphuric acid. Ten water-softening plants in operation, the oldest of which has been installed two and one-half years. Capacity is from 15,000 to 60,000 gals. per hour—averaging 25,000 gals. The cost for softening is: lowest, 0.5 of a cent; highest, 2.5 cents; average, 1 cent per 1,000 gals. Benefits derived from the use of softened water, are: increased life of fireboxes and tubes; absence of scale, collapsed tubes and corrosion; greater amount of service from locomotives, and great reduction in number of engine failures.

Rio Grande & Eagle Pass.—Character of boiler water supply poor. Two water-softening plants in operation, the oldest of which has been in service four years and seven months. Capacity of plants is 1,000 gals. per hour. As a result of the use of softened water, there has been a saving of 40 per cent. in boiler repairs, 20 per cent. in fuel, and 50 per cent. in labor and water used for washing out locomotives.

Rio Grande Western.—Three water-softening plants, the oldest in service five years. Capacity of the lowest is 50,000 gals. per 24 hours; highest, 120,000 gals., and average 70,000 gals. per 24 hours. The plants reduce the incrusting solids to three or four grains per gallon, eliminating the matter in suspension and improving the water treated.

Southern Pacific Company—Pacific System.—Boiler water supply includes both scale-forming and corrosive waters. Sixteen

water-softening plants in operation, the oldest of which has been in operation six and a half years. Capacity of plants varies from 12,500 to 175,000 gals. per 24 hours, with an average of 51,000 gals. per 24 hours. Seven more plants in course of construction. Average cost for softening water is 4.2 cents per 1,000 gals. This varies from 1.9 cents in the lowest to 6.5 cents per 1,000 gals. in the highest. Beneficial results shown in an average decrease in scale-forming matter and prevention of corrosion due to action of unstable salts naturally contained in the waters before treatment.

Texas & Pacific.—All kinds of water. One water-softening plant which has been in service eight months. Capacity 80,000 gals. per 24 hours. Cost 3 cents per 1,000 gals. Results have been beneficial, but to what extent has not yet been determined. Water at this point was so bad that it was necessary to replace the boiler used in the pumping plant every four months, but that the boiler used since plant was installed is still in use.

Union Pacific.—General character of boiler water supply is poor—carrying a considerable amount of both the carbonates and sulphates of lime and magnesia, to which is attributable hard scale. Thirty-six plants in operation, the oldest of which has been in operation four years. Capacity varies from 8,000 to 20,000 gals., averaging 11,600 gals. per hour. Cost of softening water per 1,000 gals. varies from 0.8 of a cent in the lowest, to 3.9 cents in the highest, with an average cost of 1.9 cents per 1,000 gals. Benefits derived are a very marked decrease in boiler repairs and in fuel consumption, decrease in number of boiler washings, and increase in mileage of locomotives owing to less frequent shoppings.

Wabash.—The Wabash Railroad has one softening plant, with a capacity of 175,000 gals. per 24 hours. Cost of softening water 3.1 cents per 1,000 gals.

The report is signed by G. M. Davidson, Chairman; Anthony McGill, Vice-Chairman; Geo. Crocker, C. A. Morse, R. S. Parsons, J. P. Ramsey, E. J. Randall, H. S. Waterman, M. H. Wickhorst and K. J. C. Zinck.

Discussion.

Uniform Rules, Organization, Titles, Etc.—The rules submitted by the committee were taken up seriatim. Mr. Walker (N. C. & St. L.) pointed out that paragraph 11 of the rules required a report on accidents *attributable to* track, roadbed, etc. He thought the department should also report on accidents which *result in* damage to track, roadbed, structures, etc., as a broken axle, for example. The committee accepted the suggestion.

Mr. Ewing (P. & R.) called attention to the fact that under the head of "general rules" certain specific duties were outlined. He moved that the general rules contain such matter as is applicable to the heads of all departments, and the specific duties of each head of department be outlined under a separate heading. The motion was carried, as was also another declaring it to be the sense of the association that the committee is proceeding along the right lines in its formulation of rules. A suggestion that there be a separate department for water service provided for in the rules was accepted by the committee, which will take cognizance of it during the coming year.

Ties.—The committee asked the convention to take action on the conclusions. The president stated that the specifications presented year before last, and printed in the report, would, without objection, remain the sense of the association. He also called attention to the fact that the following paragraph has been inserted in the specifications: "Ties treated with a water solution, like zinc-chloride, particularly red oak and beech ties, must be piled in close piles on well-drained ground, to prevent checking."

Conclusions 1 and 2, regarding approval of the specifications and adoption of the definitions, stood as recommended. Conclusion 3, on dating nail, was likewise adopted. Mr. Wendt (P. & L. E.) stated that his road had been using copper instead of galvanized steel dating nails for several years, as the latter would not last in the industrial districts. This was due to the fact that the figures were raised instead of depressed. A depressed-figure galvanized steel nail as provided for in specifications, he thought would give satisfactory service.

Conclusion 4, on rules for tie records, was approved. No. 5, on size of standard tie, provoked some discussion. Objection being made to the recommended size, 7 in. x 8 in. x 8 ft., Mr. Curtis, of the committee, explained that it was the general consensus of opinion, as indicated by replies to a large number of inquiries, that this size was large enough. One of the roads represented was using a 6 x 8 tie, and reported it perfectly satisfactory. In the instances where the 6 x 8 tie was reported as not satisfactory, the objection was of a two-fold nature: first, that the tie was too thin for the length of spike which is now being used, and that consequently after a few years' wear the spike would go entirely through the tie; for that reason it was decided to adopt the 7 in. thickness; second, that the 6 x 8 tie was too light where the ballast was poor, or there was no ballast; a condition which has to be met, but not a condition to determine the size of the tie. Nevertheless, the size of the tie was increased to 7 x 8. The general consensus of opinion expressed in the reports was to the effect that where ballast was good, a 6 x 8 tie was ample for heavy traffic. There is a prevailing opinion that a 7 x 8 or a 7 x 9, or some other size tie, does not cost any more than a 6 x 8, but I think if you undertake to buy any great number on that basis, you will find it is a mistake. We find that is more and more true, as we are coming to sawed ties instead of hewed ties."

Asked regarding an 8 ft. 6 in. length as against 8 ft., he said there were two or three reasons recommending the latter: It is long enough for good ballast; an 8 ft. 6 in. tie must be cut from a 17-ft. log, and the logs are not cut that way. It therefore seemed wise to adopt a size according with present sawmill and lumber practice.

Mr. Bremner (C., B. & Q.) suggested that there are at least three classes of track to provide specifications for, and a size should be specified for each; also the specifications should differ for different kinds of woods. Mr. Wentworth (C., M. & St. P.) said he believed that an 8 ft. 6 in. tie equalized the bearing so as to minimize trouble from center binding. Mr. McGuigan (G. T.) referred to the difficulty of getting ties of any particular standard, many roads being glad to get ties of any acceptable size whatever. The conclusion was finally referred back to the committee to give three sizes of standard tie corresponding with the three classifications of track. Conclusion 6, asking discussion on specifications for tie treatments and referring them back to the committee for further consideration, was adopted.

Mr. Carl G. Crawford, Chief of the Section of Wood Preservation, Forest Service, U. S. Department of Agriculture, then addressed the convention with reference to the work of the Forest Service, and of his particular section. In the latter connection he said that they hoped, in the course of a year, to erect and equip a laboratory at Washington which will be a great help in research work.

Ballasting.—The committee's definition for "disintegrated granite" was approved; also its definition for "cinders," which is as follows: "Cinders—The residue from the coal used in locomotives and other furnaces." Discussion of the report pertained to the recommendation that the ballast cross-sections submitted be approved as good practice. Chairman Hanna explained in detail the reasons for adopting certain features of the cross-sections. Mr. Barnard (Penn. Lines) called attention to the fact that the association had adopted a roadbed without crown, and that therefore cross-sections of the ballast committee should harmonize therewith. This was later put in the form of a motion and adopted. In regard to crowning, Mr. Trimble (Penn. Lines) said he had for years believed in this, but he had found that although the roadbed may be nicely crowned in the original construction, examination a year or so afterward will reveal the absence of any crown, and that the ballast has been hammered into the roadbed. He also doubted the advisability of a uniform section for gravel and rock ballast.

Mr. McDonald (N. C. & St. L.) inquired about the practice of other roads in treating ballast that has become foul, having been seeking information on the point for a long time. Prof. Allen (M. I. T.) suggested, as a precautionary method against fouling, the use of fine gravel or sand on the roadbed before the ballast is put on; this being accepted practice of highway engineers for the construction of macadam roads, and is also being followed to advantage by some railroad engineers. Mr. Stevens (P. & R.) said the only way to properly get rid of the water that would otherwise remain around each tie as soon as the roadbed becomes impervious, is to provide end drainage where the ballast is banked around tie ends, by leaving an opening from the end of the tie through the ballast.

A motion to have the cross-sections applicable also to stone and slag ballast, the ones shown being only for gravel, was adopted. Also a motion to have the ballast come flush with the top of the tie in the particular cross-section, showing it 3 in. above.

Yards and Terminals. The committee asked the adoption of the conclusions on hump yards, which was done with some slight changes, the most important being in clause (a), which stated that "a hump yard is the best form of yard, etc." This was modified to read: "A hump yard is a desirable form of yard for receiving, classifying and making up trains, because cars can be handled through it faster and at less cost than through any other form of yard." Clauses (a) and (b) were then transposed, as being more properly the order in which they should occur.

Mr. Baldwin (Ill. Cent.) thought that all freight car repair tracks should be under cover, instead of only those for heavy repairs, as recommended. This evoked some interesting discussion, in the course of which he asked if any members had ever gotten from their master mechanics a statement of time actually lost by the car repairmen in bad weather. He had and found it amounted to a large sum of money during a season. A motion to amend the conclusion in accordance with his suggestion was lost. The conclusions about team delivery yards were adopted.

Suggestions were asked from members as to the direction of committee investigations for the coming year. A number were made, including Methods of surface drainage, grades, poling

yards; additional data on cost of operation of hump yards; location of scales; actual data from railroads on loss of time by car repairmen due to bad weather during certain seasons; handling of switches outside of large terminals in cold weather, and in hump yards; electric lighting of yards.

Iron and Steel Structures. The report contained a revision of last year's specifications. The chairman read the clauses which were changed, discussion being offered as he proceeded. He said that the maximum fiber strain allowed for ties in timber bridge floors had been changed from 2,400 to 2,000 lbs. per square inch. Mr. Robinson (A., T. & S. F.), of the committee, explained that he was opposed to the adoption of this figure and read a list of the sizes of ties that would be required under these conditions for different wheel loads and spacings, to indicate what it would mean in increased cost. He then gave the cost of open decks on the Santa Fe, based on 60,000 lbs. axle load, 4 in. between ties (12 ft. long ties being considered): 7 ft. centers of stringers, $2.50 per lineal foot of track; 8 ft. centers of stringers, $3.15 per foot of track; 10 ft. centers of stringers, $3.50 per foot of track. A ballasted floor of creosoted timber would cost as follows: For 8 ft. spacing of stringers, $4.20 per foot of track; for 10 ft. spacing, $6.70 per foot of track. The advantages of the ballasted floor were given in brief detail.

Some of the clauses had been changed since the report was printed and these were indicated as the reading progressed. One of these was a change in the elongation from 18 per cent. to 15 per cent. On this same clause (84) discussion arose over the figure for the phosphorus content for acid steel—0.08 per cent. Mr. Webster (Cons. Eng.) suggested reducing this to 0.06 per cent., and after similar expressions from other members the committee announced its willingness to accept the suggestion.

Mr. Condron (Cons. Eng.) moved to increase the mean ultimate tensile strength of structural steel from 60,000 lbs. to 62,000 lbs. per sq. in. Mr. Webster's amendment to refer the matter to the committee for report next year was defeated. A subsequent motion, following considerable discussion, referred the matter to the committee to report next year on the advisability of raising the limit, as suggested.

The committee's impact formula brought out lengthy discussion, relating principally to the provision of funds to enable the committee to conduct impact experiments in order to derive a satisfactory formula. The matter was finally disposed of by a motion of Mr. McDonald (N. C. & St. L.) that the committee be requested to inaugurate as soon as possible and push to an early completion an exhaustive series of experiments on the subject of impact, and to submit, as the result of such experiments, a formula for impact; and that the board of directors be requested to provide the necessary means for the experiments in such manner as they deemed advisable.

The two parts of the specifications as read to the convention were accepted.

Records, Reports and Accounts.—Conclusions 1 and 2 of the report, relating to definitions, were, in conformity with the practice of the association, not discussed. No. 3, relating to ledger accounts with individual pieces of work, was offered for discussion. The adoption of this conclusion involved the approval of two forms, M. W. 1,013 and M. W. 1,014, shown in the report. The former is an "approval of authority for expenditure." Mr. Tye pointed out the omission of provision in this blank for distribution of the expenditure to various accounts. It was suggested that separate lines be added for this purpose. Mr. L. C. Fritch (Ill. Cent.) suggested the addition of a "completion report," covering the same work as the authority blank and being the report from which the ledger account is finally closed up. Both suggestions were accepted by the committee.

The need was referred to of an estimate form to accompany the form for authority for expenditure and a motion was adopted requesting the committee to prepare such a blank or else change the "authority-for-expenditure" form to provide for both. Mr. Montzheimer (E. J. & E.) moved the addition of provision for an estimate number on the blank, which was adopted.

Mr. Hunter McDonald raised the question of the practicability of keeping a ledger account in the maintenance of way engineer's office, there being certain charges which the engineer never sees until they show up on the comptroller's accounts, such, for example, as charges through the legal department resulting from suits. The chairman of the committee admitted that this particular point had not been considered; however, he expressed his conviction that the ledger accounts could be kept satisfactorily. After further discussion as to the practicability of keeping such accounts and their value, the conclusion (No. 3) was approved.

Conclusions 4 and 5 were adopted as read and No. 6 was approved. In regard to No. 7, Mr. McDonald pointed out that its adoption as read involved the adoption of many conventional signs that had not been passed on. The committee suggested the addition of the clause "except the conventional signs, which are subject to the later action of the convention." In this form the conclusion was approved.

Classification of Track. This was a special committee which had been asked to give a means for classifying districts of a railroad so that on portions of any road or even on the whole of some lines, lower standards of roadbed, track and other items of construction may consistently be used. The chairman of the committee, Mr. Churchill (N. & W.), explained in detail how they reached their conclusions and decided to classify on the basis of car mileage in conjunction with the actual speed of trains, after considering such points as size of locomotive, maximum axle loads, character of traffic, gross and revenue tonnage, train mileage and speed of trains.

The three classes recommended by the committee were taken up in order. Regarding Class A, it was objected by some members that the standard was too low, reference being made to the statistics accompanying the report, which showed freight car mileages per year per mile of track as high as 1,550,000. Such figures, it was asserted, called for a higher standard, since this was ten times the standard set. The committee's standard was for single-track mileage and was not high enough for lines of two or more tracks.

The chairman directed attention again to the definition, which showed Class A to include all roads having more than one main track. If a district of a railroad has enough business to require more than one track, that district is regarded as one which should adopt the highest standard of the association, Class A. The duty of the committee was to designate the lower limit—the point at which it is wise for any railroad to decide that a given district on that road shall adopt the highest standard. . . . They did not wish to rule out all single-track railroads, simply because a double, three and four-track road runs a million cars. Many of the single-track roads should be made first-class in their standards. They should adopt first-class standards throughout. Therefore the limit must be placed low enough to include districts of single-track railroads whose business is of such a character, either passenger or freight, as to warrant them in having a first-class roadbed and in adopting first-class standards. For that reason it was thought wise not to place the limit too high, and it was made 150,000 car miles. One trunk line represented on the committee has fast trains, many of them merchandise freights, and there are some districts of this road where the fast trains run in greater numbers than on other sections. That district of the road should use the highest standards. The company is working for the highest standards, and it should consistently have a reason from the committee for the latter's belief.

The committee was asked what was meant by "maximum speed of passenger trains." It was explained that the words meant the allowable speed of the district which generally appears on the time-tables, the speed for which the road is built.

Mr. Tye pointed out that up to 150,000 car miles per mile of track there were three different standards, and beyond that there was nothing else. For the lower one-tenth there were three standards, and for the upper nine-tenths nothing additional. He hardly thought a board of directors could be induced to spend the same amount of money to get a good track where there were only 150,000 car miles, as where there were 1,500,000.

Mr. Camp, of the committee, replied that 150,000 freight car miles amounts to about ten trains, figuring 50 car trains. Some locomotives can haul more than this but the average locomotive does not haul 50 cars per train; 1,500,000 car miles means 5,000 cars a day. If this number of cars a day is moved over a single track the passenger trains will have to be got rid of. Dividing this among four tracks gives a proportion of less than one-tenth, which is the proportion of 150,000 car miles and 500 cars on one track.

Mr. Porter (B. & L. E.).—The freight car mileage is fixed at 150,000 miles, and the passenger car mileage at 10,000 miles. On that basis one passenger car mile is equal to 15 freight car miles. If a road had 5,000 passenger car miles and 75,000 freight car miles, should it be in Class A? The sum of the two makes 150,000 miles.

Mr. Churchill.—Our intention is to make the 150,000 car miles solely a freight requirement. Since passenger trains run at greater speed, we thought 10,000 should be their limit. We might conceive of a condition of this kind: 140,000 freight car miles over a district and 11,000 passenger car miles. I would recommend, in a district of that kind, under the action we have suggested, that that district use the Class A standard on the basis of the passenger car mileage.

Mr. H. J. Slifer said he did not think the association could afford to say that if a section of road was handling ten trains a day it should have Class A track. He thought the freight mileage should be placed higher.

It was answered that the figure quoted would represent an average throughout the year. As the heavy business of a railroad is limited usually to a few months the number of trains during that period would be considerably in excess of ten a day. But even accepting 500 cars a day, on a basis of 40 cars per train this is 12 freights. Adding four passenger trains each way, the daily total would be 20 trains—a fairly busy piece of road.

The recommendation of the committee for Class A was finally

accepted without change, and Class C likewise. Class B was amended by adding "less than the minimum described in Class A," as the original form made it include Class A. A motion to adopt the report and publish it in the Manual of Recommended Practice was amended to refer it to the vote of the association by letter ballot.

Roadway.—The chairman of the committee asked for an expression of views and discussion on the three methods of overhaul described in clauses A, B and C, under "Abstract of Current Practice of Association Members." He called attention to the fact that the association is on record against an overhaul proposition as a part of the specifications; the present question being the submission of an alternate clause for such roads as desired to pay for overhaul.

In view of the fact that the returns to the circular of inquiry of the committee showed that out of 110 answers received, 73 allowed overhaul, and 54 of these favored method C, Prof. Allen (M. I. T.) moved that the committee be requested to bring in next year a specification in harmony with method C. But the chairman having announced that such a specification had already been prepared, and having read it to the convention, the motion was withdrawn and a substitute offered that this article on overhaul be adopted. This was amended to submit the matter to letter ballot.

The clause to be so voted on is as follows:

"No payment will be made for hauling material when the length of haul does not exceed the limit of free haul, which shall be —— feet.

"The limits of free haul shall be determined by fixing on the profile two points, one in excavation and the other in embankment, such that the distance between them equals the specified free haul limit and the included quantities of excavation and embankment balance. All haul on material beyond this free haul limit will be estimated and paid for on the basis of the following method of computation, viz.:

"All material within this limit of free haul will be eliminated from further consideration.

"The distance between the center of gravity of the remaining mass of excavation and center of gravity of the resulting embankment, less the limit of free haul as above described, shall be the length of overhaul, and the compensation to be rendered therefor will be determined by multiplying the yardage in the remaining mass as above described, by the length of the overhaul. Payment for it will be by unit of one cubic yard hauled 100 ft.

"When material is obtained from borrow pits along the embankment and runways are constructed, the haul shall be determined by the distance the team necessarily travels. The overhaul and material thus hauled shall be determined by multiplying the yardage so hauled by one-half the round distance made by the team less the free haul distance. Runways will be established by the engineer."

Signs, Fences, Crossings and Cattle-Guards.—The specifications for standard right-of-way fences were taken up, clause by clause. No. 14, providing that the [wire] fence shall be so manufactured as not to remove the galvanizing, etc., called forth the remark from Mr. McDonald that this was impossible, as the twisting of the wire breaks off the zinc. Fencing can be obtained where the wire is galvanized after the weaving is done, and the quality is much better, though the price is higher. He suggested an alternate clause, admitting both methods. No action was taken on the suggestion. The specifications covering posts were modified so as to include concrete posts.

Conclusion No. 2, regarding the tensile strength of wires, was adopted. A new conclusion was interpolated as No. 3, being the last paragraph to the section on "Galvanized Wire Fencing," reading as follows: "In conclusion, the committee believes, first, that the rapid deterioration of modern woven galvanized fence wire is caused by the coating of zinc being too thin and of an uneven thickness; second, that to procure better protection to the wire and a longer-lived fence it is necessary to secure an increased uniform thickness of the zinc coating on the wire; and to insure that the galvanizing is intact after the wire has gone through the fence-weaving machines it would seem to require that a second coat of zinc be applied to the fence after it is manufactured." Conclusion No. 4 (formerly No. 3) was adopted.

Suggestions from members for the work of the committee for the coming year included: Gates; comparative economy of metal and wood signs; different kinds of metal and other posts, extent to which used and results obtained; best kind of cattle-guard; best form of private and highway crossings.

Signaling and Interlocking.—The specifications for construction of telegraph block signal and connections were taken up first, and were adopted after being read. Action was next asked on the conclusions. Objection was made to No. 1 on the ground that it involved a transportation question rather than a maintenance-of-way question, and after some suggestions for amending it, it was finally withdrawn by the committee. Conclusions 2, 3, 4, 5 and 6 were adopted without discussion. No. 7 asked the indorsement as good practice of the standard specifications for mechanical interlocking and material for construction work adopted by the Railway Signal Association. Discussion of these specifications was requested.

Mr. Trimble (Pennsylvania Lines) objected to sections 2 and 3 relative to provision of transportation, moving to modify them to make this provision of transportation for men and material optional with the railroad company. Carried. Section 6 was likewise included.

Section 12 was modified materially, a portion being stricken out. As adopted, it reads: "Any devices furnished shall be subject to acceptance by the —————— Engineer before being placed in position." The remainder of the specifications as submitted were approved as good practice.

The portion on automatic block signals was next considered. Mr. Dunham, chairman of the committee, moved that the several arrangements of signals shown in the report be adopted as standard practice in the matter of signal locations. Carried. The conventional symbols were also approved.

Attention was asked by the committee to the diagrams of signals shown in connection with the result of letter ballot on the question of angle of travel of semaphore arm. Particular reference was made to Fig. 7, illustrating the use of an upper inclined arm. The committee considered that this type is correct in principle, and that the various types with drop arms have weaknesses which are overcome entirely when the upward-travel arm is used. On motion, the committee was instructed to examine during the coming year a signal of this sort and report next year.

Rails.—Discussion was opened by a motion to adopt the following paragraph in the report:

"There shall be sheared from the end of the blooms formed from the top of the ingots not less than 25 per cent., and if, from any cause, the steel does not then appear to be solid, the shearing shall continue until it does. If, by the use of any improvements in the process of making ingots, the defect known as piping shall be prevented, the above shearing requirements may be modified."

Mr. F. E. Abbott (Lackawanna Steel Co.), of the committee, was not in favor of the adoption of the paragraph, on the ground that manufacturers would oppose it. The object is to get rid of the piping, and the only matter of agreement will be to reach a point where sufficient shearing is done to remove the piping. If it can be removed by shearing 15 per cent., manufacturers will not agree to shear 25 per cent. Mr. Webster, chairman, said that this would simply be going back to the old requirement, which is known not to accomplish the object. Motion carried.

The committee asked for information during the year on the cause and nature of failures in 70, 75, 80, 85, 90 and 100 lb. rails. In explaining the kind of information wanted, Mr. Trimble (Pennsylvania Lines), of the committee, said: "The 85-lb. rail is by some people called a shallow-head rail; other people have a rail which has a deeper head, and the statement has been made that the American Society's rail is defective in having a shallow head. It has been stated that the head is so shallow that it fails by shearing in the track. Ws use the 85-lb., the American Society section, and I haven't seen any cases of that kind, although it has been reported to me that there have been such cases on our road. I have been told that other 85-lb. rail, with a deeper head, has been better wearing and stronger than the American Society section rail. If you will look at the 100-lb. rail of the American Society and compare it with the other 100-lb. rails, you will see there is very little difference in the depth of the head. The difference is so small I do not think you could tell it by observation in the track, either from the effect of the loads that pass over it or in any other way. In the 85-lb. rail the variation in the depth of the head is very marked, and we have the statement of the manufacturers that the 85-lb. American Society rail is a defective one. I am not sure about the other weights, but I assume that the same difference applies to the 80-lb. and the 90-lb. rails. We are asking now for definite information to compare the American Society section with other sections which have a deeper head, to find out whether we should have a deeper head or not."

A motion to adopt the A. S. C. E. specifications relating to drop tests was carried. Also another to adopt the committee's recommendations for shrinkage clause. A motion to adopt the A. S. C. E. specification for chemical composition, including a footnote recommended by the committee, reading, "Carbon may be reduced to suit local conditions," aroused considerable discussion on the question of the carbon and phosphorus contents. The motion was finally carried as originally made.

Another lengthy discussion ensued upon motion to adopt the committee's recommendation for a specification for straightening rails. This specification reads:

"Straightening. Care must be taken in hot straightening the rails, and it must result in their being left in such a condition that they shall not vary throughout their entire length of 33 ft. more than 3 in. from a straight line in any direction when delivered to the cold straightening presses. Those which vary beyond that amount, or have short kinks, shall be classed as second quality rails and be so stamped. The distance between supports of rails in the gagging press shall not be less than 12 ft."

Section II. in our specifications should also be modified to read as follows:

Rails shall be straight in line and surface when finished, the

straightening being done while cold, smooth on head, sawed square at ends, variation to be no more than [illegible] in., and, prior to shipment, shall have the burr [illegible] by the saw cutting removed and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds."

Mr. Abbot was opposed to the clause as it reads. The A. S. C. E. committee has a clause in its proposed specification making the limit of variation from a straight line 5 in. The effort of this association to reduce this to 3 in. would undoubtedly be met with strong opposition from manufacturers. In rolling rails any mill will endeavor to have them come through so that by the time they are cooled they will be nearly straight; the more nearly they are straight, the better it is for the mill and the road that buys rails. They would not fill their hot-bed with rails with a 5-in. camber. That would be against the interest of the mill. They would ordinarily try to keep down to 1 in., and make them perfectly straight, if possible; but if by mishap rails should come down that had a camber of 3¼ in., the mill would expect to straighten those rails and make them first quality rails, and they would object to a clause in the specifications which would require them to make such rails second class.

Mr. Trimble said he thought Mr. Abbot had given all the argument needed to get the 3-in. clause into the specification. Since there are only a small proportion of the rails which have a camber of 3 in. when they reach the hot-bed, the larger part do not reach anything like that figure, and rails are injured in the "gagging" process in straightening them.

There was further discussion, in which Mr. Webster explained that the 3-in. provision was inserted on the strength of information furnished the committee by Mr. E. F. Kenney, Inspecting Engineer of the Pennsylvania Railroad, who had looked very carefully into the matter of rail straightening and had requested the reduction from 5 in. to 3 in. The motion to adopt the clause as submitted was carried.

Written discussion under the heading, "Arrangement of Matter in Specifications," was invited by the committee in lieu of discussion on the floor.

Masonry.—The specifications for stone masonry were taken up, item by item. The principal discussion was on the 8th, which provides "that all stones must be laid on natural beds," etc. The question arose as to the ability always to determine the natural bed. Mr. Fritch (Illinois Central) thought that the clause should be changed to provide that all but unstratified stone should be laid on its natural bed; this to prevent the rejection of stone not laid on its natural bed where it made no difference, and thus avoid working an unnecessary hardship on the contractor.

Mr. Humphreys (U. S. Geol. Survey) said tests of large cubes of homogeneous stone showing no natural quarry bed gave quite different results under compression when the load was applied against the bed, as compared with application in the direction of the bed. He thought it important that the engineer should satisfy himself that the stone was being laid on its natural bed. Cases were cited by members illustrating the action of stone laid under different conditions and indicating the difficulty of determining the natural bed at time of laying, but no motion was made and the clause was accepted as read.

There was little discussion on the remainder of the specifications, occasional slight changes being made. A motion to adopt as a whole the classification for masonry given in the report, with such modifications as may be necessary to meet the changes made in the specifications, was carried. In final action on the report a motion was made for its acceptance, leaving it to the committee to make the necessary corrections in wording as developed by the discussion. Motion carried.

Buildings.—The report of this committee included engine houses, the advantages and disadvantages of circular and rectangular houses, smoke-jacks and engine house doors.

Conclusions as to the advantages and disadvantages of the different styles of houses were adopted.

A written discussion offered by Mr. Duncan McPherson (Nat. Trans. Ry.) criticised the arguments about the small cubical capacity and consequent economical heating of the circular house, pointing out that the item following, which advocates roofing over the turntable, is a tacit admission of the great loss of heat through open doors of this type of house. The roofing over is costly, increases the cubical capacity per stall beyond the rectangular house, and makes a difficult building to ventilate. Personal experience with a house so equipped was disagreeable in the extreme. Also no reference was made by the committee to the excessive time required to empty the circular shed in case of fire. Attempts to counteract this disadvantage have produced the expensive so-called fireproof designs. Mr. McPherson also took exception to each of the six disadvantages enumerated by the committee relative to through rectangular houses.

Under smoke-jacks, Mr. Buck (C. P. R.) called attention to the fact that the committee made no recommendation for height. Mr. Raymer, Chairman, explained that that would depend almost entirely on the construction of the house; that with the present types of large jacks the use of the jack as an extension to the locomotive stack and an aid to the draft as in the older small jacks is lost, therefore the length is merely a matter of getting the jack through the roof. This is dependent on the building construction.

The conclusions about smoke jacks and engine house doors were accepted.

Economics of Railway Location.—Chairman McNab reported progress. The first bulletin will be issued as early as the matter now in hand can be put into concrete form.

Track.—Action was asked on the conclusions in the report. No. 1, relative to a standard rail joint, was adopted without discussion. No. 2, relative to the appointment of a committee to confer with a committee from the American Railway Master Mechanics' Association in regard to widening gage on curves was amended to provide that the report of this committee include the action of all kinds of locomotive driving-wheel arrangements on track, and the need for increasing the spacing between the inner pairs of drivers on locomotives having four or more pairs of drivers. Mr. Kittredge (Big Four) spoke of trouble they were having from some new engines with all-flanged drivers, especially on curves sharper than 6 degrees. The amended conclusion was accepted.

Conclusion 3 referred to maintenance of gage and inspection of track. One clause in the recommendations, relative to maintenance of gage read: "Within proper limits, a slight variation of the gage from standard is not seriously objectionable, provided the variation is uniform and constant over long distances. Under ordinary conditions it is not necessary to regage such track when the increase in gage has not amounted to more than ⅝ in." Objection was made to the clause on the ground that it tended to minimize the importance of accurate gaging. A member referred to the existence up to recently of two gages—4 ft. 9 in. and 4 ft. 8½ in., and asked how the objection would be reconciled with this condition. In answer to this, Mr. Fritch (Ill. Cent.) said that when these two gages were in use much more trouble was had from broken wheel flanges than now with only one gage, and many roads went to considerable expense to change the gage ½ in.

The clause was finally modified by omitting the first sentence and having it read: "Under ordinary conditions it is not necessary to regage track when the increase in gage has not amounted to more than ⅝ in., provided such increase is uniform." The desire was expressed by some members to reduce the ⅝ in. to ¼ in., but this was not urged.

Conclusion 4, asking the approval as good practice of the easement curve formula submitted in the report, was accepted, it being understood by members that the tables derived from the formula could be extended to take in longer curves than the figures given by the committee included.

Water Service.—Interest in the rather brief discussion of this report centered in a statement made by Prof. McGill (Canadian Inland Revenue Service), of the committee, regarding the advantages and possibilities of using barium hydrate for water treatment. The present practical objection is the cost of the reagents, but he had strong hopes of this being brought down to where it would be profitable for a railroad to use this substance on a large scale. Barium hydrate has two qualities of permanently high importance in the softening of water not possessed by carbonate of soda or lime. In the first place, the sulphates are completely thrown out of solution, and they are really the worst scaling features of a water. The second advantage is that barium hydrate renders available for actual softening of the water the lime which is present in the water; that is to say, the lime which is an objectionable quality in the water is made by a chemical reaction with barium hydrate to become valuable itself for further softening of the water. If railroads could arrive at or determine some maximum price they could afford to pay for barium hydrate it would then rest with chemists and manufacturers to try to bring down the cost to this limit. If a fixed and large demand existed it was thought that certain methods could be applied which would cheapen considerably the cost. At least two cases are known where barium hydrate might be turned out as a by-product in the course of other manufactures.

The further point was made that although by present methods the scale matter may be brought down to 4 or 5 grains per gallon, if sulphate of lime remains even to the extent of 1 grain, scale will continue to form. Therefore a slight excess of soda ash is necessary to give best results. But this excess makes trouble in its turn by increasing greatly the foaming tendency. Barium hydrate disposes of the sulphate of lime without objectionable influence on the foaming trouble.

Wooden Bridges and Trestles.—Prof. Hatt (Purdue Univ.) said that the American Society for Testing Materials has appointed a committee to draw up specifications for structural timber. This committee includes not only engineers, but consumers and producers. As timber must be used as it is found in the forest, it is necessary that specifications shall reflect the condition of supply. The present specifications are an advance, but further consideration seems necessary. He therefore moved that the specifications for bridge and trestle timbers and piling be referred back to the

committee with the instruction that they co-operate with the committee of the American Society for Testing Materials for structural timber, with a view to the preparation of joint specifications. The motion was rejected, and instead the committee's specifications, embodying some slight changes indicated by the chairman of the committee, were adopted:

Under "recommended specifications for workmanship" Mr. Cartlidge (C., B. & Q.) objected to the provision that "ties shall be notched over the stringers to a close fit," suggesting the substitution of "sized to a uniform surface," or words of like meaning, which would leave the notching optional instead of making it compulsory. Motion to this effect carried. Certain clauses were pointed out that seemed to relate to design as well as workmanship, and on motion the specifications were referred back to the committee for consideration with regard to workmanship only. The specifications for metallic details used in wooden bridges and trestles were approved.

Exhibits at the Maintenance of Way Association.

Numerically, the exhibits at the Engineering and Maintenance of Way convention were fully 50 per cent. greater this year than last, and were of unusual interest and variety. They occupied the parlor floor of the Auditorium Hotel, as usual, but it was quite evident that any further increase in their number will necessitate the provision of exhibit space elsewhere for future conventions. This will, of course, mean the changing of headquarters and place of meeting also. Just how the problem is to be met is at present only a matter of conjecture. However, its solution may be required before the next convention. The list of exhibitors follows:

Adams & Westlake Co., Chicago. Samples of "Adlake" signal lanterns.

Affleck Concrete Steel Tie Co., Chestertown, Ind. Models of concrete ties and frames for moulding the same.

Allis Chalmers Co., Milaukee, Wis.- Literature describing Gates rock and ore breakers, crushing machinery, timber preserving plants, steam shovels and dredges and power and electrical machinery.

Allith Manufacturing Co., Chicago. Full-sized door, showing application and operation of Allith adjustable door-hanger.

American Hoist & Derrick Co., St. Paul Photographs of American railroad ditchers.

American Iron & Steel Manufacturing Co., Lebanon, Pa Screw spikes and ties showing effect of spikes on ties.

American Lock Washer Co., Chicago. Samples of double positive lock-washer.

American Locomotive Co., New York. Photographs of locomotives.

American Signal Co., Boston, Mass. Working model showing operation of pulsating current cab signal.

American Steel & Wire Co., Chicago. Full-size samples of steel wire fence.

American Valve & Meter Co., Cincinnati, Ohio. Full sized samples of "Economy" switch stands and model of track and switch showing operation of Anderson interlocking switch-stand.

Atlantic Equipment Co., New York. Photographs of Atlantic steam shovels and contractors' saddle-tank locomotive.

Atlas Railway Supply Co., Chicago. Atlas rail joints, braces and tie-plates, including the Atlas insulated and compromise joint.

Barker Mail Crane Co., Clinto, Ia. Full-sized Barker mail crane and device for putting up pouch.

Barrett Manufacturing Co., Chicago.- Samples of Barrett roofing materials.

Battery Supplies Co., Newark, N. J. Samples of Gladstone Lalande batteries.

Beaver Dam Malleable Iron Co., Beaver Dam, Wis. Samples of malleable iron tie-plates and rail braces; also F. & N. anti-spreader and anti-creeper.

Belle City Malleable Iron Co., Racine, Wis.- Samples of L. & S. anti-rail creeper; L. & S. adjustable rail brace; L. & S. stationary rail brace; also model of track showing effect of application of L. & S. anti rail creeper.

Bird & Son, F. W., Walpole, Mass. "Parold" roofing, "Hydrex" waterproofing and "Neponset" insulating paper.

Bowser & Co., S. F., Ft. Wayne, Ind.—Full-sized samples Bowser self measuring oil tanks.

Brown-Sphinx Co., Chicago. The R. L. Brown switch stand.

Bruley Steel Fence Post Co., Neillsville, Wis. Samples of Bruley's steel fence post.

Bryan Manufacturing Co., Racine, Wis.- Models of "Bull Dog" grip anti rail-creeper.

Bryant Zinc Co., Chicago. Samples of crossing bells, batteries, relays, etc.

Bucyrus Co., South Milwaukee, Wis. Photographs of Bucyrus steam shovels and 100 ton wrecking crane.

Buda Foundry & Manufacturing Co., Chicago. Paulus, Buda and Wilson track drills, switch stands, rail benders, car replacers, ratchet and friction jacks, etc.

Buffalo Steel Co., Tonawanda, N. Y. Samples of twisted high carbon steel bars for concrete reinforcement.

Cambria Steel Co., Johnstown, Pa. Sample 100 per cent. rail joint and 100 per cent insulated rail joint.

Carbolineum Wood Preserving Co., Milwaukee, Wis. Photographs showing trestles, roundhouse floors, ties, etc., treated with avenarius carbolineum

Carnegie Steel Co., Pittsburg. Sample of Duquesne splice bar and steel cross tie.

Capitol Lock Nut & Washer Co., Columbus, Ohio Samples of "Capitol" lock nut and washer.

Chameleon Signal & Manufacturing Co., Edwardsville, Ill Working model of "Chameleon" automatic block signal.

Chicago Bridge & Iron Co., Chicago. Photographs showing steel tanks and towers built for various railroads.

Chicago Pneumatic Tool Co., Chicago Samples of riveting and chipping hammers, drilling, reaming and boring machines; also sand rammer

Chicago Steel Tape Co., Chicago. Measuring tapes and jointed leveling rods.

Chicago Wire Fence & Tool Co., Chicago. Heavy fence stays and tools

Clark Publishing Co., Myron C., New York. Sample copies of engineering books.

Climax Stock Guard Co., Chicago. Samples and model showing "Climax" shale clay stock guard.

Conley, J. E., Arcola Ill Wooden model of Conley frog

Cook's Railway Appliance Co., Kalamazoo, Mich Full sized samples of Cook's collapsible rail drill and drill grinders, also standard track jacks and Cook's combination steel and wood cattle guard.

Cortwright Metal Roofing Co. Philadelphia, Pa Samples of metal roofing and model showing application.

Corrugated Bar & Expanded Metal Co., St. Louis, Mo (formerly St. Louis Expanded Metal Fireproofing Co.). Samples of various sizes of Johnson corrugated bars, also electrically lighted transparencies showing bridges and buildings of reinforced concrete.

Crescent Compound Manufacturing Co., Ellwood City, Pa Samples "Crescent" compound roofing and roofing paper and cement

Dayton Hydraulic Machine Co., Dayton, Ohio. The Brooks centrifugal pump in operation

Dempsey, J. A., Chicago Dempsey telegraphic cipher code and model of boiler showing operation of Clark mechanical boiler cleaner

Detroit Graphite Manufacturing Co., Detroit, Mich.—Photographs and pamphlets describing suspension graphite paints.

Dickinson, Paul, Chicago. Sectional models of roundhouse equipped with the Dickinson movable smoke-jack and Dickinson ventilator; also full sized section of Dickinson smoke jack made from "vitribestos" and full sized section of 40 in. cast iron jacks. Also full sized samples of Dickinson cast iron chimneys and ventilators

Dixon Crucible Co., Jos., Jersey City, N. J. Samples of Dixon silica graphite paint, and of lumber crayons

Dressel Railway Lamp Works, New York. Samples of signal lamps

Eyeless Tool Co., Newark, N. J Samples of eyeless picks, hammers, sledges, etc

Eastern Granite Roofing Co., New York Samples of perfected granite roofing and sand-surfaced roofing.

Edison Manufacturing Co., Orange, N. J. Edison primary batteries for semaphore signals and crossing bells.

Electric Storage Battery Co., Philadelphia, Pa.—Samples of "Chloride" and "Exide" accumulators, battery cells, etc

Fairbanks, Morse & Co., Chicago. Full sized Sheffield inspection car; also samples of Barrett track jacks, rail drills, stand pipes, wheels, etc.

Frost Railway Supply Co., Detroit, Mich. Samples of Daly spikes.

Gabriel Concrete Steel Reinforcement Co., Detroit, Mich. Drawins illustrating Gabriel system for reinforcing concrete

William Goldie, Jr., & Co., Bay City, Mich. Samples of Goldie perfect tie plug

Goodwin Car Co., New York. Literature describing Goodwin coal, ore and construction cars

Gordon Battery Co., New York. Samples of Gordon primary cells

Graham Flange Frog Co., Salem, Va. Model of Graham flange frog

Gray National Telautograph Co., Chicago. Sample of Gray "National" telautograph in operation.

Grip Nut Co., Chicago "Grip" nuts in various sizes.

Hall Rail Joint Co., Chicago Samples of the Hall rail joint for various sized rails

Handan Buck Manufacturing Co., St. Louis, Mo Circulars describing the "I. C." water cooler and full sized sample of signal lamps

Hayes Track Appliance Co., Geneva, N. Y. Full sized samples Hayes lifting and Hayes pivot derails.

Hubbard & Co., Pittsburg Catalogues of track tools, nuts, washers, etc.

Hussey Binns Shovel Co., Pittsburg, Pa. Samples of shovels and scoops.

Indianapolis Switch & Frog Co., Springhed, Ohio Blue prints of frog and sample of adjustable switch rod.

Inland Steel Co., Chicago. Samples of twisted high carbon steel bars for concrete reinforcement

Illinois Steel Co. (Cement Department), Chicago. Samples of material showing method of manufacture of "Universal" Portland cement and specimens of finished product.

International Creosoting & Construction Co., Galveston, Tex. Literature describing processes of wood preserving.

H. W. Johns Manville Co., New York. Samples of asbestos roofing, pipe coverings and packings; also electrical devices, fuses, "Transite" board, etc.

Philop S. Justice, Philadelphia, Pa.—Samples of Justice spike-puller and "Reliance" hydraulic jacks.

Kalamazoo Railway Supply Co., Kalamazoo, Mich.—Full-sized samples hand cars, velocipedes, track drills, jacks, gages and levels; also new wheel with reinforced tread, and Root scraper and flanger.

Kennicott Water Softener Co., Chicago.—Photographs showing installations of Kennicott water softeners on various railroads, and map showing their location.

Kettle River Quarries, Minneapolis, Minn. Samples of creosoted wood blocks.

Keuffel & Esser Co., New York. Sample steel tapes, transits, surveying and measuring instruments.

Kitson Portable Light Co., Philadelphia, Pa. Full sized samples of Kitson portable light.

Liberty Manufacturing Co., Pittsburg, Pa.—Samples of boiler tube cleaners for locomotive arch flues and twin strainers for condensing plants

Lidgerwood Manufacturing Co., New York. Photographs of hoisting engines, Lidgerwood rapid unloader and apparatus for coaling vessels at sea

Link Belt Machinery Co., Chicago. Photographs showing coaling stations erected for various railroads.

Locomotive Appliance Co., Chicago. Full sized samples of Smyth derailers Nos. 1, 2 and 3; also Newton wrecking frogs

Lord & Burnham Co., New York. Full sized sample of sash operating device in operation.

Lufkin Rule Co., Saginaw, Mich. Metallic and linen tapes, steel rules, etc.

Mahoney Railroad Ditching Machine Co., Vincennes, Ind Working model of railroad ditching machine.

McClintock Manufacturing Co., St. Paul, Minn Working model of truck and locomotive showing application and operation of McClintock new cab signal.

McCord & Co., Chicago. Model of new structural steel "Gibraltar" bumping post.

L. J. Mensch, Chicago. Photos showing reinforced concrete coal and cinder bins tanks, buildings, etc., erected.

McMyler Manufacturing Co., Cleveland, Ohio. Full sized sample of "Economy" separable switch point and Odenkirk switch stands

John S. Metcalf Co., Chicago. Photos showing concrete selevators erected

Mississippi Wire Glass Co., New York Samples of wire glass and figured rolled glass.

Morden Frog & Crossing Co., Chicago Model of track and switch showing "Security" switch stand, samples "G. L. M." switch stands, working model of "Universal" switch stand; samples of adjustable open side switch sockets; also photographs of Leighton-Hansel continuous rail crossing

Meurer Bros. Co., Brooklyn, N. Y. Samples of metal Spanish tile for roofing, "Anchor" ventilators; tin plate and Welsh charcoal iron plates

Municipal Engineering & Contracting Co., Chicago Working model of "Chicago" improved cube concrete mixer

National Coal Dump Car Co., Chicago Photographs and literature illustrating the "National" coal dump car

National Lock Washer Co., Newark, N. J Samples of various sizes of "National" lock washers

National Railway Materials Co., New York Samples Murray anti-rail creepers, guard rail braces and clamps, rail braces etc

National Roofing Co., Tonawanda, N. Y Samples of Security mineral asphalt roofing.

New Castle Forge & Bolt Co., New Castle, Pa Samples of track bolts grip nut bolts, etc.

Newman Clock Co., Chicago Full-sized watchman's clock and time indicator

Otto Gas Engine Co., Philadelphia and Chicago Photographs showing coaling stations, water tanks and cranes, sand hoists and pneumatic tools

Palmer Davis Rail Joint Co., Chicago Samples of Palmer rail joints

Pease Pearson Continuous Blueprinting Co., Chicago Samples of continuous blue-prints made with the Franklin continuous blue printing machine

The Pennsylvania Steel Co., Philadelphia, Pa Models of New Century switch with adjustable stand and double crank, Mundy switches. Also photographs of steel bridges.

Percival Reinforced Construction Steel Pile Co., Galveston, Tex. Samples and photos of Percival reinforced concrete pile

Quincy Manchester Sargent Co., Chicago Samples of Q. & C. Bonzano

[illegible] Co., [illegible] Ill. [illegible] Model of D. & C. [illegible] rail creeper.

The Rail Joint Co., New York.—Several styles of "Continuous" insulated rail joints, "Continuous" [illegible] Weber standard and Weber standard conditions, steel and [illegible] insulated rail joints.

Railroad Supply Co., [illegible] Wellington Q. & W. and Servis tie plate.

Ramapo Iron Works, Niagara [illegible], N. Y.—Model showing MacPherson's patent safety switch; also new Ramapo automatic switch stand.

Reinforced Concrete Pipe Co., Jackson, Mich.—Sample of reinforcing for concrete sewer pipe; also [illegible] descriptive of concrete sewer pipe.

Roberts & Schaefer Co., Chicago.—Photographs showing coaling stations erected for various railroads.

Robertson Manufacturing Co., Chicago.—Photographs and blue prints showing installation of Robertson pneumatic under conveyor.

Robt. A. Ford Bridge & Crossing Safety Gate Co., Chicago.—Working model of bridge and crossing safety gate.

Jos. T. Ryerson & Son, Chicago.—Samples of "Simplex" track jacks.

Safety Nut Lock Co., Minneapolis, Minn.—Samples of "Safety" nut lock.

Safety Switch Appliance Co., St. Louis, Mo.—Working model showing operation of "Safety" switch.

Scherzer Rolling Lift Bridge Co., Chicago.—Album and miscellaneous photographs showing Scherzer rolling lift bridges.

Scott Manufacturing Co., Racine, Wis.—Samples of "Racine" rail anchor and pamphlet describing the Hercules bumping post.

Sherwin-Williams Co., Cleveland, Ohio.—Literature descriptive of "Metalastic" paints.

F. A. Smith, Chicago.—Sample of curve lining gage.

Robt. C. Smith, Chicago.—Drawings and blue prints showing Smith system of water softening and purification.

Smith Improved Lock Nut Co., Rockford, Ill.—Sample of Smith improved lock nuts.

Spencer Otis Co., Chicago.—Samples of Hart tie plates and photographs of the "National" coal dump car; also samples of McKee rolled shoulder tie plates.

D. P. Springer, Waverly, N. Y.—Model of Springer rail joint.

Stowell Manufacturing & Foundry Co., South Milwaukee, Wis.—Showing the Wilhern door-hanger.

Strauss Bascule & Concrete Bridge Co., Chicago.—Working model of the Strauss trunnion bascule bridge; model of ribbed reinforced concrete bridge.

Truss & Cable Fence Co., Cleveland, Ohio.—Samples of wire board fencing.

Truss Steel Tie Co., Pittsburg, Pa.—Sample sections of truss steel tie.

U. S. Wind Engine & Pump Co., Batavia, Ill.—Full-sized samples of switch stands and semaphores and literature describing the new U. S. adjustable water columns; also water tanks.

U. P. Van Hook, Bloomington, Ill.—Sample of concrete steel fence post.

Verona Tool Works, Pittsburg, Pa.—Samples track tools, nut locks, gages, etc.

Versailles Railway Signal Co., Pittsburg, Pa.—Samples of vulcanized fibre for rail insulation.

J. W. Walker, Pittsburg, Pa.—Full-sized sample of Ritter horizontal folding door.

Walters & Okell, Fort Madison, Iowa.—Sample of Walters ballast placing device.

H. S. Waterman, Manitowoc, Wis.—Samples of Waterman spike lock.

C. H. Whall & Co., Boston, Mass.—Samples of Whall special railroad insulating fibre.

Wm. J. Wharton, Philadelphia, Pa.—Photographs and samples showing Wharton manganese steel frogs; also switch stands.

Jas. G. Wilson Manufacturing Co., New York.—Full-sized sample of sliding swing door; also samples of rolling doors.

E. J. Winslow Co., Chicago.—Full-sized sample of "Hydrolithic" battery chute; also photographs and literature describing "Hydrolithic" battery vaults, cisterns and "Hydrolithic" waterproofing.

Investigation of Concrete Materials Under National Board on Fuels and Structural Materials.

In view of the importance of and general interest in the work which is to be carried out under the supervision of the National Board on Fuel and Structural Materials, the following statement made at the recent convention in Chicago of the American Railway Engineering and Maintenance of Way Association by Mr. R. L. Humphrey, who has the direction and supervision of the Government laboratories for the testing of structural materials, regarding what has thus far been accomplished, is reproduced:

I have heard some little criticism and comment relative to the work which was being done in the investigation of structural materials, on the ground that there has been a great deal of talk and very little action. The work was inaugurated last June under two appropriations by the Government, one for $5,000 and the other for $7,500. The first appropriation became exhausted June 30, as it was necessary to use the money in the purchase of necessary equipment, leaving $7,500 to carry on the work during the year. When I say that we have some 14 assistants at the laboratory, and that we have been examining some 77 samples of sands, gravels and crushed stones in different parts of the country, which were donated to us by the people who owned the deposits and were carried by the railroads free of charge; that the steel we used in the reinforced concrete was donated by the manufacturers, and cement was donated by cement manufacturers, you will understand the work necessary for your committee to do in co-operation with the joint committee on concrete and reinforced concrete, as well as with members of the advisory boards in getting all these assistants, and the co-operation we had. There was insufficient money, and we did the best we could. There is in preparation at the present time a bulletin which will appear before the end of this year, telling of the work which was done in that line during the past year, and also setting forth the work which has been done at various technological institutions under the work of the joint committee.

It takes a good deal of time and effort to organize. I think our organization in St. Louis, where is located the laboratory of your committee on concrete and reinforced concrete, is fairly under way. We hope to get $100,000 from the United States Government, and it seems sure that we will get it; and we hope every member interested in the work will write endorsing this work, because it is only through this interest that we will get the appropriation. We will accomplish more next year than we did this year. What I want to bring before the members of this organization is the need of the co-operation of the railroads in enabling us to get characteristic samples of deposits, sand, stone and gravel, which form the constituent parts of concrete. This is the first thing we must get information on as the basis of the final report of concrete and reinforced concrete. If the organization has to buy all this material, has to pay the freight, as well as the expenses of the inspector who goes over it, it will quickly exhaust the appropriation. So that when we appeal to you members from the various railroads to help us in this thing I trust you will understand the reasons why we are doing it, and, after the samples are furnished, to realize that it takes time before that material can be tested and a report made.

We tested some 77 samples last year. Those tests extend over a year, embracing three months, six months and a year's time, and they were made systematically and regularly, and while we have been doing a great deal of talking, as has been said, we have also been doing a great deal of work, with a limited amount of money. I hope you will have patience, and I think the coming year will show the value and extent of the work we are trying to do, and with which your sub-committee is so cordially and heartily co-operating.

Standard Locomotives for India.

The Engineering Standards Committee has issued a report supplementing that of 1903, in which five designs of locomotives were recommended as standards for the Indian State Railway. Of these, two are intended for lines of 5 ft. 6 in. gage and three for those of the metre gage. In both cases the Belpaire firebox and a boiler pressure of 180 lbs. per square inch was adopted. The reason for the adoption of the Belpaire firebox is that it gives more steam and water capacity than the usual arrangement with semi-circular outside shell and girder stays for the firebox, and with increasing pressures and larger fireboxes the length and weight of girders become excessive, and direct staying has to be resorted to.

For the engines of the 5 ft. 6 in. gage, inside cylinders were decided upon as being the type most universally adopted on the Indian railroads. With these the Stephenson link motion and balanced slide valve have been adopted, though the Walschaert gear and outside cylinders are to be used on the roads of metre gage.

Although the Calcutta Conference for Engineers expressed a preference for frames outside the wheels for the metre gage engines, inside frames have been adopted, because the difficulties anticipated in the oiling and examination of the inside frame engines have not been found to exist in the new engines sent to the Bengal & North Western, and Rohikund and Kumaon railways, and the width of the firebox is only 2 in. less than in the outside frame engine. On the other hand, the advantages gained in reduction of the width between the cylinders, the elimination of the fly crank from engines of high power, the more effective staying of the frames and reduction of weight in all parts except the boiler, which can thus be made more powerful, are of such importance that the committee, after full consideration, have adopted the inside frame, which, it may be observed, is very largely used on narrow gage lines in other countries than India.

Among the details adopted as standard are copper staybolts of 1 in. diameter spaced not more than 4 in. between centers, on the broad gage engines. The cylinders of these are to be 18½ in. diameter, with a piston stroke of 26 in., and the two are to be cast in one piece. The reversing gear is to be, preferably, of the screw type, though a steam gear may be adopted if required. The wheel centers are to be of cast steel, with balance weights cast solid, those of the passenger engines to be 5 ft. 8 in. in diameter, with 3 in. tires, making the diameter of the wheel 6 ft. 2 in. The corresponding diameters on the freight engines are to be 4 ft. 7½ in. and 5 ft. 1½ in., respectively.

The steam brake may be used on the engine and tender in combination with the automatic vacuum brake fittings on the engine, to enable the vacuum brake to be applied on the train simultaneously with engine; or the vacuum brake alone may be used.

Owing to a difference of opinion among the members of the conference as to the merits of flanged and unflanged brake shoes, there are no recommendations as to this detail.

There is to be a cab over the engine only on the broad gage engines. It is to be fitted with sliding shutters, and no cab is to be put on the tender except in the case of those roads that especially require it. Tender cabs are, however, to be used on all of the metre gage engines. The matter of the shape of the firebox is evidently to be left to the discretion of the management of the several lines, as it is merely stipulated that, "if rectangular fire holes be adopted," the sheets shall be disked out to meet the thin plate that is to be used.

In view of the practice prevailing in this country, the tubes are to be very short, that is, 11 ft. 4½ in. on the broad gage engines, and strangely enough, this is increased to 4 ft. 9½ in. on the narrow gage. The cylinder diameters of these narrow gage engines are to be 15½ in. for the passenger service, and 15 in. and 16 in. for the

light and heavy freight engines, respectively. The common stroke of all three to be 22 in. The five classes of locomotives that have thus been adopted as standards are for broad gage passenger service, 4-4-0; for broad gage freight service, 0-6-0; for narrow gage passenger service, 4-6-0; for narrow gage freight, 4-6-0 and 4-8-0.

The following is a schedule of the general dimensions of these engines:

Service	Passenger.	Freight.	Passenger.	Freight.	Freight.
Gage	5 ft. 6 in.	5 ft. 6 in.	1 meter.	1 meter.	1 meter.
Class	4-4-0	0-6-0	4-6-0	4-6-0	4-8-0
Diam., cylinders	18½ in.	18½ in.	15½ in.	15 in.	16 in.
Stroke of piston	26 "	26 "	22 "	22 "	22 "
Boiler press., sq. in.	180 lbs.	180 lbs.	180 lbs.	180 lbs.	180 lbs.
Valve gear	Stephenson.	Stephenson.	Walschaert.	Walschaert.	Walschaert.
Heating surface:					
Tubes, sq. ft.	1,229.5	1,229.5	954	954	1,164.8
Firebox, sq. ft.	120.0	120.0	108	108	126.2
Total, sq. ft.	1,349.5	1,349.5	1,062	1,062	1,291.0
Grate area	25.3	25.3	16	16	17.5
Tubes, length	11 ft. 4½ in.	11 ft. 4½ in.	11 ft. 9¼ in.	11 ft. 9¼ in.	11 ft. 9¼ in.
" number	236	236	177	177	216
" diameter	1¾ in.	1¾ in.	1¾ in.	1¾ in.	1¾ in.
W't. working order:					
Engine	51.0 tons.	48 tons.	33.7 tons.	33.3 tons.	39.5 tons.
On drivers	32.5 "	48 "	26.1 "	25.8 "	32.0 "
On tender	39.5 "	39.5 "	22.95 "	22.95 "	22.95 "
Eng. & tender	90.5 "	87.5 "	56.65 "	56.25 "	62.45 "
Wh'l base: Rigid	9 ft. 6 in.	15 ft. 6 in.	12 ft. 0 in.	12 ft. 0 in.	14 ft. 3 in.
Engine	22 " 11 "	15 " 6 "	21 " 1½ "	21 " 1 "	23 " 4½ "
Eng. & tender	44 " 9⅜ "	38 " 4⅜ "	42 " 1¾ "	42 " 1¼ "	44 " 10¾ "
Diam. drvg whls.	6 " 2 "	5 " 1½ "	4 " 9 "	4 " 0 "	3 " 7 "
Tractive power of boiler press.:					
At 75 per cent.	16,233 lbs.	19,533 lbs.	12,518 lbs.	13,922 lbs.	17,682 lbs.
At 90 per cent.	19,480 lbs.	23,440 lbs.	15,022 lbs.	16,706 lbs.	21,218 lbs.
Factor of adhesion 75% boilr press.	4.48	5.50	4.67	4.15	4.05
Tender capacity:					
Coal	7½ tons.	7½ tons.	4 tons.	4 tons.	4 tons.
Water	3,000 gals.	3,000 gals.	2,000 gals.	2,000 gals.	2,000 gals.

In this the factor of adhesion is obtained by dividing the adhesive weight by the tractive power.

While these dimensions seem small when considered in the light of the great distances and long hauls of India, as well as in comparison with what is proving so economical in this country, it must be remembered that in Mr. Priestley's recent exhaustive and valuable report on American railroads to the Indian commission, he called attention to the economies effected by the use of large cars and locomotives in the country, and at the same time expressed the opinion that Indian traffic was not yet ready for such capacities, though advising that efforts should be made toward that end.

Automatic Signals for the Union and Southern Pacific.

During the past two years the Union and Southern Pacific lines have been especially active in affording additional safeguards to traffic by extension of automatic block signaling on their principal lines. Up to December 31, 1905, 1,038 miles of track had been thus protected. Our yearly report on progress in the use of the block system, published February 2, gave the proposed new work on these lines for 1906 as 664 miles. Since that time plans have been made for further large extensions of this work during 1906, so that by the end of this year it is expected that 3,237 miles of the main lines, including all of the lines where traffic is densest, will be fully protected by automatic block signals. This includes complete protection of the entire principal main line between Omaha and San Francisco, the entire Coast Line between San Francisco and Los Angeles, and short stretches on various other parts of the roads.

The accompanying map shows the location and extent of this work, the solid lines indicating the mileage protected at the end of 1905, and the shaded portions the work projected for the current year. With the completion of this work the U. P.-S. P. lines will have by far the greatest mileage of road equipped with automatic block signals in the country, and nearly all of it single track. The estimated cost of the work to be done this year is reported to be in the neighborhood of $3,000,000.

The foregoing figures may perhaps be taken as throwing some light on the statement published in our issue of March 16, showing the remarkable amount of work now being done at the shops of the Union Switch & Signal Company; for that company furnishes, we believe, all of the material used for automatic signaling on the Union and Southern Pacific lines.

Train Accidents in the United States in February.

bc, 1st, San Pedro, Los Angeles & Salt Lake, Rowland, Cal., butting collision of passenger trains; three passengers injured.

dr, 1st, Great Northern, Towner, N. Dak., passenger train No. 3 was derailed by spreading of rails, and 14 passengers and four trainmen were injured.

bc, 3d, Cincinnati, Hamilton & Dayton, Leipsic, Ohio, butting collision of passenger trains. One engineman and two passengers were injured.

xc, 3d, night, Seaboard Air Line, White House, Fla., the engine of a freight train, backing into a side track to take out a part of its cars, collided violently with the cars, killing one and injuring five of the trainmen.

unx, 3d, Erie Railroad, Midvale, N. J., the locomotive of a freight train, which was running tender first, was derailed and fell down a bank, and the engineman was killed.

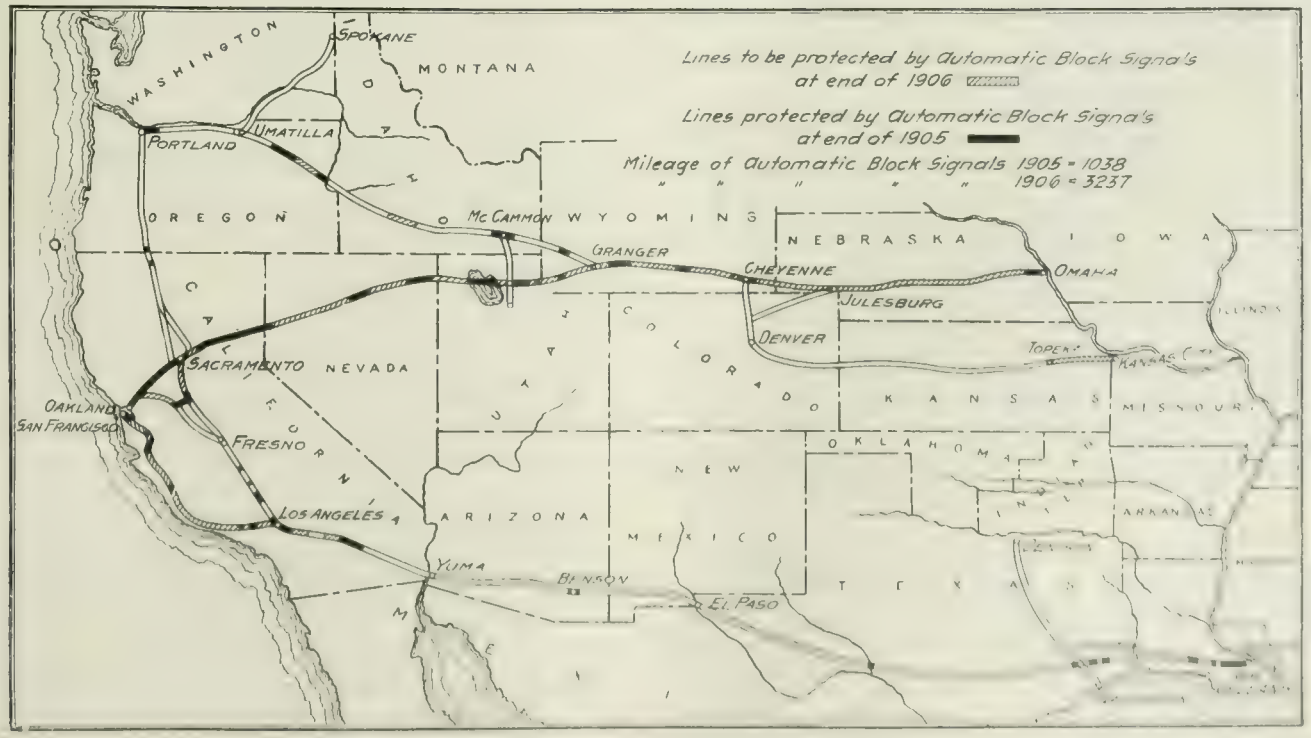
unx, 3d, Chicago, Rock Island & Pacific, Duran, N. Mex., a passenger train was derailed and the tender and seven cars were

*Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.



Automatic Block Signals for the Union Pacific and the Southern Pacific.

ditched the tender [illegible] were injured, two of them [illegible]

xc, 9th, 11 p.m., No. [illegible] Glenora, Mont., a freight train which became [illegible] on a steep grade collided with a passenger train which [illegible] cars in both trains. The wreck took fire and all of the [illegible] cars and several freight cars were burnt up. Two persons, one trainman and one express messenger were killed; [illegible] bodies were burned up, and it is believed that two other persons, not identified, perished in the fire. One trainman was injured.

bc, 6th, Missouri Pacific, Verdon, Neb., butting collision between a passenger train and a freight, due to a misunderstanding as to the meeting point. One man was killed and several were injured.

*rc, 7th, 1 a.m., Norfolk & Western, Rippon, Va., a freight train drawn by two engines ran into the rear of a preceding freight, wrecking the caboose and several cars and overturning one of the engines. The wreck took fire and was partly burnt up. One engineman was killed and one fireman injured.

rc, 8th, 1 a.m., Central of Georgia, Forsyth, Ga., rear collision of passenger trains; five passengers injured.

unf, 8th, 3 a.m., Southern Pacific, La Moine, Cal., a freight train was derailed by a rock which fell on the track, and three cars fell down a bank. An unknown man riding on one of the cars was killed.

rc, 9th, Illinois Central, Manchester, Iowa, a freight train ran over a misplaced switch and into the rear of another freight standing on the side track; two trainmen injured, one fatally.

dr, 10th, Texas & Pacific, Odessa, Tex., eastbound passenger train No. 4 was derailed by a broken rail, and two passenger cars fell down a bank and were overturned. The conductor and two passengers were injured. The injuries of one passenger were reported as probably fatal.

xc, 11th, Baltimore & Ohio, Shenandoah Junction, W. Va., a freight train became uncontrollable on a steep descending grade and collided with a preceding freight; three trainmen injured. It is said that the runaway was caused by the engineman being asleep.

xc, 11th, 1 a.m., Southern Railway, Greensboro, N. C., a passenger train ran over a misplaced switch and collided with a yard engine. Both enginemen, one fireman and the yard conductor were killed and two other trainmen were injured.

unx, 11th, 9 p.m., Illinois Central, Chapmansboro, Tenn., a passenger train running at full speed was derailed and some of the cars were ditched. Six passengers and three trainmen were injured.

o, 12th, Louisville & Nashville, Bank Lick, Ky., the locomotive of a freight train was wrecked by the explosion of its boiler, and the engineman, fireman and one brakeman were injured, the fireman fatally.

bc, 13th, 4 p.m., Louisville & Nashville, Maurice, Ky., butting collision of passenger trains; one engineman and one fireman killed; five other trainmen injured.

bc, 13th, Southern Railway, Asheville, N. C., butting collision of freight trains due, it is said, to misreading of orders; one trainman killed, three injured. There was a dense fog at the time.

unf, 13th, 3 a.m., Southern Pacific, Shasta Springs, Cal., passenger train No. 15 was derailed by a rock which had fallen on the track, and both of the two engines drawing the train were wrecked. One engineman was injured.

bc, 14th, Chicago & North-Western, Janesville, Wis., butting collision between a passenger train and a freight; three trainmen killed and four trainmen and six passengers injured. There was a blinding snowstorm at the time.

*†xc, 14th, St. Louis & San Francisco, Columbus, Kan., passenger train No. 118 collided with some freight cars which had escaped control and run to the main track, and the engine and several cars were wrecked. The wreck took fire and the entire passenger train, except one sleeping car, was burnt up. One passenger, one express messenger and a newsboy were burnt to death, and the engineman and firman were injured.

dn, 14th, Baltimore & Ohio, Okonoke, W. Va., a freight train became uncontrollable on a steep descending grade and was derailed at a curve; engineman killed, two other trainmen injured. It is said that the engineman was asleep.

*14th, Missouri Pacific, Gasconade, Mo., westbound fast mail train No. 7 was derailed and the engine and two mail cars were ditched. The wreck took fire and the mail cars were burnt up. Four trainmen were injured.

o, 14th, Northern Pacific, Frazee, Minn., the locomotive of a freight train was wrecked by the explosion of its boiler; one brakeman killed, two other trainmen injured.

xc, 15th, 1 a.m., Pennsylvania Railroad, Lancaster, Pa., collision between a fast parcels express train and a freight train, making a bad wreck, blocking all main tracks. Both trains were westbound and the freight train, apparently in consequence of disregard of signals, attempted to pass from the four-track section to the two-track section simultaneously with the express train, and struck the cars of the latter on the sides. All of the express cars were occupied by messengers [illegible] and [illegible] there were no [illegible] injuries.

ex, 15th, 8 p.m., Boston & Albany, Boston, Mass., a westbound passenger train passing from the two-track section to the four-track section of the line, collided with a train of empty passenger cars, and one passenger car in the passenger train was wrecked. One passenger was killed and eight were injured. The empty train, backing, appears to have disregarded a stop signal. The car in which passengers were killed and injured was a smoking car of comparatively light construction. Its position in the train was immediately behind two heavy baggage and mail cars, and behind it were heavy sleeping cars.

xc, 16th, New York Central & Hudson River, Ravena, N. Y., eastbound passenger train No. 4 ran over a misplaced switch and through a cross-over track and collided with a coal train, making a bad wreck. Two passengers and two trainmen injured.

unx, 17th, Durham & Southern, Holly Springs, N. C., a locomotive was derailed at a switch and the engine was overturned. The conductor was killed and the engineman and fireman were injured.

bc, 18th, Southern Railway, Swannanoa, N. C., butting collision of passenger trains, both running at good speed; one conductor and one brakeman killed, three other trainmen injured. Misunderstanding of orders is given as the cause.

xc, 18th, Baltimore & Ohio, Ohio Pyle, Pa., a freight train broke in two and the rear portion afterward ran into the forward one, wrecking many cars. Three trainmen were injured.

19th, St. Louis, Iron Mountain & Southern, Carondelet, Mo., a fast mail train, carrying no passengers, was derailed, presumably by a broken rail. 12 men injured.

bc, 20th, Iowa Central, Eldora, Iowa, butting collision of freight trains, due to disregard of orders by the northbound train; one engineman and one brakeman killed, one fireman injured.

unf, 20th, Southern Pacific, Delta, Cal., a passenger train drawn by two engines was derailed by a landslide. The engines were wrecked and two mail cars fell down a bank. After the derailment a second landslide occurred, killing one of the enginemen.

unx, 20th, Mobile & Ohio, Marion, Miss., a freight train was derailed and an engine and nine cars were wrecked. The engine was overturned and the fireman killed.

rc, 21st, Lake Shore & Michigan Southern, Amasa, Pa., rear collision of freight trains; one conductor killed, one trainman injured.

rc, 21st, Southern Railway, Chatham, Va., rear collision of freight trains, derailing and overturning one engine and five cars; four trainmen injured.

unx, 21st, Louisville & Nashville, Nortonville, Ky., a freight train was derailed and the engine was overturned; engineman killed, several other trainmen injured.

xc, 22d, Pittsburg, Cincinnati, Chicago & St. Louis, Carnegie, Pa., collision between a through freight train and a yard train, wrecking eight cars; two trainmen killed, eight injured.

dn, 23d, 2 a.m., Central of Georgia, Matthews, Ala., freight train No. 38 was derailed by a misplaced switch; three trainmen injured.

eq, 24th, Toledo, Peoria & Western, Crescent City, Ill., a westbound passenger train was derailed by the breaking of the flange of a wheel of the tender, and the engine and first two cars were ditched. The engineman was killed and 20 passengers were slightly injured.

bc, 25th, St. Louis, Iron Mountain & Southern, Diaz, Ark., butting collision of freight trains, wrecking both engines and six cars; two trainmen injured.

bc, 25th, New Orleans & Northeastern, Enterprise, Miss., butting collision of passenger trains, making bad wreck. One engineman was killed and 12 passengers and trainmen were injured. It appears that one of the trains should have waited for the passage of four trains in the opposite direction, but started out after the passage of the third.

bc, 26th, Delaware, Lackawanna & Western, East Buffalo, N. Y., butting collision of switching engines; employee killed.

unx, 28th, Coal & Coke, Elkhurst, W. Va., a passenger train was derailed and the locomotive and two cars fell down a bank, one of them turning over twice. Some of the passengers were thrown into Elk river; 13 passengers, a mail clerk and three trainmen injured.

The Hungarian State Railroads have had to defend suits for non-delivery of freight within the time prescribed by law during or after the great railroad strike which disabled them for some time. Their defence was that such delivery was rendered impossible by "higher power," which in their law is about what is called "act of God" in ours. The courts upheld their claim and pronounced that a railroad strike, at least such an one as they suffered from, is "*force majeure*," which certainly sounds better than to call it an "act of God." At least there have been railroad strikes in this country which it would be flat blasphemy to call "acts of God."

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- New York Transportation 345
- President Stickney on Rate Regulation.. 345
- Electric Railways in New England..... 345
- Electric Railway Accounts 346
- The Progress of Rate Regulation..... 346
- Prizes for Improved Railroad Appliances 347
- Trade Catalogues 347

ILLUSTRATED:
- The Pennsylvania Railroad's Extension to New York and Long Island..... 349
- Charging Storage Batteries from Alternating Current Circuits: The Mercury Arc Rectifier 352
- Map of New York Freight Terminals..... 354
- The New Bergen Hill Tunnel of the Lackawanna. 356
- Test of the Sauvage Air Brake..... 359
- A Reinforced Concrete Elevated Roadway 364
- The McCord Draft Gear..... 367
- A New Design of Metal Saw. . . 368

CONTRIBUTIONS:
- Approach and Detector Locking 347
- Filing Right of Way Records..... 348
- The Operator and the Adobe Collision... 348

MISCELLANEOUS:
- Railway Signal Association..... 348
- Michigan Railroad Tax Law Upheld..... 353
- National Association of Railway Commissioners 354
- Washington Correspondence 354
- Passes on Italian Railroads (Note)..... 356
- President Stickney on Rate Regulation... 358
- Railroad Decisions in March..... 363
- Foreign Railroad Notes:
  - The Simplon Express ..... } 364
  - Russian Rolling Stock ..... }
- Machine Shop Practice 365
- Professor Hutton's Resignation. 368
- Passenger Earnings on Baden Railroads (Note) 368

GENERAL NEWS SECTION:
- Notes 101
- Meetings and Announcements..... 104
- Elections and Appointments..... 104
- Locomotive Building 104
- Car Building 104
- Bridge Building 105
- Railroad Construction 105
- Railroad Corporation News 108

VOL. XL., No. 14. FRIDAY, APRIL 6, 1906.

The statistics of passenger traffic in great cities are a never-failing source of wonder. As soon as we get accustomed to the hugeness of one set of figures we are presented with a new lot, which so far surpass any previous statement that we lose the basis of comparison by which we gage the size of things. The New York railroad commissioners have just issued a pamphlet of statistics of transportation in New York City, and this pamphlet shows that in the year 1905 in the five boroughs of Manhattan, Brooklyn, Bronx, Queens and Richmond, constituting Greater New York, there were 1,171,151,698 fares paid, an increase of something like 100,000,000 over the year previous. Now, according to *Poor's Manual*, all the steam railroads in the United States in the year 1904 carried 716,244,858 passengers; therefore, it appears that within the limits of Greater New York in the year 1905, 454,906,840 passengers more were carried than were carried in the previous year over all the ramifications of our steam railroads from Maine to California, and from the Canadian frontier to the Gulf of Mexico. But the passenger train mileage of the United States in 1904 was 444,156,014. The car mileage in Greater New York in 1905 was 230,249,455. To get the full dramatic value out of these figures, we must add to the paid fares the number of transfers, since a transfer means a ride just as much as a paid fare does and has the same effect in congesting traffic. If, therefore, we add transfers and paid fares, and divide by the car mileage, we find that throughout the railroads of the country in 1904 there was an average of 1.6 passengers per train-mile, while on the Greater New York transportation system there was an average of 6.2 passengers per single car-mile.

In the early stages of the rate regulation controversy Mr. A. B. Stickney, President of the Chicago Great Western, was looked upon as somewhat of a radical because he advocated the enactment of legislation that would really regulate rates, instead of saying, with most critics of the Esch-Townsend bill, that effective regulation was impossible. In a very excellent paper, published in the *Political Science Quarterly*, part of which we print this week, Mr. Stickney maintains his position in a very able way. He also shows with great clearness the nature of the task that is comprised in attempting to formulate legislation that will be of any conceivable use. He says, most happily, that it is a distinguishing characteristic of the American mind that it seeks to remedy every economic evil by passing a law. The average mind regards the enactment of the law as sufficient. The average mind is always in favor of enacting a law. But after the law is enacted the average mind is opposed to its enforcement; and when such a law has been enacted and no attempt has been made to enforce it and the evil continues to exist, the demand of the average mind is not to enforce the existing law but to enact a new law. This is a keen sighted exposition of a trait of the American character that is prominently in the foreground at the present time. Mr. Stickney expressed the same point graphically just about a year ago, when he called attention to the fact that the law which makes it a misdemeanor for any individual not an officer of a railroad company to use a pass was enacted by Congress and approved by the President fifteen years ago, while, as an individual rule of action, it was ignored by the Congressmen who passed it and by the President who approved it. What, then, is Mr. Stickney's remedy? He mentions, in passing, that if there are such things as reasonable rates they must be based on something, and that nobody knows what they must be based on; while, if Congress confines itself to enacting laws which declare, like the present law, that all rates shall be reasonable and just, it is simply enacting a moral rule which no one will dispute and which no one can interpret or apply. Mr. Stickney suggests that before the enactment of any legislation Congress provide an interstate commerce investigation committee, on which there shall be a sound lawyer, a mathematician, a railroad auditor, an engineer, a superintendent, a traffic manager and a station agent. He is disposed to believe that this body of men will find that net rates—the remainder of the rates after deduction of the rebates—are the reasonable and just rates which should constitute the tariff. How hopeless the present situation is from the standpoint of the possibility of actually accomplishing anything good or useful Mr. Stickney clearly concedes when he says that after, but not before, a thorough investigation by such a committee it would seem possible to frame legislation which would be just, intelligible and enforcible. As there is not the slightest possibility that Mr. Stickney's suggestion will be carried out, the chance of a useful law must seem remote to him, as it does to us.

During the last two or three months in the steam trolley annals of New England, history or, at least, the outline of history has been making itself at an exceptional pace. The Boston & Maine already with power to acquire electric lines in New Hampshire is still seeking like privilege in Massachusetts and seems pretty sure ere long, to get it. This will be probably the prelude to belated fulfilment in upper New England and Massachusetts of a plan that copies the largely accomplished work of President Mellen in Connecticut and southern and central Massachusetts. While

minor in dimension, the Boston & Maine policy promises to be almost exactly similar in execution and character to the Mellen idea. But the inchoate situation in upper New England dwarfs in meaning when compared with present elements of the New Haven policy and its possibilities now and prospective. There seems to be little doubt that the mighty absorbent corporation has acquired the whole street railway system of Worcester, while only a final agreement as to the price of much watered stocks bars the way to purchase of control of the 140 miles or more of track of the Connecticut Railway & Lighting Company. These two purchases would carry the New Haven's street railway mileage well up toward the thousand mile mark. It would create several interesting new situations ahead, which one is worth special attention: The New Haven would then be anchored firmly by purchased street railway systems at three points of population in Massachusetts—Pittsfield in the west, Springfield at the center and Worcester in the east. All three of these are on the Boston & Albany steam line already paralleled by a long distance electric road between Worcester and Boston; and acquired electric lines of the New Haven already span a considerable part of the distance between Worcester and Springfield. What such a system imports, only the future can tell; but, as a guess, the immediate policy of the New Haven is self protective rather than aggressive and may be described metaphorically, as that of the sheathed club. Meanwhile two more general facts deserve sharp attention: First, how the non-protective and ultra-conservative policy of the Boston & Albany in refusing during its long life to acquire steam lines has been repeated in the case of electrics, in spite of the different policy of the lessee corporation, the New York Central, in New York state. And, secondly, bulks very big the more striking fact that in the very important, if not extensive, railroad region represented by the New England the knell has been sounded of steam railroad extension for almost every railroad purpose—whether competition, protection or business in new territory. For policies, plans and combinations based on the precedents of steam railroad operation and development there is now substituted in that region a policy based on electricity. How long will it be before we find a similar condition of railroad affairs in other and much greater areas of the country, especially those of dense population?

ELECTRIC RAILWAY ACCOUNTS.

A handbook, recently issued, deals with the subject of electric railway accounting, taking into consideration the monthly report of a street railway company, the annual report and the general work of the accounting department.*

It seems worth while to devote special attention to this book because of the lamentable lack of fullness, of clearness and of uniformity of practice in the reports which are sent out by the street railway companies throughout the country. The diversity of these reports is so great that nothing like the same estimate of the properties involved can be obtained that can be gotten from the reports of the steam railroad companies, harmonized and unified under the wise guidance of the Interstate Commerce Commission. The author of the present book does not go into his subject very deeply from the standpoint of the investor or of the student of transportation. He is an accountant, and he is chiefly concerned in having certain things brought out properly and clearly in the statements which the companies make. Thus, he is concerned that the monthly reports should be issued promptly; that companies should adopt a uniform style of making these statements, and that the work should be done in an honest and thorough manner. In all this we heartily concur, as also in the objections which he raises to dependence on the operating ratio, so called; the ratio of operating expenses to gross earnings, as a measure of the efficiency or economy of a property. As Mr. Brockway points out, this ratio is affected by a great many things which the ratio itself does not disclose. He cites a case in a city where two companies compete practically throughout. Assuming that each gets half the business and has to run full service to do it, it follows that the percentage of expenses to earnings is very high with each company as each has expense enough for all the business, although it gets but half of it. This high ratio is not the fault of physical conditions in this case, and is certainly not a figure by which the efficiency of the management can be tested. As the author also points out, if the bonded indebtedness is large (as it is very apt to be with street railway lines), the fixed charges may absorb all that is gained by low operating cost, and therefore it is quite possible for a company to operate for 50 per cent. of its earnings and still not pay dividends to its stockholders.

Looking at the subject of street railway accounts from a standpoint perhaps rather broader, it has always seemed to us most unfortunate that the expense statement is quite habitually lumped, and not separated into its component parts. The man unacquainted with a particular property who tries to derive some knowledge of it from the company's report would doubtless hold that this division of expenses is just about as important an item as the statement of expenses itself. Under the present customary way of presenting street railway reports, we know what the gross earnings are and we can rely upon that figure, and we also know what the operating expenses are and what is left for payment of fixed charges and for distribution to stockholders; but we cannot possibly tell whether the net earnings stated have been obtained by starving the property, or whether track, rolling stock and power plant have been liberally maintained out of earnings. We can only suspect, because of many sorrowful experiences in the past, that a company is likely to be insufficiently maintaining itself out of earnings if we happen to know that it needs new capital and is particularly anxious to make a good showing. Therefore, the mere fact of this omission of detail in the expense account throws almost every company under suspicion at one time or another in its corporate history. The information about what a company ought to spend for maintenance of way and structures and for maintenance of power house and equipment is actually so scarce that a single company might give these details with all fullness and find that they conveyed very little meaning to its critics because of the lack of a standard of comparison.

The best street railway report which has come to our attention is that of the Twin City Rapid Transit Co., of St. Paul and Minneapolis. The income account of this company, for the year ending June 30, 1905, is shown as follows:

Receipts	
Passenger earnings	$4,733,335
Miscellaneous earnings	25,928
Total earnings	$4,759,263
Expenses	
Maintenance of way and structures	$143,491
Maintenance of equipment	203,762
Operation of power plant	403,574
Car service	945,784
General expenses	228,585
Legal expenses	22,999
Injuries and damages	122,948
Insurance	26,605
Insurance Fund	21,395
Total operating expenses	$2,119,145
Net earnings from operation	2,640,117
Interest and taxes	1,050,797
Surplus available for dividends	1,589,320
Preferred dividends	$210,000
Common dividends	881,387
Total dividends	1,091,387
Balance, after dividends	497,933
Appropriated for renewals	240,000
Profit, forward	257,933

This statement is printed in full as an example of what street railway accounts ought to be—and are not! The Twin City report is not only favorable; it is also honest, and it seems to us most desirable that all street railway accounting should not only be honest and thorough as far as it goes, as the author of the present book recommends, but also that it should embrace with frankness this truly critical matter of the expense account, and thereby take pleasure in showing all the world when it has nothing to conceal.

THE PROGRESS OF RATE REGULATION

Rate regulation by government may be said to have been a potential possibility since early in President Roosevelt's first term. The passage of a specific law has been directly imminent since the President's message at the close of 1904, and the hasty introduction of the Esch-Townsend bill into the House December 5, and into the Senate December 6, 1904. Two other dates—really three other dates—stand prominent in the history of the efforts which are being made to give Congress direct authority over railroad rates. It was on March 2, 1905, that the Committee on Interstate Commerce, by resolution of Senator Kean, was authorized to take testimony on the subject, and started its efforts, resulting in the publication of a five-volume report. The Hepburn bill, embodying what has been assumed to be the Administration's position and eliminating some, though not all, of the crudities of the original measure, was introduced in the House of Representatives January 24, 1906, and

* Electric Railway Accounting. By W. B. Brockway, General Accountant Nashville Railway & Light Company and ex-Secretary Street Railway Accountants' Association of America. McGraw Publishing Co., New York. 1906. Price, $1.25.

was passed by the House with but little demur. The last date to be kept in mind is February 23, 1906. After the crude and unconsidered action by the House the Hepburn bill had a narrow escape in the Senate Committee, where Senators Aldrich, Elkins, Foraker and others failed by one vote to bury it. Then, by a sudden turn, which puzzled many beholders and edified all, they put Senator Tillman, a Democrat, hostile to the Administration, vengeful, distrustful of President Roosevelt personally and politically, and most wont to execrate his Southern policy, in charge. Thus it is six weeks to-day since the Hepburn bill emerged from committee under the most unique circumstances as a Democratic measure, in charge of the Senator who hates the President as the devil hates holy water.

Since February 23 the history of the rate regulation bill has been marked by some of the best debate that has ever been brought out in the Senate of the United States. The traditional obstructionism of that body has given way to an earnest and sober discussion, with speeches of great brilliancy by Senators Foraker, Lodge, Knox, and others. The opponents of the bill take their ground that it is unconstitutional. Its friends hold to the contrary.

During the last few weeks the special point of debate has narrowed down very much from the earlier discursive attacks and rejoinders. Many of the attacks had been aimed at side issues, and many of the rejoinders had shown no obvious connection with the attacks. The Hepburn bill provides in its amendment to Section 15 of the Act to Regulate Commerce, lines five to nine on page 11, that orders of the Commission shall go into effect thirty days after notice to the carrier, and shall remain in force and be observed by the carrier unless the same shall be suspended or modified or set aside by the Commission, or be suspended or set aside by a court of competent jurisdiction. It provides in its amendment to Section 16 of the Act to Regulate Commerce, page 17, lines four to nine, that from any action upon petition a bill shall lie by either party to the Supreme Court of the United States, and in such court the case shall have priority in hearing and termination over all other causes except criminal causes; *but such appeal shall not vacate or suspend the order appealed from.* The italics are ours. And in these 12 words lie the crux of the situation. There are now two parties in the Senate; the party of broad review, and the party of limited review by the courts. President Roosevelt long stood firm in his determination that no other provision for court review should be placed in the Hepburn bill than that already quoted, but on March 31, to the surprise of all and to the consternation of many, he changed this position and gave out an amendment indorsed by Attorney-General Moody and the radical Republican Senators, providing that the orders of the Interstate Commerce Commission may be suspended or set aside in a suit brought against the Commission in the circuit court of the United States sitting in equity.

Prior to this amendment, the stock answer of those opposed to tampering with the bill was that if the courts could not be prevented from exercising their normal functions, no provision could be made for such exercise further than that already stated. Against this it was contended that the courts could only work in the fields assigned them, and that if they were not given freedom of review they would simply declare the bill unconstitutional, and that would be the end of it. Greatest of all difficulties has been the question whether a judge should have power to suspend a litigated railroad rate pending final adjudication.

Here, then, is the issue. Shall the court be given full power of review for the fear that if not given it it will decline to uphold the bill as being plainly unconstitutional; and, if it is given this power, are we not again unconstitutional in vesting a judicial body with legislative powers?

This doubt that the courts can do any useful reviewing without transgressing their functions has never been more sharply accentuated than by the decision by Mr. Justice Brewer, of the United States Supreme Court handed down April 2, upholding the Michigan tax law, primarily because it was not shown that the state had attempted to vest an administrative body with legislative functions, as claimed. Together with this decision, the justice included a most lucid and direct declaration that in the Nation no one of the three great departments can assume or be given the functions of another, for the constitution distinctly grants to the President, Congress and the judiciary separately the executive, legislative and judicial powers of the Nation.

But Justice Brewer went further than this expression of doubt that a judicial body could become legislative. He added, "It may therefore be conceded that an attempted delegation by Congress to the President or any ministerial officer or board of power to fix a rate of taxation or exercise other legislative function would be judged unconstitutional."

In brief, the present situation is that nineteen senators, including such leaders as Spooner, Hale, Lodge, Kean, Knox and Lodge are put down to vote flatly against the Hepburn bill and any amendment that falls short of an absolute court review. Twenty-nine Republican senators are counted in favor of the President's amendment. It is certain that the Hepburn bill cannot be passed without specific provision for court review, and the observer is compelled to feel that the chances of passing any kind of a rate regulation bill that will be constitutional in its important provisions are extraordinarily small. We have already taken occasion to point out some of these points and to ask whether the Hepburn bill need be feared. We may add our full belief that it need not be.

The German Railroad Union offers every four years prizes for improvements in railroad appliances and methods. This year 7,500 marks are offered as first prize, 3,000 as second and 1,500 as third for inventions and improvements affecting the construction and maintenance of the railroads, the same for those affecting rolling stock; and a first prize of 3,000 marks and two prizes of 1,500 marks each for improvements in administrative methods, operation and statistics and for publications of notable value. The Union suggests some of the subjects which are felt to need improvement, though the prizes will not be confined to these. Among these suggestions are: Mechanical apparatus for firing locomotives; improvement of steam car-heating apparatus, especially for long trains; hose coupling for air-brakes, in which cut-off cocks may be dispensed with, without affecting the automatic working when trains break in two; apparatus for communication between trainmen and the locomotive, especially for long passenger and freight trains without continuous brakes, and also in passing through tunnels; a critical consideration of the present condition of the motor-car question, and of the running of light trains either by motor-cars or locomotives; simplification of the methods of dividing receipts from freight passing over more than one line, and of other freight accounting. The objects competing must have been put into use (or the writings published) between July 16, 1901, and July 15, 1907. Any such improvement must be in use on some railroad of the Union and be approved by such railroad. The applications for competition must be made between January 1 and July 15, 1907.

TRADE CATALOGUES.

Special Paints.—The National Paint Works, New York, is distributing its new blue book, being the sixth edition, entitled "Technical Review of Paints for Metal." It contains a number of comprehensive articles on paints for special purposes, such as station and railroad paints, structural iron paints, etc. About three pages are also devoted to an interesting discussion on the painting of steel cars.

CONTRIBUTIONS

Approach and Detector Locking.

Omaha, Neb., March 30, 1906.

To the Editor of the Railroad Gazette:

There is a certain system of electric route locking used in connection principally with electric interlocking plants, which seems to me to possess some rather objectionable features. In this system the indication circuits of the home signals are normally broken through open back points of indicator relays, controlled by the home track circuits, so that the signal lever cannot be put normal without forcing the indication or using a hand release unless a train happens to be occupying the track section. In other words if the signalman clears a home signal he cannot restore his lever in the usual way unless a train is within the interlocking limits on the track governed. The approach locking is accomplished by breaking the power circuits of the switches. In the route governed through points of a stick relay, whose circuit is controlled by a circuit breaker on the distant signal lever in parallel with the back point of an indicator relay controlled by the distant circuit.

I suppose the reason for this arrangement was to prevent the signalman from changing the route immediately in front of an approaching train by sticking his signal indication. To my mind this system has the following defects:

1. It is impossible to test signals [illegible]
2. It interferes with flexibility of operation.
3. To make the plant absolutely safe it is necessary to provide not only detector locking by breaking the power circuits of the

switches in a certain route through a relay, but also to break those of conflicting routes, which introduces undue complication in the wiring.

4. It leads signalmen into the habit of forcing their indications, as it is easier and quicker than to operate a hand release.

Having these points in mind when called upon to design the electric locking for a large and important plant recently, I devised the following scheme, which I wish to submit for criticism to the readers of the *Railroad Gazette*. Indicator relays are provided, controlled by track circuits in the usual manner. The indication circuit for each high home signal is broken through a front point of the indicator relay controlled by the track circuit in the route governed. With this arrangement signals can be cleared and the levers put normal at any time, provided a train is *not* in the section governed. The power circuits for all switches are broken through relays controlled by the indicator relays of their own sections, thus providing straight detector locking as an additional precaution. The approach locking is accomplished by breaking the indicator circuit of the home signal governing a certain route through the front points of a stick relay controlled by a circuit breaker on the distant signal lever in parallel with a front point on the distant indicator relay. The stick relay is restored as soon as a train has passed out of the home circuit. The result is that if a train passes the distant signal clear the indication circuit of the home signal is broken, until it has passed out of the home circuit. But if the distant signal is not clear, the electric locking does not operate until the train passes the home signal. In this plant it is proposed to cover up the home signal indication magnets so that they cannot be forced unless the signalman should crawl under the machine, a proceding which would consume as much time as the operation of a hand release and be much more difficult. The hand releases are arranged so that the first turn will break the circuit of the relays controlling the switches in a route, and the last will shunt out the points of the indicator relay controlling the signal indication.

W. H. ARRENBURGH,
Chief Draftsman, Signal Department, Union Pacific.

Filing Right of Way Records

Roanoke, Va., March 28th, 1906.

To the Editor of the Railroad Gazette:

Thinking that my method of filing right-of-way records might prove interesting to some of your readers who are engaged in purchasing railroad right of way, I give you below a brief sketch of the same. This system of keeping these records is what I call the envelope system. While this system is not new for keeping lease records, and possibly other records as well, yet I am not aware that it has ever been used before in filing right of way records.

In buying right of way, of course, individual maps are made for each piece of property desired, and before the deed is obtained and the matter closed considerable correspondence is generally necessary. For instance, in dealings with the right of way agent, attorneys, land owners, company officials and others, this correspondence becomes quite voluminous. Our method of handling the records of each individual piece of property is to have the plan, all correspondence sent and received, copy of voucher bills, etc., contained in an envelope about 9½ in. by 15 in., with the following record printed on the same, which gives a complete history of the essential facts connected with any individual piece of property; in other words, it is a combination of the envelope and card systems:

7206 LOW GRADE LINE CONCORD TO FOREST — CONCORD BRANCH **N. & W. RY. 7206**

Plan, No. 7206. Date: Feb. 4th, 1906.
Sta. 448+63 to Sta. 450+85
Name: JOHN JONES
State: Virginia.
County: Campbell 2 ex Lynchburg.
Cost: $1,000.00
Acres: 7.58
Option: March 14th, 1906, 6 mo. —$1,000;
Option Accepted: March 21st, 1906
Price per Acre: $128.
Vouchered: March 29th, 1906

A. 7 1/100

This envelope contains the complete file in this case.

JOHN JONES.
V. 2.

21.

I believe that the above record is self explanatory, with the exception of the figure 21 in the lower right-hand corner. This number has reference to the numerical number of that particular piece of right of way acquired on each piece or line of work, when more than one piece of right of way is purchased.

The advantages of this system are obvious to those who handle right of way records.

First.—During the negotiations for the purchase of right of way all the correspondence and facts in relation to the same are at your instant command without searching through letter files, plan racks, voucher books, etc.

Second.—After the purchase of any piece of land is fully consummated and deed secured, the envelope can be filed away and given a permanent file number if desired.

I have used this system to great advantage since, by its use delays, misplacing of correspondence, etc., never occur. This seemingly unimportant and insignificant system (like the card system) of keeping right of way records is only fully appreciated, and its true value only becomes known by its use. Therefore I gladly submit it to those who may find it an improvement on their own methods of filing right of way records with the sincere hope that they may get the same absolute satisfaction from the use of the same that we have obtained.

THEODORE LOW,
Real Estate Agent, Norfolk & Western.

The Operator and the Adobe Collision.

To the Editor of the Railroad Gazette:

"The case is one more disheartening instance of a man who knows his duty, but lacks the moral courage to do it when doing it may involve a little censure. Rather than admit having been asleep, and by such admission risking the loss of a dollar, this operator risked and lost a score of lives."

After perusing the editorial in the *Railroad Gazette* of March 23, of which the above is a part, the casual reader would be led to believe that this operator who slept while No. 3 passed Swallows was a moral derelict who deliberately made himself comfortable, took a good nap and upon awakening was so criminally indifferent to his responsibilities that he told the despatcher that No. 3 had not passed when he knew that there was a possibility if not a probability that it had passed while he was asleep. Thus far there has been no evidence to show that this operator's previous record was not good. Until such evidence is forthcoming it would seem that he should be entitled to a little more charity. There is no one who realizes the awful responsibility which is upon him more than the operator himself—if he is old enough and has had the experience which one in such a position should have. Anyone who has experienced the terrible feeling which a railroad man has (though it be but for an instant) when he erroneously believes he has made a terrible mistake, will never take any chances which might make that state of mind permanent. The shock to the nervous system is something awful and indescribable. It is no wonder that some of the best of railroad employees have become violently insane soon after making such a mistake. An old conductor once said: "A man suffers the tortures of a thousand deaths in trying to keep awake while doubling the road at night." This operator was "doubling" at the time of this wreck. Any operator who has ever done this at night will tell you that it is quite possible for one to go to sleep sitting bolt upright at his sounder, sleep several minutes and awaken again without realizing that he has been asleep at all. It is quite possible that this was the case with the operator in question, as there was a snow storm at the time which would do a great deal towards muffling the noise of the slowly moving No. 3.

EX-TELEGRAPHER.

Railway Signal Association.*

At the meeting of the Railway Signal Association, held in Chicago, March 19, Mr. F. B. Corey, of the General Electric Company, read a paper on the Charging of Storage Batteries from Alternating Current Circuits, the main part of which is reprinted in this issue of the *Railroad Gazette*. This is a subject which has been of much interest to telegraph, telephone and signal engineers for a number of years. Almost all lighting plants are alternating and this explains in part why storage batteries have not been more rapidly introduced on telegraph and telephone as well as signal circuits; for to use this current it was necessary to install motor generators which are not only costly but undesirable for outlying points owing to the skill required in their maintenance. All of the objections to the different methods spoken of in Mr. Corey's paper were discussed by the members at Chicago, but the discussion was limited mainly to a comparison of the tube and motor generator sets. If, as this paper indicates, the mercury arc rectifier tube is a success the operation of outlying signals will be materially advanced.

Mr. Mock (Detroit River Tunnel Co.) suggested that comparative figures should be reported to show the relative value of the various systems, but no figures were obtainable because of the limited number of installations now in use.

Mr. Short (I. C.) has 27 plants at which he is using motor generator sets to charge storage, and two plants where he is using mercury arc rectifier tubes. He said that the average cost for installing motor generator sets was approximately $180, and rectifiers $200 each.

Mr. Corey said that the life of the tubes described in his

*The other doings of this meeting were reported March 23.

paper under normal operating conditions would be at least 600 hours; some running as high as 2,000 hours. One tube in a laboratory test operated for 8,000 hours. Answering a question as to whether the burning out of the tube destroys it, he said not necessarily, the supply of mercury being simply exhausted. The cost of materials required to make the renewal is so small that it scarcely pays to return them to the factory to be refilled. Mr. Corey said that the tubes do not decrease in efficiency with age. The question of labor in operating is simple. The arc rectifier needs no attention after the charging has been begun, and the current saved by its use is so great that it pays to make renewals as frequently as necessary. Motor generator sets need continual lubrication or other attention; there is continued expenditure for oil and waste, and they consume more current than the rectifiers. If there is a drop in voltage on the line side of the rectifier (below 28) the tube assumes the normal position and the battery is taken off charge, and unless some one is present to start the charge by adjusting the tube there will be an interruption to the completion of the charge. To meet this condition self-starting switches have been designed and are in use to a limited extent.

Mr. Mock compared the two systems and figured a net saving of $2,400 in ten years in favor of the rectifier, assuming the life of motor generators to be 10 years and that of tubes at 600 hours.

The details of operating the two systems were minutely discussed and the consensus of opinion was in favor of the installation of rectifiers for charging batteries in signal service. A point in favor of the rectifier is the fact that in putting them in use on a line from 5 to 15 miles from the power plant no adjustment of reactance is necessary, for it is self compensating, whereas with motor generator sets the motor needs adjustment for the various drops in voltages. This increases the cost of installation.

With this development of mercury arc rectifiers new fields are opened for the economical use of storage batteries, particularly in districts remote from current supply. The records, as far as available, show that the use of transformed alternating current does not, as has been believed to be the case, affect the life of the battery plates.

The next meeting of the Association will be held at the Grand Union Hotel, New York, on May 8, at which time the three-position signal and the installation of all-electric and mechanical interlocking plants without detector bars will be discussed.

The Pennsylvania Railroad's Extension to New York and Long Island.

THE LONG ISLAND CITY POWER STATION.

The Pennsylvania Railroad Company has had under consideration for a number of years plans for establishing a terminal for its lines on Manhattan Island. The earliest of these contemplated a bridge over the Hudson River with elevated approaches and terminal in the City of New York.

The demonstration that electric traction was practicable for heavy train units made possible, however, an entrance by means of tunnels, which would enable the adoption of a well rounded out plan for a terminal which would embrace not only the Pennsylvania Railroad main line business, but through connection with New England and the railroad system on Long Island.

The announcement that the Pennsylvania Railroad Company proposed to enter New York City was made in May, 1902, and since that date the project in all its features has been actively underway.

It is the purpose of the present series of articles to describe the progressive development of the terminal plans in their transportation, engineering and architectural features, the present article being a description of the first unit in the construction which has been completed in operative condition, namely, the Long Island City power house. Other articles will follow as rapidly as they are prepared and as the development of the plans warrants.

ORGANIZATION.

Two companies have been incorporated through which the Pennsylvania Railroad Company is carrying on its New York extension work. One of these, the Pennsylvania, New Jersey & New York Railroad Company, will build all of that portion of the tunnel and approaches in the state of New Jersey and extending under the Hudson river to the boundary line of the states of New Jersey and New York; from this boundary the other, the Pennsylvania, New York & Long Island Railroad Company, will build the tunnels, terminal station and yards on Manhattan Island, under the East river and in Long Island City. The officers of these companies are officers of the Pennsylvania Railroad Company, the President being Mr. A. J. Cassatt.

The engineering and architectural features are subdivided in accordance with the character of the work, the whole project being under the general direction of the management of the Pennsylvania Railroad.

The tunnel work proper is divided into two parts, the East River Division being under the direct charge of Mr. Alfred Noble, Chief Engineer, and the North River Division under the direct charge of Mr. Charles M. Jacobs, Chief Engineer; the general railroad facilities and the electrical and mechanical features of the railroad and terminal are under the charge of Mr. George Gibbs, Chief Engineer of Electric Traction. These three officials, together with Brigadier-General Charles W. Raymond, Chairman, constitute a board of engineers to whom the general engineering features of the whole plan are entrusted. In addition, advisory committees consisting of officers of the road have been appointed to pass upon and work out the special problems relating to the required railroad facilities, and pass upon the adequacy of the operating features as developed by the labors of the various departmental bodies.

It will be seen that by this comprehensive organization a harmony of operation with proper degree of independence is effected, which, while it keeps the officials of the Pennsylvania Railroad in close touch with the enterprise in all its stages, relieves them of multiplicity of detail.

POWER HOUSE ARRANGEMENTS.

The magnitude of the work to be done very early led to the decision that to secure reliability of service, as well as convenient power distribution, there should be two main generating stations, sites for which could be more readily obtained if they should be located one in New Jersey and the other on Long Island. The latter station would also naturally be used as the main source of power for the Long Island Railroad lines as fast as equipped, and the electrification of the Atlantic avenue improvement, which was pending when the general project took shape, required the early construction of the Long Island City power station.

The flexibility of the alternating current system of power transmission permits the generating station to be placed at any reasonable distance from the natural center of load that may be dictated by the important considerations of condensing water supply and cheap coal delivery, and the proximity of the East river was obviously advantageous for both these purposes. Such a site was fortunately available in Long Island City, and it had the additional advantage of a location convenient to the Long Island Railroad freight yard, which facilitated the cheap handling of coal and ashes by rail, as well as the delivery of building materials and equipment during construction. The site consists of an entire rectangular block with the short side toward the river, extending 200 ft. north and south on Front street and on West avenue, and 500 ft. deep along Third and Fourth streets.

STATION CAPACITY.

At the time the design was undertaken, the extent of electrification in sight was such as to necessitate station capacity of not less than 50,000-k.w., and probably more. A station of such size requires for economical operation generating units of the largest practicable size. When the decision was made the largest size of steam turbines and generators that had been standardized was of 5,500-k.w., and this size, therefore, became the unit basis of the power station design. The rectangular shape of the lot, practically 200 ft. x 500 ft., made it possible to plan a station that could readily be extended to occupy the entire block. The adopted design will permit the disposition of fourteen 5,500-k.w. generating units in the building covering the block, or about 105,000 electrical h.p. if such an amount of power be eventually required.

For the initial load that was to be placed upon the power station during the earlier years of the Long Island Railroad electrification, it was decided that three 5,500-k.w. units would suffice. The building as designed for this initial equipment covers the full width of the block and half its length, and contains room for six 5,500-k.w. units and two 2,500-k.w. units of the same type to be used for lighting the tunnels.

As now built, therefore, the station can hold more than double its present equipment, and when extended in size will accommodate more than four and one-half times the original installation of electrical generating machinery.

DETAILS OF CONSTRUCTION.

The site was formerly under water and had only been filled in to an extent that brought the surface about 12½ ft. above the extreme high water. A series of borings showed that the soil consisted of from 10 ft. to 15 ft. of loose fill and river mud overlying successive strata of clay, sand and gravel, with rock at a depth of 35 ft. to 60 ft. below the level of the street.

The structure and equipment of a large power station involved the carrying of heavy concentrated loads upon the side walls, building columns and machinery foundations which have to be properly distributed over the underlying soil in a manner that will secure absolute stability and uniformity of settlement. In the design of this foundation it was finally decided to use a comparatively uniform spacing of piles overlaid by a monolithic concrete mass of a thickness which should take up the distance between the point at which the piles could be safely cut off and extreme high water.

The point selected for pile cut-off was 2½ ft. below mean high tide. Test piles indicated a safe carrying capacity for piles from

20 ft. to 35 ft. long of 12 to 15 tons, varying on different parts of the site. The foundation is designed to carry a load of 12 tons per pile, and the spacing of the piles is on an average 2 ft. 4 in. between centers over the entire area. The total number of piles required for the foundation was 2,210.

The top of the concrete cap was placed at elevation 303.5, based on P. R. R. datum, which is 300 ft. below mean high water. The proper distribution of column loads down through the grillage beams and the concrete cap to the tops of the piles required the thickness of the cap to be 6 ft. 6 in., which in turn enabled the cutting off of the piles 2 ft. 6 in. below high water level, in a water-bearing stratum of river mud, thus insuring perpetual moisture sufficient to preserve the piles from decay.

Underneath the stacks the concrete cap is 8 ft. 6 in. deep, the piles being cut off 2 ft. lower down. The stack anchor bolts pass through a grillage of steel T-rails, embedded in the bottom of the concrete.

In reviewing the character of this construction, it should be remembered that nearly all large power stations are, for the same reason that dictated the location of this one, placed adjacent to bodies of water of considerable size, and in such a location the adjacent soil is frequently of a soft or treacherous character. This type of foundation is eminently well suited for a power house so situated, as when finished it closely resembles natural bed rock in its ability to sustain concentrated loads as heavy as are likely to be met with, and is entirely free from the necessity of rearrangement, should circumstances attendant upon the development of a change or increase in the power station equipment require the shifting of loads upon the foundation subsequent to its construction.

The flume for the condenser intake, and the overflow flume directly above it, traverse the building foundations completely from west to east, and are integral with it. Both the intake and the overflow flumes are nominally 10 ft. in diameter, this large sectional area being required to provide sufficient condensing water with a low velocity of flow when the power station is extended to its maximum future length of 500 ft. and filled with generating machinery.

At the bulkhead line the intake is provided with an ice fender, extending to a point below the extreme low water, in order to prevent a boat that may be lying against the face of the timber rack from packing ice against it and stopping the water supply. This timber rack extends from the bottom to the top of the intake opening, and is built of 3-in. x 10-in. yellow pine timbers spaced 4 in. apart in the clear.

The flume is made entirely of concrete, which, at the outer end of the intake flume, is reinforced vertically and horizontally by corrugated rods. Between the power station and the bulkhead the flume runs underneath the freight yard, which necessitated the reinforcement of the considerable portion of the overflow flume with 15-in. I-beams. The concrete roof of the overflow was further reinforced under the I-beams with expanded metal.

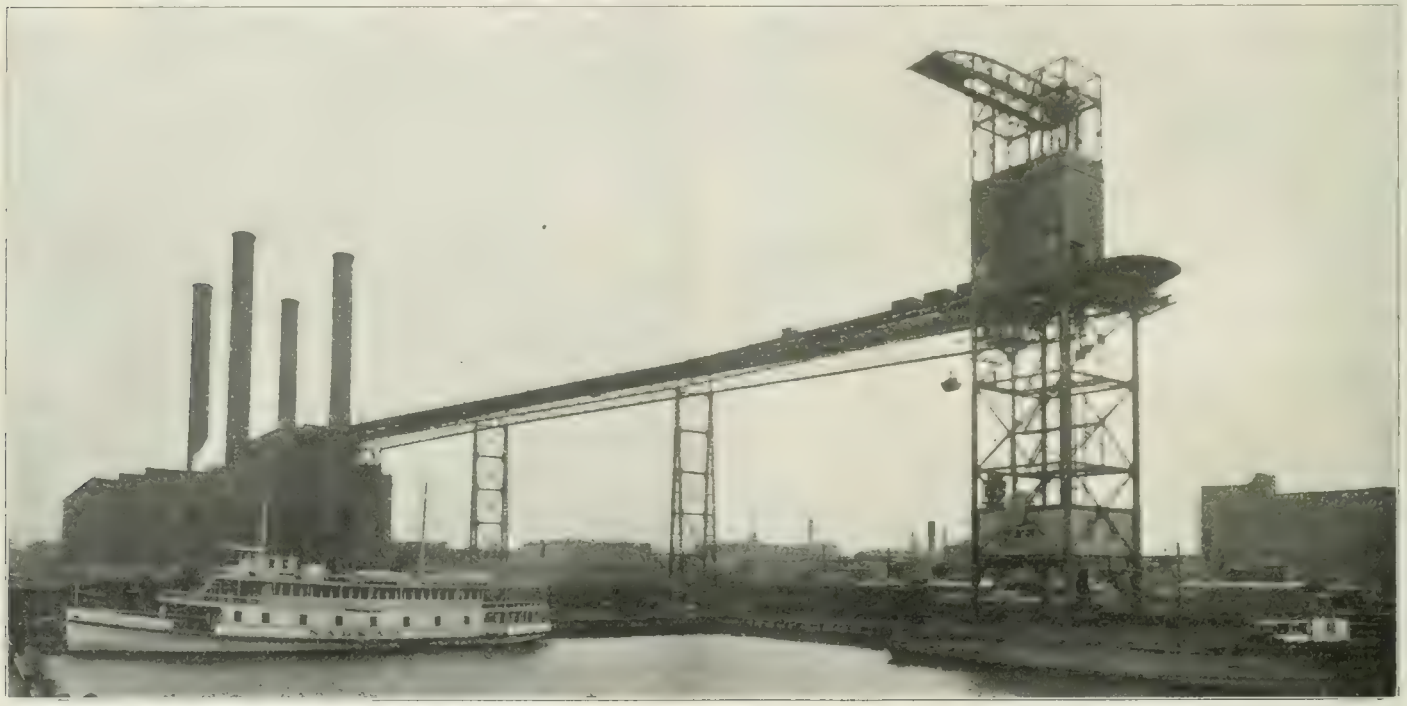
The general plan of the foundation indicates the method of handling the condensing water supply to and from the flumes. The condensers are placed directly under each turbine foundation. The intake being underneath the overflow, the circulating water must be lifted from it past the overflow flume, and to accomplish this a well is provided in the concrete foundation reaching down from the surface of the concrete cap to the bottom of the intake flume. The circulating water discharge pipe from the condenser drops directly from it into the overflow flume.

The work of excavation was begun Oct. 20, 1903. The only difficulty encountered was a layer of quicksand which made necessary the driving of 6-in. sheet piling for the whole length of the site on the Third street side, and for a part of the distance on the Fourth street side. A sump was located at the corner of Third and Front streets by means of which the excavation was kept drained until the concrete was finished. The entire area was excavated for 2 ft. below the level at which the piles were cut off in order to allow for the raise of the ground as the piles were driven.

Spruce piles were used, varying in length from 25 ft. to 40 ft. They were driven practically to refusal with a 2,000-lb. hammer falling 18 ft. to 20 ft. The first pile was driven on Nov. 16, 1903, and the last one on March 5, 1904.

COAL TOWER FOUNDATION.

The foundation construction for the complete plant and equipment includes the foundations for the coal unloading tower on the dock, and of the ash bunker and two coal bridge piers in the yard. The arrangement of the steel structures of the towers erected upon these foundations was such as to permit the use of the yard for railroad purposes. This is especially true of the arrangement of the coal unloading plant on the dock, which was carefully planned to save this valuable property for other requirements.



General View of Long Island City Power Station from River, Showing Coal Tower in Operation—Pennsylvania Railroad.

The coal dock on which the unloading tower was placed is opposite the foot of Third street, and the tower is about 500 ft. from the river wall of the power house and offset somewhat to the south, causing a horizontal bend in the apparatus for delivering coal from the unloading tower to the power house bunkers.

The design for the coal handling apparatus called for the construction of a tower 170 ft. high, with a hoisting boom projecting 43 ft. 6 in. over the slip at a height of 163 ft. above the dock, coal being passed by gravity through crushers to a cable railway operating on a level track and arranged to automatically dump coal at the required points in the bunker over the boiler rooms.

The elevation of the rail of the cable railroad is 107 ft. above the general surface of the railroad yard. This height of lift was decided upon in order to do all the work of hoisting in one operation, and to cover in this single hoist all the vertical space necessary for dumping into the crusher and loading hoppers, the location of the crusher and the crusher coal storage and loading hoppers and weighing apparatus being directly over the cable railroad.

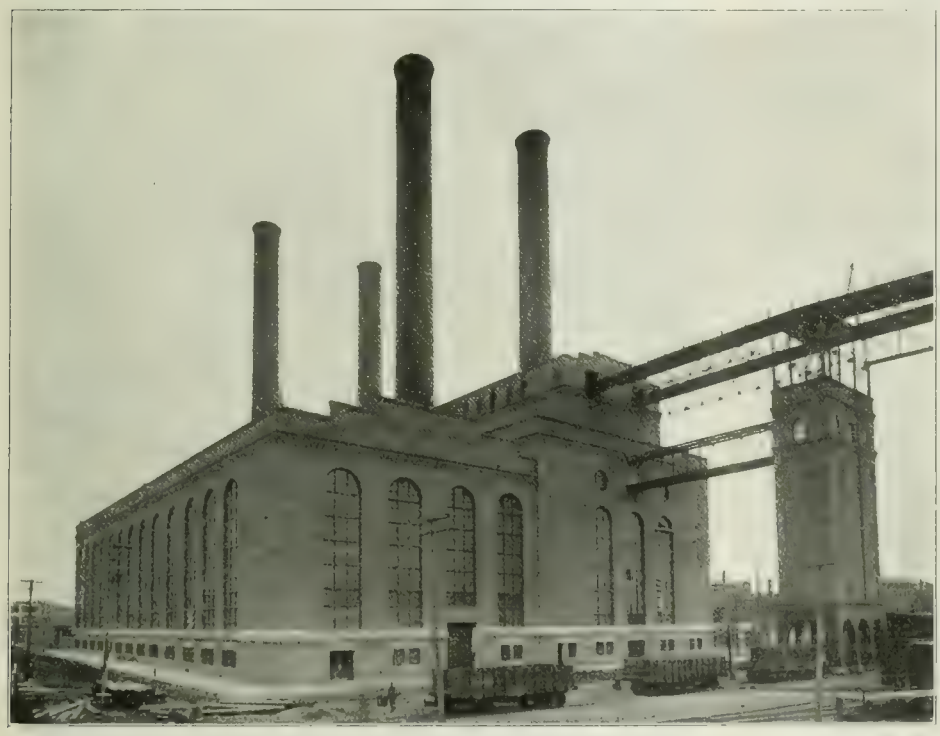
The cable railroad operates on a level track so as to prevent runaways and consequent difficulties. In order to insure suitable operation of such apparatus it was felt desirable to have a very rigid foundation for the main tower on the dock, especially since it was likely to receive shocks from boats on both sides of the pier in which it stood. The dock at the point where this tower is located is approximately 55 ft. in width and the river bottom is

20 ft. below the dock. The base of the hoisting tower is 30 ft. by 37 ft. 4 in., the longer dimension being crosswise of the dock.

The foundation of the tower practically extends the entire width of the dock. An examination of the river bed on the site of this tower showed that the rock, while not far below the bottom, presented a sloping surface, but at no place was there a great quantity of earth between the bottom of the harbor and the rock. It was therefore necessary to devise some method which should retain and reinforce the piles and prevent any tendency to side displacement.

A crib was therefore provided which is 46 ft. wide and 50 ft. long, having its walls of 12-in. x 12-in. timbers solidly built up and fastened with ⅞-in. dock spikes, the sides being tied together by four interior partitions, two in each direction. Two of these compartments thus formed were provided with floors to form loading pockets for the sinking of the crib. A section was cut out of the dock sufficiently large to permit the introduction and sinking of the crib and the site was dredged to within 2 ft. of the highest point of the rock. The crib was then constructed in an adjacent slip, towed into position and sunk.

After placing a sufficient quantity of riprap to prevent movement out of true position the piles were driven, in the four corner compartments, down to rock, and were cut off flush with the top of the crib at a point below mean low water. The interior of the crib was then filled with riprap placed between the piles, and the top of the crib, where it was to support its load, was capped with a double layer of 6-in. x 12-in. timbers, the upper layer being laid at right angles to the lower, and the concrete piers supporting the corner columns of the tower were constructed on these timber caps.



General View of Long Island City Power Station and Ash Tower—Pennsylvania Railroad.

A considerable space around the crib, formed by the slopes caused by the excavation was filled with riprap, forming a solid and continuous buttress on all sides. The resulting construction thus forms a solid mass 46 ft. wide and 50 ft. in length and 27 ft. deep, extending well below the river bottom with the piles carrying the weight to bed rock, and the timber crib and its riprap reinforcing its bracing and securing all parts against lateral displacement.

As thus executed, no cofferdam, cut stone masonry, or expensive hand labor was required below water level, but a massive and stable structure was obtained by the employment of cheap materials, simple methods and cheap labor.

The foundations for the piers and ash bunker in the yard required no special treatment, but were carefully carried out in the same general manner as all the other foundations on the work.

DIMENSIONS.

The overall dimensions of the present building are 200 ft. x 262 ft. outside measurement. The boiler house is 103 ft. wide inside, the engine room 66 ft., and the electrical galleries 25 ft. wide. The boiler house proper is 82 ft. high to the top of the parapet. The coal pocket enclosure, superimposed on the boiler house, is 60 ft. wide, and its parapet is 118 ft. high. The engine room is 70 ft. high to the top of the parapet.

The first floor of the boiler house is 16 ft. above the basement, and the second floor of the boiler room is 35 ft. above the first floor. In the engine house the engine room floor is 23 ft. 6 in. above the basement, and thence to the roof trusses the height is about 40 ft. in the clear. This is a much lower engine room than is commonly met with in power stations of this size, the saving in head room being due to the adoption of the horizontal type of steam turbine, which enables economy in vertical space required as well as in the floor area.

STEEL CONSTRUCTION.

Like all large power stations of modern construction, the superstructure of the buildings consists of steel framework which carries the weight of the room and the entire contents of the building excepting such portions of the machinery as may be more conveniently carried on separate foundations. The south wall of the boiler house supports the outer ends of the boiler room roof trusses on that side of the building, but in other respects the steel superstructure is independent of the building walls.

The steel framing of the boiler house and engine room are necessarily different in type, as the former has to carry a double tier of boilers with flues, economizers, with a coal pocket of 52,000 tons capacity on top of everything, while the engine room consists of simply a large open space which makes the roof truss construction the most conspicuous feature, but aside from this does not involve any difficult construction. Conditions in the boiler house are, however, more complex, chiefly by reason of the imposition of the coal pocket which runs the entire length of the building.

The steel stacks are independent of the boiler house excepting where it passes through the lower fire room floor, at which point the floor is built against the stacks. At other points they pass through circular openings in the floors and roofs, so that there is no stress induced upon the structure by deflection of the stacks under stress of wind.

The columns are grouped in the most effective manner to carry these heavy concentrated loads. Their bases are supported on grillages of steel beams embedded directly in the monolithic concrete foundations which underlie the entire structure.

The first steel was placed in position on the foundation on March 17, 1904, and the steel erection was completed about the 20th of September, 1904.

COAL AND ASH HANDLING STRUCTURE.

The foundation of the coal tower has been already described. The rather unusual height of its structure was due to the adoption of the level cable railroad to convey the coal from the hoist to a position where it could dump by gravity into the coal pocket without any intermediate hoisting operations.

The completed structure may be said to consist of three parts, the coal hoisting tower, the bridge supporting the cable railroad, and the ash bin structure which is so arranged that it forms a part of one of the piers of the cable railway bridge. This level bridge is 107 ft. above the dock, and is at about two-thirds the entire height of the tower, whose top is 170 ft. above the dock.

From the foundation up to the level of the cable railway the width of the superstructure of the tower is nearly the full width of the dock, and the structure consists of essentially four heavy corner columns of the box pattern thoroughly braced to each other in all directions, except below the engine room floor, where latticed bracing is omitted in order to accommodate the railroad equipment on the three tracks passing through the tower along the dock. The floor on which is located the hoisting apparatus is 25 ft. above the dock, and the space around and over this deck is enclosed for a height of 14 ft., forming an engine room for the hoisting mechanism. The sides of this engine room are made of expanded metal and plaster, and the roof of cinder concrete tar and gravel.

The upper third of the tower, extending above the level of the cable railway, carries the hoisting boom, the receiving hopper, the crushing and weighing apparatus, and the cable railway machinery. It is about half the width of the lower portion of the tower, but in other respects is similar in construction, consisting of heavy columns substantially braced in all directions. The boom is 150 ft. long over all, and projects 63 ft. beyond the northerly face of the tower and over the slip at an elevation of 167 ft. above the dock. It consists of two parallel trusses thoroughly braced on top, and with portal braces at each panel point. It supports the trolley carriage from which the hoisting bucket is suspended and

over whose drums the hoisting cables operate. The track for this trolley is carried by brackets on the bottom chord of the boom. The top chord of the boom was so designed as to properly compensate for the deflection due to the heavy trolley and a hoisting stress of 12,000 lbs. applied at its outer extremity.

Between the coal tower proper and the boiler house structure, a distance of about 500 ft., there are four spans of bridge construction supporting the cable railway.

The ash bin is directly across Front street from the boiler room, and ashes are delivered to it through a bridge at an elevation of 69 ft. above the street by means of a telpherage system which hoists and transports the ash cars from the boiler room basement up to the level of this bridge and thence over into the tower, where the contents are dumped into the bin. The bottom of the bin is 20 ft. above a railroad track that runs through the base of the tower, and the ashes are handled through dumping gates into gondola cars standing on this track. The capacity of the bin untrimmed is 300 tons.

(To be continued.)

Charging Storage Batteries from Alternating Current Circuits; the Mercury Arc Rectifier.*

BY F. B. COREY, GENERAL ELECTRIC COMPANY.

* * * The places where direct current power is available for signal batteries are comparatively few. Alternating current circuits, however, are found extending over the country in all directions, but in order to use such alternating current circuits for charging storage batteries some means must be available for rectifying this current, *i.e.*, converting it into direct current. Where such existing circuits are not available, a single alternating-current generating plant with high-tension transmission and rectifying substations will be found, in many instances, to be an economical plan.

Of the means used for rectification, the single-phase rotary converter requires careful attention and does not possess a wide range of regulation. The motor-generator set is more complicated in construction, though more simple in its operation; but for machines of small capacity their efficiency is low and the cost is high, considering their capacity. Synchronously driven rectifiers are unsatisfactory, and the chemical rectifier has not proved to be a commercial success.

The mercury arc rectifier is a device which, although recent, has been developed to a point where it has assumed considerable commercial importance. Large numbers of these rectifiers are now in successful operation. While its principal application has been the charging of batteries for automobile service, it has been successfully used to operate direct-current arc lamps, small d. c. motors, and for other purposes for which direct current is essential. Its low first cost, small floor space, high efficiency and simplicity of operation all serve to render it an almost ideal apparatus for use in charging batteries for automatic signals and those used for electric interlocking. With this apparatus a skilled mechanic or electrician is not necessary, which fact is proved by the successful operation of those rectifiers by owners of automobiles. The mercury arc rectifier, as its name implies, consists primarily of a mercury-vapor arc, this arc being enclosed in an exhausted glass vessel of peculiar construction. Fig. 1 shows the standard form of tube with the metal caps which serve to protect the electrodes from injury and through which connections are made to the various circuits.

Mercury vapor in its ordinary, or molecular condition, is practically a non-conductor of electricity. Such vapor might be formed by applying heat to a mass of mercury enclosed in a vacuous chamber. If a body of vapor thus formed were subjected to the action of an electromotive force, either continuous or alternating, its resistance would be found to be very great. If, however, the mercury vapor is ionized—in other words, if the atoms of mercury in this vapor are electrified—the electrical resistance to current in one direction will be very small, while its resistance to current in the opposite direction will still be great. To use a very crude analogy, its action on an electric current is similar to the action of a check valve on a current of water flowng through a pipe.

The ionization of mercury vapor is easily accomplished. If an arc is formed between one mercury electrode and another electrode, the mercury being the negative, ionized mercury vapor will result. When a mercury arc is formed, as in the mercury arc lamp, the negative electrode being mercury, the resistance of this arc is small, but only to current of one direction. Hence it is seen that the current in a mercury arc must be uni-directional. This brings us to an understanding of the action of the rectifier. A mercury cathode is provided and two anodes of suitable material are connected across the terminals of an alternating current circuit, thus becoming alternatively positive and negative. The arc shifts from one anode to the other with each alternation, always passing from a positive anode to the negative cathode. The current in the wire connected to the cathode is, therefore, always in the same direction.

The direct current delivered by the mercury arc rectifier is very different in its characteristics from that delivered by the synchronously driven rectifier. As mentioned above, the current from the synchronously driven machine consists of a series of pulsations each separated from the others by a certain small interval. If we were able to operate a mercury arc rectifier, in accordance with the above theoretical considerations, without any accessory apparatus, this rectified current would be composed of a series of pulsations, but without the separating gaps mentioned, the current wave being similar in form to the impressed alternating current wave, except that the negative half would be transposed, so as to become positive with reference to the zero line. This, however, is not the case.

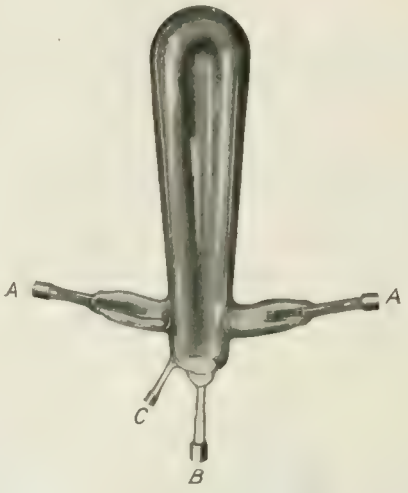


Fig. 1—Mercury Arc Rectifier Tube.

If, when a mercury arc is once established, the current falls to zero, even for the most minute interval of time, the arc is extinguished, and certain means are necessary for its re-establishment. It is, therefore, necessary to insure that the current through the mercury arc rectifier shall not fall to zero, and so cause an interruption of the arc. The means used to bring about this result are reactances introduced in the circuit of the rectifier, and so designed as to obliterate the pulsations, so far as needful, and make the resulting current continuous.

Bearing in mind the fact that the current flow through mercury vapor must always be in the same direction, a clear understanding of the mercury arc rectifier may be secured by a careful study of the diagram, Fig. 2. In this diagram, A and A′ are the operating anodes; B is the cathode; C is the starting anode; E and F are reactance coils, and G and H are the terminals of the alternating current supply. The battery to be charged is connected between cathode B and the point D between the two reactance coils. The rectifier is supported by a movable frame, so arranged that the top of the tube may be tilted slightly in starting. This movement of the tube forms a bridge of mercury between the cathode B and the starting anode C, and current may then flow between them through the mercury. When the tube swings into its normal position, this bridge is broken and an arc of ionized mercury vapor is formed. This ionized vapor, ascending in the tube to the anodes A and A, permits a flow of current from each of them in turn to the cathode B, and the tube is then in operation through a starting resistance. The load switch is then closed, and the starting anode and the starting resistance are both disconnected by opening the starting switch. Automatic starting devices have been used to some extent, but the operation of starting, as above described, is so extremely simple that the necessary complications incident to the use of automatic devices are not considered advisable, except in special cases.

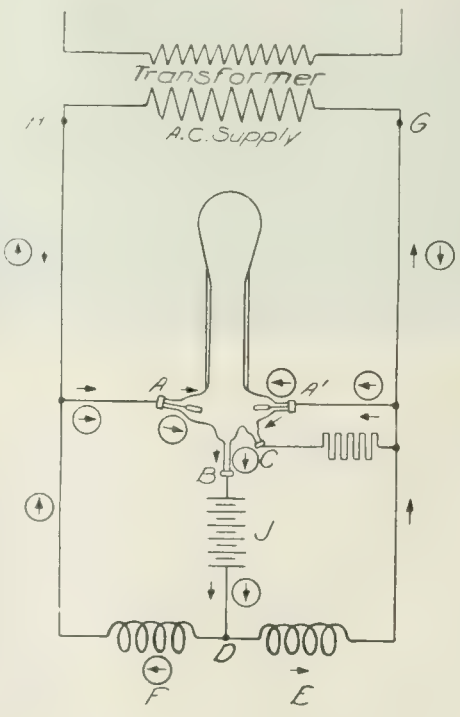


Fig. 2—Rectifier Connections.

From inspection of Fig. 2 it will be seen that the alternating current circuit is through the mercury arc, the battery and one of

*A paper read before the Railway Signal Association at Chicago, March 19. Condensed.

the reactance coils, one-half of the wave being through the anode at the right and the reactance at the left of the diagram, while the other half wave flows through the anode at the left and the reactance at the right. When the impressed e.m.f. falls below that required to overcome the counter e.m.f. of the mercury arc (about 14 volts) plus the load, the reactance which has been receiving current from the line discharges, maintaining a current in the same direction. This action maintains the excitation of the anode, and prevents the current from approaching the zero value until the voltage at the other anode has risen to a point where an arc is started between it and the cathode. To make this action more plain, the path of the current through the battery, due to one side of the wave, has been shown in plain arrow heads, while that due to the other half of the wave is indicated by the arrow heads in circles.

* * * The action of the rectifier tube is independent of the frequency of the alternating current circuit. Standard outfits can be operated on any frequency from 25 to 140 cycles, inclusive, thus covering the whole range of commercial circuits.

On account of the action of the reactance coils the voltage delivered by any given rectifier will vary somewhat with changes in frequency. Rectifiers are designed to deliver direct current at

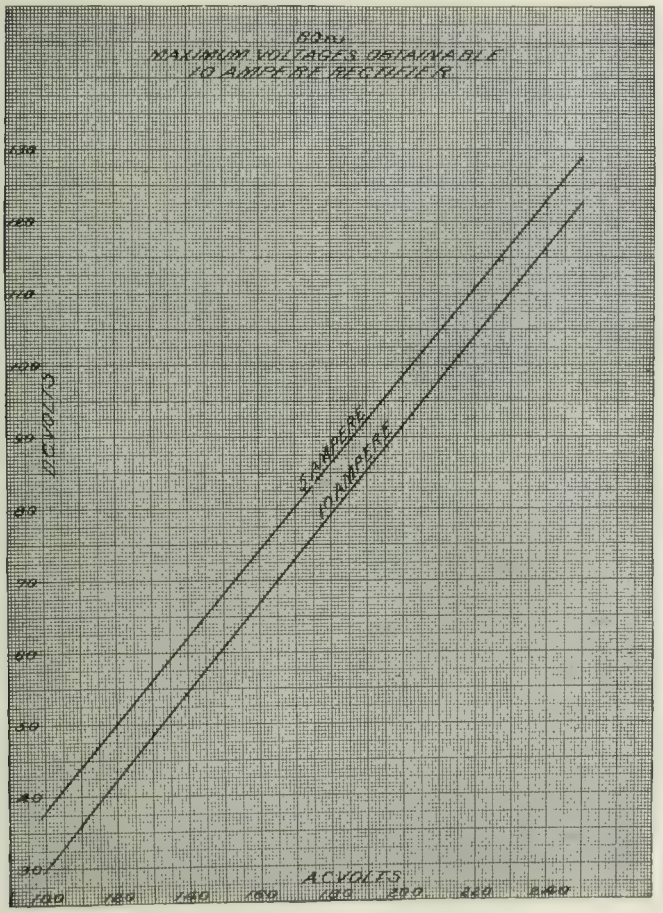


Fig. 3—Regulation of Ten-Ampere Rectifier.

voltages up to 200, and special rectifiers are supplied for somewhat higher voltages when required. According to the connections used, the direct-current voltage varies from 20 to 25 per cent. of the impressed alternating voltage.

The mercury arc rectifier is furnished in three standard sizes, viz: 10 amperes, 20 amperes and 30 amperes. In case a greater current capacity is desired, any number of tubes may be operated in multiple, making the maximum current capacity practically unlimited. In electric generators the only limit to be considered is the maximum, but in the mercury arc rectifiers we have also to consider the minimum limit. For instance, the minimum current on which a 10-ampere rectifier can be operated is approximately three amperes. By a proper arrangement of charging switches at each signal the batteries connected to the charging circuit may be thrown into a series-multiple arrangement, thus increasing the current and reducing the voltage of the charging circuit. The increased transmission losses incurred by such an arrangement are more than offset by the small losses in the rectifier itself, as compared with other charging apparatus.

The drop in voltage across the mercury arc is constant, so that the efficiency varies with the direct-current voltage delivered by the rectifier. The efficiency of the 10-ampere rectifier operating from a 220-volt 60-cycle circuit quarter load to full load is over 80 per cent. for direct-current voltage averaging 112, it being practically constant for all loads between quarter and full load. In this respect it shows a marked superiority over the motor-generator set.

Another valuable property of the mercury arc rectifier is its inherent regulation which obviates the necessity of moving the regulating switch so frequently during charge, as would otherwise be the case. This inherent regulation, with standard reactances, is from six to eight per cent., with changes in d.c. load. When the e.m.f. of the battery increases during charge the current decreases, and as this occurs the voltage of the rectifier rises, thus tending automatically to compensate for the increased voltage of the battery. Fig. 3 shows the regulation of the 10-ampere rectifier. So far as I know, storage battery manufacturers agree that no harm can result to the battery from the rapid variations in current strength, and some are of the opinion that charging through a rectifier is more efficient, on account of better chemical action and less gassing.

The life of the rectifier tube varies in much the same way as the life of incandescent lamps, it being dependent on the maintenance of the vacuum. The life of the tube under normal operating conditions is at least 600 hours. Two tubes are always shipped with every panel, and the cost of the renewals is small.

The saving in cost of operation of the mercury arc rectifier set over a motor-generator set, when charging a 44-cell battery, has been shown by tests, when figured at 6 cents per k.w.-hour, to be 56½ cents per charge.

Cost per charge, motor generator set	$1.867
Cost per charge, mercury arc rectifier	1.302
Saving per charge	$0.565

Assuming the minimum life figure of 600 hours:

Seven hours per charge equals 85.7 charges during life of tube.

Total saving during life of tube = $0.565 × 85.7 = $48.42.

Michigan Railroad Tax Law Upheld.

The Supreme Court of the United States on April 2 decided against the railroads in the Michigan Railroad tax cases, involving the taxes of all the railroads in that state for several years past. The opinion was by Justice Brewer.

There were 27 cases, all involving the validity of an act of the Michigan Legislature of 1901 changing the method of taxing railroad and kindred corporations from the old system of exacting the payment of a certain percentage of their gross earnings to an ad valorem system, providing for the fixing of the value of the railroads for taxation on the average value at which other property in the state is assessed. The taxes levied against the various railroads of the state for 1902, the first year after the new law went into effect, aggregated $744,898, as against $263,446 which would have been called for under the old system. The railroad companies tendered the latter sum and resisted the payment of the difference, amounting to $481,451. Each year since the companies have refused to pay the difference, so that the suits involved an accumulation of about $2,000,000 in taxes, as well as the establishment of a tax system for the state permanently fixing their annual payments at about three times as much as they have been in the past. The railroad companies contended that in arriving at a decision as to the valuation of their property the State Board of Assessors undervalued other property in the state 17.6 per cent. and thus discriminated against the railroads. Hence, they alleged that the action was in contravention of the Fourteenth Amendment to the Federal Constitution. The Circuit Court dismissed the bill of the railroad companies, thus sustaining the action of the tax authorities and upholding the law under which it was taken; and this decision is now affirmed.

Justice Brewer, delivering the unanimous opinion of the court, said there had been frequent occasions to consider questions of state taxation in the light of the Federal Constitution, and the scope and limits of national interference were well settled. There was no general supervision on the part of the nation over state taxation, and in respect to taxation the state had, speaking generally, the freedom of a sovereign, both as to objects and methods. In view of the frequent and uniform expressions of opinions by the Supreme Court, the Fourteenth Amendment would not prevent a state from changing its system of taxation in all proper and reasonable ways nor compel a state to adopt an ironclad rule of equality in taxation. The decision in effect holds that a tax levied on railroads is not necessarily illegal because it bears more heavily on that property than upon other property in the same state, and further that the Federal courts will not interfere in the matter of state taxes unless the constitutional rights of the owners of the property taxed are clearly infringed.

The railroads contended, also, that the law taxed property in other states; that debts were not deducted as they were in valuing other property, and as it taxed property used partly in other states it was an attempt to regulate inter-state commerce.

Justice Brewer accepted as final the decision of the Michigan court as to the validity of the tax law under the state constitution. Remarking on the contention of the railroad companies that the

fixing of the rate of tax to be paid to authorities as authorized by the state law is a [illegible] question. Justice Brewer touched on a point now receiving consideration in Congress and in the public prints. He said:

"There might be a question whether, even if there were a clear delegation of legislative functions to other departments of the government, it would be valid under the Federal Constitution. In the nation no one of the three great departments can assume or be given the functions of another, for the Constitution distinctly grants to the President, Congress and the judiciary separately the executive, legislative and judicial powers of the nation. It may, therefore, be conceded that an attempted delegation by Congress to the President or any ministerial officer or board of power to fix a rate of taxation or exercise other legislative function would be judged unconstitutional. But does it follow that a state is subject to the same restraint? Crimes against the nation must be prosecuted by indictment, yet a state may proceed by information. Suppose a state by its constitution grants legislative functions to the executive or to the judiciary, what provision of the Federal Constitution will nullify the action? Will the grant work an abandonment of a republican form of government, or be a denial of due process or equal protection?"

Coming to the case at issue, he said there was no abandonment by the Legislature of its functions. He added:

"The state prescribes as the rate of taxation upon railroad property the average rate of taxation on all other property subject to ad valorem taxes. It provides the most direct way for ascertaining such average rate, deducing it from a consideration of all the other rates. No authority is given to the local assessors to apply their judgment to the question of the railroad rate. Their authority in respect to the matter of taxation is precisely the same as it was before and independently of this statute. . . . Why is it necessary that the Legislature be convened to add its formal approval of the integrity of the action of the local officers? May it not intrust the mathematical computation to the State Board of Assessors, and, if so, may it not likewise act upon the assumption that the local assessors will discharge their duties with an eye single to these duties and irrespective of the effect upon the railroad rates? It may be laid down as a general proposition that where a Legislature enacts a specific rule for fixing a rate of taxation, by which rule the rate is mathematically deduced from facts, and even this occurring within the year and created without reference to the matter of that rate, there is no abdication of the legislative function, but on the contrary a direct legislative determination of the rate. Unless there be some specific provisions in the state constitution compelling other action the state may treat its entire territory as composing only a single taxing district and deal with all property as within the district and subject to taxation accordingly. The state is traversed in almost every direction by railroads. To hold that for each railroad the average rate must be determined from the property in the localities immediately contiguous or through which its road passes might well introduce into the matter of taxation a confusion and inequality resulting in far greater injustice than the uniformity established by the present system.

"So far as the restraints of the Federal Constitution are concerned it is within the power of a state to separate a particular class of property, subject it to assessment and taxation in a mode and at a rate different from that imposed upon other property and apply the proceeds to state rather than local purposes. This is not open to question."

The opinion passes over the other questions raised in the case as not of paramount importance, and concludes:

"It is enough to say that generally we accept the findings of a trial court upon a question of fact when the testimony respecting it is conflicting. It may also be said that a Legislature is not bound to impose the same rate of tax upon one class of property that it does upon another. As it may exempt all of one class, so it may impose a different rate of taxation. It is sufficient if all of the same class are subjected to the same rate and the taxes administered impartially upon them."

National Association of Railway Commissioners.

The eighteenth annual convention of this body was held in Washington, April 2, 3, 4 and 5. The roll call of the first day showed commissioners or clerks present from the states of Connecticut, Georgia, Illinois, Indiana (C. V. McAdams), Kansas, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New York, North Carolina, North Dakota, Pennsylvania, South Carolina, South Dakota, Washington and Wisconsin (John Barnes and B. H. Meyer). Also representatives from the American Railway Accounting Officers and the Street Railway Accounting Association. All of the Interstate Commerce Commissioners were present.

The President of the Association, Mr. W. G. Smith, one of the commissioners of South Dakota, delivered the opening address, discussing chiefly the questions of state regulation and of safety, which have been before Congress and the public during the past six months. The only report adopted on the first day was that of the committee on the classification of expenses on electric railways. This committee, in co-operation with representatives of the American Street and Interurban Railway Accountants' Association and of the Association of American Railway Accounting Officers, proposes to hold a meeting within three months to consider proposed changes in forms, with a view to arranging the classification of operating expenses of steam and street railroads, so that all practicable uniformity may be reached.

The convention again adopted (for the eighteenth time, we believe) a resolution declaring that Congress ought to require the railroads to adopt a uniform classification of freight.

The reports of the committee on safety appliances and on other subjects are deferred to a future issue.

Map of New York Freight Terminals.

The engraving on the opposite page, which explains itself, is reduced from one published in the *Railway Equipment Register*.

Washington Correspondence.

WASHINGTON, April 3. President Roosevelt and the radical Republican Senators have surrendered to the conservative advocates of amending the Hepburn railroad rate bill so as to provide explicitly for the judicial review of orders issued by the Interstate Commerce Commission, but they have done so in such a way as to complicate the situation rather than clarify it. When the limited review amendment indorsed by the President, by Attorney-General Moody, and by the radical Republican Senators was given out at the White House on Saturday evening it was claimed that it would have the support of twenty-nine Republicans and of enough of the Democrats to insure its adoption. It was soon found that this was an overestimate of its strength, and all of the Republican support that is now claimed for it is sixteen, with the probability that this is an overestimate. It has also been repudiated by many of the Democrats, and there seems to be little probability that it could get a majority of the Senate if it should be brought to a vote. On the whole, the interjection of the Administration amendment has probably increased the difficulty that will be encountered in arriving at an agreement on the text of the review amendment to be adopted.

An event that may have more to do with shaping the action of the Senate on the Hepburn bill than the introduction of the President's amendment was the announcement by Mr. Justice Brewer on Monday of the decision of the Supreme Court in the Michigan railroad tax cases. This decision was looked upon in some quarters as a virtual notice to Congress that the Supreme Court would hold the Hepburn bill to be unconstitutional. One of the contentions of the railroads was that the Michigan law required the assessors to perform a legislative function in fixing the rate of taxation of railroad property by a mathematical computation based on the average of the other rates in the state. The Supreme Court upheld the Michigan law, but the reasoning by which this was done, it is believed by some Senators, would, if applied to the Hepburn bill, insure its being declared unconstitutional. Justice Brewer interjected into his opinion a declaration not necessary to the decision of the case before the court as to the division of the powers of government between the executive, legislative and judicial branches, in the declaration that "an attempted delegation by Congress to the President or any ministerial officer or board of power to fix a rate of taxation or exercise other legislative functions, would be unconstitutional." The decision has not yet been published officially, and it is understood that when it is published this part of it will be stricken out because some of the other justices, while concurring with Mr. Justice Brewer's opinion as a whole, object to this as an unnecessary expression of opinion on a point not involved in the case. The court held that the question of a state statute attempting to confer legislative power on an administrative agency was not involved in this case, for the reason that the Michigan legislature had not attempted to do so, and it is the part of the decision showing that no such attempt was made that has the most direct bearing on the question of the constitutionality of the Hepburn bill. One ground on which the court held that no such attempt had been made was that the Michigan law gave no authority to the assessors to apply "their judgment" to the question of the railroad tax rate. If this means that a requirement that they should apply their judgment would bring the question of the validity of such a state enactment under the Federal constitution into the case, it is questioned what view the court would take of the Hepburn bill, which proposes to require the Interstate Commerce Commission to prescribe what will in "its judgment" be the just and reasonable and fairly remunerative rate. It is hardly probable that the court would follow one rule as to a tax rate and another as to a freight rate. The court also finds that the question of the delegation of legislative power was not involved in the Michigan cases, for the reason that the state law prescribes "a


FREIGHT TERMINALS IN NEW YORK CITY and Vicinity
Railroads shown thus:
Railroad Freight Terminals shown thus:
Free Lighterage Limits shown thus:
Freight Car Interchange Points shown thus: ★ 1
Freight Car Interchange Points.
It is possible to interchange cars by floats from any one railroad terminal in New York Harbor to any other terminal in that Harbor. A considerable interchange of cars is effected daily by this means.
1 New York, New Haven & Hartford and New York Central & Hudson River
2 New York, Susquehanna & Western and New York Central & Hudson River (W. S.)
3 New York, Susquehanna & Western and New York Central & Hudson River (W. S.)
4 New York, Susquehanna & Western, Erie R. R., and New York Central & Hudson River (W. S.)
5 New York, Susquehanna & Western, Erie R. R., and New York Central & Hudson River (W. S.)
6 Erie R. R. and Delaware, Lackawanna & Western
7 Delaware, Lackawanna & Western, Erie R. R., and New York, Susquehanna & Western
8 New York, Susquehanna & Western and Pennsylvania R. R.
9 New York Central & Hudson River (W. S.) and Pennsylvania R. R.
10 Lehigh Valley and New York Central & Hudson River (W. S.)
11 Delaware, Lackawanna & Western and Pennsylvania R. R.
12 Lehigh Valley and Pennsylvania R. R.
13 Hoboken Shore Road and Erie R. R.
14 Lehigh Valley and Pennsylvania R. R.
15 (Passengers) New York Central & Hudson River and New York, New Haven & Hartford
16 Erie R. R. and New York Central & Hudson River (W. S.)
17 Long Island R. R. and Brooklyn Rapid Transit
18 Bush Docks and Brooklyn Rapid Transit
Freight Docks.
Atlantic Terminal (see New York Dock Co.)
Brooklyn Dock and Terminal Co.
Brooklyn Terminal
Bush Docks & Independent Stores
Fulton Terminal
Harlem Transfer Co.
Jay Street Terminal
National Storage Docks
New York Dock Co.
Palmer's Dock
Wright's Docks
RAILROAD STATIONS AND TERMINALS
Stations and Terminals used for Freight are displayed thus: Staten Island Terminal.
Baltimore & Ohio R. R.
Central R. R. of New Jersey Sta
South Ferry, New York
Staten Island Terminal
Pier 22, North River, New York
East 26th St., North River, N. Y.
Pier 25, North River, New York
Harlem Transfer Co., New York
Bush Docks, Brooklyn
New York Dock Co., Brooklyn
Palmer's Dock, Brooklyn
Jay St., Brooklyn
Central R. R. of New Jersey.
Fulton Terminal, Brooklyn
Communipaw Terminal, Jersey City
Liberty Street, New York
South Ferry, New York
Pier 8-9, North River, New York
Pier 10-11, North River, N. Y.
Pier 21-22, North River, N. Y.
Pier 46, North River, New York
Pier 81, North River, New York
West 23d St., New York
Harlem Transfer Co., New York
Fulton Terminal, Brooklyn
Jay Street Terminal, Brooklyn
Palmer's Dock, Brooklyn
New York Dock Co., Brooklyn
Constable Hook
Bush Docks, Brooklyn
Jersey Ave., Jersey City
Claremont, Jersey City
East 40th Street, Bayonne
East 23d Street, Bayonne
East 22d Street, Bayonne
West 8th Street, Bayonne
Elizabethport
Communipaw Ave
Del., Lackawanna & Western R. R.
Hoboken Terminal, Hoboken
Barclay Street, New York
Christopher Street, New York
West 23d Street, North River, N. Y.
Cortlandt St., Pier 11, N. R., N. Y.
Pier 41, North River, New York
Pier 68, North River, New York
Harlem Transfer Co., New York
Fulton Terminal, Brooklyn
Brooklyn Terminal
Jay Street Terminal, Brooklyn
New York Dock Co., Brooklyn
Brooklyn Dock & Terminal Co., Brooklyn
Bush Docks, Brooklyn
Warren Street, Jersey City
Erie R. R.
Jersey City Terminal
Chambers Street, New York
Duane Street, New York
West 23d Street, New York
West 40th Street, New York
Harlem Transfer Co., New York
Freight Docks and Stock Yards, Weehawken
Pier 8, East River, New York
Jay Street Terminal, Brooklyn
W. 28th St. Freight Terminal, N. Y.
New York Dock Co., Brooklyn
Brooklyn Dock & Terminal Co., Brooklyn
Bush Docks, Brooklyn
Fulton Terminal, Brooklyn
Palmer's Dock, Brooklyn
Warren Street, Jersey City
Lehigh Valley R. R.
Pennsylvania Depot, Jersey City
Jersey City Terminal
West 23d Street, New York
Cortlandt Street, New York
Desbrosses Street, New York
Pier 2-3, North River, New York
Pier 14, North River, New York
Pier 66, North River, New York
42d Street, East River, New York
West 27th Street Freight Yard, North River, New York
Diamond Despatch, East River, New York
New York Dock Co., Brooklyn
Bush Docks, Brooklyn
Fulton Street, Brooklyn
Fulton Terminal, Brooklyn
Jay Street Terminal, Brooklyn
Palmer's Dock, Brooklyn
Grand Street, Jersey City
Communipaw Ave., Jersey City
Warren St. 30th Depot, Jersey City
Warren Street, Jersey City
Greenville Ave., B
National Je., Jersey City
East 40th Street, Bayonne
East 22d Street, Bayonne
Constable Hook, Bayonne
National Storage Docks
Oak Island Yard
Johnston Ave., Jersey City
Long Island R. R.
Long Island City
Flatbush Ave., Brooklyn
Bushwick, Brooklyn
Bay Ridge, Brooklyn
34th Street Ferry, East River, New York
Nos. Chambers Street, New York
New York, Ontario & Western R. R.
Weehawken Terminal
Franklin Street, New York
30th Street Terminal, New York
West 45th Street, New York
East 125th Street, New York
Jay Street Terminal, Brooklyn
Bush Docks, Brooklyn
New York Dock Co., Brooklyn
Palmer's Dock, Brooklyn
Warren Street, Jersey City
New York, Susq. & Western R. R.
Edgewater
Other Freight stations same as Erie R. R.
Passenger Stations same as Pennsylvania R. R.
New York Cent. & Hudson R. R. R.
Grand Central Sta., New York
125th Street Station, New York
158th Street Station, New York
60th St. Freight Terminals, N. Y.
33d St. Freight Terminals, N. Y.
Fulton Terminal, Brooklyn, Despatcher's Street
Pier 16-17, North River, N. Y.
Pier 31, North River, New York
Pier 34, East River, New York
Pier 4, East River, New York
West 120th St. Sta., New York
Port Morris
East 129th St. Sta., New York
Jay St. Terminal, Brooklyn
Harlem Transfer Co., New York
Westchester Ave., New York
Bush Docks, Brooklyn
New York Dock Co., Brooklyn
Palmer's Dock, Brooklyn
Warren St., Jersey City
Continuation of RAILROAD STATIONS AND TERMINALS
New York, New Haven & Hartford R. R.
Grand Central Station, New York
Harlem River Station, New York
Oak Point Terminal
Pier 20, East River, New York
Piers 18-19, North River, N. Y.
Pier 40, North River, New York
Pennsylvania R. R.
Jersey City Terminal
Greenville Terminal
West 23d Street, New York
Communipaw Ave., Jersey City
Pier 1, North River, New York
Piers 4-6, North River, New York
Pier 20, North River, New York
Pier 24, North River, New York
Pier 36, North River, New York
Pier 1, North River, New York
Piers 4-6, North River, New York
Pier 20, North River, New York
Pier 24, North River, New York
Pier 36, North River, New York
Brooklyn L. I. Freight Sta.
Wallabout Freight Sta., Brooklyn
Jay Street, Brooklyn
178th St. Freight Sta., New York
Bay Ridge
Jersey City Freight Sta.
Staten Island Rapid Transit R'y
Staten Island Terminal
South Ferry, New York
West Shore R. R.
Weehawken Terminal
Hoboken
Weehawken Ave., West Hoboken
Jersey City
Greenville Terminal
West 23d Street, New York
Communipaw Ave., Jersey City
Pier 1, North River, New York
Factory Terminal, Jersey City
Pier 4, North River, New York
Jersey Terminal, Jersey City
Pier 20, North River, New York
New York Dock Co.
Bush Docks
Warren Street, Jersey City
Copyright, 1906, by The Railway Equipment and Publication Company.

specific rule" for fixing the rate of taxation, in accordance with which the actual rate can be determined by a "mathematical computation." This, it is suggested, is an indication that the court would require the fixing by Congress of some definite standard or specific rule for the determination of freight rates by the Interstate Commerce Commission, such as a provision that the rate should be a certain amount per ton per mile. The Commission could then determine the rate by a "mathematical computation."

This decision has so strongly reinforced the arguments of Senator Foraker as to the unconstitutionality of the basic principle on which the Hepburn bill is based that it may lead to a reconsideration of the provision conferring the rate-making power and to an attempt to modify it so as to increase the probability that it will stand the test of the courts. It is not probable, however, that any very material change will be made in this part of the bill, but it will be passed despite the protests of Senator Foraker and possibly a few other Senators, and the Supreme Court will be called upon to decide whether it involves an attempt to confer on an administrative commission the functions of the legislative branch of the government.

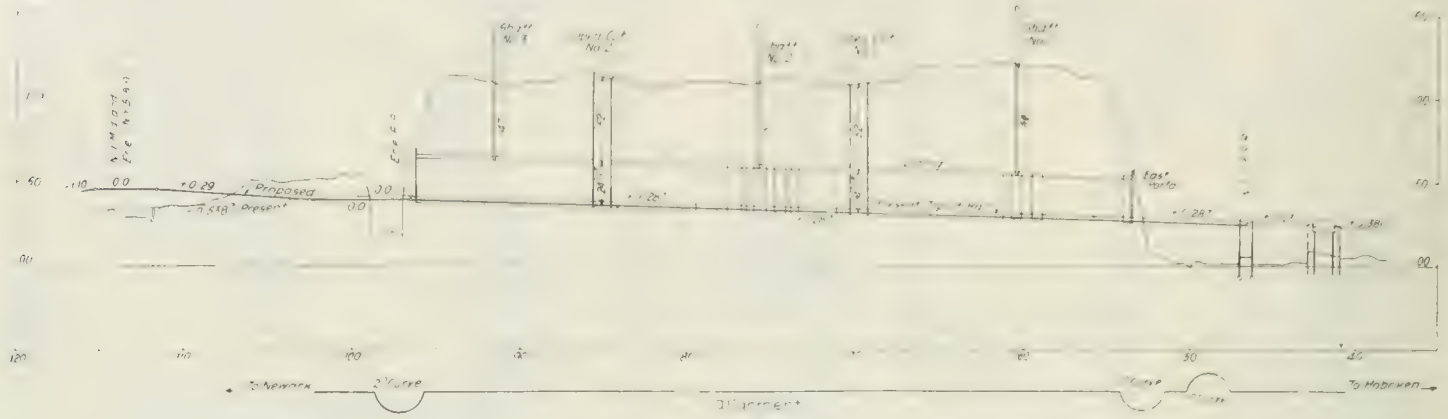
J. C. W.

The Italian authorities are charged with designing to use free passes on the state railroads for political purposes, and to moderate criticism of the railroad management. The government has submitted to Parliament a bill concerning the subject. This provides for extending pass privileges, formerly secured by law to certain government officers, to the families of senators and deputies. Further, the Minister of Public Works is authorized to issue monthly not more than 60 single-trip passes, good for not more than five persons each, and 100 tickets at reduced rates "to be allotted to persons who have done the state service, or for other reasons"—which here probably would be interpreted as available for packing conventions, etc. Similar privileges are authorized for retired railroad officials, including those of the companies formerly working the state railroads. As "members of the family" shall be considered parents, grand parents, sons under 25, unmarried or widowed daughters, widowed daughters-in-law living under the same roof, and two servants per family. Tables of the classes of officials, etc., entitled to passes are contained in the bill. With regard to the press, Italian journalists and editors of important foreign periodicals may have as many as three tickets, personal or family, at reduced rates, and one free pass per year, taking into consideration the number of the journalists and the importance of each journal, under regulations to be fixed by the Ministry after hearing the Italian newspaper union and the syndicate of foreign correspondents in Rome.

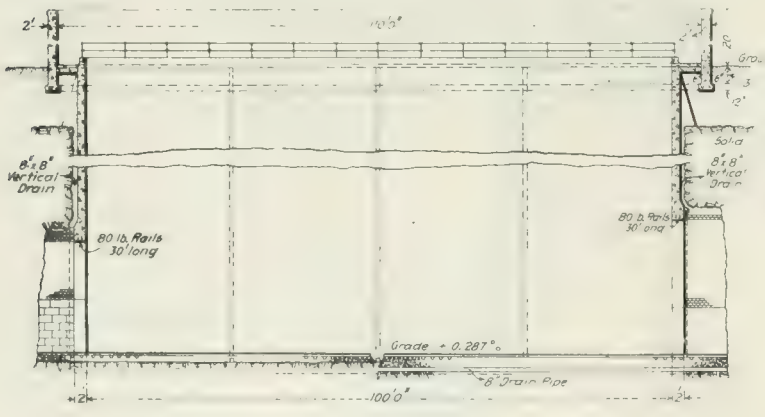
The New Bergen Hill Tunnel of the Lackawanna.

BY J. H. PHILLIPS,
Assistant Engineer Delaware, Lackawanna & Western.

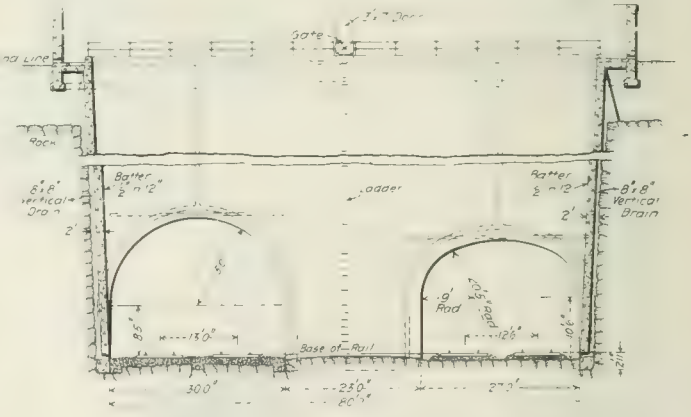
The present Bergen tunnel of the Lackawanna Railroad is situated one mile west of the Hoboken Terminal, and is a single tube for double-track, 4,280 ft. long. At the west end of this tunnel is the junction of the Morris & Essex, or the "Old Road" with the Boonton Branch, or as it is now called, the Main Line. The "Old Road" is purely a suburban line, and runs through Harrison, Newark, the Oranges, Summit and Morristown, and joins the Main Line just east of Dover, having branches from Roseville to Montclair and from Summit to Bernardsville and Gladstone. The greater part of the people in these towns do business in New York City and commute daily to and from their business. The Boonton Branch, or Main Line, is the more direct route to Buffalo, and all through passenger trains, with one or two exceptions, and all freight trains are run over this route. All freight for Hoboken, Jersey City and New York, and all export freight, besides the immense volume of suburban passenger traffic, has to pass through this tunnel, which is seven-eighths of a mile long, and is operated as a single absolute block. As there are more than 100 trains (scheduled) each way in 24 hours, besides the great number of freight extras taking freight to and from the terminal, it can be readily seen that this absolute block nearly one mile long within a mile of the river front is a great handicap to the operating department, and it has been thought for several years to be an absolute necessity to get more tracks through Bergen Hill. To relieve the congestion at this point is the object of the new tunnel tube through Bergen Hill, the contract for which has been let to the William Grace Co., of New York and Chicago.



Profile of New Tunnel Through Bergen Hill—Delaware, Lackawanna & Western.



Longitudinal Section of Tunnel at Open Cut.



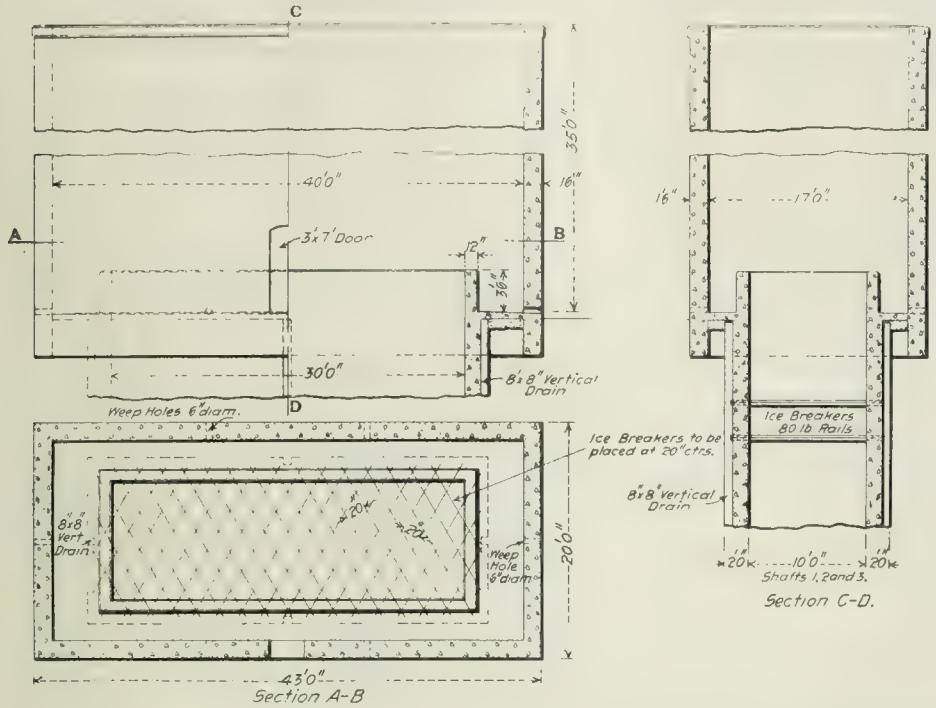
Cross Section of Tunnel at Open Cut.

The new tunnel will be a single tube for double-track 4,280 ft. long with portals flush with those of the present tunnel and having three air shafts and two 100-ft. open cuts across both tunnels. The new tube will be built parallel with and distant 51 ft. 6 in. southerly at right angles from the center line of the present tunnel, leaving a wall of natural rock between the two tunnels of from 19 ft. to 23 ft. in thickness, depending on whether the old and new tunnels are lined or not. The new tunnel will be built on the same grade as the present tunnel, which is descending eastward at the rate of 18 ft. per mile, as shown in the profile.

The material to be penetrated is solid trap rock and is classified as follows: Tunnel approach excavation to include all excavation outside the portals; tunnel excavation to include all excavation of the tunnel between portals, and shaft excavation to in-

clude all excavation from shafts down to the roof of the tunnel. The material from the approach excavation at the east end of the tunnel will be wasted in a fill between the east end of the tunnel and the West Shore tracks.

All material from the tunnel tube and from the west approach will be loaded on cars furnished by the railroad company on side tracks adjoining the work, and all suitable rock will be hauled to Boonton, N. J., and crushed in the railroad company's crusher and



Details of Shaft and Shaft House, New Bergen Hill Tunnel Delaware, Lackawanna & Western.

used for ballast. The contractor will crush sufficient rock from suitable excavation to furnish all crushed rock used for concrete in this work. The contractor will be paid an additional price per cu. yd. for all rock so crushed. The earth excavation from shafts and open cuts may be wasted by the contractor in dumps to be arranged for by him. The portals of the new tunnel will be built of concrete and the new tunnel tube will be lined for at least three-quarters of its length. The side wall lining will be of concrete, and the arch will be lined with two rings of vitrified brick laid on edge, backed by concrete. The lining will be 2 ft. thick, as shown in the illustration of the tunnel section. It was decided to line the arch of the tunnel with two courses of vitrified brick backed with concrete instead of using all concrete arch lining, to obviate the possible damage to the roof lining from engine gases or blast effect from engine exhaust. The tunnel will be 30 ft. wide, with a semi-circular roof 30 ft. in diameter, the springing line of the arch of the tunnel being 8 ft. 5 in. above the base of rail. The roadbed will be so cut as to drain to the side ditches, and three ditches, each 2 ft. wide and 1 ft. deep, will be cut at the center of the roadbed, in each of which a line of 8-in. vitrified drain tile will be laid. One cable conduit, 6 in. square, will be built in each concrete side-wall. The top of the conduit will be 6 in. above the base of rail, and its nearest edge will be 8 in. from the face of the side-wall. Hand holes 8 in. square and 14 in. deep will be left in the side-wall at sufficient intervals to give access to cables. Six refuge niches, two located at each of the air shafts, 4 ft. wide and 6 ft. high, will be left in the sides of tunnel lining for the use of workmen. Weep holes, made of vitrified tile, will be built at the bottom and through the side walls where the tunnel is lined. These will be spaced 50 ft. apart or less. Vertical drains, 8 in. square, will be left in the concrete lining, extending from the weep holes to the crown of arch and located in the back of masonry, next to the natural rock.

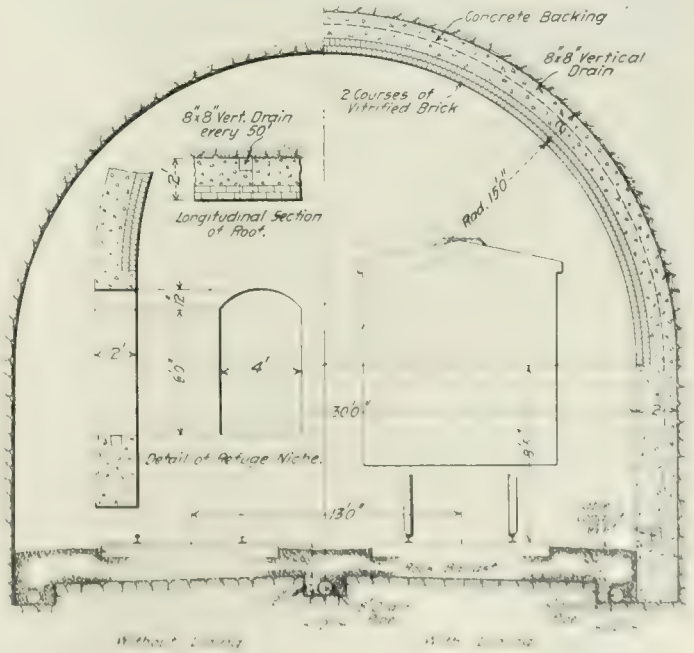
Three air shafts, 10 ft. by 30 ft. inside, will be built for ventilation. The two side walls of these shafts will be even with the side walls of the tunnel and all of the shafts will be lined with concrete 2 ft. thick. Shaft houses, 20 ft. by 40 ft. inside, located at about 35 ft. above the surface of the ground, will be built around each of these shafts. The details of the shafts and of the shaft houses are shown in the illustration. The surface inside of shaft houses and outside of shafts will be covered with concrete. The shafts will be drained by means of weep holes left in the sides of shaft house walls. Vertical drains will also be left in the back of shaft lining on both sides and ends, and will be connected with the side ditches of the tunnel. Metal ice breakers of 80-lb. rail will be built in the shaft lining at a height to be determined by the engineer.

Two open cuts, 100 ft. long, will be built across the width of both tunnels, each about one-third distant from either end of the tunnel. These open cuts will be lined with concrete throughout, the end walls being vertical and the side walls being built on a batter of ½ in. per foot. A wall of concrete about 20 ft. above the surface of the ground will be built around each of these open cuts to keep persons from throwing stones, etc., on the cars below. A ladder of iron steps will be built up one of the end walls of each open cut located between the two tunnels. The construction of these two open cuts will probably make it possible to operate the tunnel in three blocks instead of one as at present.

During the construction of the new tunnel, an inspection engine equipped with platforms and searchlights will be run through the present tunnel to inspect the roof of the tunnel after each blast, before letting any trains through either way. The periods of blasting will be limited to four periods of 15 minutes each in 24 hours, when the schedule will be arranged to accommodate this.

All sand, stone, cement, vitrified brick, vitrified tile pipe for drains and conduits, steel rails, doors and door frames for shaft houses and open cut enclosures will be furnished by the railroad company on the site of the work, the proportions of the concrete mixture are also to be made as the engineer directs. The furnishing of all material by the railroad company stops all controversy between the railroad company and the contractor about the proportions of material used in the mix. It also allows the contractor to carry work with less investment of capital. Wet concrete is preferred, and will be put in, except in extreme cold weather. A smooth face will be obtained by spading the stone back from the face of the wall. When dry concrete is used, a facing mixture of one part cement and three parts sand will be placed next to the face boards.

The contractors have arranged to install an electric plant and will use electric drills on this work. The drills will be furnished by the Box Electric Drill Co., of Denver, Colo. The advantage claimed by the maker of this drill is that it can be operated with



Cross Section and Details of New Tunnel Through Bergen Hill Delaware, Lackawanna & Western.

1½ h.p. to 2 h.p. per drill, while the steam and compressed air drills require about 15 h.p. per drill.

All plans and specifications for this work were worked up under the personal direction of Lincoln Bush, Chief Engineer, assisted by A. J. Neafie, Principal Assistant Engineer, and Mr. E. I. Cantine, Division Engineer. Mr. J. H. Evans, Contracting Engineer for the Wm. Grace Co., will have charge of the work for the contractors.

President Stickney on Rate Regulation.

The following extract is from a paper by A. B. Stickney, President of the Chicago Great Western, printed in the Political Science Quarterly for March [illegible].

If the disease has been properly diagnosed, what is the remedy? For nearly half a century the railroad companies have tried to abolish the rebate system by agreement amongst themselves not to pay rebates. To destroy such agreements it has not been necessary for the large shippers even to make a protest. They have only to route all their shipments over one of the competitive lines and pay the full tariff rates. Immediately thousands of stock-exchange tickers announce the increase in earnings of the favored line and the decrease in earnings of all the others. Tick, tick, tick, up go the stocks of the favorite, and tick, tic, tick, down go the stocks of the others. No management can stand against such attacks through the ticker. It has no alternative but to apologize humbly for the strike and agree to pay a still larger rebate in the future. The strike being thus ended, the commercial magnates have only to turn their whole traffic to the lines which have surrendered, in order to obtain full rebates on the traffic which the single line had carried during the strike under the impression that it was getting full tariff rates. It has thus been proved by experience that an agreement among the railroads to maintain tariff rates and pay no rebates is not a remedy.

Would consolidation of all the railroad companies into one huge corporation be a remedy? It seems altogether probable that the autocracy thus created would be strong enough to defy rebate-seekers. Whether it would destroy rebates would depend to some extent upon the personal interest in manufacturing and commercial enterprises of the railroad czar and of the grand dukes, his bankers, his uncles, brothers, brothers-in-law, sons and sons-in-law. If the reign of the first czar should be benign, what would be the character of the reign of his hereditary successors? The disclosures of the insurance investigation are not reassuring.

The autocracy would necessarily be localized somewhere, probably in New York City, thousands of miles from many of the activities which are dependent upon railroad transportation. It would entail upon the country evils akin to, if not essentially identical with, the evils of absentee landlordism, which has cursed Ireland, Russia and all the countries in which it has existed. Out of touch with the activities and the aspirations of distant communities, the czar would expect his managers to make present returns as large as possible, letting the future take care of itself. The ticker is always crying: "More, more!" Consolidation has already reached a stage which produces many complaints. It is alleged that no person authorized to act in redressing a wrong, or in meeting the needs of a new industry, can be reached without undertaking a journey across the continent and humbly submitting the case to the unsympathetic decision of the "unconscious arrogance of conscious power."

If, as is by no means certain, autocracy would be a remedy, the remedy may well be regarded as worse than the disease. With a grand duke in control of each of the great combinations which now command rebates, and the czar getting a "rake-off" as stockholder, or otherwise, from all, it does not seem probable that the chances of individual enterprise would be improved.

Would legislative control of rates be a remedy? It is a distinguishing characteristic of the American mind that it seeks to remedy every economic evil by passing a law. The average mind regards the enactment of the law as sufficient. The average mind is always in favor of enacting a law, but after the law is enacted the average mind is opposed to its enforcement. And when such a law has been enacted and no attempt has been made to enforce it and the evil continues to exist, the demand of the average mind is not to enforce the existing law but to enact a new law. Besides, if the statutes of this class be examined, it will be found that the average legislative mind possesses the same reverence for enactment and the same disregard for enforcement, and that, consequently, none of the statutes contains proper provisions for enforcement.

If it were not for these well-known characteristics, the fact that the Interstate Commerce law has been in existence for more than 18 years without results would be evidence that legislation is not a remedy for the rebate system. This law forbids in the most comprehensive language the rebate and other kindred evils, but it provides no adequate instrumentalities for its enforcement. Besides, its penalties are in many cases so out of proportion to the offence that this enforcement cannot be expected. For illustration: under this law, as originally passed, if a man rides on a pass from New York City across the state line into Connecticut he commits a misdemeanor, punishable by a fine of not less than $1,000 nor more than $5,000, or by imprisonment in the penitentiary for not less than one year nor more than five years, or by both fine and imprisonment, in the discretion of the court for each ride. A later amendment abolished the prison penalty and made the fine not less than $1,000 nor more than $20,000. The same penalties are imposed for paying rebates; and under the original law these penalties ran, not against the railroad company which paid the rebate and reaped the profits from the traffic which the rebate secured, but against the minor traffic agent, who, on a salary of perhaps $2,500 per year, was supporting a family, and who, it might be claimed, had by a wink or a nod or by absolute silence agreed to pay the rebate. The writer was present at a controversy between a shipper and such an agent as to whether the agent had agreed to make the rebate claimed, and heard the following dialogue:

Shipper. I spoke to you about the rebate at the time.

Freight Agent. Yes, but I said No.

Shipper. I know you said No, but there was a queer look in your face which I thought meant Yes.

On this evidence the rebate was paid in the interest of future traffic from the same shipper. What American jury would fine or imprison a man for having a queer look in his face when he said No?

In one of the outbursts of public excitement which have periodically occurred since the enactment of the law, one poor fellow was convicted; but the conviction so outraged common decency that the president promptly pardoned him. Speaking from recollection, this is the only conviction under the law in the 18 years of its existence.

Under the original law the penalties ran only against the payers of rebates, but a later amendment imposed the same penalties "for soliciting or receiving a rebate." This seemingly just amendment made it well nigh impossible to convict anybody, because the rebate crime is, as a rule, known only to the giver and the receiver. Neither party can testify against the other without incriminating himself, and this, under the provision of the federal constitution, no witness can be compelled to do. This predicament necessitated another amendment, which required both parties to testify, and avoided the constitutional provision by guaranteeing absolute immunity from prosecution for offences which such persons might disclose either to the Interstate Commerce Commission or to the courts. Since the passage of this amendment, the giver or receiver of a rebate has only to confess to become immune and to render both the Interstate Commerce Commission and the courts powerless to enforce the penalties of the law.

Under the Elkins amendment, the penalty of imprisonment was abolished, and the fine of not less than $1,000 and not more than $20,000 was imposed upon the railroad companies themselves as well as their officers and agents, and upon those who may solicit or receive a rebate. This amendment was passed in 1903, and no convictions have yet been made. It is a disputable question whether a railroad company will be immune against penalties if it produces its books or other testimony in court. A case involving this question is before the Supreme Court.

It is needless to add that the law has had little effect upon the rebate system. At the time of the first enactment, which was during a period of intense public excitement, and at the time of each subsequent enactment, and since the president has become "perniciously active" in attempting its enforcement, there have been, not organized and effective revolutions, but just common ordinary strikes against the rebate system. Like all strikes, they have lasted only as long as the excitement has lasted.

Notwithstanding the failure of the Interstate Commerce law during 18 years of trial, it is the conviction of the writer that it is possible to frame a reasonable and just law, with reasonable and just provisions for enforcement, which would be effective. Such a law cannot, however, be drafted off-hand, with a few days or even a few months for its consideration, during a period of excitement amounting almost to hysteria.

A law intended to establish and enforce just and reasonable rates must be framed with reference to the fundamental facts which are the basis of such rates. A great deal of intelligent investigation has been devoted to ascertaining the principles of economic operation, but no investigations have been attempted in respect to the fundamentals of reasonable rates. Ask the expert traffic official what is the basis of reasonable rates and by what method they can be ascertained, and, if he regards the question seriously, he must confess that he does not know. Ask the doctrinarians who write books, and they must confess that they do not know. The fact is nobody knows; nobody has the basis, the formula, or even a theory. Have reasonable rates relation to the cost of producing transportation, or to the interest on the fortuitous capitalization of each railroad company? Is a railroad company entitled to earn reasonable profits on cost of production, or reasonable interest on securities issued? Nobody knows. The people, the legislators and the courts are at sea upon these fundamental propositions. All is mystery.

If there are such things as reasonable rates, they must be based on something, have relation to something, which, by investigation, can be ascertained and demonstrated. If there are no such things, then in enacting laws which declare, as the present law declares, that "all rates shall be reasonable and just and that all unjust and unreasonable rates are unlawful," Congress simply

enacts a moral rule which no one will dispute and which no one can interpert or apply. If laws of this class, making those things criminal which the day before their enactment had been regarded as lawful, are to be enforced, they must be intelligible and explicable, so as to appeal to that sense of justice which is innate in the American people.

It is probable that such an investigation as is here suggested would prove that the net rates—the remainder of the rates after deduction of the rebates—are the reasonable and just rates which should be made the tariff rates, open to all shippers, alike.

It would therefore seem to be a wise procedure for Congress to provide an interstate commerce investigation committee, composed of, say, seven members, four members to be appointed by the president, and three members to be appointed by the railroad companies. One member should be a sound lawyer; one a mathematician; one an experienced railroad auditor; one an engineer of capacity, experienced in calculating costs of transportation; one a superintendent, experienced in the actual movement of trains and of rolling stock; one a station agent, experienced in the details of station or terminal service, and one a traffic manager, experienced in present rates. The committee should have authority to demand from the railroad companies a new line of statistical facts which have never been compiled, relating to costs, and particularly to relative costs as between the different conditions under which commodities are transported. To give a single illustration: the committee should demand statistics showing the commodities which require, under certain conditions, the hauling of only half a ton of non-paying car to each ton of pay-freight and, under other conditions, the hauling of three or four tons of non-paying car to each ton of pay-freight. The statistics should cover all the relations of weight of car to weight of load which this illustration suggests. There are other lines of facts which, like those just cited, would need only to be mentioned to show their relevancy to the problems to be investigated.

The investigation should be systematic and thorough; it should, above all, be public; and the results should be published from time to time so as to keep the public informed during the progress of the work, and to permit public discussions in the newspapers and elsewhere. There is no corrective influence so powerful as publicity; no other agency can secure thorough comprehension of the facts and proper control of the inferences.

After, but not before, such investigations, publications and discussions—if there remained evils which such investigations, publications and discussions had not remedied—it would seem possible to frame legislation which would be recognized as just and intelligible and which would accordingly prove to be enforceable.

Test of the Sauvage Air Brake.

BY GEO. L. FOWLER.

Ever since the introduction of the air brake into freight service it has been recognized that a means should be found whereby the pressure on the brakeshoes should be proportioned to the weight on the wheels. The current method of adjusting the leverages so that 70 per cent. of the weight of the empty car is used in brakeshoe pressure leaves only about 23⅓ per cent. of the weight of a loaded car of 60,000 lbs. capacity available as brakeshoe pressures, and this meagre percentage is cut down still further, so that it is less than 20 per cent. in the case of a car of 100,000 lbs. capacity.

The Sauvage safety brake is intended to overcome this trouble and to substitute for the ordinary arrangement one that permits the use of the full 70 per cent. of the loaded weight of the car. It also provides a greatly increased braking power with a small addition to present equipment, and with no increase in the consumption of compressed air, or it makes it possible to attain the present brake power with a considerable saving in the consumption of air. The device was tried tentatively on the New York, Ontario & Western Railroad in the summer of 1904, and in the fall of the year it was decided to equip the milk cars of the road. This has been done, in part, as fast as the work could be carried on at the Middletown shops, and early in September last a series of tests were made to determine the relative efficiency of this brake in comparison with the standard Westinghouse equipment.

The arrangement as used and recommended by the Sauvage Safety Brake Co., of 42 Broadway, New York, consists of a second cylinder coupled to the brake levers in such a way that it comes into action only after the piston of the first cylinder has traveled a predetermined portion of its stroke, brought the shoes to a bearing against the wheels and applied the ordinary braking pressures.

The illustration shows this connection. No change is made in the triple valve, auxiliary reservoir, or the brake cylinder connection, with the exception of the connection of the auxiliary cylinder. This is so arranged that its piston is not acted upon by the air until that of the first cylinder has done all of the work of taking up the slack and adjusting the brakeshoes to the wheels.

The air is admitted to the regular brake cylinder, A, in the usual manner from the auxiliary reservoir. When its piston has moved out to a point uncovering the opening to the pipe, C, air is admitted to the rear of the second cylinder, B. In the meantime, while the piston of A is traveling out it is carrying the swinging lever to which the piston rod of the cylinder, B, is attached, with it, and this in turn, pulls out an extension of the piston of B, as will be explained later. It will be seen, then, that as soon as air is admitted to the second cylinder it transmits through the swinging lever a pull upon the cylinder lever at the point of attachment of the piston rod of A, twice as great as that of the latter if the cylinders are of the same size, on account of the multiplying effect of this lever. In this way, if the brake cylinder pressures were the same, the brakeshoe pressures would be three times as great as when the single Westinghouse cylinder were used, which is about the increase needed between an empty and loaded car of 60,000 lbs. capacity.

The mechanism by which the extension of the piston rod of the second cylinder is drawn out is shown in the illustration. The main piston rod is hollow and the extension telescopes into it. To the extension there is hinged the drop piece, or latch, D, which when lifted to the central position slides in the hollow rod. When it is drawn out beyond the edge of this hollow rod it drops down and catches on the end of the same, as shown in the lower portion of the engraving. Then when air is admitted to the second cylinder the rod catches on the drop piece and does its work through it.

When the brakes are released the two pistons retract together, and as the end of the drop piece, D, approaches the cylinder head it is raised by the inclined lug attached to the latter to its central position and slides into place in the piston rod.

A cut-out cock in the pipe C by which the second cylinder can be put out of use completes the mechanism of the new device, and in it there is nothing of complication or anything that is apt to get out of order. When it is desired to use the single cylinder on empty car work the cock in the pipe C is closed and the extension to the piston rod of the second cylinder is merely drawn in and out. To use the cylinder, the cock is opened, thus practically duplicating the work of attention required by the ordinary retaining valve.

It has been found to be unnecessary to close the valve for empty cars in service, as will be shown in greater detail later.

In order to provide for the semi-automatic adjustment of the cylinder and guard against the use of the second cylinder on an empty car where there might be a danger of flattening the wheels, various forms of automatic cut-out valves have been devised, one of the first forms of which is shown in section in the engravings, and its operation is as follows:

It is placed in the pipe C together with the cut-out cock, the latter to be used for emergencies only.

Within there are two valves, O and *n*, opening downward and held against their seats by springs. The stems of these valves project up into a cylindrical space in which a piston *q* is free to move up and down. Above this piston there is a disc with a packed stem *r* that can be depressed by the double-acting lever *s*. This is so constructed that no matter which way the upper portion is moved the central part will come down against the disk stem and push it and the piston down.

The device has been tested on a number of cars on the New York, Ontario & Western Railroad. The first trial was on a passenger train, where its work was so satisfactory that the equipment of all of the milk cars on the road was ordered, and this is nearly completed. These cars are of the ordinary type, are equipped with Fox trucks, and weigh empty about 38,850 lbs.

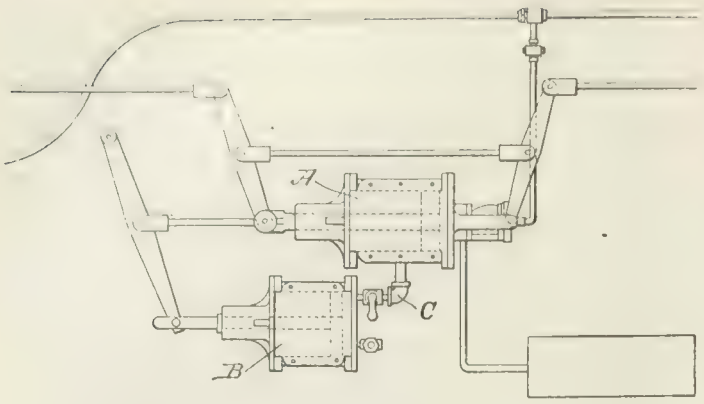
It was desired to make a comparative test of the stopping and working qualities of this new brake with the ordinary Westinghouse equipment, in order to obtain the stopping efficiency, the amount of air used and the control of the train. That this might be done, trains were placed at disposal for the execution of the work. This was done in the regular service of the road, with no interruption and no variation except as noted later. The cars, when loaded, carried about 30,000 lbs. of milk and 3,600 lbs. of ice each.

The main tests were made with the leverage recommended for use with the Sauvage brake against the high leverage in connection with the Westinghouse brake.

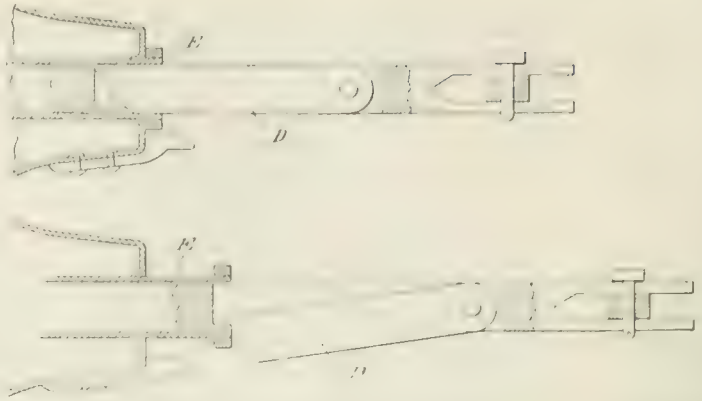
The work was done between Sidney and Middletown, a distance of 121.31 miles. The trains used for the greater portion of the work, with the cars loaded, were in regular milk service scheduled to leave Sidney at 1.35 p. m. and arrive at Middletown at 7.30 p. m. On the return trip with empty cars the work was done on the trains scheduled to leave Middletown at 7.55 p. m. and arrive at Sidney at 1.25 p. m..

In order to secure an autographic record of the brake events throughout the whole period of the run, an instrument especially designed for the work was placed in the eight-wheeled caboose car that was attached to the rear end of each train tested.

This instrument was fitted with a driving mechanism by which a roll of brown manila paper 14 [illegible] was driven over the table and rolled upon a reel at the end opposite to that from which it started. The driving was done by gearing worked from one of the axles, and the reduction of motion was such that the paper



General Arrangement Sauvage Safety Brake.



Detail of Auxilliary Cylinder Piston Rod and Latch of Sauvage Safety Brake.

traveled 20.75 in. for each mile traveled by the car.

The registering apparatus consisted of six stylographic pens, each of which drew a continuous line from one end of the run to the other.

The indications of the several pens were as follows:

The pen at one end of the row, which made the line shown at the bottom of the record, was attached to the armature of a double magnet, so arranged that if the circuit through one magnet coil was closed the armature would be drawn in one direction, whereas if that passing through the coil of the other magnet, it would be drawn in the opposite direction.

This pen was used to indicate the passing of mile-posts and stations. Two sets of circuit wires were led from the two magnets to the monitor of the caboose, and there provided with push buttons. According as the circuit was closed by one or the other of these buttons the pen was moved up or down, causing a notch to appear in the line, and thus locating the mile-post or station, as the case might be. The pen was moved upward to indicate mile-post and downward to indicate station location.

The second pen was attached to an armature whose magnet was in a circuit that was closed at intervals of 10 seconds by a clock. As the paper traveled at a speed in direct proportion to that of the car, the speed of the latter can be determined at any moment of time or place by the distance separating the notches on the second line, as they are farther apart the higher the speed. A suitable scale makes it possible to measure this speed at once.

The third pen was attached to an armature whose magnet was in a circuit closed by a wiper on the driving mechanism. These marks measure distances of about 570 ft., and were used as a check on the mile-post and for use in the determination of short distances.

The fourth pen was attached to the piston rod of a small cylinder, to the rear end of which the train pipe pressure was admitted. This piston was held normally at the rear end of the cylinder by a spring, which was compressed when the train pipe pressure was admitted. As this pressure was lowered by the application of the brakes, the spring pushed the piston back towards the end of the cylinder, carrying the pen with it and thus registering the reduction made for the application of the brakes.

The fifth pen was attached to the piston rod of a similar cylinder, to which the brake cylinder pressures were admitted. Normally the piston was held by its spring against the back head of the cylinder, to be pushed out, compressing the spring when the brakes were applied, thus registering the brake pressures used and indicating on the record where the work was done.

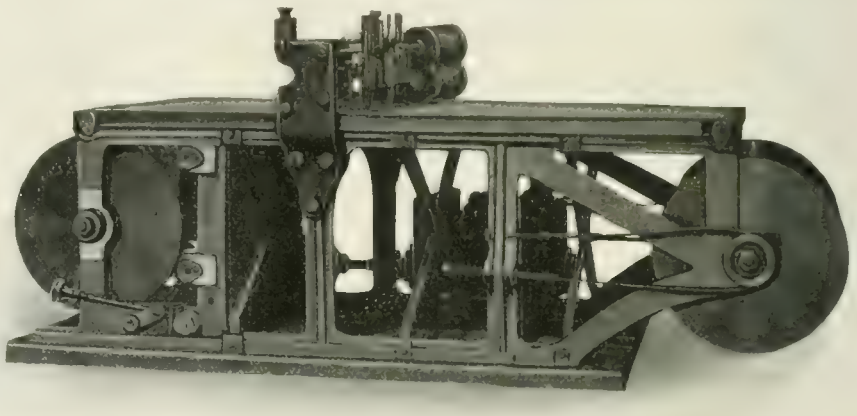
The sixth pen was fixed and served merely to draw a base line.

The whole of the record was thus autographic with the exception of the indications for mile-posts and stations, which were made by an assistant in the monitor.

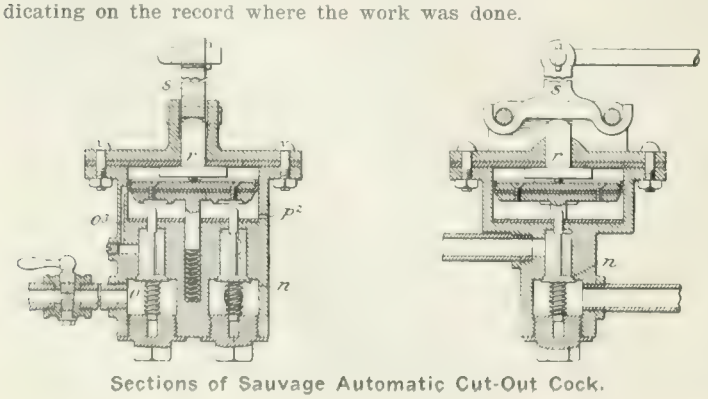
In this way a complete record, unaffected by the personal equation of the operator, was obtained showing the intensity, character and location of all the brake events, as well as the speed of the train with its accelerations and decelerations due to engine pull or brake applications.

In addition to this principal instrument a pressure recording gage was placed in the caboose and connected with the train pipe.

On the engine there was a stroke counter attached to the air pump.



Autographic Recording Apparatus Used in Sauvage Brake Tests.



Sections of Sauvage Automatic Cut-Out Cock.

Work was commenced on a run from Sidney to Middletown on August 29, 1905, and finished on a run from Middletown to Sidney on September 12, 1905.

In all 10 runs were made. Of these three were with loaded cars and the Sauvage brake from Sidney to Middletown; three with loaded cars and the ordinary air brake, using the high leverage, over the same run; one the same as the above, except that the standard leverage was used; one from Middletown to Sidney with the Sauvage brake and empty cars; one the same as the last except that the Sauvage brake was coupled to the high leverage used with the ordinary brake, and one with the latter and high leverage.

The trains were hauled by the same engine and engineer with one exception, and were as near the same composition and weight as the exigencies of service would admit. There were some variations in the brake equipment, as will be noted. The following is a detail of the composition of the several trains that were used between Sidney and Summitville, between which points all of the special stops were made:

Date.	No. cars.	Brake.	Weight of train.	Direction of movement.	Remarks.
Aug. 29.	11	Sauvage.	761,290 lbs.	South.	One car was not fitted with Sauvage brake. Cloudy, wet and dry rail.
Aug. 31.	10	Ordinary.	774,838 "	"	Clear, dry rail.
Sept. 2,	7	Sauvage.	578,852 "		One car (6029) cut out. Rainy, wet rail
Sept. 6	9	Ordinary.	669,813 "	"	Clear, dry rail.
Sept. 7.	11	Ordinary.	540,600 "	North.	Clear, dry rail.
Sept. 8	9	Sauvage.	687,239 "	South	Clear, dry rail
Sept. 9.	13	Sauvage.	629,600 "	North	Clear, dry rail.
Sept. 10.	9	Ordinary	675,362 "	South	One car (6033) standard leverage Clear, dry rail.
Sept. 11	12	Sauvage	582,300 "	North	Foggy. Damp rail to Livingston Manor
Sept 12	8	Ordinary	642,443 "	South	Cloudy, dry rail

In this list the caboose is not counted in the number of cars, nor is the engine included in the weight of the train. This is placed at the uniform figure of 275,500 lbs.

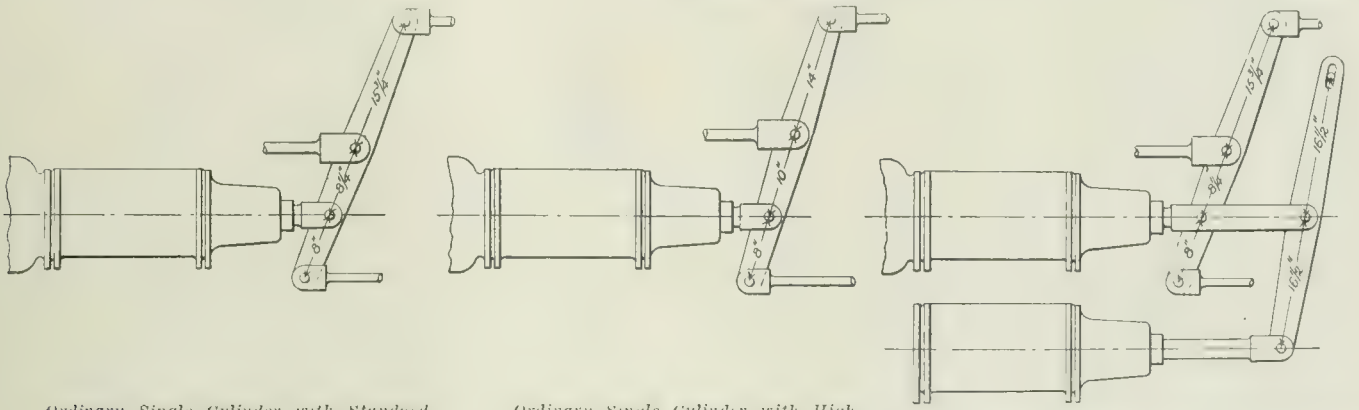
In doing this work arrangements were made for a series of special stops in each direction, so that comparisons could be made between the action of the two brakes at the same point in the track and at approximately the same speeds, independent of the regular service work.

The special stops were made as follows:

SOUTHBOUND (LOADED TRAIN).

Emergency Stops from Full Speed.

At mile-post 163, on descending grade of 74.45 ft. per mile into Cadosia.
At mile-post 150 (East Branch), level.



Ordinary Single Cylinder with Standard Leverage. *Ordinary Single Cylinder with High Leverage.* *Sauvage Cylinders with Standard Leverage.*

Method of Attaching and Cylinder Lever and Proportions Used in the Sauvage Brake Tests.

At mile-post 113, on descending grade of 59.66 ft. per mile into Luzon.
At mile-post 102 (Mountaindale), descending grade of 64.26 ft. per mile.

Service Stops from Full Speed.

At mile-post 154 (Fish's Eddy), ascending grade 50.21 ft. per mile.

NORTHBOUND (EMPTY TRAINS).

Emergency Stops from Full Speed.

At mile-post 92, on descending grade of 52.8 ft. per mile into Summitville.
At mile-post 150 (East Branch), level.
At mile-post 189 (Franklin), descending grade of 66 ft. per mile.

Service Stops from Full Speed.

At mile-post 135 (Rockland), level.
At mile-post 171 (Rockrift), descending grade of 68.32 ft. per mile.

A higher leverage than that previously employed was used, and is shown in the engraving, in which the arms of the cylinder lever are 8¼ in. and 15¾ in. long, and which is marked "standard" leverage. The high leverage is shown on the engraving, in which the lengths of the two arms are 10 in. and 14 in., respectively; a change that increased the pull on the rod leading to the trucks from .523 lbs. to .714 lbs. for each pound of pressure in the brake cylinder; an increase of 36.52 per cent.

In the case of the Sauvage brake, the arms of the main cylinder lever are of the same length as in the standard leverage arrangement of the ordinary brake. In addition to this the Sauvage cylinder is attached to a lever that doubles its pull on the cylinder lever; so that when the second cylinder is at work the effect is the same as though three 8-in. cylinders were connected to and acting upon the end of the main cylinder lever.

A fourth engraving shows the arrangement of the foundation brake rigging under the milk cars with which these tests were made.

Following these leverages out from the cylinder to the brake-beam, it will be seen that the pressure upon the beam for each pound of pressure in the brake cylinder will be for:

Ordinary brake (Standard leverage)	2.22 lbs.
Ordinary brake (High leverage)	3.03 "
Sauvage brake	6.67 "

For an equalization of the brake cylinder pressures at 55 lbs., the brakebeam loads were as follows:

Ordinary brake (Standard leverage)	6,137 lbs.
Ordinary brake (High leverage)	8,376 "
Sauvage brake	18,328 "

At 60 lbs., this becomes for the ordinary brake with

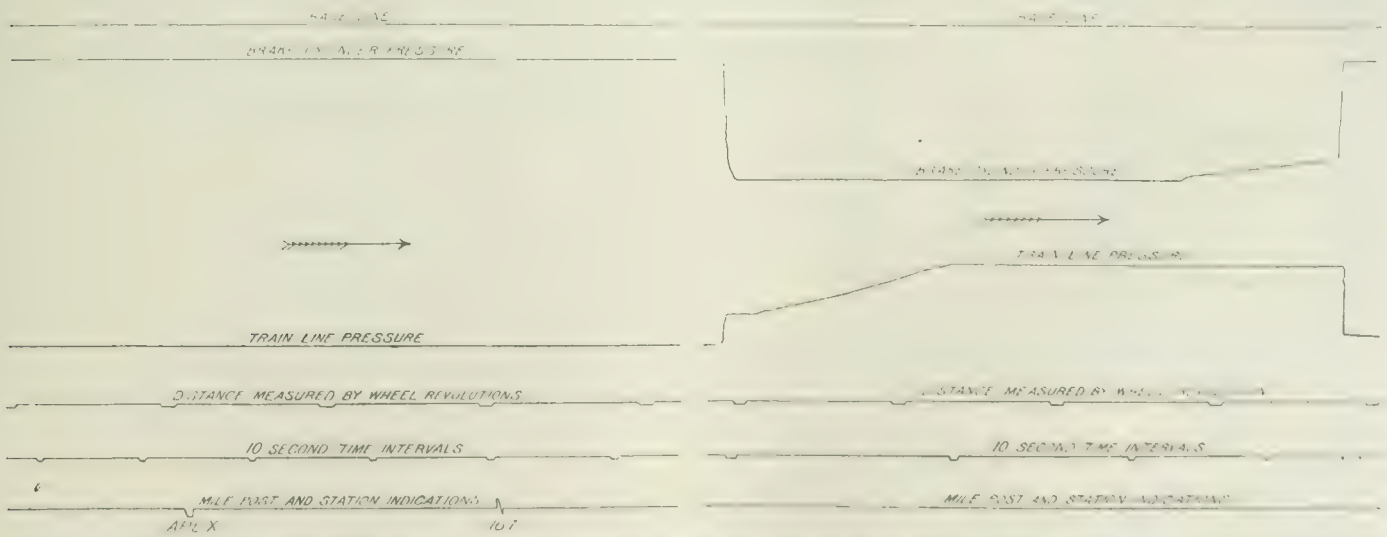
Standard leverage	6,695 lbs.
High leverage	9,137 "

It will be shown later that 55 lbs. was the maximum pressure obtained in the Sauvage cylinders. The average weight of the loaded car was 73,610 lbs.

These equalized pressures under emergency application therefore show the following percentage of the weight of the car in the brake-shoe pressure.

	Cars—Empty.	Cars—Loaded
For 55-lb brake cylinder pressure:		
Ordinary brake (Standard leverage)	63.18 per cent.	32.80 per cent
Ordinary brake (High leverage)	86.23 "	45.51 "
Sauvage brake	188.49 "	99.59 "
For 65-lb. brake cylinder pressure:		
Ordinary brake (Standard leverage)	74.66 "	39.46 "
Ordinary brake (High leverage)	101.91 "	53.79 "

In the case of these tests a train pipe pressure of 80 lbs. was used, which equalized in the cylinder of the caboose at 65 lbs.



Specimen of Autographic Record of Brake Events in Sauvage Brake Tests.

It was the intention to use the same engine worked by the same crew during all of these trips; but, owing to the floods and the consequent disturbance of the service about the first of September, another engine of the same kind and weight, but with a different braking power, was used on the southbound run September 6, with a loaded, ordinary high-leverage brake. This extra braking power, amounting to about 42 per cent., tended to lower the length of the stops on that day.

The caboose was not equipped with the Sauvage brake. The result is that the pressure registered by the cylinder of that car is

somewhat higher than in the Sauvage cylinders on the balance of the train.

In order to determine just what allowance should be made for this, a standing test was made with the result that the Sauvage brake cylinders equalized at a lower pressure than the single cylinder of the Westinghouse system. The difference in their equalizing pressure amounts to about 10 lbs., that is to say, with a pressure of 65 lbs. in the brake cylinder of the caboose the cylinders of the train would have a pressure of 55 lbs.

In addition it has been found, by means of a dynamometer placed in the pull-rod, that the stress actually transmitted to the brakeshoe is considerably less than that called for by theoretical considerations. This loss of power is due to the frictional resistance of the cylinder packing, the friction of the levers on their pins and the binding of the connections. In all, it amounts to about 22 per cent.

It follows, then, that the actual brakeshoe retarding force is much less than that called for by the theoretical calculations. Consequently, instead of having 188.49 per cent. of the weight of empty and loaded cars in brakshoe pressure, it becomes 147.02 per cent. and 77.68 per cent. respectively.

The travel of the brake cylinder pistons was kept in careful adjustment throughout the whole course of these tests at from 5 in. to 6 in. with the ordinary brake, and from 7 in. to 7.5 in. with the Sauvage brake.

The accompanying engravings show samples of the work transcribed from the original. One shows the time, distance and location marks when running; a second is a copy of the record of the emergency stop made on September 8 near mile-post 164. A third is a short section from the details of the report showing the grade of the road, the location of the mile-posts, the points of brake application, the amount of train pipe reduction and the brake cylinder pressures. The upper set of lines and figures refer to the work of the Sauvage brake with a loaded train on September 8, and the lower lines to the run with a similar test and the ordinary brake with the standard leverage August 31.

The records of the special emergency stops were as follows:

Date.	Brake.	Location at milepost.	Grade, in feet per mile.	Speed per hour.	Time required to stop, in secs.	Distance run after brake application in feet.
Aug. 29.	Sauvage.	151	+ 1.32	42 miles	17.50	713
Aug. 29.	"	113	—59.66	37 "	22.50	708
Sept. 2.	"	163	—74.45	60 "	50.75	2,544
Sept. 2.	"	150	Level.	41 "	31.00	1,073
Sept. 2.	"	113	—59.66	46 "	29.22	1,228
Sept. 2.	"	102	—64.26	44 "	33.30	1,123
Sept. 8.	"	163	—74.45	60 "	42.80	2,114
Sept. 8.	"	150	Level.	44 "	20.80	679
Sept. 8.	"	113	—59.66	44 "	24.10	898
Sept. 8.	"	102	—64.26	45.5 "	28.50	1,050
Sept. 9.	"	189	—66.00	48 "	29.00	858
Sept. 9.	"	150	Level.	48 "	19.40	687
Sept. 9.	"	92	—52.80	52.5 "	31.10	437
Sept. 11.	"	150	Level.	43 "	22.40	787
Sept. 11.	"	92	—52.80	51 "	30.20	1,113
Aug. 31.*	Ordinary	163	—74.45	60 "	77.50	4,496
Aug. 31.*	"	150	Level.	42 "	.....	1,202
Aug. 31.*	"	113	—59.66	38 "	31.20	1,088
Aug. 31.*	"	102	—64.26	45.5 "	51.90	2,099
Sept. 6.†	"	164	—74.45	60.5 "	45.70	2,293
Sept. 6.†	"	113	—59.66	59.5 "	46.50	1,734
Sept. 6.†	"	102	—64.26	47 "	40.00	1,622
Sept. 7.†	"	189	—66.00	52 "	31.20	1,218
Sept. 7.†	"	150	Level.	51 "	28.50	1,117
Sept. 7.†	"	92	—52.80	55 "	43.90	1,733
Sept. 10.†	"	185	—74.97	51 "	42.74	1,920
Sept. 10.†	"	163	—74.45	62 "	62.80	3,176
Sept. 10.†	"	150	Level.	39 "	18.16	729
Sept. 10.†	"	113	—59.66	50.5 "	51.20	1,700
Sept. 10.†	"	102	—64.26	40 "	38.60	1,230
Sept. 12.†	"	185	—74.97	57 "	50.60	2,306
Sept. 12.†	"	161	Level.	57 "	62.20	2,799
Sept. 12.†	"	150	Level.	42 "	37.00	1,033
Sept. 12.†	"	113	—59.66	49.5 "	39.50	1,448
Sept. 12.†	"	102	—64.26	46.5 "	41.10	1,571

*Brakes worked with Standard leverage.
†Brakes worked with High leverage.

In these the ordinary brake was used with the standard leverages on August 31, and with the high leverages on September 6, 7, 10 and 12. The Sauvage brake was worked with the standard leverages at all times except on September 11, when it was attached to the high leverages.

In the comparison of these records a certain amount of grouping is required.

The runs with the Sauvage brake on August 29, September 2 and September 8 may be compared with the high-leverage tests of the ordinary brake on September 6, 10 and 12.

The same runs of the Sauvage brake may be compared with the standard-leverage test of the ordinary brake of August 31.

The run with the Sauvage brake of September 9 may be compared with that of the ordinary high-leverage run of September 7.

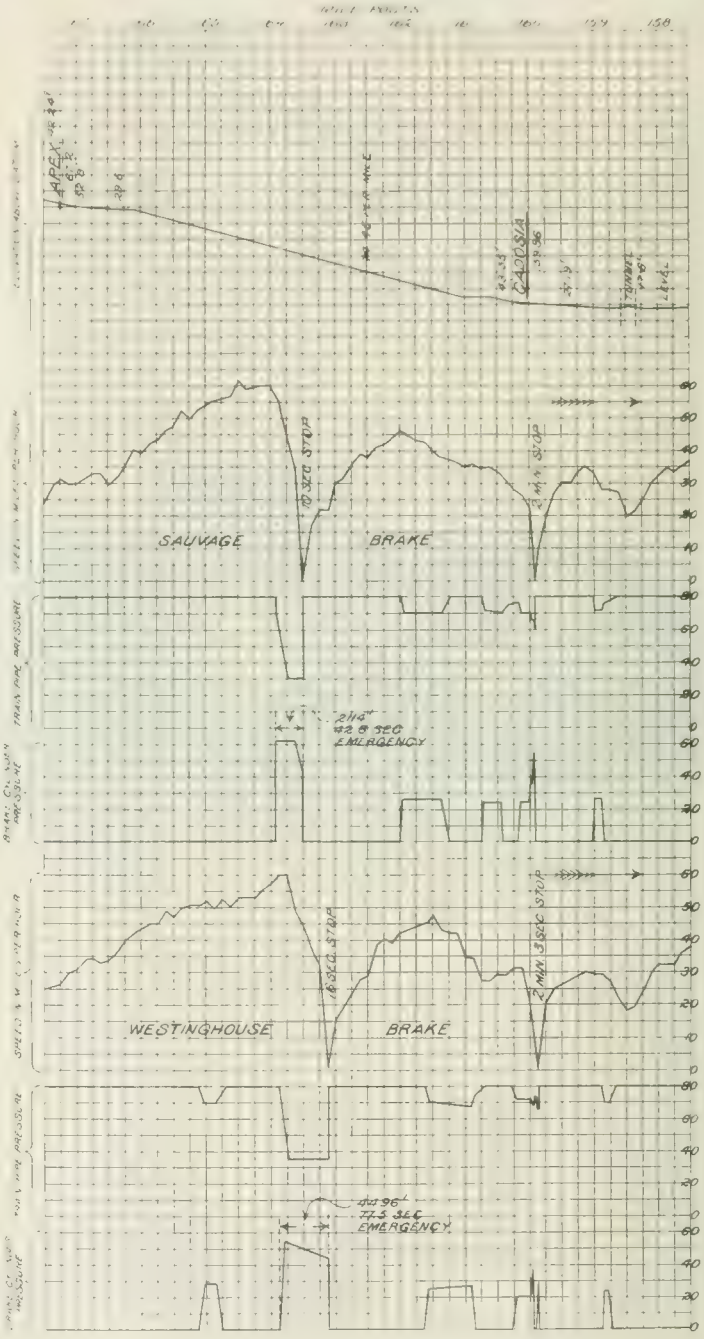
The run with the Sauvage brake, coupled to the high leverages, of September 11, may be compared with the run of the ordinary brake of September 7.

Taking up these tests in detail, it is seen that, grouping the three runs of August 29, September 2 and 8, there were nine emergency stops made from an average speed of 47.68 miles per hour, and that the average length of stop was 1,364.6 ft. The average record for the tests of September 6, 10 and 12 is for speed 50.88 miles per hour and for distance 1,819.3 ft.

This shows a loss of 6.27 per cent. in speed and a reduction of 25 per cent. in distance for the Sauvage brake. If, however, we consider the length of the stop to represent the actual amount of work done, and that this varies with the square of the velocity, it will be found that there is an increase of efficiency of 18.3 per cent.

It must be borne in mind, however, that in this comparison the ordinary brake was working with a leverage that results showed, as will be indicated later, is impractical for regular service work.

If now we compare the runs of August 29 and September 2 and 8 with those of August 31, we have, as before, for the former an



Specimen of Report Diagram of Speed, and Brake Events in Sauvage Brake Tests.

average speed of 47.68 miles per hour, with an average distance of 1,364.6 ft. run after the application of the brakes, while for the run of August 31 the average speed was 46.37 miles per hour and the distance 2,221 ft. This shows an increase of speed for the Sauvage brake of 2.82 per cent., and a decreased average distance of 38.56 per cent. Applying the principle of squares of velocities to this series, we find that the increased efficiency of the Sauvage brake is 43.89 per cent.

This is a fairer comparison on the basis of service work than the preceding one, in that both brakes were operated with the regular leverages that are used in service.

On September 8 and August 31 the conditions of operation were most nearly identical. September 8 was the only trial of the Sauvage brake in which all cars were equipped with it; the weather

conditions were the same, both brakes were working on the standard leverage, and the weights of the two trains, including engine and tender, were 961,600 lbs. for the Sauvage and 1,051,000 lbs. for the ordinary.

Taking up the stops in detail, they were as follows:

Milepost.	Sauvage Speed, miles per hr.	Sauvage Distance in ft.	Ordinary Speed, miles per hr.	Ordinary Distance in ft.
163	60	2,114	60	4,496
150	44	679	42	1,202
113	44	898	38	1,088
102	48	1,050	45.5	2,099

In this there was a saving of distance on the part of the Sauvage brake in actual distance at

Milepost 163....52.98 per cent. Milepost 113....38.45 per cent.
Milepost 150....43.51 per cent. Milepost 102....50.00 per cent.

If we equate on the basis on the squares of the velocities, the saving of distance on the part of the Sauvage brake was at

Milepost 163....52.98 per cent. Milepost 113....17.48 per cent.
Milepost 150....51.09 per cent. Milepost 102....55.06 per cent.

This is an average of 49.39 per cent., with a minimum of 38.45 per cent., from which it seems safe to conclude that, at the same speeds, the Sauvage brake will stop a loaded train in from 40 to 50 per cent. shorter distance than the ordinary. In other words, it will require from 1.66 to 2 times as great a distance in which to stop a train with the ordinary than it will with the Sauvage brake.

The shorter the train, the greater was the distance run. This is quite in accord with the expected in that, with a heavier train fully braked, the unbraked weight of the locomotive forms a smaller percentage of the whole in a long than in a short train. In other words, there is a greater amount of resistance in the train to effect the engine retardation.

The air consumption in these tests was about the same in the case of the two trains. There was a certain varying amount of leakage from the train pipe at all times, and this was a burden that tended to increase the percentage of the brake using the smaller quantity and decrease the proportional difference between the two.

The total number of brake applications in the whole series was 154 for the Sauvage and 172 for the ordinary, or an average of 39.7 for the Sauvage and 38 for the ordinary on the southbound runs and 35 for the Sauvage and 32 for the ordinary on the northbound.

In order to ascertain approximately the air consumption on the two types of brakes when the special and emergency stops were eliminated and nothing but the working service conditions obtained, two runs were made between Norwich and Middletown, 146.95 miles.

The elapsed times between terminals were 6 hrs. 14 min. 15 sec. for the ordinary brake, and 6 hrs. 53 min. 30 sec. for the Sauvage train. Of this 5 hrs. 13 min. 15 sec. and 5 hrs. 40 min. 51 sec. were occupied in running, respectively. The pump stroke counter registered 18,701 strokes for the ordinary brake and 10,558 for the Sauvage train. There were 54 distinct brake applications with the former and 37 with the latter. Taking the averages of the time and amount of train pipe reduction for the runs, they were a reduction of 12.25 lbs. throughout a period of 37.64 minutes for the ordinary and a reduction of 8.73 lbs. for 24.93 minutes for the Sauvage brake. If these are compared on the basis of the products of these two sets of figures, it will be found that the train pipe reductions were but 47.10 per cent. of those used on the ordinary brake train.

The air consumption, with allowances for leakage, amounted to 11,969 strokes of the pump with the ordinary brake and 5,608 strokes with the Sauvage brake, making the latter 46.85 per cent. of the former.

If it is assumed that the cylinder capacities of the engine, tender and passenger car brakes are equivalent to those of five milk cars the relative capacities of the two trains would be as 15 to 14. Dividng the strokes of the pump required for brake applications by these figures and comparing, it will be found that the Sauvage brake required only 50.25 per cent. the amount of air per car in order to do the braking that was required by the ordinary brake.

It is, of course, unsafe to make broad generalizations from single tests, especially where there is a chance for a variation in the handling of the brake and the exigencies of the run; but it does seem fair to state that a loaded train can be handled on a much lower air consumption with the Sauvage than with the air brake as ordinarily applied. Whether this saving will range from 35 to 50 per cent., as these particular runs would seem to indicate, remains to be proven by future use and investigations.

One criticism may, however, be forestalled, and that is regarding the fact that the number of applications were fewer and the periods shorter. Both of these were due to the superior action of the Sauvage brake. Fewer applications were required in order to keep the train under control because a higher speed was permissible on the grades, while the greater efficiency of the brake, when applied, reduced the period during which a brakeshoe pressure on the wheels was required.

There is one final point to which attention should be called, and that is the effect of the two brakes on the wheels. In this the effect of the ordinary brake with the standard leverage may be disregarded. When the cars were worked with the high leverage it was feared that there might be trouble on account of the sliding of the wheels. The engineer was, therefore, instructed to use and did use sand on all of the special stops with the ordinary brake and high-leverage brakes except on those of September 6, and on this day the most serious sliding took place on a clean, dry rail; whereas no sand at all was used on any of the stops with the Sauvage brakes. It is, therefore, evident that the ratio of effectiveness of the Sauvage brake in comparison with the ordinary would have been much greater on all of the comparisons with the exception of that of August 31, had the conditions of application of the brakeshoes to the wheels been the same.

Even as it was, there was a serious amount of flattening according to the railroad reports as the result of these brake applications. In all, 28 pairs of wheels were reported to have flattened with the high-leverage ordinary brake, and but four pair when the Sauvage brake and the high-leverage connections on the test of September 11, and none under current conditions. Since that time no wheels have been flattened in the regular service using the Sauvage brake.

There has been no opportunity to investigate as to the exact reason for this, and a cause can, therefore, merely be suggested.

In the case of an ordinary brake in an emergency application the whole of the brakeshoe pressure is put upon the wheel in the form of a blow. With the Sauvage brake, on the other hand, the regular cylinder takes up all of the slack and puts on a pressure that causes the shoes to adjust themselves to the wheel. Then the second cylinder puts on the extra pressure, which thus takes on the form of static load instead of a blow, with the result that the effect on the wheels is not sufficient to bind and skid them.

The conclusions to be drawn from a consideration of this work is that the Sauvage brake is especially valuable in the case of loaded cars, and the situation may be summed up in the statement that the advantages possessed for the Sauvage brake are not purchased at the expense of any modification in the present equipment that will require a change in the method of operation or the parts in use. The same triple valves, brake cylinders, levers and connections can be used as in the standard equipment. If these are already in position on the car they need not be moved, for the new cylinder can readily be put in position beside or ahead of them, as in the case of the milk cars that have been tested.

The advantages offered by the device are that a brakeshoe pressure proportional to the weight on the wheels can be obtained, and this on about the same consumption of air that obtains for the ordinary brake working on empty car-wheel loads, and that for ordinary handling the air consumption is materially less. In short, it adds efficiency to the present brake without any additional complication and without any change in the standards of construction or operation of that to which railroad employees have been trained.

Railroad Decisions in March.

The following decisions in railroad cases were handed down by the United States Supreme Court and the Federal courts during March:

Effect of discrimination clause of commerce act on railroads authorized to mine and sell coal.—The Interstate Commerce Commission having construed the prohibition of the interstate commerce act against rebates and discrimination to be inapplicable to the freight rates charged by interstate carriers authorized to mine and sell coal by legislation existing at the time of the enactment of the act, and this construction having been long followed in practical execution, will be regarded as read into the interstate commerce act by its re-enactment by Congress without alteration in this particular. But this construction will not avail a carrier not authorized to act in this dual capacity at the time of the enactment of the interstate commerce act, and which buys coal on the market and transports same at a price insufficient to yield its published freight rates after deducting the cost of purchase and delivery. New York, New Haven & Hartford Railroad Co. v. Interstate Commerce Commission. 26 Sup. Ct. Rep. 373.

Exemption from taxation. The antebellum charter of the Cheraw & Darlington attempted to confer a tax exemption privilege on that company. After the war the authorities of South Carolina, in disregard of the provision, assessed the property for taxation and attempted to collect the same. This effort was resisted and culminated in a decision of the Supreme Court of the United States sustaining an injunction against the levy and subsequent proceedings for its enforcement. This decision sustained the validity of the exemption in the charter. The suit was participated in by the State through its Attorney General, and the decision was accepted and respected by the taxing officers of the State until the consolidation of the Cheraw & Darlington with the Atlantic Coast Line terminated the privilege. In 1900 the Legislature passed an act authorizing the levy of back taxes on this property for the ten years before the consolidation, these to be collected from the Atlantic Coast Line. This has resulted in another decision, in which the finality of the earlier decision sustaining the validity of the exemption is asserted,

and this conclusion is supported most strongly by the conduct of the State of South Carolina in its attitude of acquiescence in the decision for more than twenty-five years. Gunter v. Atlantic Coast Line Railroad Co. 26 Sup. Ct. [illegible]

School children's rates.—The Texas statute requiring street railroad companies to issue half-fare tickets to children is held not to impair the obligation of contracts with cities in that State fixing the rates which were entered into after the adoption of a constitutional provision giving the Legislature control of all privileges granted by it or created under its authority. San Antonio Traction Co. v. Altgelt. 26 Sup. Ct. 261.

Conditional right of way deeds. A deed of right of way on the express condition that the railroad company maintain a passenger station and stop certain of its trains at the station to take on passengers, failing in which the land will revert to the grantors, will be taken to merge a previous contract between the parties which did not provide for the reversion, and the railroad company having failed to perform the condition cannot in a court of equity ask to have the deed changed to conform to the prior contract. Gray v. Chicago, Milwaukee & St. Paul Railway Co. 140 Fed. Rep. 337.

Right-of-way contracts.—A contract made by a land owner granting a railroad company "the full and free right of way of the width of fifty feet" through his land and covenanting to execute a deed, when required, conveying the land in fee simple, vests the company with a right of easement only prior to the execution of the deed, and hence a lease by the railroad company of a portion of the land thus held will confer on the lessee no right to enter upon such land to operate for and take away oil and gas therefrom. South Penn Oil Co. v. Calf Creek Oil & Gas Co. 140 Fed. Rep. 507.

Railroad construction contract.—In a contract for railroad construction a provision that "solid rock" shall include "all other material which in the judgment of the engineer cannot be moved without being blasted" will be given a reasonable construction with reference to practical railroad construction; and, thus construed, the term may include material having the characteristics of solid rock, but the blasting of which is not practical, even though it could be removed without blasting. In such a contract a penalty clause is also to be liberally construed. Thus a penalty of $100 a day for delay beyond the time fixed for the completion of the road was held not operative after the railroad company took possession of the road for commercial purposes, though the road was not completed according to contract. Fruin-Bambrick Construction Co. v. Ft. Smith & Western Railway Co. 140 Fed. Rep. 465.

Excessive speed and failure of signals at crossings. A person in full possession of his senses of sight and hearing who deliberately walks upon a track in front of an approaching train in broad daylight at a point where there is an unobstructed view of the track for a quarter to a half mile, is guilty of such a reckless disregard for his own safety that there may be no recovery for his death by being run over at the crossing, though the train is run at an unlawful speed and without sounding the statutory signals. Gipson v. Southern Railway Co. 140 Fed. Rep. 410.

Foreign Railroad Notes.

The International Sleeping Car Co. announces that it will add to its limited trains a "Simplon Express" between Calais and Milan. This train will leave Calais at 2.55 p.m., receiving passengers from the trains leaving London at 11 a.m. It will arrive at 6 the next morning at Lausanne, at 9.55 a.m. at Domodossola, and at 12.35 p.m. at Milan—a considerable reduction of the present shortest time between London and Milan.

The waste of war has sensibly reduced the available rolling stock of the Russian railroads, which was insufficient previously, and the whole country is reported suffering from the inability of the railroads to handle their traffic. Under these circumstances the Minister of Transportation was preparing to order rolling stock from foreign works. The Russian car and locomotive builders protested. Owing to strikes and other disorders they claimed that they were suffering great losses. They interested the Ministry of Commerce and Industry, and on its representations it is said that no orders will be given to foreign works. As the Russian works are of limited capacity, and as the railroads probably need fully double their usual annual requirements, it seems to an outsider as one additional calamity for Russia, though perhaps this is an unavoidable one.

A Reinforced Concrete Elevated Roadway.

The reinforced concrete approach to the viaduct over the tracks of the Chicago, Rock Island & Pacific and the Atchison, Topeka & Santa Fe at Walnut avenue, Oklahoma City, Okla. T., embraces some interesting features. The main part of the structure is on Walnut street. It is 340 ft. in length, of which 112 ft. consists of fill between reinforced concrete retaining walls, the balance being made up of six girder spans of 26 ft. each, two of 25 ft. and one of 22 ft. On Main street joining this at right angles at a point about a third of its length from the tracks is a similar structure, having a total length of 230 ft., consisting of 100 ft. of fill confined by concrete retaining walls and five girder spans of 26 ft. each. Thus it will be seen that the combined approach forms a roughly T-shaped structure one-tenth of a mile long.

The roadway on Main street has a uniform grade of 6 per cent., while on Walnut street a maximum grade of 8 per cent. was found necessary. At the point where the approach joins the viaduct proper the roadway is about 23 ft. above the ground level. The Kahn system of reinforced concrete was used throughout. The roadway is uniformly 24 ft. in width and consists of 4 in. of asphalt pavement laid on a 6-in. concrete slab, reinforced with ½-in. x 1½-in. Kahn bars 10 in. on centers. Bars of the same section 6 ft. long were inverted in the top of the slab over the center girders.



Reinforced Concrete Elevated Roadway at Oklahoma City.

The roadway is carried on three lines of concrete girders 11 ft. apart supported in turn by three rows of columns. Small transverse stiffening beams 20 in. deep connect the girders at the columns and act as transverse bracing. The outside girders are 20 in. x 26 in., the central one is 2 in. deeper. All girders are reinforced with two 1¼ in. x 3¾ in. and two 1 in. x 3 in. Kahn bars the full length of the span and two 1¼ in. x 3¾ in. bars 12 ft. long. Two 1 in. x 3 in. bars are inverted over the columns. In addition, the middle girder has a 1 in. round truscon bar, which is bent up over the supports.

The columns are 20 in. square at the top and are battered one-quarter of an inch in a foot on all sides. They are reinforced with four ¾ in. x 2 in. bars. The railing is also of concrete 6 in. thick, reinforced longitudinally with ½ in. round rods and vertically with ½ in. x 1½ in. bars. Projecting stiffening ribs 6 in. wide placed at 6 ft. 6 in. center to center help to support and stiffen the rail.

Foot passengers mount the structure by means of two reinforced concrete stairways starting beneath the roadway and coming up on either side in the third panel from the viaduct proper,

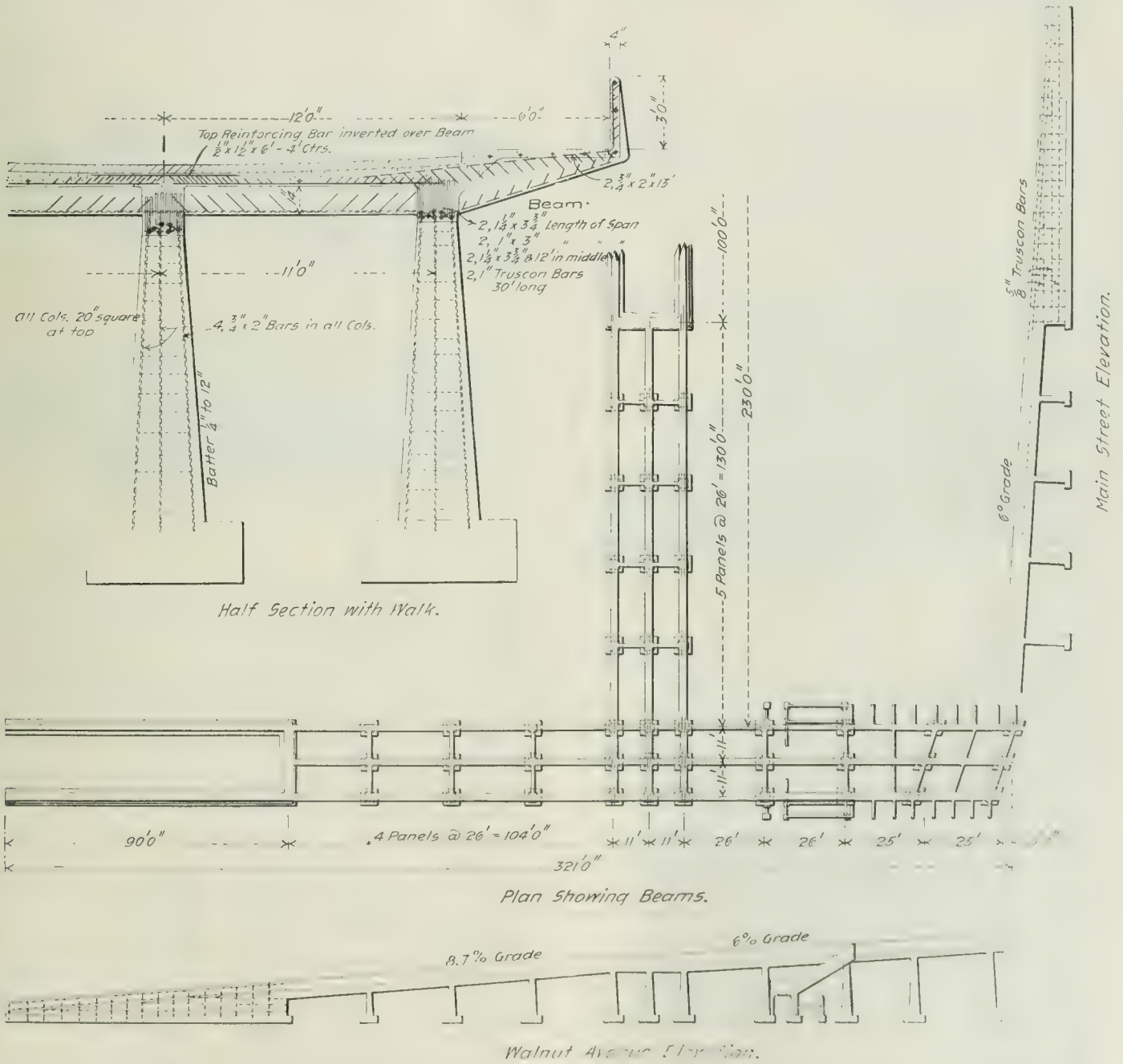
which is reached by 6-ft. sidewalks supported on cantilever brackets placed at 7 ft. centers. These brackets are 10 in. wide and are reinforced with two ¾ in. x 2 in. bars on the tension side and a ½ in. x 1½ in. bar on the compression side. The sidewalk slab is 4 in. thick reinforced with ½ in. x 1½ in. unsheared bars.

The stairs are built with longitudinal strings and a smooth underside. They have a ½ in. x 1½ in. transverse bar in each tread. They are built in three flights, the longer reaching from the roadways to a platform about 7 ft. above the ground; the shorter runs from these platforms to a common landing beneath the roadway, from which a few steps lead to the ground. Separate posts support the platforms.

The retaining walls have the same section as the hand rail above the roadway. Below the street level they widen out with a batter of 1 in. to 1 ft. on the outside and twice as much on the inside.

In the structure there were used 1,200 cu. yds. of concrete and 37 tons of steel. The total cost was $15,600, $3,000 of which was for the asphalt paving. This is less than the estimated cost of a steel structure with wooden flooring and having an approach from Main street only. The asphalt paving was rolled with a nine-ton steam roller and the completed structure tested with a 20-ton moving load without deflection.

The approaches were built under the superintendence of W. C. Bourk, City Engineer, by the John Gilligan Co., of Falls City, Neb., in accordance with plans prepared by the Trussed Concrete Steel Co., of Detroit, Mich. The latter company furnished the steel reinforcement.



Reinforced Concrete Approach and Elevated Roadway Over the Tracks of the Chicago, Rock Island & Pacific and the Atchison, Topeka & Santa Fe at Oklahoma City.

Machine Shop Practice.*

(*Concluded from page 314.*)

The advantages of a motor-driven shop over a belt-driven one are now so universally accepted that no argument is necessary. All the technical magazines have had frequent articles on the special advantages of electrically driven shops toward getting cleaner, better lighted, easier handled shops and it would be but wasting time to repeat the arguments. The electric motor presents the opportunity of obtaining the close variations in speed that are so conducive to economy, and there are many different systems which will give, more or less accurately, the speed changes required. Until quite recently the multi-voltage system of control was undoubtedly the best, but owing to the great improvement or rather specialization of motors this system may probably be replaced entirely by the use of field controlled motors giving wide variations of speed. Although many engineers approve the use of the motor, yet they restrict it to the larger tools, but if it holds good for the larger tools why not also for the smaller? Do not exactly the same arguments hold? The value of the introduction of the motor was the reduction in the cost for labor. If any tool is driven by use of belt driven cone pulleys, what difference does it make in the output of that machine whether the counter-shaft is belt-driven or motor-driven? None whatever. It may readily be proved that for any tool on which variation in speed is required, that the installation

*Paper by G. M. Campbell, read before the Mechanical Section of the Engineers' Society of Western Pennsylvania.

of an individual motor drive with 10 per cent. speed increments will be an economical investment. The time is coming when practically every metal working tool where speed changes or changes in material are required will be, in an up-to-date machine shop, equipped with its own individual motor and at practically the price of the present belted tool. It is usually claimed that a group driven system of motor drive is much cheaper than the individual motor drive, but [illegible] the experience in the shops of the Lake Shore Railroad [illegible] was shown in an exhaustive report by the committee of the Master Mechanics' Association and published in their proceedings for the year 1903. An extract is given herewith.

Cost for Group Driving.

11 group motors	$4,550.00
Wiring 11 motors at $18.30	201.30
Wiring 202½ H. P. at $4.80	972.00
Countershaft, line belt, pulleys, etc.	6,667.00
Belting	3,881.00
	$16,271.30

Estimated Cost for Individual Drive.

103 motors	$12,340.00
Wiring 103 motors at $18.30	1,884.90
Wiring 242½ H. P. at $4.80	1,164.00
	$15,388.90

"This result may seem surprising, but it is even more favorable to the direct-driven estimate than it appears. The roof construction must be appreciably heavier when it is expected to support countershafting than would be the case if simply required to cover the building. Additional members must be incorporated, but this expense we are not in a position to estimate at present. Then no charge is made against belt-driven tools for belt shifters and the cost of applying the belting, which for 103 tools is quite an expense." On the other hand the speaker thinks the estimate for the individual drive is somewhat low both in capacity of motors and cost of wiring. The whole report from which the above extract is taken is an excellent one and worthy of close inspection by anyone interested in shop equipment.

One argument often brought up against the old belt-driven shop was the great waste of power, and the same is brought up against the use of individual motors as against group driving on account of the lower efficiency of small motors, but the argument is not worth considering when the total amount of the power consumed is taken account of. The cost of power is very rarely 2 per cent. of the cost of the output in shops of any size. Suppose by the strictest economy 50 per cent. of the cost of power could be saved, yet the net saving would be only 1 per cent. During the year 1904 the total cost for power at the Pittsburg & Lake Erie shops was slightly over one-half of 1 per cent. of the cost of the labor and material.

Some information concerning the motor equipped shop of the P. & L. E. R. R. at McKees Rocks may be of interest. The shops are compactly situated and consequently direct current could be used to advantage; the voltage in use is 250. For machine work, the multi-voltage system of drive is used and with excellent results. The voltages vary by steps of 40 from 40 to 240, with intermediate and additional steps obtained by means of field resistance. The controllers in use have 21 steps in forward motion, giving approximately 10 per cent. increments. Individual motor drive was carried to a much greater extent than in any shop previously put up, but experience has not shown that any mistake was made in so doing. In the machine shop only one small group of tools is driven from shafting. All the others have individual motors. The tools in the group above referred to are such tools as drill grinders, polishers, bolt threading machines, etc. In the wood working shops, however, group driving is the rule; individual motors are used only on the larger machines; in general in machines of this class no change in speed is required and therefore group driving is entirely satisfactory.

One excellent feature of the electric installation is the entire absence of exposed wiring, and yet every foot of the floor of the big machine and erecting shop, 172 x 530 ft., is accessible. This is accomplished by running a tunnel 3 ft. 6 in. by 4 ft. the full length of the shop, and from it branch ducts 4 x 12 in. from side wall to side wall every 5 ft. 6 in. These latter were made part of the floor and were put in practically without expense. All the wiring in these ducts was put in after the floor was put down, loricated conduit being used.

In order to protect the machine, not the motor, the motor is controlled through a fused switch and also a circuit breaker. Up to date there have been only three cases where the machine gave way, though all the machines have had severe work. The weak parts, chiefly gears, were replaced in these instances by heavier material, and no further trouble is expected. In obtaining speed variation, in a large number of machines it is impossible to obtain it entirely by the motor. Speed ranges of 50, 75 or 100 to 1 are not at all infrequent, such, for example, as changes given by the old triple or quadruple geared lathes. This is, in an electrically driven tool, taken care of by obtaining, say a 3 to 1 variation in the motor and the necessary number of change gears, each increasing the speed in proportion of, say 3½ to 1. A very common method of obtaining these changes is to use sliding or rocking gears. This the writer considers bad design; nothing but clutches should be used, for otherwise it is impossible to change from one gear drive to another except when the machine is idle, and then on the heavier machines only with difficulty, whereas with clutches the change can be made without stopping the machine. In the P. & L. E. R. R. equipment this point was absolutely insisted on despite the severe opposition of every tool maker. Magnetic clutches for the reciprocating tools were not used, as it was considered that the improvement in results would not be sufficient to warrant the expense, and also the clutches at that time were in a state of development. Better results may now be obtained and probably at lower cost.

The complete list of all motors installed numbers 83. This list of motors shows sizes as follows:

No.	Rating.	Total, H. P.	No.	Rating.	Total, H. P.
1	2	2	13	15	195
6	3	18	3	20	60
6	4	24	7	25	175
11	5	55	3	35	105
3	6	18	1	45	45
16	7½	120	1	60	60
1	9	9	—	—	—
10	10	100	83		1,000
1	13	13			

It should be noted that the rating is for full speed and voltage, not the actual horse-power obtainable at all times and not the horse-power required by the machines. The horse-power rating for the variable speed machines would be only 40 to 50 per cent. of the motor rating. The other motors around the plant would add about 450 h.p. and the cranes about 250 h.p., bringing the total motor rating up to about 1,700 h.p. Of the 83 motors, 75 are used for individual drive and eight for group driving; five of these eight being in wood-working shops; 27 are constant speed and 56 variable speed motors. The total cost of these 83 motors was $20,275, or an average cost of $244.50, exclusive of mounting. The same motors could now probably be bought from 15 to 25 per cent. cheaper. The average horse-power of these 83 motors is 12.05.

During the year 1904, the average horse-power taken by all machine tool motors was about 200 during working hours, but all the tools listed above were not in operation. The average power consumption at present is about 300 h.p., or about 30 per cent. of the horse-power rating of the motors. During the year 1904, the average power consumption of the machine tools was 17.3 per cent. of the output of power house; it was 38.71 per cent. of the total electric power; lighting was 24.9, heating motors 23.78 per cent. The electric power consumption of the machine tools including cranes and blast fan was subdivided as follows:

	Per cent.
Variable speed tools	39.71
Constant speed tools	26.80
Blast fans	28.44
Cranes	5.05
Total	100.00

The total cost of power for the machine tools, including the cranes, was $2,662.66; this does not include the maintenance of motors.

In addition to the shops being well equipped with motor-driven tools, there are at present in service seven cranes from 120 ton to 7½ ton capacity. Three more will be added shortly.

The capacity of the power house for electric work is 600 k.w. full load rating, or 750 k.w., with 25 per cent. overload. There is space for one additional generator of 150 k.w. capacity.

The following few items are given concerning speeds of cutting. These are not given as maximum and are not special tests, but are every day practice, as previously stated.

P. & L. E. R. R. Co.—McKees Rocks Shops.
Sample Cutting Speeds.

No.	Machine description.	W't removed lbs. per min.	Speed ft. per min.	Material.	Remarks.
10	Lathe	2.63	106	Cast iron.	
10	"	2.33	44	Steel.	
16½	"	1.69	170	Steel.	
13	"	3.43	43	Steel.	
20	"	4.2	54	Wrought iron.	
14	Wheel lathe	6.3	13.2	Steel.	
23	Wheel lathe	5.3	15.5	Steel.	
51	Planer	3.2	30	Cast steel.	
52	Planer	18.3	29	Cast iron	
62	Sharper	2.03	120	Brass.	60 strokes, min
39	Drill	0.52	74.5	Wrought iron.	1¼-in. drill.
147	Drill	0.88	53.9	Wrought iron.	1¼-in. drill.
33	Boring mill	1.1	59.5	Steel.	

Railroad shops are in general repair shops, so the weight of metal removed is not at all remarkable, compared to many tests which have been reported.

To show the excellent results obtained in the new shops the following figures may be noted. The shops were opened in February, 1904, but were not in full operation until some months later. It, of course, took some time to become used to new conditions, so that results for year 1905 would probably show a higher increase over year 1903.

	1904.	1903.
Locomotives repaired	145	64
Locomotives built	10	None.
New fireboxes	21	5
Cost of labor	$236,871	$216,472
Increase of only	9.5%	...
Credit for outside work	$61,516	$4,800

The force of men is now 25 per cent. more than during 1903,

but the output is very considerably greater. Formerly five to seven locomotives were overhauled per month, now from 14 to 20. Very much of the increase in number is due to the repairing of locomotives for other roads—Erie, Lake Shore, Pennsylvania and Union R. R.

The new shops are considered an excellent investment despite the heavy first cost, and it is estimated that they will have paid for themselves, including first cost and interest, in ten years or less.

The McCord Draft Gear.

A high capacity draft gear embodying an entirely new principle is shown in the accompanying illustrations. It is not a friction gear, and although friction is an unavoidable element of its operation, it is in no way essential thereto. The gear is designed on the theory that the proper way to absorb the shock of a blow is through an elastic medium rather than by means of frictional surfaces, which at the very least require a certain amount of power to operate, the work of which is necessarily transferred to the draft lugs and underframe and absorbed by them. The principle of elastic resistance to shock is accomplished in this gear by simple arrangement of cam-shaped levers acting on the spring as the drawbar moves, the leverage decreasing as the load applied increases. The final result is to increase about 12 times the capacity of the spring, the gear showing an ultimate capacity of about 250,000 lbs. when solid.

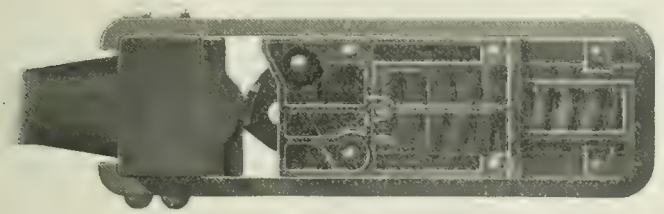


Fig. 1—McCord Draft Gear Showing Position of Lever and Spring When Under no Load.

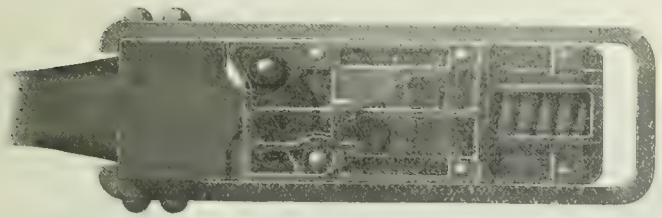


Fig. 2—McCord Draft Gear Showing Position of the Moving Parts Under a Buffing Load of 250,000 lbs.

The best idea of the operation of the device is obtained by conceiving the coupler acting against the spring through a lever, and this connection between the spring and the lever so arranged that as the coupler moves the spring is automatically moved out on the lever until at the end of the coupler movement the spring has gained an increased leverage against the coupler of about 12 to 1. In order to get the device into a more compact and practicable form for application to cars, this single-lever effect is obtained by means of two cam-shaped levers, and the variation of the leverage

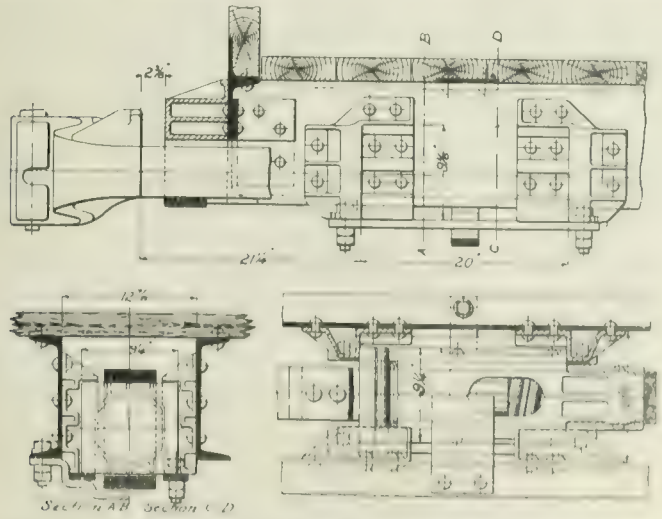


Fig. 5 McCord Draft Gear as Applied to 100,000 lbs. Capacity Steel Car.

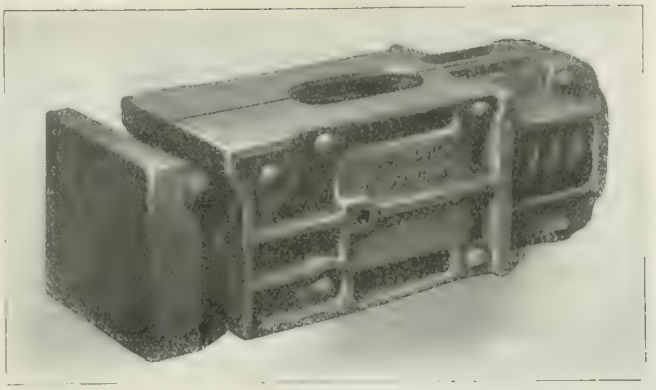


Fig. 3—Perspective View of the McCord Draft Gear.

is secured by shaping these levers so that in rocking one upon the other the leverage is increased in practically the same way.

Reduced to practice the device is extremely simple, consisting of two malleable iron castings forming the casing, a malleable spring cap, two cast-steel levers, a cast-steel front follower and a spring. The shoulders on the malleable casings take the place of a rear follower. The entire device consists, therefore, of six castings, one spring and seven rivets.

Fig. 1 shows the position of the levers and spring of the draft gear assembled in the yoke under no load. Fig. 2 shows the posi-

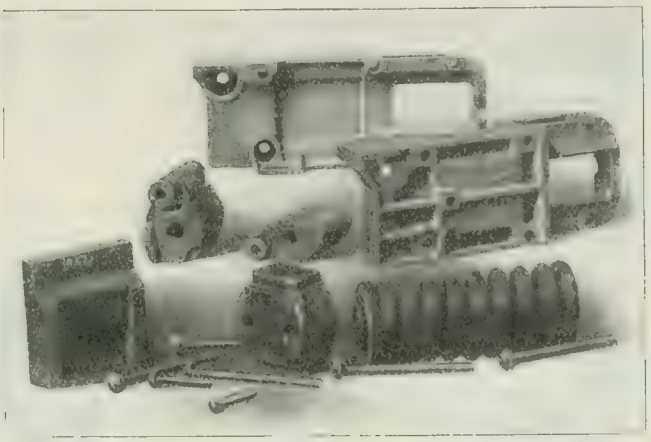


Fig. 4—The McCord Draft Gear Before Assembling.

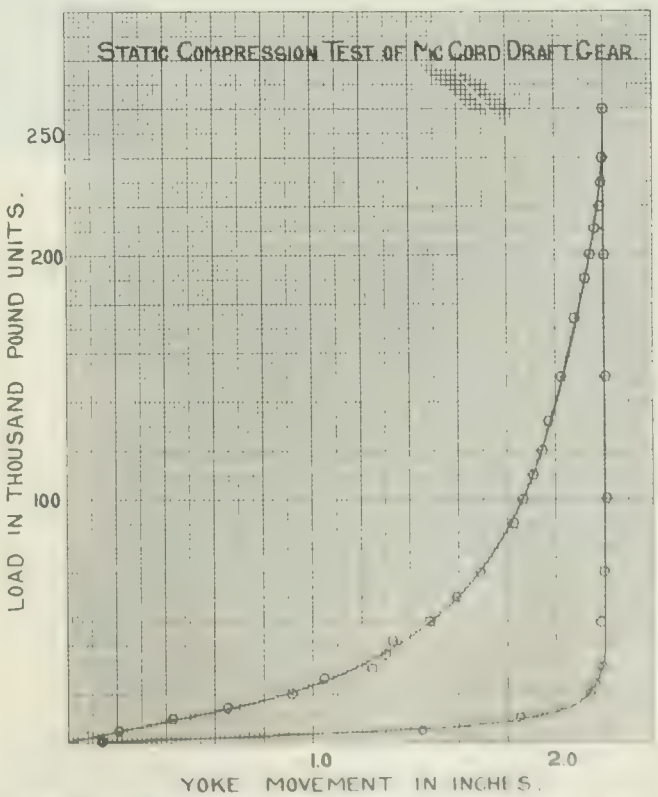


Fig. 6—Diagram Showing the Action of the McCord Draft Gear Under Compression Test.

tion of the moving parts under a buffing load of 250,000 lbs. when the gear becomes solid. Fig. 1 is a perspective view of the draft gear ready to slip into the yoke, and Fig. 4 shows all the parts of the gear before assembling. Fig. 5 is a detail of the application to a 100,000 lbs. capacity steel car. Fig. 6 exhibits the action of the gear under compression test. In this latter, special note should be taken of the relation between the drawbar travel and resistance to load, indicating that ample coupler movement is allowed, to give adequate elasticity to the gear until the load is increased beyond ordinary service conditions and up to present maximum drawbar pulls. After this point is reached the resistance increases very rapidly until the capacity of the gear is exhausted. The release line is almost vertically down to 20,000 lbs. This same vertical release line is obtained at all loads from about 30,000 lbs. up to the capacity of the gear.

Besides the ordinary compression, tension and drop tests, in which this gear is said to have shown as good if not better results than any other, the device has been most thoroughly tested for over two years under the most severe service conditions. The type shown here is suitable for standard steel sill spacing and is interchangeable with many of the high capacity gears now in use.

A special design embodying the same mechanical features, but of 125,000 lbs. capacity, is made, which can be applied to the M. C. B. sill and draft lug spacing for wooden cars.

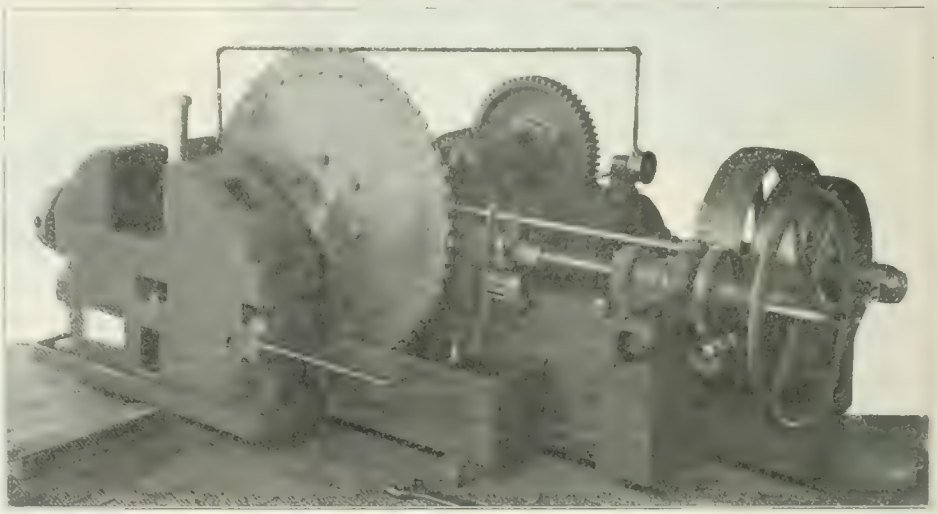
The gear is made by McCord & Company, Chicago, and is called the "McCord" draft gear.

A New Design of Metal Saw.

The High Duty Saw & Tool Co., Eddystone, Pa., has furnished to the American Locomotive Company its latest designed machine for high duty sawing. It is made primarily for sawing 13 in. square, 0.60 carbon steel billets into convenient lengths for forging into locomotive driving axles, but heavy irregular shaped pieces such as forgings and castings can likewise be handled by the machine by the temporary removal of the special appliance fitted to the machine and shown in the illustrations for handling billets. The massive vise, with its supplementary table for the firm holding of the heavy axle billets, is a noticeable feature of the tool. The machine weighs about ten tons. The "Tindel" high duty saw blade with which the machine is equipped is 48 in. in diameter by 5/8 in. in thickness, and has 76 high-speed steel cutters spaced on alternate sides of the blade. The blade cuts to a depth of 16 in. The machine is of high power, with an initial drive of 20 h.p. The bearings of the main driving shaft are provided with phosphor bronze bushings. The spindle is a high carbon steel forging running in a solid tapered phosphor bronze bushed bearing 30 in. long. To insure rigidity the ordinary split bearing is avoided, the arbor seat being cast solid on the carriage. The saddle carrying the spindle has a surface bearing on the bed of the machine of 30 in. by 26 in. and is square locked both front and back. It is gibbed front and back with heavy phosphor bronze taper shoes. Following the "Tindel" system of sawing, no worm gearing is used in the main drive, the power being transmitted entirely through straight gearing. The feed, however, is by roller friction discs transmitted through a worm and worm wheel to a heavy screw engaging in a long bearing bronze nut in the back of the saddle. The friction feed is preferred as it gives a better gradation of feed than can be accomplished through gearing.

The housing and bed plate of the machine are cast in one piece to insure rigidity. This plan also affords opportunity for affixing the massive vise and supplementary table by large bolts so that the utmost rigidity of the holding appliance is obtained, it being of prime importance in high duty sawing that there be no vibration or spring of the material in cutting. Both vise and supplementary table are removable, leaving the bed plate of the machine available for such shapes as steel castings, forgings, etc. It adds much to the effectiveness of high duty sawing to lubricate and keep the saw cutters cool. For this purpose a plentiful supply of drilling compound is pumped in a steady, liberal stream into the kerf by a rotary pump affixed to the machine and operated by a small belt from the main driving shaft.

The machine is designed for a minimum feed of ½ in. per minute up to a maximum of 1¼ in. The periphery speed of the saw blade is in two steps, 35 ft. and 50 ft. p.m. An automatic stop is provided so that the depth of cut can at all times be under the control of the operator. Trials of this machine at the High Duty Saw & Tool Co.'s Works, previous to its shipment, showed a cut of 1 in. per minute on 14 in. square, .50 carbon steel billet, without the slightest strain on the machine.



A New Design of High-Duty Saw.

Prof. Hutton's Resignation.

The following is from the *American Machinist* of April 7.

Prof. F. R. Hutton, Secretary of the American Society of Mechanical Engineers, presented to the council at its meeting in January a letter of resignation, the work connected with the conduct of the society's business having increased to such an extent that it seem to him impracticable to continue to carry the burden along with his work as the head of the department of mechanical engineering of Columbia University. This resignation was not accepted, but action upon it was deferred to give opportunity for conferences with absent members of the council and others. It was later proposed that the services of Professor Hutton be retained for the conduct of meetings and for the performance of other functions for which he has proven his exceptional fitness; the society employing another man to attend to and supervise the detail work of the secretary's office and to be the business manager; this last-mentioned man to have the title of Secretary, and Professor Hutton some such title as Honorary Secretary.

This plan was approved by the council at its meeting of March 27, and a special committee was appointed to select the new man and to rearrange the methods of the office and its personnel, if necessary, in order to institute the new regime. In this way the society may for a long time secure the benefit of Professor Hutton's special skill, ability and experience, while at the same time the aim will be to secure an efficient manager for the society's business and routine work, and one who can give much more time to it than it is possible for Professor Hutton to give. It is generally recognized that in the work of building up the society his services during the 23 years that he has been its secretary have been invaluable, and that for the high position the society occupies to-day its members are very largely indebted to him. Professor Hutton's letter follows:

New York Jan. 29.

To the Council of the American Society of Mechanical Engineers:

Gentlemen:—It may be known to some members of the Council that for several years I have had the thought in mind of resigning the Secretaryship of the Society, on the completion of twenty five years of service. I was first elected in March, 1883. My more recent thought has been that instead of waiting for a merely sentimental period to elapse, which would have meaning to myself alone, I might rather emphasize the more obvious culmination of my service to the Society by withdrawing at the time when the Society shall cross the threshold of its new home in the Engineering Building. It will then have been given to me to have wrought for the Society from the days of small beginnings, when I paid my own office rent and expenses, through the period of rented offices, and of the ownership of the modest home in Thirty first street and up to the opening of the days of larger opportunity in the splendid surroundings of the new enterprise. It is wise, I am sure, that a the time of this external change the Society should also make the internal change incident to securing as its Secretary one who will and can devote his entire time to the work and development of the Society.

It is well known to you that I have felt that I must owe and pay my first allegiance to the work of my professorship in Columbia University.

This being the case, the Council should be advised far enough in advance, so that the least embarrassment may be entailed by my withdrawal. I have therefore thought it best to present this formal letter at the first meeting of the year, and to ask by it that proper action may be taken looking to the question for the future which it raises. I ask that I may be relieved of the duties of the Secretaryship at the end of the current society year, or at such other time thereafter as the Council may see fit to have this resignation take effect.

It would be my wish and preference that no unnecessary or premature publicity be given to the fact of my decision. I seek to avoid having anything like a "fuss" made. (Signed) F. R. HUTTON, Secretary.

On the State Railroads of Baden only 24⅝ per cent. of the passenger earnings were yielded by the sale of simple one-way tickets, while 21 per cent. was due to round trip tickets, and more than 33 per cent. to mileage books.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Missouri Pacific 369
- The Yoakum Railroad Interests 369
- The Paternity of Strikes 370
- Electric Systems for Heavy Railroad Service 370
- The Unjust Seniority Rule 371
- Lake Shore & Michigan Southern 372
- Missouri Pacific 373
- New Publications 373
- Trade Catalogues 373

ILLUSTRATED:
- The Pennsylvania Railroad's Extension to New York and Long Island. 374
- Details of the A. C.-D. C. Locomotives for the N. Y., N. H. & H. R. R. 379
- Effects of a Sleet Storm on Different Types of Third Rail Protection. 384
- Reinforced Concrete Bridges on the Chicago & Eastern Illinois 388
- A Rational Method for the Introduction and Management of Piece Work in Railroad Shops. 391

CONTRIBUTIONS:
- Electric Systems for Heavy Railroad Service. 374

MISCELLANEOUS:
- Per Diem 25 cents. 374
- The Anthracite Coal Strike of 1902. 377
- Some Phases of the Panama Problem... 382
- Railroad Commissioners' Convention at Washington 385
- Mr. Buehring on Seniority 386
- Washington Correspondence 390
- New York City Rapid Transit (G.N.S.). 109
- The Coal Strike (G.N.S.) 110

GENERAL NEWS SECTION:
- Notes 109
- Obituary 111
- Elections and Appointments 112
- Locomotive Building 112
- Car Building 113
- Bridge Building 113
- Railroad Construction 114
- Railroad Corporation News 116

VOL. XL., No. 15. FRIDAY, APRIL 13, 1906.

"Results of operation" and the "condensed balance sheet" failed to fill two pages, one leaf, of the recent Missouri Pacific report. It is somewhat difficult to bind a single leaf in a pamphlet, and it is uneconomical to print a form of less than four pages; but this difficulty has been overcome by a somewhat enlarged record of turbulent Nature's dealings with this property. We are told that the early part of the year "was marked by extremely cold weather and severe snowstorms in January and February." These seasonable incidents were succeeded by rain—which made it bad. We learn, too, that the "appearance of yellow fever in July" was unexpected. The habit of disaster is an acquired taste, and by early autumn the management records that their "unfortunate condition was supplemented by a shortage in the cotton crop," and lightly touches on the fact that "later in the year a renewal of the flood conditions hereinbefore referred to affected your lines." The writer of the report slowly recovers poise and good cheer after these lamentations, and perhaps has read in Tennyson's Ulysses that "Though much is taken, much abides," for the meagre figures show that, although "smitten of God and afflicted," the company almost earned its regular dividend. Indeed, they came so near earning it that they paid it.

> "I loved the garish day, and spite of fears,
> Pride ruled my will; Remember not past years."

But we can't help doing so, and this tale of heroic happenings whets our appetite for the literature in the same company's reports in "past years." We find that in 1903 "during the months of April and May that portion of the states of Missouri, Kansas and Nebraska traversed by the Missouri Pacific Railway was visited by continuous heavy rains." The M. P. management must feel, with Noah, that "water has tasted of sinners ever since the flood." Notice, too, that we are not told that these three states suffered as a whole; the visitation fell upon "that portion traversed by the Missouri Pacific." The inference is obvious: hostile interests, perhaps the Rock Island, have been praying for rain. In 1904 the sun reappeared, only to hide again, as we have seen, in 1905. But this abject submission to the forces of Nature is now a thing of the past. The management has gone to the root of the matter, noted that these disasters occurred only in the odd numbered years, and so has altered their fiscal year to end June 30, completely disabling the arithmetic of the elements, and, like the crew of the "Bolivar,"

> "Euchered God Almighty's storm,
> Bluffed the eternal sea."

The moral, the serious undertaking in this brief mention, is that Nature's behavior in the Southwestern states has been observed recorded, and paid for during many years, so that, with all facts known, the engineer, whose office is to direct the sources of power in Nature for the use and convenience of man, has a comparatively easy problem to solve, if the management tells him to save money in that way.

The "Yoakum System" is coming to be more and more often commonly spoken of as though under this name there were as distinct a group of railroads as those controlled by Mr. Harriman or Mr. Hill. The growing prominence of Mr. B. F. Yoakum in the railroad world is one of the noteworthy signs of the times, particularly in the railroad development of the Southwest. Since 1904 Mr. Yoakum, previously President, has been Chairman of the Executive Committee of the St. Louis & San Francisco. Last December, on the rearrangement of offices due to the retirement of Mr. Leeds from participation in Rock Island affairs, he was made Chairman of the same Committee of the Chicago, Rock Island & Pacific Railway. In these two positions he directs a combined system of something over 14,000 miles of line, a group which, although not confined to that section of the country, essentially belongs to the Southwest. There is another road in which Mr. Yoakum is a not unimportant director—the Colorado & Southern—which, with its Fort Worth & Denver City line, reaches from Denver southeast into Texas as far as Fort Worth, where it connects with both the Rock Island and the Frisco Systems. The other important line already in operation in which Mr. Yoakum is interested is the St Louis, Brownsville & Mexico, which has track laid from Brownsville at the extreme southernmost point of Texas, north along the coast to within less than 50 miles of Houston and Galveston. Of this road Mr. Yoakum is President. At least two other roads of which Mr. Yoakum is more or less completely in control are aiming at Houston and Galveston. From the east the Colorado Southern, New Orleans & Pacific is already at work on a New Orleans-Houston line paralleling the Southern Pacific. The new company expects to have trackage rights over the Yazoo & Mississippi Valley from New Orleans to Baton Rouge, to build from Baton Rouge west to a point on the Kansas City Southern, 17 miles of which into Beaumont is to be used under trackage rights, and after using the present line, improved, of the Beaumont, Sour Lake & Western for a short distance west of Beaumont to build over the remaining distance into Houston. It has this month sold $7,500,000 notes to obtain funds for construction. From the north, the Colorado & Southern's extension to the Gulf also has

Houston and Galveston as its objective points. Bonds to the amount of $100,000,000 have been authorized, and of this amount $17,000,000 issued and sold to finance this and other extensions. The Trinity & Brazos Valley, a 77-mile road in Texas, has been bought, and is to be used as part of the new line. On completion of the Fort Worth-Houston line a Gulf outlet may be provided, not only for the Colorado & Southern, but for the Rock Island and Frisco Systems as well, each of which already runs into Fort Worth, and has long looked toward Galveston with envious eyes. Thus all the railroads with which Mr. Yoakum is identified seem to be converging on the most important Gulf outlet in Texas through Houston and Galveston. At the same time, both the Frisco and the Rock Island are reaching south toward New Orleans. The Frisco already gets to this, the most important Gulf port, by trackage rights over the Mobile & Ohio. In New Orleans it shares with the Southern Railway, ownership of the New Orleans Terminal Company, which is building large terminal accommodations for these roads. South from Little Rock, Ark., the Rock Island has nearly completed a connection with the recently purchased Arkansas Southern, which, with a southern extension already built, brings it into Louisiana to within 250 miles of New Orleans. These are accomplished facts. There is also news of other plans under the direct leadership of Mr. Yoakum. These include the acquiring and connecting up of various short local lines in Texas and the establishing of a shorter Rock Island line into Mexico. In accomplishing the latter object the St. Louis, Brownsville & Mexico is to be used. Once the Rock Island and Frisco reach Houston and Galveston, this road, its extensions to those cities completed, would bring them to the mouth of the Rio Grande river. Across the river from Brownsville is Matamoras, the terminus of the Matamoras branch (lately made standard gage) of the National Railroad of Mexico, over which the Rock Island would have a connection to Mexico City some 800 miles shorter than its present connection via El Paso and the Mexican Central. If the St. Louis, Brownsville & Mexico should carry out its reported plan for a line of its own across the Rio Grande river at Brownsville and south along the east coast of Mexico, at present unoccupied by a railroad, to Tampico, and eventually southwest to Mexico City, a large additional amount of distance would be saved. This may be far in the future, but it seems highly probable that connection will soon be established with Mexico by way of Brownsville. Some of these developments, no doubt, are considerably in advance of Mr. Yoakum's present plans, but taking into account only those which are definitely decided on, it is no wonder that the Rock Island and Frisco Chairman is coming to be credited with headship of a system of his own. If he is soon to control allied railroads connecting Chicago with the Gulf, Chicago with Colorado, Colorado with Galveston and Galveston with New Orleans, together with a new short line into Mexico and a more extensive system of intermediate feeders and connecting lines even than at present included in his two largest railroads, the "Yoakum system," will be a very definite reality.

THE PATERNITY OF STRIKES.

A short story of the anthracite coal strike of 1902 is told in another column by Dr. Warne, who watched and studied closely its incidents as they occurred at the time. It is printed now "lest we forget" what then occurred, and the basic principles which were violated both in the beginning of the strike and in the interference, improper in form, which led to the appointment of the commission. In this land of liberty every man should conduct his business lawfully, and he is entitled to the protection of the law. It is axiomatic that a strike is inseparable from violence and lawlessness. It should not be so, for a strike is a lawful undertaking; but ignorant human nature is such that until that time when the public recognizes the necessity for the immediate protection of property and life when a great strike is ordered, there is certain to follow a period of killing, wounding, boycotting and destruction.

The report of the Anthracite Coal Strike Commission clearly shows and the data in its appendices confirm the fact that if the authorities of the State of Pennsylvania had simply enforced existing laws and had taken the necessary precautions at the beginning of the strike, when violence was inevitable, that a result better and more enduring, alike for the men, the operators and the public, would have been secured. It is easy to say that employees are at the mercy of their employers, but it is quite equally true that the employers are at the mercy of their employees—sustained, supported and protected by all lawful means, as workmen nearly always are, by the communities, by the state and by the national government. The control of corporations by either the national government or by the states is complete. It needs simply to be rationally enforced, but not enforced in a way to harass or destroy the usefulness of these corporations. The public lends a quick ear of sympathy to oppressed employees, and when such oppressions are presented at court or to legislative bodies, or even in the newspapers, the remedy comes as quickly, and probably more quickly, than it does to employers when they are treated with like injustice.

The commission supplemented its decision in declining to make an award "which would compel an agreement by the operators with the United Mine Workers of America" by a considerable discourse, making it clear that here a principle was involved; and the commission made its awards on the several questions at issue between the several operators and "their respective employees, whether the latter belonged to a union or not." Award No. 11 is as follows:

> "That no person shall be refused employment, or in any way discriminated against, on account of membership or non-membership in any labor organization; and that there shall be no discrimination against, or interference with, any employee who is not a member of any labor organization by members of such organization."

The arrogance of the leaders, who are primarily agitators, of the United Mine Workers of America is shown by their quick departure in the beginning of the present negotiation, not simply from the rules of procedure and methods of conciliation provided by the commission, but from the principles made clear in the above quotations. They demand not simply a recognition of their union as a party to the contract, but also demand that the employers of labor in the anthracite coal region shall arbitrarily deduct from the wages of employees the amount of the dues of each individual as a member of the union and pay the gross sum over to the treasurer of the union. It is as if one nation in hostile relations with another nation should be compelled in intervals of peace to aid in placing the bonds to secure the money to pay the costs of the other nation's warlike preparations.

Looking back over the record of many employer and employee struggles, and especially the strike of 1902 in the anthracite region, it seems difficult to come to any other conclusion than that the interference by the President of the United States was harmful. This is a republic—a government by the people. Tyranny is abhorrent. Paternal government is distasteful. This is the United States of America; it is not Russia. We have no "White Czar." We must learn, and we are learning, to govern ourselves—to settle our own individual disputes either privately or in the courts of law. That habit of mind which leads individuals or associations of individuals to go beyond the law is like Bret Harte's men in pursuit of some murder suspects. One of them says: "We have no warrant." The leader says: "We have five good men, and don't need no damn warrant." It is also shown in another less crude but, as we believe, more dangerous form in overlooking the municipalities and the courts and appealing directly to the President of the United States for interference in the constituted order. It is dangerous, weak, unmanly and infantile.

ELECTRIC SYSTEMS FOR HEAVY RAILROAD SERVICE.

The letter in another column from Mr. Wilgus is one of several reasons for returning to this subject, which was editorially discussed two weeks ago. We then simply undertook to summarize the more important arguments and facts contained in the long papers presented before the New York Railroad Club, so as to make them available by non-technical railroad officers. This necessarily resulted in calling attention to apparently conflicting statements, but it should be borne in mind that Mr. Wilgus was induced to contribute to the discussion by the highest motives—that of giving to railroad officers a summary of the results of his long study for a safe and reliable electric traction system under the governing conditions existing on his own road.

In substituting electric for steam traction on a busy line it would be reckless to use other than "well-tried apparatus that has passed beyond the experimental stage." Mr. Wilgus' protected, under-contact, conductor rail "has been in actual use near Schenectady, both experimentally and otherwise, for nearly a year under the most severe conditions in temperature changes, snow and sleet storms, and actual operation of both steam and electric equipment." Its successful operation in a sleet storm is described in another column. If, in its severe trial, all kinds of equipment which is to be used have passed safely over this experimental installation, then it may fairly be said that the under-contact conductor has passed beyond the experimental stage and is "well tried." We do not mean to

question it, if in this year of trial of this conductor rail all the working conditions of a great railroad, including a position of safe clearance, were met. It was not accepted by the engineers of the other Eastern roads who were called in conference during the past year to try to standardize the position of conductor rails, but we understood at the time that among the objections were novelty, height and consequent reduction of clearance, and the mechanical difficulties of under contact, which have been overcome.

This seems to be the proper place to say that the editorial referred to contained one inexcusably careless sentence. No "holocaust" has been reported to have been caused by a derailment and contact of the car body with the conductor rail; and yet no one will deny that the conditions are ripe for it. The sentence should have been a more careful reference to the train burnings caused by short-circuiting in the Mersey tunnel in December, 1902, in the Paris Metropolitan, August, 1903, and in the New York subway in March, 1905. The causes are alike, and the result is the same as may be expected to come from a wreck driven over a conductor rail.

Of losses of life, due to the conductor rail, by employees and trespassers no record is available in this country. In England, on the small number of electrified miles of the Northeastern and the Lancashire & Yorkshire railways, these were, in 1904, seven killed and eight injured trespassers, and one killed and twelve injured employees and "persons on business." This total of about one man for each two miles of road per year occurred on lines much more carefully hedged and patrolled than are American roads. Nevertheless, we should not exaggerate this danger, for these losses should decrease year by year, and also have a recompense of less trespassing with its attendant dangers.

Through bridges for trains or overhead trusses for signals or single-phase current wires have a degree of danger, and Mr. Wilgus gives some facts. On four-track roads the signal trusses and enough additional trusses to make intervals of 300 ft. are to carry the a.c. wires, and by so much increase the number of supporting columns to be hit by derailed trains. On double-track lines, with the same number of columns to be hit, but without overhead trusses, losses and delays by these unusual accidents would presumably be less serious. In yards it has commonly been assumed that overhead construction for the d.c. system is necessary. It has not yet, we believe, been fully worked out, but a certain amount of this overhead work will apparently be needed in complicated yards where electric locomotives are used, although not necessary with multiple unit trains only. There are surely more derailments in yards than on equal mileage of main line, so that this necessity—if it proves to be a necessity—for overhead trusses for the d.c. system in the yards tends by so much to even up the comparative dangers. It is worth while to refer again to the record, published in the *Railroad Gazette*, for May 12, 1905, page 475, of safe high-speed trolley schedules. The conditions vary somewhat from those which will prevail on electrified steam roads; nevertheless, the record is indicative.

A considerable study has been made in England and data obtained which indicate that the quantity of coal needed for a unit of transportation work is quite nearly alike for the steam locomotive and for either of the electric systems under consideration, under certain assumed conditions. Power-house coal costs less per ton than locomotive coal.

The sum of it is that the killing power of the electric current adds something to the dangers of heavy and high speed traction, although there should be some offset to this because of the elimination of smoke from yards and tunnels, but the theorists do not agree on the comparative dangers of the two electric systems; and, further, electric traction eliminates some of the dangers and most of the nuisances of the steam locomotive; but, still further, the steam locomotive will, as far as we can see in the future, be the more economical where the bulk of the transportation is done within a few hours of each day.

THE UNJUST SENIORITY RULE.

Mr. Buehring's ideas are printed in this issue, not with the notion that any officer may accept them prescriptively, but because they are suggestive.

Nothing is more obvious than the frequent injustice of the seniority rule. Not only does the service suffer from inefficient men, and from the discouraging effect of the rule on bright and energetic men whom it keeps down; the senior man himself often secures less ultimate happiness than if he had known enough to stay on the level for which he was fitted. Superintendents see the absurdity of promoting an inferior man of long service instead of the best man with a shorter time of service, and some have the courage to choose by merit, with the occasional result of being charged with favoritism. Mr. Buehring thinks that the reason for this apparent favoritism can be formulated and recorded, and, if necessary, promulgated.

He proposes a record of merits. The bane of our disciplinary records is that they deal so largely in demerits—in emphasizing what is wrong. We dogmatize to each other about the need of turning the matter around the other way and emphasizing good conduct instead of bad, but we don't make much headway in actually turning it. Every road's rules for the Brown system provide for marking merits for heroism and other unusual things, but they are unusual and have little effect on everyday practice. We must find some way to commend men oftener if we are to expect the practice to work any general benefit to the service. Mr. Buehring himself seems to be afraid of the idea, and he gives the reader little help in applying it. Those roads which write an employee a letter at the end of a year telling him that his 12 months' undisturbed record has effaced a previous record of demerits, go part way in solving the problem, and we hear nothing but praise of that system; but more is needed. Commendatory letters to men who have no sins to be washed away are good.

Mr. Buehring desires to have merits so recorded that they can be measured, and different men's records compared. In spite of its difficulties, this seems worth trying. We already weigh and compare men in our minds, and may perhaps do it better and more defensibly from the pages of a book. The objection to commending men for known merit is (1) fear that we may afterward overlook a merit or demerit, and so leave an unjust record on the book, or (2) that when we are obliged subsequently to censure we shall give the impression that the commendation has been revoked. But the remedy for this is simple if we apply Sir George Findlay's prescription for all troubles between employer and employee: "Have a good understanding." Talk with the aggrieved, and get an understanding. This takes time, but it is the rational way, and no one has devised for the railroad service any better way. The bigness of the railroads is a chief reason why discipline is less satisfactory than it was in the day of smaller things, when the real commanding officer was more nearly in touch with the men. Let us admit with equal frankness the corollary of this, that the superintendent is bound (1) to get from his manager the limit of authority of, say, 30 years ago, and (2) to keep in touch with his men. The first part of this requirement implies a campaign; but may not the employees on a big road rightfully expect their 5, 10 or 20 division superintendents to be men of large size, and expect them to co-operate with each other in magnifying the importance of their offices until the general management takes the action necessary to convert them individually into vital connecting links between the owners and the workmen? And the second part, if you have a large number of men, means that you must have two or three high-grade assistants—men nearly as competent as yourself. It is a long campaign that Mr. Buehring's suggestions call for, and better salaries.

But though it would be a fine thing to know your men so well, to so enlighten them by your counsel, and to so hold their confidence that you could have the courage to promote B, a 90 per cent. man, instead of A, a 75 per cent. man, even when A is three years ahead on the list, we must admit the difficulties. Mr. Buehring stipulates that each man's record must be fairly kept, and no tyrannous superintendent allowed to do any injustice. The scheme outlined cannot be carried out in a day. For the present the tyrannical superintendent must keep his own "fair" records. Again, even the superintendent who is not a tyrant must exercise his own fallible judgment; can he ever make the records of 50 or 100 men such that they will stand scrutiny? If credits are given for efficient service as a passenger conductor or brakeman or ticket seller, men who are born polite will quickly knock out seniority. They will easily put themselves five years ahead of other men who are efficient except in suavity. Mr. Buehring assumes that all the men will measure up to a reasonable standard of courtesy. But it is not safe to so assume. There is no satisfactory standard of courtesy except the highest.

Dealing with a crew as a unit is also bothersome. The conductor and engineman who run together but do not get along well with each other cannot easily be changed around to run with more congenial men.

To praise a man only when you can praise him wholly, and under an implied bond never afterward to censure him, is like waiting to send flowers to his funeral. To put in writing these things which we have become accustomed to note and forget will at first be difficult, and will often seem absurd. After making an elab

orate list, report or estimate, it may sometimes be necessary to throw the whole record aside and decide the case in hand by rule of thumb that is, on grounds which you do not formulate, much less divulge. But a little trouble of this kind affords no justification for giving up. Freight traffic managers had long held that they could not formulate the reasons for raising or lowering freight rates; but Interstate Commissioner Prouty, working at $625 a month, quickly showed them how to classify thoughts and philosophize concerning reasons, even when dealing with such small matters as rates on shoe-blacking daubers c.l., X-ray apparatus n.o.s., and leather scraps k.d. Commissioner Prouty has set a good example to superintendents.

Lake Shore & Michigan Southern.

The Lake Shore & Michigan Southern is an example of an exceedingly well situated and prosperous railroad which is controlled by another company and, owing to this control, is enabled to regularly spend very large sums out of earnings for the improvement of the road. It was in 1898 that the New York Central's purchase of majority control was made and all but a little over four of the fifty millions stock exchanged for twice its face value in 3½ per cent. collateral bonds of the New York Central. Stockholders who held aloof from this arrangement, although they have received only a small proportion of the actual earnings on the stock since that time, have fared better than those who made the exchange, for holders of the convertible bonds are getting 7 per cent. on the amount capital stock and funded debt. During the next 16 years the capitalization per mile of line was actually reduced, being in 1885, $72,735; in 1890, $66,447, and in 1895, $65,810. In 1893 the figure was $70,830, but this apparent increase was offset by the fact that refunding had lowered interest rates on bonds. At present the capitalization amounts to $50,000,000 stock (of which $533,500 is guaranteed 10 per cent. stock), and $101,324,000 bonds. The bonds are gold mortgage 3½ per cents. and gold 4 per cents.—each a $50,000,000 issue—and $1,324,000 in bonds of other roads assumed by the company, $924,000 of which, in Detroit, Monroe & Toledo 7 per cents., mature on August 1st. The company's present capitalization, then, per mile of main track is $32,895 stock and $66,660 bonds, a total of $99,555 per mile. There could hardly be a more striking way of showing how low this capitalization is for a splendid railroad like the Lake Shore with its 312 miles of second track, 129 miles of third track and 73 miles of fourth track, than by mentioning the fact that the New York, Chicago & St. Louis, its weak brother, with its total of 6.24 miles of second track, is capitalized at $60,640 stock and $38,490 bonds per mile, a total of $99,130 per mile; only $425 a mile less than the capitalization of the Lake Shore & Michigan Southern.

The Lake Shore is the great Vanderbilt holding company. During the year its holdings of the $36,300,000 outstanding stock of the Cleveland, Cincinnati, Chicago & St. Louis (Big Four) were increased from $11,224,000 to $18,752,700, and the remaining $127,400 Indiana, Illinois & Iowa stock was acquired, making the Lake Shore owner of the total issue of this road. One-half the capital stock of the Indiana Harbor Railroad, a connecting line



Lake Shore & Michigan Southern.

of their old stock, while 8 per cent. is now being paid on Lake Shore stock. As against this rate of 8 per cent., which is paid both on the $45,289,200 stock held by the New York Central, and the $4,177,300 still in the hands of the public, earnings for the year ended Dec. 31, 1905, were equal to more than 23 per cent. on the entire issue of $49,466,500. Here, to a certain extent, is an example of the "freezing out" process by the company which owns majority control; but, on the other hand, the fact that so large a proportion of the stockholders were willing to make the exchange in 1898 shows that this increased value came as unexpectedly as the rest of the fortune-making rises in value of standard railroad stocks during the last decade.

The difference between the 8 per cent. paid and the much larger rates earned in recent years has either been expended on the road itself or used to increase the Lake Shore's holdings of other companies' securities. Included in expenses of operation in the report for 1905 are two items, one of $3,743,020 for new construction (addition betterments) and the other of $3,360,773 for additions to equipment—a total of $7,103,793 spent out of income for returns properly chargeable to capital. This was in addition to such liberal regular maintenance expenses as $2,875 a mile for maintenance of way, and for equipment repairs and renewals, $2,270 per locomotive, $1,006 per passenger car, and $74 per freight car. Adding together the construction expenditures for addition betterments, which amounted to $2,463 per mile, and the maintenance of way expenses, total expenditures on the line, out of income, amounted to $5,338 for each mile of main track, a very remarkable figure for any railroad.

These habitual expenditures out of income have naturally resulted in keeping down the capitalization of the company. As long ago as 1879 the road was capitalized at $74,289 per mile, including recently completed south from the lake shore near Chicago to Danville, Ill., this year for the first time appears in the list of securities owned. It was announced last week that these two companies, the I., I. & I. and the Indiana Harbor, are to be merged under the title of the Chicago, Indiana & Southern. Besides these purchases, the Lake Shore increased its holdings of securities of various other subsidiary companies.

Naturally, from its position as the most important Vanderbilt line west of Buffalo, results for the past year shared conspicuously in the general prosperity in trunk line territory. In 1902 $30,000,000 and a year ago $35,000,000 were record figures for gross earnings. This year there were gross earnings of $38,600,000, an increase of more than $3,400,000 over 1904. Of this increase, $2,800,000 was contributed by the freight earnings, largely due to the unusually heavy westbound movement of merchandise and by a total increase of 4,152,736 tons in "products of mines" tonnage, principally in ores. Regular expenses of operation increased $2,600,000, and addition betterments $1,546,500 more; a total of over $4,000,000 increase in expenses of operation. The larger amounts spent on addition betterments make the nominal net earnings a decrease of $700,000 from the preceding year. In reality net earnings showed an increase of over $800,000. Fixed charges increased $230,000, due to the sale of additional gold bonds during the year and to increased payments on account of leased lines; but income from investments covered this three times over, with an increase of $947,693. After all payments, including dividends, there was a surplus for the year of $510,600, from which $279,700 was written off to cover sundry uncollectable charges, discounts on bonds sold, etc., leaving a balance of $230,900 to be added to the profit and loss balance of the previous year, raising it to $17,118,973. In reality the resultant figures of

the income account are purely arbitrary, as they depend entirely upon the amounts spent for addition betterments, etc.—outlays which no ordinary railroad would include in its income showing.

Passenger earnings were $7,675,938, an increase of $436,042 over 1904. This does not include mail and express earnings, which amounted to $3,317,864, an increase of $120,643 over the previous year. The sum of passenger, mail and express earnings was $10,993,802, or $7,231 per mile, $10 per mile more than the sum of all earnings on such a road as the Chicago, Milwaukee & St. Paul last year. The size of the mail and express business shows clearly enough the importance of the Lake Shore as a link in the country's transportation system, and the extent to which fast mail and express are routed over this line. There were 6,545,616 passengers carried and 369,901,000 carried one mile. This is an increase of 21,503,851 passenger miles over the preceding year. The average passenger was carried 56½ miles and the average train carried 53 passengers.

There were 35,181,074 tons of freight carried, an increase of 6,126,779 tons. The ton miles were 5,382,839,643, an increase of 562,527,979, which is certainly a striking figure of gain. The ton-mile rate was 0.520 cent, a decrease of 0.002 cent from the preceding year. Earnings per freight train mile were $3.22 and per mile of road $17,752, an increase of $1,116 in freight earnings per mile of road. The passenger density was 243,300 passengers one mile per mile of road and the freight density 3,540,527 tons one mile per mile of road.

Of the total of 32,314,514 tons of revenue freight carried, the largest single items are: Grain, 1,886,214 tons; live stock, dressed meat and other packing house products, 748,593 tons; anthracite coal, 1,217,820; bituminous coal, 6,970,313; coke, 1,034,859; ores, 4,919,489; stone, sand, etc., 4,795,173; bar and sheet metal, 1,129,709; other manufactures, 1,982,931, and miscellaneous, 1,279,961 tons. The combined tonnage of manufactures and miscellaneous commodities was 8,098,692 tons. In view of this substantial proportion of high-grade tonnage (25 per cent.), it is very remarkable to find so large a train load as the Lake Shore is able to show. For the past year the revenue train load was 620 tons and, including company freight, 654 tons, the former an increase of 31 and the latter of 37 tons over the previous year. This showing is highly significant when we consider that out of a total of 1,520 miles, 980 miles are not main line, and that the past year's increase has been accomplished along with a largely increased movement of high grade freight.

The gains in earnings were reflected in increased maintenance expenditures. Maintenance of way cost $2,875 a mile against $2,159 in 1904, an increase of $716 a mile. Repairs of locomotives per locomotive were $2,270, an increase of $116 over 1904. Repairs of passenger cars ($1,006) increased $191 over 1904. Repairs of freight cars is the only item which shows a decrease, being $74 per car against $76 in 1904. The expenditure of $3,360,000 for additions to equipment appearing in income account was independent of charges to maintenance for renewals, on which there was spent $396,954 for locomotives and $845,689 for freight cars. Figures for renewals are included in the item "repairs" used in obtaining the unit charges for maintenance of equipment.

During the present year the four-tracking of the road is being continued and further extensive improvements made, the eventual plan being undoubtedly to have a four-tracked road from Buffalo to Chicago. The splendid condition of the road and the efficiency of its operation as illustrated in the train load figures are exceptional, especially in view of the fact that they have been accomplished with such low capitalization. The Lake Shore as it stands to-day is a wonderfully valuable and efficient property and forms one of the chief assets of the New York Central system of railroads.

The principal statistics of operation follow:

	1905	1904.
Mileage worked	1,520	1,454
Freight earnings	$26,989,655	$24,185,294
Passenger earnings	7,675,938	7,239,896
Express earnings	1,032,058	920,646
Mail earnings	2,285,807	2,276,575
Gross earnings	38,600,810	35,161,053
Maint. way and structures	4,369,542	3,281,901
Maint. of equipment	4,944,965	4,340,250
Conducting transportation	14,292,416	13,182,788
Operating expenses	24,227,715	21,627,046
Addition betterments	7,103,791	5,557,281
Total expenses	31,331,508	27,184,281
Net earnings	7,269,302	7,976,772
Gross income	10,787,965	10,547,742
Net income	4,467,965	4,457,742

Missouri Pacific.

It has been generally known that the Missouri Pacific was unfortunate during the past year and stockholders have consequently awaited with interest a full detailed report covering the fiscal and calendar year 1905. Instead of such an informing document, the company has recently issued a four-page pamphlet, which contains separate statements for the two six-month periods in the year. These show only the totals of gross earnings, operating expenses, net earnings, other income, fixed charges, sundry charges, dividends and surplus. No corresponding figures for the previous year are given, which makes comparisons inconvenient. There are condensed balance sheets of the Missouri Pacific and of the St. Louis, Iron Mountain & Southern; the rest of the space being taken up with a summary of the physical conditions that worked against the road, which included floods, yellow fever and a shortage of the cotton crop, a paragraph devoted to the new Thebes bridge, and the announcement of a change in the fiscal year, which is in future to end on June 30 instead of on December 31. This does not explain why the company did not do as other companies in the same situation have done; that is, issue in the spring a full annual report covering the whole year ended December 31, and later an equally detailed report for the six months ended June 30. It is hard to explain the policy in thus withholding from the shareholders, for six months' information which is of vital interest to them and which, of course, is in the hands of the management. Further, if the announcement is to be taken literally, stockholders will never get detailed figures for the six months ended June 30, 1905, since the President says: "Hereafter the annual reports of the company for distribution to the stockholders will cover fiscal years ending June 30."

The regular annual reports of the Missouri Pacific, although bulky documents, are considerably open to criticism because of their involved character and particularly because operating expenses are not listed under the customary headings so that results are not susceptible of comparison with other railroads. In this case, such detailed criticism is impossible on account of the meagreness of the information vouchsafed in the recently issued statement. Operating expenses here are not even shown under any separate accounts whatever. Considering the report merely as the barest sort of a summary of totals, it seems worth mentioning that on its face the statements for the two half years show a total surplus after dividends of $1,927,228, whereas in reality the road failed by $18,207 to earn the 5 per cent. paid during the year on its capital stock. In other words, in the account as shown there was charged against the year's income only $1,945,435 instead of double that sum, or $3,890,870, the actual annual dividend requirement at the 5 per cent. rate.

By adding together the figures given for the two six-month periods, we are able, with the 1904 report at hand, to make the following comparison, which sums up all the information concerning the operation of the company which the recent statement gives:

	1905.	1904.
Mileage operated	6,237	6,234
Gross earnings	$42,518,272	$43,693,617
Operating expenses	30,177,727	30,406,041
Net earnings	$12,340,545	$13,287,576
Taxes	1,123,256	1,298,771
Net operating income	$11,217,289	$11,988,805
Sundry charges	1,100,907	1,282,337
	$10,116,382	$10,706,468
Other income	2,439,376	2,937,274
	$12,555,758	$13,643,742
Fixed charges and rentals	8,683,096	7,718,108
Surplus*	$3,872,662	$5,925,634
Dividends	1,945,435	3,890,868
Surplus	$1,927,228	$2,034,766

*Applicable to dividends.

NEW PUBLICATIONS.

Steam Turbines. By Carl C. Thomas, Professor Marine Engineering, Cornell University. Published by John Wiley & Sons. 281 pages.

This volume gives in logical order the fundamental principles of steam-turbine design. It discusses the action of steam or turbine buckets, the thermodynamic principles involved in the flow of steam, and the effect upon velocity of friction resistance. It includes graphical representations of work done in heat transformation, calculations of velocity and weight of flow, an account of experiments on the flow of steam and excellent descriptions of the impulse turbine, and of the impulse and reaction turbine. The Curtiss turbine is shown as a type of the first and the Parsons of the second class. The last chapters describe various other types of turbines, their operation, and their application to various work. The text throughout is clearly written and the illustrations excellent. The mathematical work is nowhere obtrusive and the significance of all important equations is enforced by means of well chosen numerical illustrations. A feature of the book also is the array of experimental data drawn from many sources. While the volume is evidently planned for class-room instruction, it will go far in satisfying all who are interested in the problems of the turbine. It is readable, even for the layman, and yet is sufficiently complete to serve well the purposes of the designer.

TRADE CATALOGUES.

Electric Traveling Cranes. A well illustrated 19-page catalogue bearing the title "Outdoor Cranes" is being distributed by the Niles-Bement-Pond Co., New York. Illustrations of electric cranes of various types are shown in actual use, ranging in capacities from five tons to 40 tons. Among these is a 65-ft. span, 10-ton crane installed in the storage yard of the American Car & Foundry Co.

at Detroit, Mich; a 51 ft. span, 10-ton crane in the freight yards of the New York Central at Buffalo and an eight-ton, 32 ft. radius, three-motor electric pillar jib crane for the Continuous Rail Joint Company's Troy Works.

Graphite Paint.—The Detroit Graphite Manufacturing Company, Detroit, Mich., has published a neat little pamphlet on "The Best Way to Prevent Rust." The chemical action resulting in the formation of rust is explained in a popular manner and cases are cited showing its disastrous effects on insufficiently protected steel or iron structures. The pamphlet is illustrated with half-tones of buildings and bridges painted with Superior graphite paint, made by this company.

Coal Handling Machinery.—The C. W. Hunt Company, New York, is distributing a 60-page catalogue of their coal handling machinery. The company installs complete plants and this catalogue gives descriptions of towers, booms, elevators, steam shovels and hoisting engines, as well as narrow gage railroads for piers and shops. It also describes conveyors, chutes and various minor supplies. It is well illustrated with drawings and half-tones.

Sprinkling Car.—The Brill Centrifugal Sprinkling Car is described in a pamphlet published by the J. G. Brill Company, Philadelphia, Pa. Instead of applying pressure inside the water tank, a centrifugal pump, driven by a 500-volt, direct-connected motor, expels the water through the sprinkling heads, of which there are four. The apparatus is simple and will sprinkle the road for 50 ft. on each side of the track.

Panel-Back Seats.—A little pamphlet entitled "Prejudice and Progress in Railway Car Seating" illustrates and describes the advantages of the panel-back or "fit-the-back" feature of the Richards Chair-Panel Co., Chicago. Parlor car chairs, reclining chairs, office and dining room chairs are shown; also a new design of double seat for day coaches, first used on the new "Alton Limited."

Coaling Stations, Cinder and Sand Bins and Water Tanks.—A circular just issued by Roberts & Schaefer Co., Chicago, shows half-tone views of locomotive coaling stations built by this company; also reinforced concrete cinder bins, sand bins and water tanks.

Cement Making.—The Allis-Chalmers Company's, Milwaukee, Wis., catalogue No. 129 is devoted to cement making machinery. Both the dry and wet processes are described and the rock-crushers, mills, rotary kilns and other apparatus used are illustrated.

CONTRIBUTIONS

Electric Systems for Heavy Railroad Service.

To the Editor of the Railroad Gazette:

Upon my return from a trip over the line I have just glanced over the issue of the *Railroad Gazette* of March 30 and note with some concern your editorial on "Electric Systems for Heavy Railroad Service." For instance, you apparently infer that my remarks on the possibility of increase of revenue from change of motive power applied to express service. What I had in mind is exactly the business to which you refer as an exception, viz., suburban and other local trains. In other words, if from other reasons than an increase of revenue it is necessary on a steam railroad to change the motive power from steam to electricity, involving the use of electric locomotives to pull non-electric cars from remote points, is it not at the same time wise to adopt a type of self-contained electric suburban equipment which can be operated by the multiple unit system in such a way as to adapt the size of frequent units to the volume of business at different portions of the day? Certainly in the case of this company a careful analysis of the situation proved conclusively to my mind and to those associated with me in making the change of motive power, that as long as the change had to be made anyway for long haul traffic, electricity should be so applied to the short haul traffic as to give to the public, and therefore to the railroad corporation, all of the well-known benefits that come with the use of electricity in interurban traffic.

As to my being in conflict with myself in prophesying the comparative safety of third rail and overhead construction, I must confess that I cannot quite see where I have been guilty of this unpardonable offense. While I do admit that under certain conditions the third rail conductor may offer dangers (and for that matter what system of railroading does not offer some kind of a danger?) still I am firmly of the belief that the third rail conductor is the safest type at the present development of the art, and that it is a "well tried apparatus that has passed beyond the experimental stage." The third rail that we propose to adopt has been in actual use near Schenectady, both experimentally and otherwise, for nearly a year under the most severe conditions in temperature changes, snow and sleet storms, and actual operation of both steam and electric equipment. I hope that you will corroborate this statement.

As to the third rail having dangers that have been proven by many ghastly catastrophies, I must confess that I am in ignorance on this point. It is true that I know of a few fatal accidents on, for instance, the Manhattan Elevated Railroad due to carelessness of workmen around an unprotected third rail, but on the other hand I know of equally fatal accidents, not to workmen but to the innocent public on, for instance, the Indianapolis alternating current overhead construction. There has been much said about the "dangerous third rail," but I have been unable to find any instances in this country of accidents, even with the usual unprotected or partially protected types, except to workmen or trespassers. The N. Y. C. & H. R. R. R. type is expected to guard against even accidents of that kind.

I am very anxious not to take any attitude as a partisan in favor of either the third rail or the overhead construction, but I feel that so much has been printed about third rail that from my standpoint seems to be unfair as compared with overhead construction, that it should be made plain by those who are obliged to use both that after all the third rail is not as bad as it has been represented, and that later developments have shown that it may be protected so as to be almost innocuous.

As to knocking down overhead construction, I feel that this is not a mere theory. In my personal experience on western lines I know of at least five through pin-connected bridges that were knocked down on one railroad, and I have known of two instances on the lines of this company within the past few years where derailed trains have collided with through trusses, and we have also had several signal bridges knocked down, including a signal tower. With overhead trusses having supports every 300 ft. on a four-track railroad it seems to me that the chances are multiplied for serious results from derailments knocking down these supports so as to affect not only the track upon which the derailment occurs, but all four tracks, and that this danger is still further magnified by the carrying of extremely high voltages directly over the moving equipment. You may perhaps have noticed recently in the press that we are having difficulty with the Department of Water Supply, Gas and Electricity to secure the rights to string aerial transmission lines carrying 11,000 volts within the city limits in the upper part of the Borough of the Bronx, entirely upon our own private right-of-way and upon steel poles with concrete bases on the side of the tracks and not over them.

W. J. Wilgus,
Vice President, N. Y. C. & H. R. R. R.

Per Diem 25 Cents.

The proposed increase in the rate for the use of interchanged freight cars has been approved and it will go into effect July 1, four years from the date of the adoption of the per diem principle. Secretary W. F. Allen, of the American Railway Association, announces that the rate (25 cents a day instead of 20 cents) has been adopted by a vote of 221 members (1,640,460 cars) against 68 members (114,582 cars). The corresponding reduction of the penalty rate from 80 cents to 75 cents was adopted by a vote of 226 members (1,717,064 cars) against 61 members (131,761 cars). The proposition to reduce the penalty against companies having over 2,000 miles of road was lost, 147 members (885,425 cars) voted in favor of it, and 135 members (969,150 cars) against. The New York Central and the Pennsylvania voted in the negative. The revised form of penalty notice was adopted. The membership of the association is 304; cars owned or controlled, 1,874,100.

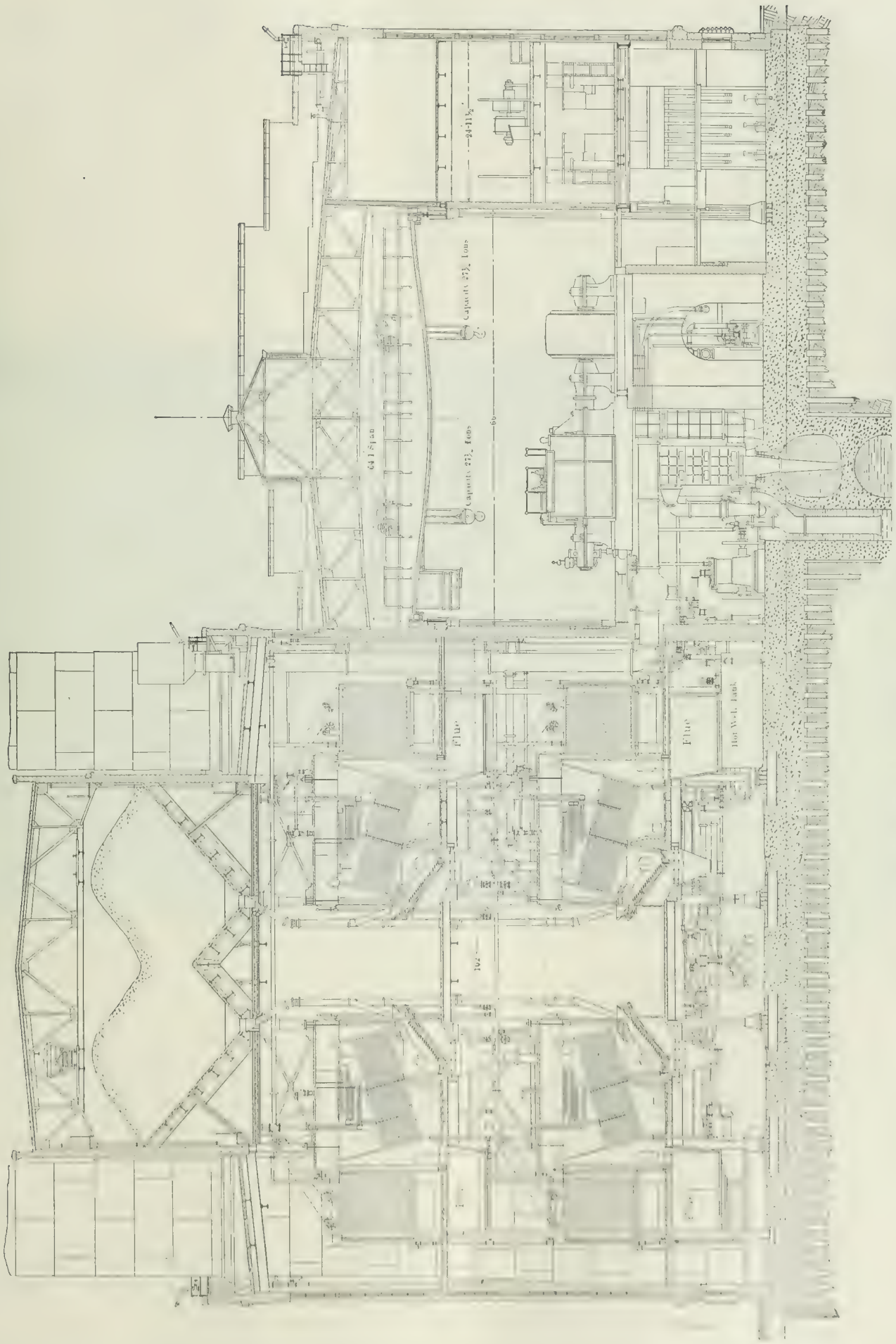
The Pennsylvania Railroad's Extension to New York and Long Island.

(*Concluded from page 352.*)

General Features of Power Station Equipment.

A description of the steam plant should be prefaced by an outline of the general system on which it is laid out. The desirability of subdivision into units or groups of units always appeals strongly to the operating force in a large steam plant, which must always be ready for emergencies no matter how perfect the design of the plant may be. The necessity which may arise at any moment for cutting out a portion of the plant makes it desirable to design it in the first place with a view to easy and economical subdivision, so that when completed a large power plant may be regarded as a collection of self-contained individual plants, all located under one roof and under one control, but capable of being readily separated. When, as is usually the case, they are joined up and operated as one plant, the lines of separation between the sections are practically obliterated.

The unit system of design was followed in laying out the



Sectional Elevation of the Long Island City Power Station of the Pennsylvania.

equipment of the power station. The boiler plant of 32 boilers is divided into eight groups of four boilers each, four of these groups being on the first floor, and four directly over them on the second floor of the boiler house. The four boilers of each group stand opposite each other across an alley or firing space, and are separate as regards economizer, flue and stack connections, but their steam connections are made up so as to form them into a group for the purpose of unit subdivision. That is to say, the four boilers at the west end of the plant on the first floor, on both sides of the alley, are piped to one manifold, which is connected to a vertical header, and the four boilers directly above them on the second floor are piped in the same manner to the same header, the two groups of four constituting the first unit group at the west end of the boiler room. This group is amply sufficient to furnish steam to the two 2,500-k.w. lighting units, which will eventually constitute the first unit subdivision at the west end of the engine room. The second groups of four boilers on the first and second floors are piped together in like manner so that they can, as one group, supply steam to the first 5,500-k.w. turbo generator. These main groups of boilers are piped together by a cross-connecting header which is to be considered as an equalizer, rather than as a large main into which all boilers feed and from which all engines take steam, which is the most usual layout of power station steam piping. Although this subdivision into unit plants may or may not be availed of by the operating force, it nevertheless constitutes a systematic and uniform scheme of development, favoring the duplication of the bends, valves and other pipe details, thereby rendering construction economical.

STEAM GENERATING PLANT.

The boiler plant for the Long Island power station consists of 32 Babcock & Wilcox water tube boilers set in batteries of two boilers each, eight batteries on the first floor and eight on the second floor immediately over the former; these batteries are equally distributed on each side of the boiler plant, with a firing space between boiler fronts of about 18 ft. in width.

The boilers are designed for a working pressure of 200 lbs. per square inch, and each boiler has a total effective water heating surface of 5,243 sq. ft., comprised in three steam drums 42 in. in diameter and 23 ft. 10⅝ in. long, and 21 sections of 4-in. tubes 18 ft. long with 12 tubes in each section. The general arrangement of the entire boiler plant and accessory apparatus is shown in the sectional elevation.

Besides the water heating surface each boiler is supplied with an internal superheater consisting of two sections of tubing arranged much like a letter U lying on its side. These superheaters are shown in position in the sectional view of the power station. Each superheater is capable of superheating the output of the boiler 200 degs. Fahr. when operating at 200 lbs. pressure, and comprises about 1,116 sq. ft. of superheating surface.

The sections and drums composing the boilers are hung from wrought-iron beams framed into the building columns, and suspended entirely independent of the brickwork in such a manner that the brick setting is not affected by the expansion and contraction. Each battery occupies a rectangular space 23 ft. 5 in. long by 30 ft. 6 in. wide. The headers, drum heads, manhole plates and cross connections are hydraulically forged from open-hearth steel. The tubes are of lap-welded charcoal iron, expanded into reamed holes in the forged steel headers. The longitudinal seams of the boiler drums are butt-strapped inside and outside, and circular seams are double riveted. All pressure parts are tested and made tight at 300 lbs. hydrostatic pressure after erection.

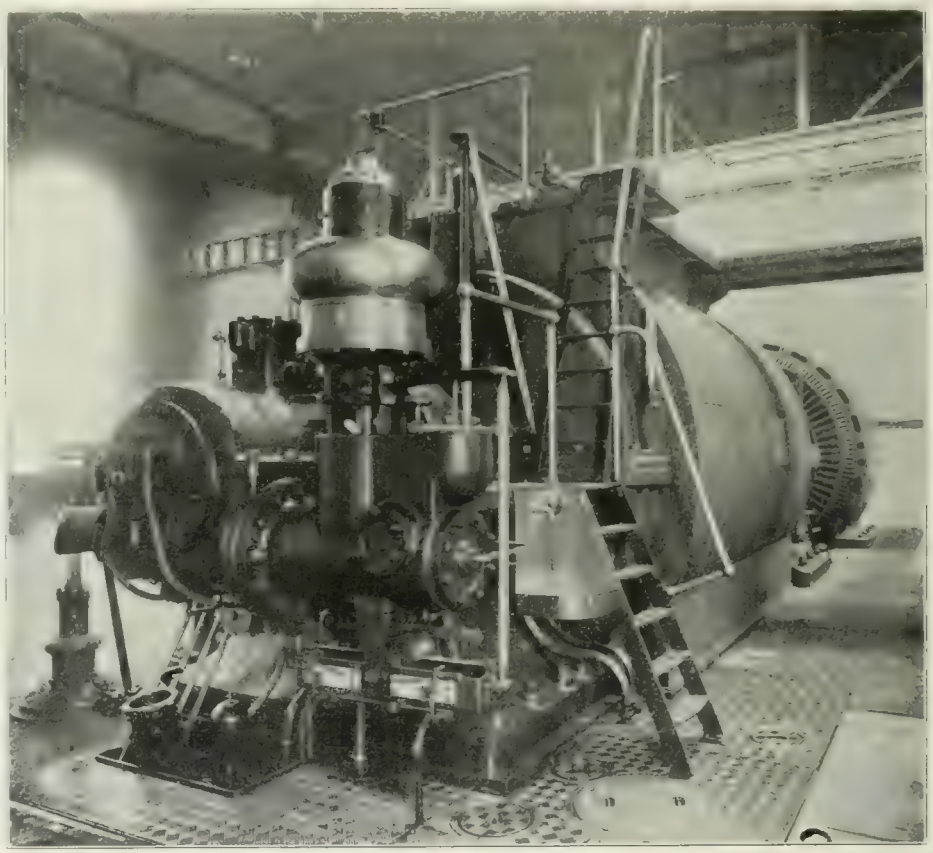
Provision is made for flooding the superheater when it is out of service. Each boiler is fitted with three 4-in. safety valves. Each boiler has two steam openings, the main nozzle receiving steam from the superheater and the auxiliary nozzle taking its saturated steam directly out of the tops of the boiler drums for use in the auxiliary mains that supply the small engines in various parts of the house.

The 32 boilers now installed are arranged in four groups with eight boilers in each group, the eight boilers being those on the first and second floors directly over one another. The group nearest the west end of the plant is intended ultimately to take care of the two 2,500-k.w. lighting units there to be installed. The other three groups are each capable of supplying one 5,500-k.w. turbine unit. The ultimate capacity of the boiler house, when finally extended, will be 96 boilers of the type now installed. Each boiler is fitted with a Roney stoker.

The disposition of the hot gases after leaving the boilers is of particular interest. The arrangement of flues, economizers and dampers has been made so as to permit the operation of the plant on the unit system (that is, by working each set of eight boilers on one turbine), but at the same time certain features of interchangeability are incorporated, so that the flues and economizers can be interchanged and cross-connected to insure the greatest capacity and highest efficiency under all conditions of operation, even though some portions of the boiler and economizer plant may be out of service. One economizer utilizes the waste heat from two batteries of boilers.

The boiler flues are of sheet steel, and are underneath the floor on which the boilers are situated. The economizers are directly behind the boilers and over the flues. Each economizer consists of 56 sections of 10 tubes each, designed for 250 lbs. pressure. The sections are designed with a special system of connections for circulating the water through them. The soot scrapers on the economizer tubes are driven by four small Westinghouse Standard engines.

The rear wall of the economizer chamber is made of vitrified asbestos air cell board, laid on in sections, so that in the event of a broken economizer tube it is not necessary to tear down any of the brick work in order to replace the section. The economizers are provided with 6-in. headers, which is a larger size than usual, and each section is provided with a separate blow off for cleaning.



Steam End of 5500-K.W. Turbo Generator.

STEAM TURBINES.

For the initial equipment three main generating units have been installed, consisting of steam turbines direct connected to three-phase 11,000-volt generators of the revolving field type. The turbines are of the Westinghouse-Parsons single-flow type, rated to develop 5,500 k.w. at 175 lbs. steam pressure, and 27½ in. vacuum, running at 750 r.p.m. A general view of the three turbine units in the engine room is shown.

A separate condenser is provided for each turbine of the counter-current surface type, built by the Alberger Condenser Co., and having 20,000 sq. ft. of cooling surface, consisting of seamless drawn brass tubes of No. 18 S. W. G., and 1 in. outside diameter.

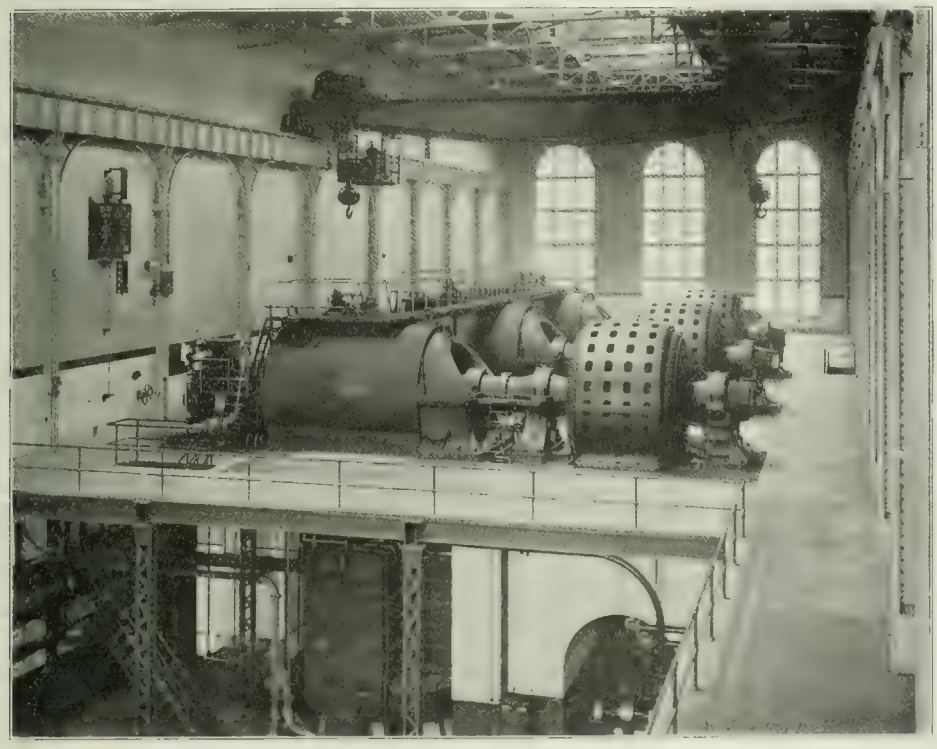
The condenser is placed in a large arched opening made in the turbine foundation. There is thus a marked saving in space made possible by the horizontal type of turbine, for it enables the entire condensing plant, consisting of condenser, circulating pump, dry air pump and hot well pump to be compactly grouped within and about the base of the foundation.

ELECTRICAL EQUIPMENT.

Since the standardization of the steam turbine as a prime mover, a distinct type of electric generator has been designed to

conform to the new speed condition imposed by the turbine. In a way, it is a reversion toward the earlier types of high-speed generator. The difference between the size and weight of a 5,500-k.w. turbo-generator and one of the slow speed engine type is no less marked than the difference between the two types of prime mover. The "engine" type of generator runs from 60 to 75 r.p.m., while the turbo type, so-called, running at 750 r.p.m., can be designed with far greater economy both of floor space and material—conditions which readily lend themselves to the greatest possible simplicity of design.

The stationary armature, enclosed in a large cylindrical yoke of cast-iron, consists of a ring-shaped core built up of overlapping punchings of soft sheet steel with the interior surface slotted to receive the winding, having ventilating strips inserted at suitable intervals to form passages for the free circulation of air through the core and winding. The coils are wound with copper wire, and as is usual with very large generators, the coils were built into the slots after the armature frames and cores were permanently in position on the bedplates. The coils are securely held in the slots by retaining wedges of hard fiber, fitted into grooves formed in the armature teeth. The ends of the coils where they project beyond the ends of the laminated core, are protected by large perforated cast-iron flanges, completely enclosing the opposite ends of the armature. The machines are "star-wound," i.e., the three sets



Interior of Engine House Showing Three 5500-K.W. Units.

of armature coils, needed for the generation of three-phase alternating current, are all connected to one point called the "neutral," and the neutral points of the three machines are connected to one neutral bus, which is permanently grounded through a resistance.

The revolving field consists of a four-pole structure formed out of solid steel disks milled to receive the winding. It is 6 ft. 8¼ in. in diameter, and about 6 ft. long. The field coils are wound with heavy copper straps embedded in slots and retained by heavy bronze wedges. Ventilating ducts are provided in the core, which enables the revolving field to draw an abundant supply of air through its interior by a sort of fanning motion, which also aids in reducing the temperature of the stationary armature.

The core is pressed on and keyed to a shaft of nickel-steel 19¾ in. in diameter, and running in bearings 15 in. in diameter, through which there is a forced circulation of oil. The field is separately excited at 220 volts, the exciting current being delivered to the winding through a two-ring collector by means of sliding carbon brushes.

These generators are each guaranteed to deliver 289 amperes per terminal at 11,000 volts, and 80 to 100 per cent. power factor for a space of 24 hours continuously, with a rise in temperature not to exceed 35 deg. C., and a 50 per cent. greater current for two hours with a rise not exceeding 55 deg. C.

EXCITERS.

Three separate sources are provided for exciting the fields of the main generators, viz., the two steam-driven exciters, one motor-driven exciter, and a storage battery. These are designed to give direct current at from 180 to 220 volts. The steam-driven engine units each consist of a Westinghouse-Parsons steam turbine directly coupled to a 200-k.w. direct-current turbo-generator, designed to run at 1,800 r.p.m.

These turbines are of the same general type as the main units and are designed to run either condensing or non-condensing, with 175 lbs. steam pressure and superheat up to 200 deg. Besides a connection to the superheated steam supply they are also connected to the auxiliary steam main that supplies saturated steam. They are arranged so that they can be exhausted into one of the large condensers, or when running non-condensing, into the auxiliary exhaust mains, passing the exhaust steam either to the feed water heaters or to a separate outboard exhaust riser.

The exciters are located near the southwest corner of the main floor.

The motor-driven exciter, also of 200-k.w. capacity, is driven by a 290-h.p., three-phase, 440-volt induction motor, both motor and generator being mounted on the same shaft, bearings and bedplate. This motor-driven exciter is located in the operating gallery. The three-phase motor derives its current from three 175-k.w. oil-insulated self-cooling transformers located in the basement of the electrical gallery.

The storage battery is intended mainly as an absolutely reliable source of supply of the exciter bus system and the other more important auxiliaries. It is installed in a specially arranged room in the engine room basement and consists of 110 cells, each containing seven plates of the type "R" chloride accumulator manufactured by the Electric Storage Battery Company. The tanks are built large enough to ultimately contain 11 plates. This battery has a discharge rate of 36 amperes for one hour, and is controlled from the operating gallery. It is normally kept floating across the excitation bus. In order to charge the battery a 12.5-k.w. booster driven by a 15-h.p. induction motor is located in the operating gallery next to the motor-driven exciter above mentioned.

CONCLUSION.

The first work of clearing the site began on Sept. 15, 1903, and the excavation on Oct. 20. The first turbine was started Jan. 16, 1905; high tension current was first turned into the transmission line April 27, 1905. Current was furnished for testing cars on May 13, and on July 26, 1905, the line between Flatbusn Terminal and Rockaway Park, the first section of the Long Island Railroad to use the new motive power, was permanently changed from steam to electrical operation.

The station was planned and built by Westinghouse, Church, Kerr & Co., Engineers for the Pennsylvania, New York & Long Island, which is the organization through which the Pennsylvania is carrying on its New York extension work. The design and construction were under the charge of George Gibbs, Chief Engineer of Electric Traction of the road, and under the general supervision of the Mechanical and Electrical Advisory Committee, New York Extension, a committee composed of officers of the Pennsylvania Railroad.

The Anthracite Coal Strike of 1902.

BY FRANK JULIAN WARNE.

The memorable strike of the anthracite mine workers in 1902 was a natural consequence of the incomplete and unsatisfactory settlement—unsatisfactory alike to both sides—which political expediency, interpreted by the leaders of the national Republican party, forced upon the country in terminating the strike of 1900. The 1900 contest had been inaugurated on September 17 of that year under nine or more specific and well defined grievances or demands on the part of the mine employees, all of which the operators had at first refused, but which were compromised before the strike had completed its sixth week through fear that a continuance of the industrial disturbance up to the Presidential election in November would jeopardize the prospects of the candidate of the Republican party. The settlement of the 1900 strike being a compromise many of the issues raised by the United Mine Workers of America were naturally left in a very unsatisfactory state, and for the 18 months following there was continual unrest and industrial disturbance throughout the entire anthracite region, marked by innumerable petty strikes with now and then a more serious suspension of coal mining.

As an outgrowth of this situation and also as a result of the failure of representatives of the United Mine Workers to secure a

joint conference with representatives of the operators for the purpose of discussing and agreeing upon some method for an adjustment of the issues, and a great strike of 1902 was on May 12 inaugurated. Before this the mining companies had posted notices at their collieries announcing that "The rates of wages now in effect will be continued until April 1, 1903, and thereafter subject to 60 days' notice. Local differences will, as heretofore, be adjusted with our employees at the respective collieries." Notwithstanding, on the day the strike order became effective, practically every mine in the entire region became non-productive and continued so for the greater part of the following six months, almost the entire 140,000 mine employees remaining idle for all of that time. Mining operations were resumed on October 23.

The specific demands embodied in the wage scale of the Shamokin convention, which determined upon suspension, were for an increase in wages of 20 per cent. to miners paid by the ton, a reduction of 20 per cent. in the hours of work each day by per diem employees, and that 2,240 lbs. constitute the ton on which payment should be based for all coal mined where miners were paid by weight. This last demand was to apply in any district where it was practicable to weigh coal, and to all miners paid by the quantity and not by the day. A fourth demand, which towards the close of the struggle really became the most important of all, inasmuch as it practically included all the demands, was that for arbitration of the issues.

On the first day the employees remained away from the collieries in response to the strike order in May, 1902, the machinery of the organization adaptable to strike conditions became operative. Pickets were stationed about the colliery grounds to prevent mine workers and non-union men, usually brought into the region from the eastern seaboard cities, from going to work. Usually the "imports," as the men from outside the region were called, arrived under guard, or secretly at night, but very few escaped the vigilance of the strikers, the result being disturbances of the peace and in cases small-sized riots. Once within the well-guarded grounds of the mining company the strike-breakers were usually safe beyond the reach of the strikers. Whenever workers were encountered by the pickets, if persuasion failed to keep them out of the collieries, recourse was not infrequently had to force, which took the form of duckings in creeks or rivers, marching of non-union men along the public highways to their homes in scanty attire, whitewashing of some, stoning and assaulting of others, and visitation upon workers of other forms of punishment devised by the ingenuity of the mob. So great was this interference with those who continued at work that by June the companies had turned their collieries into armed barricades or stockades, with newly built or repaired houses for the accommodation of the workers, the whole grounds in not a few cases being surrounded by a high wooden fence topped with four or five strands of barbed wire.

With such forces as boycotting, ostracism, picketing and the like in operation throughout the entire region it is little to be wondered at that peace and order were disturbed. Aroused human passion and embittered class hatred were given a loose rein; public sentiment, which should have held a check upon these enemies to organized society, seemed only to urge them upon their devastating course, since the great majority of the inhabitants of the coal fields strongly favored the cause of the men on strike. Despite responses of sheriffs of different counties to appeals of the operators for protection; despite the large increase in the number of officers and coal and iron policemen to preserve order, and in face of frequent proclaiming of the riot act and threats to call for troops, the machinery of local government in the coal region was interfered with and made almost useless by public sentiment, called by some the "tyranny of the majority" which not only secretly but openly supported the strikers' acts, even to violation of law. Thus justice not infrequently miscarried at the hands of juries summoned to try offending strikers who were more often than not composed of mine workers and their sympathizers. The sworn officers of the law, in their endeavors to perform their duties, were as dry leaves before an autumn storm. As early as July 10 the sheriff of Carbon County had called upon the Governor of Pennsylvania for troops, but this request was refused, the chief executive believing that the county officials had not exhausted all their powers for preserving the peace. Disorders in the various sections grew apace as the strike dragged on towards its third month. On July 29, following a riot at Shenandoah in which one man was killed and 40 and more shot, which was precipitated by an attack upon a deputy sheriff who was escorting non-union men from one of the collieries, the Eighth and Twelfth Regiments, the Governor's troop, and two companies of the Fourth Regiment, all of the Pennsylvania National Guard, were stationed in Schuylkill County. A month later they were joined by the Second Troop Philadelphia City Cavalry.

About the middle of September, after the strike had continued four months without any indication that the mine workers would soon return to their places in the collieries, the operators determined to bring the already costly struggle to a close by attempting to resume the mining of coal with non-union men. Efforts were made by the superintendents and other officials through personal interviews, by posted notices about the company grounds, in promises that "foremen will not make known the names of those applying for work," and in other ways to induce the miners in particular to return to their old places. This activity of the operators was accompanied by renewed efforts on the part of the strikers to keep the mines closed and all workers away from the collieries until the operators granted their demands or at least submitted the issues to arbitration. Railroad tracks extending into the colliery grounds were destroyed, dams supplying the mining plants with water for steam purposes were blown up, washeries set on fire and in other ways badly wrecked, and armed attacks made upon colliery guards. Non-union men were assaulted; houses sheltering the defenceless wives and children of workers were dynamited, to some the torch was applied, and in others the furnishings wantonly wrecked; deputy sheriffs escorting men to and from work were attacked, trains bearing non-union workmen were wrecked, jails stormed, and officers of the law resisted with force. Railroad bridges were dynamited or set on fire to prevent coal being shipped out from the region, crews hauling non-union mined coal were stoned and fired upon, and attempts were even made to wreck passenger as well as coal trains.

By the beginning of October acts of lawlessness were general throughout the whole anthracite region. Seven men had been killed in conflicts between strikers on the one side and non-union workers and officers of the law on the other, three of the killed being striking mine workers, three non-union men and the other one an innocent third party. The issuing of sheriffs' proclamations in all the seven counties affected; the swearing in of hundreds of deputies, and even the ordering into the region of the Ninth and Thirteenth Regiments, the Sheridan Troop, and the remaining eight companies of the Fourth Regiment to assist the military force already in the fields, were not sufficient for the preservation of law and order as the struggle between the operators and mine workers became more and more acute. Such were the conditions in Schuylkill County that its sheriff requested of the Governor that martial law be declared throughout its borders, but this request was not granted. On October 6 all the remaining fighting strength of the entire National Guard of Pennsylvania, comprising, with those already in the field, a total of nearly 10,000 officers and men, constituting one division, was ordered into the anthracite counties. In his general order Governor Stone designated the counties in which "tumults and riots frequently occur and mob law reigns," and instructed the commanding officer to "see that all men who desire to work and their families have ample protection, protect all trains and other property from unlawful interference, arrest all persons engaging in acts of violence and intimidation and hold them under guard until their release will not endanger the public peace; see that threats, intimidations, assaults and all acts of violence cease at once; the public peace and good order are preserved upon all occasions, and that no interference whatsoever be permitted with officers and men in the discharge of their duties." Under the protection of troops escorting workers to and from the collieries, anthracite was being mined for the first time since May. The operators claimed that from 17,000 to 20,000 men were at work in mines throughout the three fields by the middle of October.

But so great a quantity of anthracite had been shut off from the market by the five months suspension that a fuel famine had set in throughout all the principal cities of the eastern seaboard and middle western states. Anthracite in domestic sizes was selling for $25 a ton and in cases for as much as $30 a ton, pea sizes for $12, and buckwheat for $6 a ton. So valuable had anthracite become that the bottoms of rivers in the three fields of production and in the vicinity of coal docks near the large cities were dredged for coal. Bituminous coal for domestic use was retailing at $9 a ton. The poor on the East Side in New York City were paying 25 cents a bucket, or 75 cents a bushel, and the prospect of suffering among this class for lack of fuel was so appalling that charitable organizations held union meetings to devise some means of grappling with the pressing problem. Everywhere the public was being compelled to have recourse to substitute fuels like oil and gas and to adopt various devices for meeting the necessities for heat in their houses.

At the beginning of October, after failure of repeated efforts to terminate the strike, the prospect of a fuel famine at the opening of the winter months had become so threatening as to overshadow all else in the public mind. Public feeling was in a highly excited state and immediately moved to the support of President Roosevelt when, in behalf of the public, he undertook a settlement of the controversy. After repeated efforts on his part to bring the operators and mine workers to an agreement, on October 14 both parties agreed to abide by the award of a commission to be appointed by the President. On October 23 the 140,000 mine workers returned to their places in the mines after an idleness extending over five months and 11 days.

The Anthracite Coal Strike Commission held sessions for the

next five months, taking testimony from 558 witnesses representing both operators and mine workers. Its report was made to President Roosevelt and to the parties to the controversy on March 18, 1903. The award increased wages for different groups of mine workers, such as contract miners, engineers and pumpmen, firemen and company men; continued the prevailing methods of payment for coal mined; provided for check weighmen or check docking bosses, or both; settled upon a uniform and equitable distribution of mine cars, and provided against the limitation of output by miners; determined the size of the mine car; established a sliding scale of wages; denied alike to operators and to mine workers exercise of the power of discrimination because of membership or non-membership in any labor organization, and regulated the payment of wages to the laborers or contract miners. In addition, the Commission made general recommendations on such vital points as the enforcement of law and protection of property, the employment of children, and the compulsory investigation of industrial disturbances. At the same time, by virtue of actual conditions existing within the anthracite industry, which it was seen would give rise to issues just as important as those passed upon by the Commission, as well as for the purpose of interpreting and carrying into effect the award of that body, it called into existence a joint committee of three operators and three mine workers, with provision for an umpire in case these six could not agree, which has become known as the Anthracite Board of Conciliation. This award of the Commission was to continue in force for three years, until March 31, 1906.

The cost of the strike, estimated by the Strike Commission, was about $100,000,000. Of this amount over $46,000,000 represented loss to the coal mining companies due to the decrease in production; $25,000,000 represented loss in wages to the mine workers, and $28,000,000 the estimated loss to the railroad companies in freight receipts through the withdrawal of coal traffic. The cost to the state of Pennsylvania for maintaining troops in the coal region was about $1,000,000, and the expense to the Federal Government for the Coal Strike Commission exceeded $50,000. The Commission's estimate of the money cost of the strike of 1902 does not take into consideration the compensating advantages to one or the other side to the struggle which made the cost of suspension much less than would at first appear. What seemed a cost to the operators or the mine workers was in cases merely a deferred payment. Take the question of production as an illustration. While it is true that probably 20,000,000 tons of anthracite would have been mined if there had been no strike, yet this amount of coal was not destroyed by the suspension nor lost absolutely to the mining companies, as the estimate would indicate. The coal merely remained in the ground unimpaired, to be mined later. But all the money cost of the strike of 1902, whether counted at first as a loss to the mining companies, the mine workers, or to the railroad companies, has long since been transferred from all of those engaged in the production and distribution of coal to the pockets of the consumer, that is, upon the shoulders of the public. This has come about through the higher price for a ton of the domestic sizes which the railroad mining companies have received since the strike. It is estimated that during the three years and six months following the close of the strike of 1902 the increase in price which consumers of hard coal have had to pay amounts to more than $30,000,000. In other words, the railroad mining companies have transferred the cost of the strike of 1902 to the consumer in higher prices for anthracite to the extent that the average householder using hard coal since the close of that struggle has paid $17.50 more for his fuel.

Details of the A. C.—D. C. Locomotives for the New York, New Haven & Hartford Railroad.*

Thirty-five electric locomotives are to be furnished by the Westinghouse Company to the New York, New Haven & Hartford, suitable for operation on its direct-current division between the Grand Central depot and Woodlawn, and on its alternating-current portion of its line between Woodlawn and Stamford. One locomotive has already been constructed and the results obtained assure the complete success of the alternating-current system.

The frame, trucks and cab of the locomotive were built by the Baldwin Locomotive Works, according to designs developed with the co-operation of the New Haven Railroad and the Westinghouse Electric & Mfg. Companies. The frame is of the rigid type with side pieces made of steel channels, to which are bolted and riveted other steel channels placed transversely, two over each truck, forming transoms for the transmission of the weight to the center pins. These channels are placed outside the wheels and as close together and as low down as the wheels and draw head will permit, and are braced and squared by substantial steel flooring plates which are riveted and bolted to the top flanges. The transoms are further braced by gusset plates which are riveted and bolted to the bottom flanges of both sets of channels and which transmit the tractive power from the center-pin to the side channels. The frame is still further strengthened and secured by diagonal plate braces.

As the entire space between the wheels is occupied by the motors, it was impossible to transmit the drawbar pull through the center line of the locomotive; so the entire strain is carried by the strong plate girders which make up the locomotive frame. A Westinghouse friction draft gear is mounted directly underneath the box girder at each end and is applied to two steel bumpers laid horizontally between vertical gusset plates on the ends of the side channels.

The running gear consists of two trucks, each mounted on four 62-in. driving wheels. The trucks have side frames of forged steel, to which are bolted and riveted pressed steel bolsters which carry the center plates. The weight on the journal boxes is carried by small semi-elliptic springs with auxiliary coiled springs under the ends of the equalizer bars, to assist in restoring equilibrium. A very strong construction is secured without excessive weight by the use of bolsters 30 in. wide at the center plate and extended to nearly double that width at the ends which are bolted to the side frames. Center pins 18 in. in diameter transmit the tractive effort to the frame. They are well lubricated to permit free motion on curves. The truck pedestals are provided with wedge and gib adjustments to take up wear, and the bearing brasses are easily removable by hand. The distance between the truck centers is 14 ft. 6 in.

The cab is formed of sheet steel mounted on a framework of Z bars which supports the walls and roof. Windows are provided at each end, giving an outlook on both sides and in front of the locomotive; and the driver is so close to the front that he can see the track a very few feet ahead. This advantage is not possessed by any type of steam locomotive now in service. The master controllers, auto-transformers, instruments, grid resistances, air operating valves, compressors and other auxiliary apparatus are mounted inside the cab upon an angle-iron framework which is built into the cab and securely anchored to floor and roof. A clear passageway is left through the center. Trap doors in the floor furnish easy access to the motors for inspection or repair.

The equipment of the locomotive includes four gearless motors, controlling apparatus and auxiliaries. The motors are of the compensating gearless type, designed for operation on both single-phase alternating and direct-current. They are wound for approximately 235 volts on alternating current and 275-300 volts when operated by direct current. They have normal rated outputs of 250 h.p. on the basis of ordinary railroad practice, and a continuous capacity of 200 h.p. each. The locomotive therefore has a continuous operating capacity of 800 h.p.

The motor frames are made of cast-steel and are of a circular, skeleton form. They are divided horizontally into two parts in order to give access to the inside of the field or to the armature. A laminated core with slotted projecting poles is built up within this frame and wound with field coils of flat copper strap insulated between turns with asbestos and filled with an insulating compound which is heat-conducting and waterproof, so that a sealed coil is produced which can withstand moisture and internal heat. Copper bars are placed in slots in the pole faces and connected to form a continuous neutralizing winding which forms part of the circuit, including the main field coils, the armature coils and the auxiliary winding, all in series. This auxiliary winding produces a magnetic field which opposes and neutralizes the reaction of the armature. It is so formed that it need not be disturbed in order to remove the main field coils.

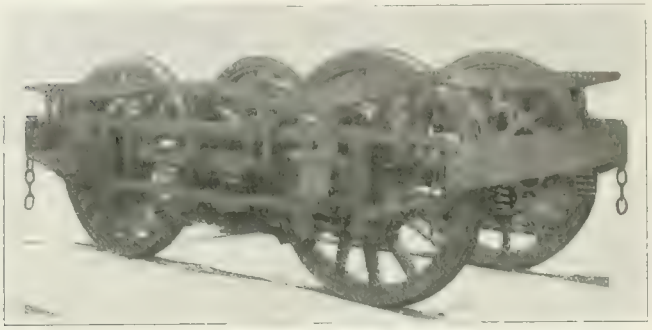
The armature core is built up of soft steel punchings which are assembled on a cast-iron spider and held in place and keyed to prevent their turning. The surface is slotted and the armature winding is arranged in three layers. The two upper layers are composed of copper strap connected to form the usual direct-current type of winding. The third layer constitutes the preventive winding. It is connected between the commutator and the main winding. The preventive winding is so proportioned as to minimize the combined loss due to the normal working current and that which is produced in the coil under commutation, when short-circuited by the brush in an alternating field. The individual coils are insulated along their entire length by overlapping layers of mica tape, and each [illegible] is further insulated from the core by a moulded mica [illegible]. The completed winding is held firmly in position by metal [illegible] wedges. The ends are banded down against the coil supports.

The commutator is formed of copper bars clamped between V-shaped cast-steel rings and insulated by V rings and bottoms of moulded mica. It is pressed on the spider which supports the armature core. The brush holders are of the sliding type with [illegible] mounted on a rocker ring. Tension is provided with flat phosphor bronze springs which have sufficient turns and are so mounted that friction between turns is eliminated and uniform pressure maintained over a considerable range without adjustment. Each spring is held

*A general description of the New York, New Haven & Hartford [illegible] electrification plan was given in a paper by B. G. Lamme before the New York Railroad Club, March 16. A reprint of this paper was given in the *Railroad Gazette* of March 23, page 302.

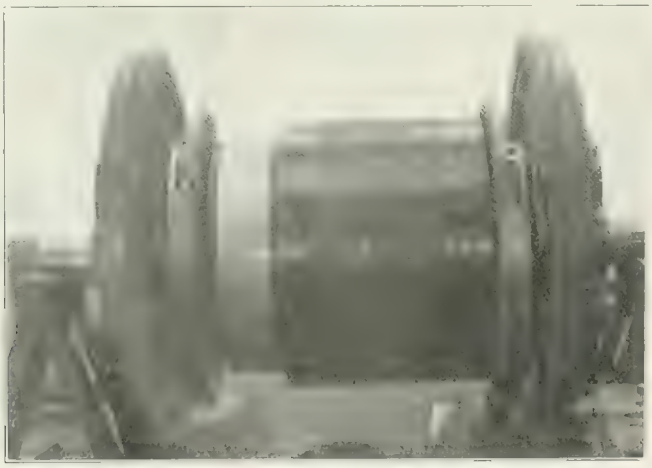
in a harness which definitely fixes the radius of movement of the spring tip. A pawl on the side of the spring harness allows easy adjustment of the tension.

The weight of each motor is carried on a frame which passes over the wheels and side frames and rests on the journal boxes. Each frame carries four bolts which receive the weight of the motor and each bolt is fitted with a heavy coil spring at its lower end through which all weight is transmitted to it, so that the motor is carried on very flexible springs and is independent of the truck frame. The torque of the motor and the jar caused by sudden starts and stops are transmitted from the motor to the truck through heavy tie-rods which affect the motion of the motor only lengthwise of the locomotive. The armature is not placed directly on a shaft but is built up on a quill through which the car axle passes with about ⅝ in. clearance all around. The bearings which carry



Truck for A. C.—D. C. Electric Locomotive.

the field frame are mounted on this quill and from a flange at each end of the quill seven round pins project parallel to the shaft into corresponding pockets formed in the hub of the driving wheel. The torque of the motor is transmitted from these pins to the wheel through helical steel springs which are wound with their turns progressively eccentric, and which are contained between two steel bushings, the smaller of which slips over the pin and the larger fits in the pocket in the wheel. These springs are under compression both longitudinally and horizontally so that, at all times, they fill the pockets in the wheel but permit a vertical and a lateral motion. Their longitudinal compression between the quill and the segmental cover over the outer ends of the pockets in the wheel keeps the motor at all times midway between the hubs. The end play of the motor does not come directly on the wheels but is taken by strong coiled springs inside of the driving pins, which press against the covers in the outer ends of the spring pockets in the wheels. Though normally required to transmit only the torque of the motor and to keep the motor axis parallel to

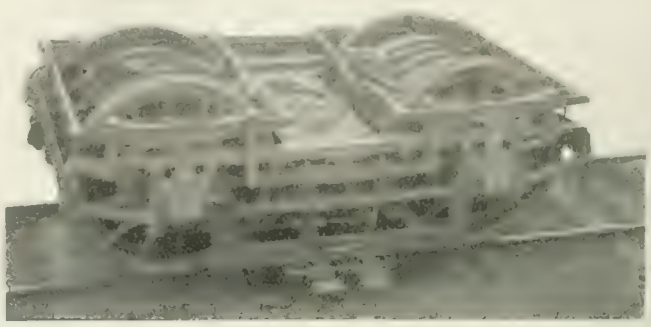


A Pair of Drivers with Motor Armature, Bearings and Housings.

the axle, these springs are amply strong to carry the entire weight of the motor. They allow a total vertical movement of about ¾ in. The torque of the motor is taken by heavy parallel rods which anchor the frame to the truck above and below the axle and permit vertical or side motion of the motor but prevent excessive bumping strains from coming on the driving springs. If these springs are compressed more than ¼ in. by the heavy centrifugal force exerted by the motor when rounding curves, the force is taken up by noses on the motor which fit into corresponding recesses in the cross-ties between the side frames of the locomotive. This suspension has the advantage of removing all dead weight from the axle, of driving through springs, and at the same time of having the motor thoroughly anchored to prevent undue strain on the driving spring. The only parts of the locomotive not spring supported are the driving whels, axles and journal boxes. It is a great improvement on any method of mounting gearless motors heretofore devised.

The motors are arranged for ventilation by a forced circulation of air which enters under pressure, is distributed throughout the motor and escapes through the perforated covers. In the floor of the cab there is a natural conduit formed by the side channels of the frame, the floor and side walls of the cab, and a lower plate, through which air is carried to the motors, transformers and resistances. This method of cooling improves the continuous capacity of the apparatus and is, in a large measure, accountable for the high continuous rating of the motors which almost equals that on the one-hour railroad basis. The air furnished to the motor is taken from the inside of the cab and can therefore be kept relatively clean and dry.

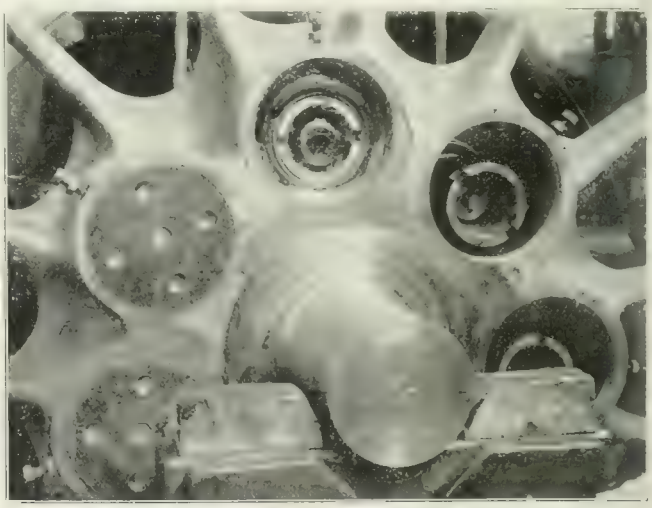
On the direct-current part of the line current is taken from the



Truck Completely Equipped with Motors and Contact Shoes.

third-rail system by eight collecting shoes, four on each side of the locomotive, arranged in pairs of two each. There are two pairs on each side, one at each end, for the purpose of bridging such gaps as may occur in the third-rail system. The direct-current contact shoes are designed to work on two forms of third-rail—one in which the shoe runs under the rail, and the other on top of the rail. To collect alternating current from the high-potential overhead trolley line, the locomotive is equipped with two pantagraph-type, bow trolleys, each of which has a capacity sufficient to carry the total current required by the locomotive under average conditions—two being provided to insure reserve capacity.

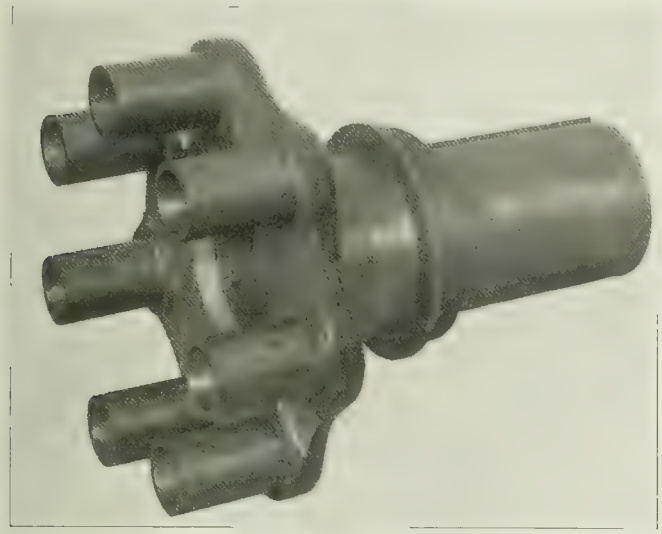
On direct-current the motors are controlled in series parallel as in ordinary street railway practice. In alternating-current operation no resistance is used in the regular run, but a small resistance, which constitutes a preventive device to diminish the short-circuiting effect when changing from one transformer tap to another, is employed in passing from one working step to the next. There are six alternating-current voltages or running points, corresponding to six taps from the auto-transformers, and there are a small number of mid-way steps which are used only in passing between working notches. Experience has shown that the number of steps required in alternating-current operation to give a smooth acceleration is considerably lower than in direct-current practice. In consequence, the controller is so arranged that on alternating-current about half as many steps are used as on direct-current. Tests so far conducted show that the acceleration on both alternating and direct-current is very smooth.



Detail of Driving Wheel.

There is one feature of the direct-current control which is not generally found at the present time in direct-current equipments, viz., the shunting of the field for higher speeds. In the series position in direct-current operation the motors have an efficient running

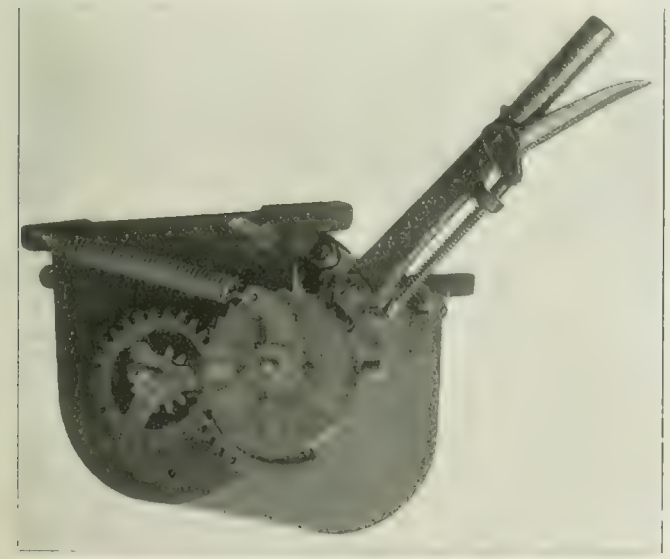
point. It is usual railroad practice to pass from the series to the multiple position without an efficient intermediate running speed. With the New Haven equipments, however, the type of motor used permits an almost indefinite shunting of the field without impairment of commutation or operation and higher speeds are provided by shunting the fields before passing into multiple. In this way several efficient running points are obtained between the series and multiple positions; and tests have shown that these motors operate properly on direct-current with their fields shunted down to less than half their normal strength. When operated on direct-current, the current is fed directly to the motors. On alternating-current,



Armature Quill.

however, auto-transformers are required, as the alternating-current trolley voltage is 11,000. Two such transformers form part of each equipment—one mounted on each side of the cab floor to balance the weight. They are connected in parallel across the high voltage, but on the low-voltage side each transformer feeds one pair of motors through a separate control unit. This means that the control system when operated on alternating current consists of two normally independent units.

The main controllers are of the well-known Westinghouse electro-pneumatic unit switch type. The design differs somewhat from that used in direct-current service, because of the fact that the



Master Controller.

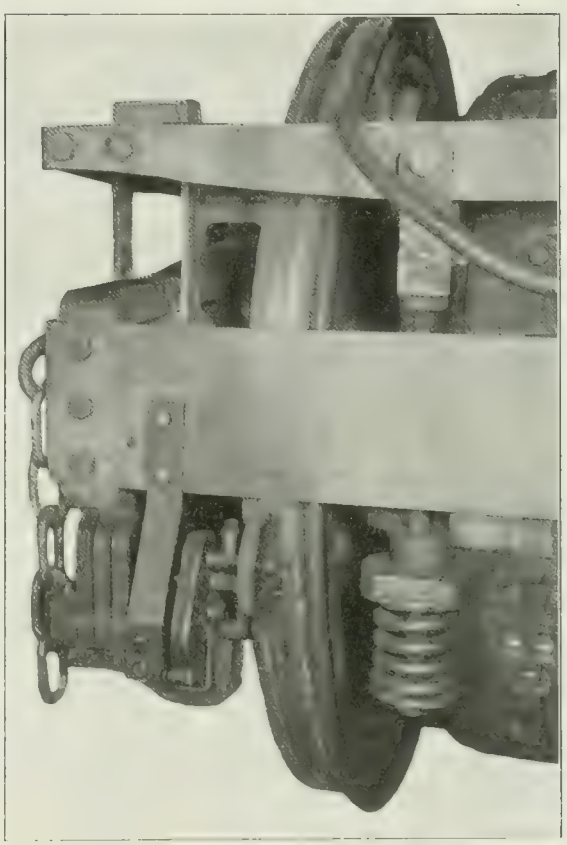
switches, blow-outs, etc., must operate on both alternating and direct current, as many parts of the controller are common to both systems. The reversing switches are also parts of the unit switch groups. The main controllers are operated from master controllers at each end of the cab. The control system is arranged for multiple unit service, so that two or more locomotives can be coupled to the same train and handled by a single driver.

There are six switch groups, each containing unit switches. The two line switches are so connected in the switch groups that each carries the current supply to each pair of motors when they are operating in parallel construction. When the motors are in series, one of the line switches carries the current supply to all

Each line switch is provided with an overhead trip so connected that all of the switches of both switch groups as well as both the line switches open in case of an overload or short circuit on either pair of motors or in the circuit of either pair. The overload trip is automatically locked out when brought into action and cannot be reset until the master controller is returned to the off position.

The external resistances used in regulating the flow of current to the motors are arranged in two groups which are connected in series when the motors are in series, and in series with each motor when the motors are in parallel. The change over between the direct-current third-rail and the alternating-current overhead system can be made easily and quickly even when the locomotive is running at full speed. An ammeter is mounted in each end of the locomotive in plain view of the operator when at the master controller.

The master controller is of the drum type and is operated by a lever which moves through an arc of about 60 deg., with notches and latch wheel to define the different positions. Reversing is accomplished by a separate handle which interlocks with the main lever. When the master controller is in the off position, connections are so established that all circuit breaker trips which may be open are closed by the simple closing of a small switch conveniently located in the locomotive cab. Current is supplied to the control



Magneto Speed Indicator.

circuits by two sets of seven-cell storage batteries, each of which has a capacity of 40 ampere-hours and weighs 150 lbs.

In connection with the switch groups, cut-out switches are provided so that either pair of motors may be cut out by simply rendering certain switches inoperative. It is thus possible to cut out the motors without manipulating the main circuit.

The auxiliary equipment includes two air compressors driven by motors which can be operated on either alternating or direct current; two blowers driven by similar motors and which furnish air to the transformers, motors and direct-current rheostats; oil circuit breakers for the high-tension circuits; switches to change the equipment from alternating to direct current; a steam generator to supply heat to the railroad coaches in cold weather; a complete Westinghouse air-brake equipment, signal apparatus, automatic bell ringers, whistles, sanding apparatus, etc.

The New Haven locomotive measures 36 ft. 4 in. over the bumpers and weighs approximately 85 tons. It is capable of handling a 200-ton train in local service on a schedule speed of 26 miles per hour, with stops averaging about two miles apart, making in such service a maximum speed of about 45 m.p.h. It can also handle a 250-ton train on through service with a maximum speed of about 60 miles per hour. With heavier trains it is planned to couple two or more locomotives together and operate them in multiple.

The tests which have been made on the first locomotive equipped

show that it will, without difficulty, meet all the requirements for which it has been designed. The locomotive has on actual test, repeatedly accelerated a 200-ton train at a rate of .5 of a mile per hour per second, which is in excess of the rate required by the service conditions of the New Haven road. The current and power consumption correspond very closely to the predetermined values. The line upon which the locomotive has been tested is not well adapted to high speed work on account of the numerous sharp curves which exist, but, in spite of these adverse conditions, the locomotive has been operated at speeds above 60 m p h without difficulty.

Some Phases of the Panama Problem.*

BY JOHN F. WALLACE.

The events connected with the Panama canal project during the first two years of American control have been of such a kaleidoscopic nature that it would require an intimate acquaintance with the actual facts to understandingly consider the situation. Briefly, the present status is that we have been in possession of the work for approximately two years, have expended some 70 millions of dollars, and have excavated about 1 per cent. of the material which must be removed from the Culebra excavation for a sea-level canal, or 2 per cent. of the amount of material to be excavated for the high-level project. The importance of the work done, however, while it cuts a very small figure compared with the amount to be accomplished, has developed very interesting figures as to the efficiency of machinery, methods and character of labor employed, nature of materials to be encountered, climatic influences; in fact, has produced a great deal of data not only useful in itself, but giving fundamental information, from which valuable deductions may be derived as to the efficiency of modern appliances and proper methods of work.

The nucleus of the organization which was started by the speaker was developed from practically 500 French and native employees to from eight to ten thousand, which, since the speaker's resignation in June, 1905, has been practically doubled. Up to the present time this force has been employed largely on preparatory work of all kinds, such as the construction of sewers and water supply for the various towns and cities, the clearing away of the jungle, the drainage of swamps, the enforcement of sanitary measures, the provision of quarters, the conduct of engineering surveys and technical studies, the construction of railroad tracks, shops and other preparatory facilities for the future conduct of the work; the purchase, manufacture, erection and installation of steam shovels, locomotives, engines, cars, shop machinery, and other facilities needed. The present situation is that of an army of 20,000 men and officers equipped and waiting for instructions as to the plan of campaign, before the word is given to strengthen up the skirmish line and commence the attack upon the enemy.

During the last two years the Isthmus has been covered with engineering parties, verifying, correcting and elaborating previous surveys and technical studies, and they have determined not only the configuration of the ground along and adjacent to the proposed line of the canal, but have drilled its surface to the depth of 40 ft. below the sea-level from one end of the canal route to the other to develop its subformation, and they have measured and gaged the streams draining the territory along and adjacent to the line of the canal.

While there remain many engineering problems of greater or less importance in regard to the solution of which even engineers of great reputation differ, and while the detailed engineering works are of magnitude, it is generally conceded that no engineering problems remain which are impracticable of solution, and that even a sea-level canal is possible, the time and cost of its consummation having been found to be within reasonable limits. And at last the great problem as to the selection of a plan—whether it shall be one with six locks at an elevation of approximately 85 or 90 ft. above sea level, or a sea-level canal—has been submitted to the American Congress by the President for its final decision, together with views and opinions of the leading engineers who have given this question study, and the data upon which these conclusions are based.

As the speaker will probably be called upon by the Senatorial committee to give his views on the general question of plan, he does not consider it proper to discuss this feature of the situation in detail at this time, but desires more particularly to call attention to the fact that consideration of the questions of administration and the methods under which this great work shall be conducted is equally vital. While there is no doubt but that, out of all the controversy on all matters connected with this great subject, success will finally come, it is a question whether it shall be attained in a straightforward, efficient, business-like manner, resulting in the economical, efficient and speedy construction of the best type of a canal to serve the commerce of the world through future generations, or whether we shall finally reach the light after stumbling along in the dark, falling occasionally in the "slough of despond," and only achieving success after the wasteful expenditure of millions, the lapse of years of time, and with our self-esteem and great American boastfulness badly damaged.

METHODS.

From the experience of the speaker in connection with this and other public works, he is forced to the conclusion that either the work should be put into the hands of one strong man, with practically unlimited authority, combining the technical and scientific training of the engineer with the administrative and executive ability of a man of force; with this should be coupled the separation of all matters connected with this work from the control of the ordinary Government departments at Washington—under such supervision only as to insure the Government that his administration is efficient; or the same result accomplished through the letting of the work to a contracting firm, large enough to control under one management the entire constructive work on the Isthmus, under broad and general specifications and under such general supervision as may appear to Congress to be proper. The first step of any contracting firm would then be to place its affairs in the hands of a strong single executive, supported by such advisory technical knowledge as might be deemed necessary. The precedent for this method, and a working application of this principle, is the special agreement which was made for the construction for the improvements at the mouth of the Mississippi under Capt. Eads. It was a contract which bound the contractor to certain results for a specific sum, and no more satisfactory compact for public work was ever made by the United States.

It is only in this way, or some substantially identical way, that the construction of the canal can be successfully accomplished. While the work may be completed at some time, and at some cost, by the poorest and most inefficient method—even by hired labor under Governmental control—the accomplishment will be far from satisfactory. It goes without saying that if any large American corporation were engaged in the business of constructing a great public work for the purpose of furnishing transportation, unhampered by political questions or selfish interests, the work would attract practically no attention, except the ordinary interest connected with an engineering project of great magnitude. It is a fact of which the public is not aware that many of the large railroad systems to-day are spending as much money annually in the improvement, maintenance and operation of lines of transportation providing for the handling of tonnage much greater than that which will pass through the Panama canal, or will be expended on the Panama canal, and their operations proceed with hardly a newspaper notice.

It may be argued that commercial interests would suffer by placing the Panama railroad under the control of a general contractor, and that it will be difficult to secure the proper control of its obligations as a common carrier.

The plan suggested in my official communications on this subject was that of operating the Panama railroad as a simple transfer organization, whose sole duty as a common carrier would be to receive the freight delivered at its ocean wharf on one side, and deliver it at the ship dock on the other side, for a flat rate per ton—regardless of classification, except so far as the cubical contents of certain light articles would be made equivalent to a ton. The proposition is simple and perfectly practicable. The forwarding agents of the world would thereafter bill all goods over transportation lines using the Panama railroad as an immediate transferring link, on their bills of lading, subject to the transfer charge across the Isthmus of Panama; this could be collected by Government agents, either from the steamship line delivering the freight or the one receiving it. In this way no complication of accounts would be necessary, and all commercial interests would be treated with equal fairness. It would be a simple, normal and logical introduction to the conditions which will exist when the canal is opened and rail trans-shipment gives way to through passage of shipping under a flat tonnage charge, and would save over $100,000 per annum of the expense of management through the present New York office alone.

One of the objections raised to the proposition was that "it would unsettle transcontinental rates." If this is to be a final and determining reason, why are we building the Panama canal?

After the proper facilities have been provided in the way of docks and wharfs, double-tracking of the Panama railroad, and providing it with modern equipment, there will be no difficulty in a general contractor easily, promptly, and economically handling all the commercial freight, without any interference with the canal construction work; particularly if he has the absolute control of both, and is held accountable only for the proper performance of the duties of a common carrier.

The question of local rates and the charges to be made for this service by the contractor are simple, and easily adjusted; it would seem a brilliant opportunity for the United States Government, either through its Interstate Commerce Commission or otherwise, to experiment with the regulation of rates across the Isthmus

*An address delivered at a dinner of the Illinois Manufacturers' Association, Chicago, March 2.

and the general control of the operation of the Panama railroad, and acquire some experience therein before attempting to tackle the complicated problem of regulating the rates and controlling the methods of doing business on 200,000 miles of railroad which interlace and ramify throughout the United States. The transportation rate problems of Panama, as compared with those of the United States as a whole, might be likened to a single grain of sand compared with the seashore.

THE TEHUANTEPEC RAILROAD IN COMPETITION WITH SUEZ AND PANAMA.

While the construction of the Panama canal will confer great benefits on the commerce of the world, the commercial interests of Great Britain have not been blind to the possibilities of a project and route, which will, in a large measure, anticipate the future benefits of the construction of the Panama canal and give immediate results, pending its accomplishment, with a strong probability of being able to retain the trade if once secured. I refer to the railroad transportation facilities which are about to be completed in the interests of British capitalists, across the Isthmus of Tehuantepec, a distance of about 176 miles.

This railroad is being constructed in a most substantial manner, provided with the very best facilities, equipment, etc., in order to handle a large amount of traffic at the minimum cost per ton. Modern machinery and methods will enable this railroad to conduct a profitable business at a rate of not to exceed $2 a ton from shiphold to shiphold; and with the best modern loading and unloading facilities, proper wharves, warehouses, and harbor terminals, the time from ship to ship should not exceed an average of two days.

It is fair to assume that modern cargo steamers are able to handle the average run of ocean freights with profit on a basis of one-tenth of a cent per ton per mile, or, in round figures, $1 per 1,000 miles. The advantages of the Tehuantepec route over the existing route to the far east by way of the Suez canal are as follows:

From New York to Australia, say the port of Sydney, the saving in distance by way of the Tehuantepec Railroad would be 5,700 miles, and any railroad rate across the Isthmus of Tehuantepec, less than $5.70 per ton, should take this business from the Suez route. In addition it would save the time that it requires an ordinary cargo vessel to steam 5,700 miles, minus the time required to transfer the freight across the isthmus by rail. This would make an actual saving of time of at least 15 days, even allowing the maximum of four days for the isthmian transit.

From New York to India and China points, this route would not be so material, as the line of least resistance from a traffic standpoint would be over the transcontinental lines through San Francisco, Seattle, or other Pacific ports.

From Liverpool to points in the far east where the distance is the same, the Tehuantepec ship railway could charge the Suez tolls, which are approximately $2 per ton, and compete for the business with a fair profit.

Turning to the ports, however, in the United States, the advantages given by this route are also remarkable. From New Orleans to Hong Kong, the saving would be 4,800 miles over the Suez canal route, and would yield the Tehuantepec railroad $4.80 a ton on the basis of equivalent charges by the Suez route, in addition to saving from 12 to 14 days in time.

From New Orleans to Yokohama the saving over the Suez route would be 8,400 miles, which would enable the Tehuantepec railroad to charge $8.40 per ton for the transit of freight on its railroad, on an equivalent basis with Suez, and save approximately 24 days in time. From New Orleans to Australia, the port of Sydney, the figures would practically be the same.

As there is little question of the ability of this railroad to handle freight from ship to ship for $2 a ton or less, its ability to build up an enormous business to the far east in competition with the Suez route is plainly manifest.

Let us now compare the Tehuantepec route with that of the Panama canal on the same assumption that $1 per ton will carry ocean freights 1,000 miles, and that $1 per ton will be the minimum rate charged for transit through the canal.

From Liverpool to Hong Kong, the saving in distance via Tehuantepec will be 1,200 miles, and allowing two days for the transit of the freight across the Isthmus of Tehuantepec, the saving of time will be approximately two days. The saving in distance will be equivalent to $1.20, which added to the minimum charge of $1 through the Panama canal, would give $2.20 as a maximum charge to the Tehuantepec railroad.

From Liverpool to Yokohama the saving as against the Panama route will be 1,100 miles. From New York to Australia, port of Sydney, the saving will be 761 miles, which, on the same basis as just stated, would yield the Tehuantepec railroad a maximum charge of $1.76 a ton, or approximately one cent per ton per mile; some 40 per cent. higher than the average rate on the trunk lines in the United States.

From New York to San Francisco the saving will be approximately 1,200 miles, which would yield $2.50 as a maximum rate to the Tehuantepec railroad.

From New Orleans to Hong Kong, a common point for northern China, the saving of the Tehuantepec line over Panama is approximately 2,000 miles, which would permit the Tehuantepec railroad to charge a maximum of $3 per ton on an equivalent basis, and save in time approximately five days.

From New Orleans to Australia, port of Sydney, the saving would be approximately 1,400 miles, allowing the Tehuantepec railroad a maximum charge of $2.40.

From New Orleans to Honolulu the saving would approximately be 2,000 miles, permitting the Tehuantepec railroad to charge a maximum rate of $3 per ton.

From New Orleans to San Francisco the saving in distance via the Tehuantepec route would be 1,800 miles, permitting the Tehuantepec railroad to charge a maximum of $2.80 per ton, with corresponding saving of several days in time.

The advantages of Tehuantepec over the Suez and Panama routes in the saving of money and time make it self-evident that in the years that will elapse before the completion of the Panama canal, our British cousins will undoubtedly build up a large and profitable business, which it will be difficult thereafter to divert back to the Panama route.

I do not submit these ideas to discourage our own enterprise, but simply to show the cold facts and to point out at least the direction in which I think the remedy lies: It is in the immediate provision at Panama of the proper facilities and equipment for the development of the maximum efficiency of the Panama Railroad, and the putting in of a flat rate of not more than $2 a ton and possibly as low as $1.50, in order to prevent other lines from diverting traffic from that route, and to encourage and expand the traffic tributary to it. That this can be done, without any material loss to our Government, is evident.

A rate as low as $1.50 a ton—which will give an average of two cents per ton per mile for transit over the Isthmus and allow 50 cents per ton for the handling of freight from ship to car and from car to ship—would be ample, after complete facilities for handling the business had been provided and the business had increased to a sufficient amount to justify it—say to 1,000,000 tons per annum.

So far as the mere question of rate is concerned, with the only disadvantage of breaking bulk, this rate would immediately enable us to compete with the Suez canal on all traffic from the United States ports to the far east, and from the ports of Europe to Australia, Japan, China and all points east of Singapore; and so far as our trade with the west coast of South America is concerned, this would give the United States, particularly the Mississippi valley, a decided advantage over all the ports of Europe, and would enable us to anticipate the larger part of the advantages of the Panama canal. It would give our merchants and manufacturers such a foothold in this trade, provided it is properly catered to and developed, as would enable it to be held at least in part.

The failure of the United States to improve and utilize the Panama railroad to its full capacity, and do it at once, may seriously affect the value of our Panama investment, which has already reached 70 millions of dollars, and may reach 300 millions.

UTILIZATION OF THE PANAMA RAILROAD.

The great direct benefit of a flat rate of $2 a ton or less across the Isthmus of Panama by rail will at once put us in a position, where, for a comparatively small investment not exceeding 2 per cent. of the total cost of the canal—which investment should be made in any event, in order to assist in its construction—a large percentage of the ultimate advantage to be derived from the canal, commercially, will be secured. The greater part of this benefit will lie in the reduction of rates, which will result to the benefit of the agricultural and commercial interests of the countries in Central and South America bordering on the Pacific below the Mexican line.

While the proportion of the rates which have accrued to the Panama railroad on business from New York to San Francisco has been low and reasonable, its charges on the traffic passing over the Isthmus to and from the countries bordering on the Pacific coast in Central and South America have been exorbitantly high and have been kept by the railroad at a figure as high as possible without causing the traffic to be diverted around Cape Horn. It is the speaker's recollection that the rate which accrued to the Panama railroad on coffee from Costa Rica has been as high as $6 a ton for the distance across the Isthmus, say 50 miles. A lowering of the rate to $2 a ton or less will stimulate all forms of agricultural and commercial enterprises in the countries affected thereby. It will largely increase the population and the consuming capacity of these countries; and if this trade is properly fostered and catered to by the manufacturers and merchants of the United States, it should yield large benefits and cement the political, commercial and personal friendships between ourselves and the nations of Central and South America.

RELATION OF TRANSCONTINENTAL LINES TO THE PANAMA CANAL.

One of the most erroneous impressions [illegible] and which the press and the public seemed to have thoroughly absorbed, is that the transcontinental railroad lines are in mysterious ways working to delay or defeat the completion of the Panama

canal. The speaker has no interest whatever in this matter, beyond a desire to correct what he feels to be a false impression.

The only ground for a motive of this kind would be in case the construction of the Panama canal would reduce the traffic rates from the Atlantic to the Pacific seaboard to such an extent as to interfere with the business of through transcontinental lines. It is a fact known only to a few persons and those who have direct knowledge of the existing rates and their divisions between the Panama Steamship line, the Panama Railroad, and the Pacific Mail Steamship line, that the average rate of charge which accrues to the Panama Railroad Company for the transportation of freight between New York and San Francisco, is less than $2 per ton. If the rate to be charged for transit through the canal is to be the same as Suez, the future rates between San Francisco and New York cannot be materially affected by the construction of the canal.

If the rate is hereafter reduced to $1 a ton for transit through the canal or pending its construction, and the Panama railroad rates are reduced to this figure, the reduction will be so slight that it will have little or no effect on through transcontinental rates, and will probably effect no greater reduction than will gradually be made by reason of competition existing between the railroads themselves.

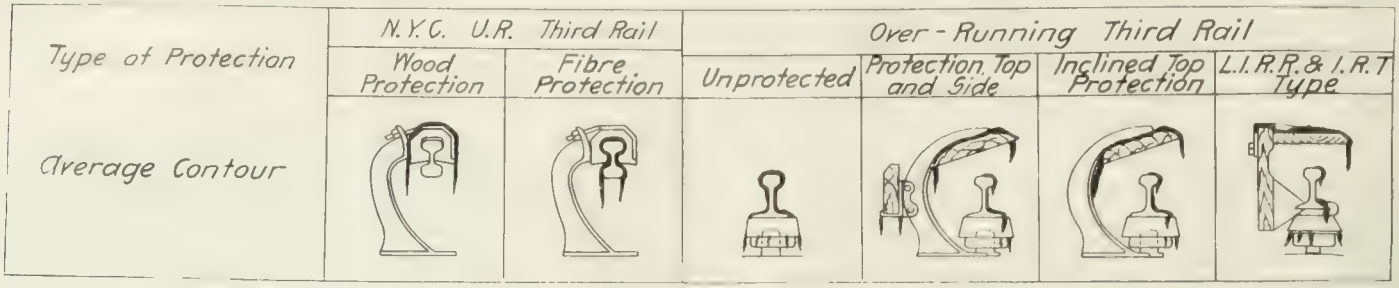
The only advantage gained, so far as New York and San Francisco business is concerned, by the construction of the canal, will be the avoidance of breaking bulk. This, to some extent, however, will be necessary even after the canal is completed, as the probabilities are that cargoes will be consolidated at least to some extent at the Isthmus in order to cheapen transportation. As the rates heretofore existing between New York and San Francisco via the Isthmus have been generally from 30 to 35 per cent. lower than the through trans-continental rates by rail, and as this differential has not been able to secure any great share of the business between these two points as against the through transcontinental lines, it would not appear that the parties interested in these lines have any cause to become unduly apprehensive, or have any motive for an expenditure of their time and money to either defeat or delay the canal project.

When it is understood that to the through ocean rate must be added the local rates for carrying freight from inland points to the seaboard on either coast before through shipments can be made, it will be readily seen that the amount of tonnage between the Atlantic and Pacific coasts using the canal route will necessarily be limited to the traffic originating at the sea ports, and that the traffic from the interior cannot be expected to take the ocean routes in preference to those offered by rail. Even in this case only certain classes of goods will withstand the ocean voyage, which will require from three to four weeks.

The speaker has had a wide acquaintance among men interested in the transcontinental lines, and he has yet to know of a single step being taken, by those interested, in opposition to the project, and is satisfied that nothing of this kind will be done and that no reasonable motive exists therefor. His attitude towards the canal project is that of a patriotic American citizen, whose only desire is the promotion of his country's welfare, politically and commercially, and whose hope is that this great enterprise will ultimately be accomplished in an honest and efficient manner, and add to the glory and prosperity of our nation.

Effects of a Sleet Storm on Different Types of Third Rail Protection.

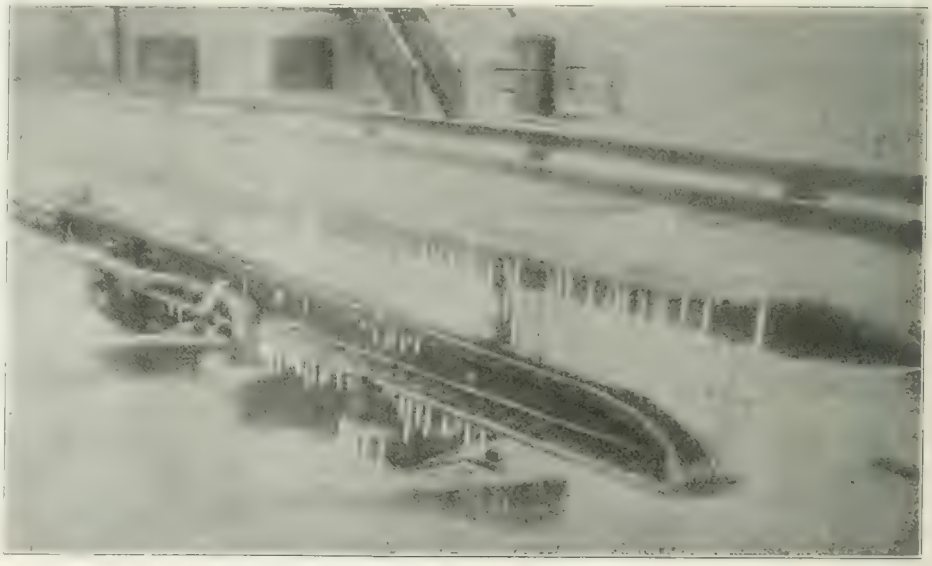
One of the drawbacks which has to be overcome in third rail operation is the coating of the contact rail by snow, ice and sleet, which causes arcing of the contact shoes and consequent difficulty in maintaining the current in the motors. In the *Railroad Gazette* of February 16th there was described a very unusual and interesting test of one of the New York Central's electric locomotives during a severe snowstorm on February 9th. This went to show the practicability of the under-running type of third rail for operation under such conditions. On March 3d a different set of weather conditions gave a further chance for comparison of various types of third rail protection. There was a light rain, followed by hail, followed by rain again, with the temperature ranging from 28 deg. to 33 deg. Fahrenheit, and an east wind with a velocity of two miles an hour. The sleet began to form at nine in the morning and continued to form throughout the day, the quality of the sleet varying with the temperature. In thickness it averaged about one-quarter of an inch. The accompanying sketches and photographs



Sleet Formation with Various Types of Third Rail Protection—New York Central & Hudson River.



Sleet formation on Over-Running Third Rail; Interborough Rapid Transit and Long Island R. R. Protection.



Sleet formation on Over-Running Third Rail: Inclined Top Protection.

Effects of Sleet Storm on Over-Running Third Rail; March 3, 1906—New York, Central & Hudson River.

show the sleet formation on the rail, with the various types of protection.

There were two types of over-running rail tested:

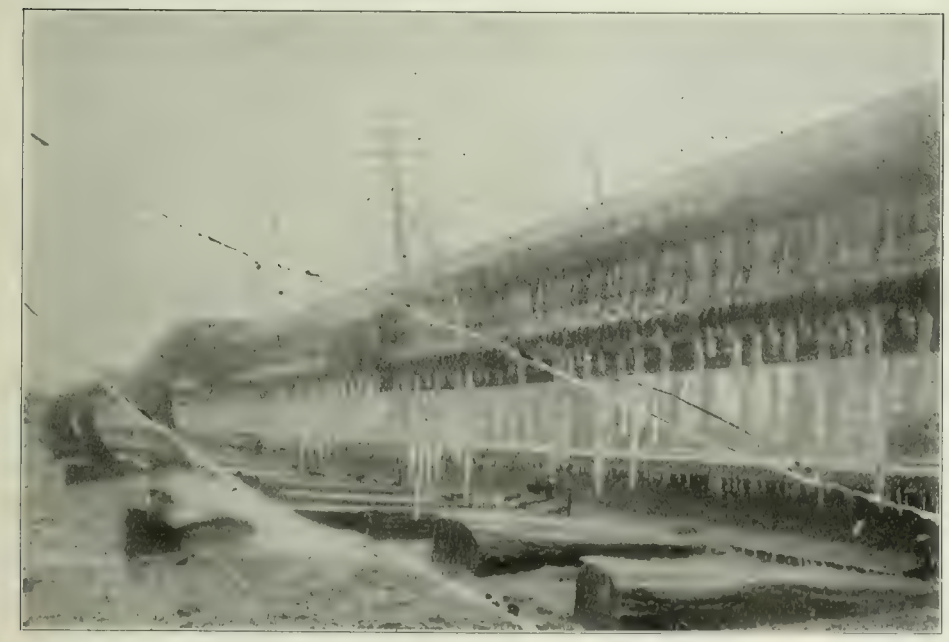
On the unprotected over-running rail the sleet was so bad that after three hours it was impossible to run.

On the inclined top protection over-running rail on the section of the track where the wind could get at the side of the rail the sleet formed at some points entirely over the top of the rail. At such places the contact shoes arced badly.

Operation of each type of the over-running rail was thus shown to be unsatisfactory under these weather conditions.



Sleet formation on Under-Running Third Rail; Three-Piece Protection.



Sleet formation on Under Running Third Rail; Fibre Protection

Effects of Sleet Storm on Under-Running Third Rail; March 3, 1906 New York Central & Hudson River.

There were three types of the under-running rail tested:

On the under-running rail with wood protection the drip carried the sleet off the edge of the slide board and no sleet formed on the rail.

On the under-running rail with fibre protection, the drip was carried off by the fibre and no sleet was formed on the rail.

On the under-running third rail with mica compound insulation, except on the edges of the rail, no sleet formed.

The superiority of the under-running rail over the over-running type was therefore shown under these weather conditions.

After a number of trials, the attempt to run on the exposed third rail was given up, and operation was confined to the protected sections. On the protected top running rail there was considerable arcing of shoes, but on the under-running rail there was no sign of arcing.

Railroad Commissioners' Convention at Washington.

[*Continued from last week, page* 354.]

The subject of rate legislation was briefly discussed and the report of the Committee was unanimously adopted. This report, which discussed the subject at length, concluded with a recommendation to the effect that the powers of the Interstate Commerce Commission should be enlarged so as to give it authority to correct any unreasonable or unjustly discriminatory rate, regulation or practice, and to substitute a just and reasonable rate, regulation or practice in lieu thereof; that the orders of the Commission should be made effective, but that the legislation should preserve to the carrier the protection of the courts in all its rights under the legislation. A proposition was submitted by Mr. Chadbourne, of Maine, the chairman of the Rate Committee, that the traffic managers of the railroads should be invited to meet with the association next year and contribute their expert knowledge on the subject of rates, but it was voted down.

The report of the Committee on Safety Appliances was adopted. This contained a recommendation to be made to the legislature of each State separately urging the passage of an act identical with the Ohio law which denies to the carrier the right to defend its act in case any one is injured by a violation of the safety appliance law. The report again called attention to the need of a law requiring the use of block signals, and a resolution offered by Mr. Kilpatrick, of Illinois, asking Congress to provide for the appointment of a commission to inquire into the matter of the best automatic block signal system available for use on the railroads of the United States, was adopted. The bill for a compulsory law, introduced in Congress by Mr. Esch, is still in committee.

The present report also emphasizes the dangers due to the employment of men in train service excessive hours. It says: "The records of the Interstate Commerce Commission show that the railroads have reported, under the requirements of the accident law of 1901, a total of 118 accidents, involving the death of 51 persons and injury of 198 persons, where the employees involved had been on duty from fifteen to forty-eight hours. Many of these accidents were directly caused by employees falling asleep at their posts of duty. * * * This question of long hours is one that urgently calls for regulation, both by the Federal Government and by the States. A bill which has the support of the railway employees' organizations was introduced in the House by Representative Esch, of Wisconsin, and in the Senate by Senator La Follette. Another bill, which is without the indorsement of railroad employees' organizations was introduced in the House by Representative Norris, of Nebraska. Only a few States have as yet made any attempt to regulate the hours of labor of train employees, and even in those cases where legislation has been attempted the effort seems to have been to prevent railroads from compelling train employees to work an excessive number of hours for a single day's pay, rather than to protect the public safety by requiring absolutely that employees shall neither be required nor permitted to remain on duty an excessive number of hours consecutively. In even the best laws there is no limit to the number of hours a man may be permitted or required to work, and there is absolutely no protection to the public.

"Following the example of Illinois, the State of Ohio has passed a safety-appliance law, patterned after the Federal statute. A law such as this should be on the statute books of every State in the Union. The Federal statute has stood the test of the courts, and no mistake can be made in adopting it as a model for State laws. Its provisions have been embodied in the Ohio statute (referred to above), and also a bill now pending in the legislature of the State of Kentucky.

"Your committee recommends also an additional section covering the matter in which it is now proposed to amend the Federal law, and that is to give the various State commissions authority to make all necessary and proper regulations to carry the law into effect, including regulations for the direction and guidance of such inspectors as may be appointed to execute and enforce the law."

The Association adopted a resolution offered by Mr. B. H.

Meyer, of Wisconsin, declared it to be the cause of the association that Congress should authorize and direct the Interstate Commerce Commission or some other department of the national government to ascertain the investment value of all of the railroads in the United States, and to ascertain the value of the railroad property of each State separately. Consideration of the report of the Committee on Railroad Taxation was deferred until next year.

The report of the Committee on the Powers, Duties and Work of railroad commissioners led to a discussion which showed that many of the commissioners are not satisfied with the existing legislation in their respective States and are seeking increased authority. One of the propositions favored by some of the delegations was that of "reciprocal demurrage," by which a railroad would be compelled to pay demurrage if a car should be demanded and should not be supplied within a specified time.

John S. McMillan, of Washington, was elected president of the association for the ensuing year, and Seattle, Washington, was selected as the place for the next annual meeting, the date (between July 1 and August 31), to be determined by the executive committee.

Mr. Buehring on Seniority.*

The Brown System of Discipline has been so generally adopted throughout the United States that it would probably be safe to say that the larger part of the operating officials of American railways regard it as giving better results than any other. Again the Seniority Rule as to promotion of employees, and especially those classes of employees generally affiliated with labor unions, is in force to even a greater extent than Brown's Discipline. The two things are interdependent because of the qualifying clause of the Seniority Rule—"Men will be promoted in order of seniority, *other things being equal.*" To the extent that regard is paid to the spirit of the italicized clause, the record of the employees enters, and, hence, the system of discipline in use as well.

This relationship is not generally acknowledged because discipline methods originate with employers and the seniority rule came from the employees, and to merge the two in any way is tantamount to each admitting the other fellow's scheme is good and acceptable *in toto*. But why not? It has not been long since the superintendent was supposed to know whether or not his employee's services were satisfactory and he had "power to act." But organized labor and other factors have changed this very generally, and greatly circumscribed not only his authority, but, by schedules and arrangements, that of the general manager, president, and even chairman of the board, as well. Some very exasperating situations consequently occur, but the men who forge ahead in life are not the ones who spend much time fretting about "tied hands," etc. If one cannot keep from having his hands tied, get as much freedom as possible, and go on.

Now as a matter of fact the employees recognize the necessity of maintaining discipline and enforcing the rules which are essential to safety and the economical operation of the road, but they properly object to arbitrary and excessive discipline, and promptly "take it up to the top" in such cases. On the other hand employers can have no valid objections to seniority if due regard is paid to the spirit of the proviso, "other things being equal." Such being the case, why not make discipline subserve both ends—observance of the rules essential to safe and economical operation of the road and also furnish the data necessary to carry out the spirit of the seniority rule proviso, "other things being equal"? This in effect is the basis of the system suggested by W. D. Buehring, Chief Clerk of the Superintendent of the Tucson Division of the Southern Pacific; and I think, as outlined by him, it is well worth very careful consideration. It consists of keeping a daily record of services rendered by each employee—not of amount in hours or miles or units of work, but of *quality*—balancing it yearly, and using it, and it alone, as the proviso of the seniority rule, "other things being equal."

This system practically possesses the most important characteristic of the Brown system so far as discipline is concerned, because it emphasizes the fact that the successful executive must have the co-operation of his men and that he can obtain it by keeping a record of quality of services. It also does a great deal more, for it is not merely a negative record, a record which shows what a man should not have done, but a positive record whereby a premium is practically paid for good service. It is true some roads now give credit in "Days" and others "Commendations on the Record" for exceptional service under the Brown system, but there is a vast difference between the man who puts in his time and misses any "Brownies" [demerits] and a "rattling good railroad man," and that difference is very largely due to lack of interest—not "hitting the ball." It is just this lack of interest which is so exasperating to the experienced railroad official, for he remembers it was not so when railroad systems were small and the unions did not run the roads. These officials often blame the unions entirely for such lack of interest. If they were right in so doing, their attitude toward labor unions would be entirely justified, because this "doing the least I can to miss the Brownies" is touching very directly the pocket book of the railroad companies. Traffic must be hauled in large units and hauled quickly; delays of even an hour are serious matters, not in overtime particularly, but in power tied up that length of time, traffic congested at terminals and loss of business. Not long since the superintendent had but few and short trains to be moved; but few crews, whom he knew and dealt with personally, and so could enthuse; and no union schedules and agreements to keep him away from his men. The successful executive could get the co-operation of his men by his personality. But conditions have grown quite too complex. The first man, that is the lowest in rank, who is permitted discretionary powers is so far removed from the "man behind the gun" that the men are not working for the "old man" but for an intangible company. They feel that officials may come and officials may go, but they will stay on regardless thereof. Furthermore, transition periods always present unusual difficulties, and the organizations of the modern large systems are getting down to an army basis so rapidly that the employees have not had time to acquire the interest in their new companies' insignias that the soldier has in the flag. And so it is that co-operation of the employees cannot be had without paying a premium for it. By paying its premiums the Buehring system would mark a big step in advance.

The premium so offered is not large enough to be objected to by the unions on the ground of a veiled attempt to lower the wages by increasing the output of the deft employee to the eventual detriment of his less talented brother. As a matter of fact, it is just an incentive to assure a good man who takes an interest in what he does, that the indifferent man, now ahead of him in seniority rights, can be passed, and passed in a time sufficiently short to make it worth trying. It is, of course, possible that the unions will object to removing absolute seniority, but if the members can be convinced that this Buehring record will be *ably and fairly* kept, and that the employee shall have the privilege of appeals from the decision of a subordinate officer, I feel sure the unions would regard it as just as effective a safeguard against the tyranny and favoritism of petty officials as is the present practice, and free from the objection of making the good man help the drone along. That drones are kept in high places by the good work done by better men below their level and that this is well understood and recognized by the men who comprise the majority of the unions, I am quite convinced from my talks with union employees on the subject.

The different methods of discipline in vogue on different railroads make it difficult to lay down iron clad rules, but the following is suggested by Mr. Buehring:

1. A book record will be kept of the service rendered by each employee, in detail, which will be balanced once each year and summarized; each year's record for merit and demerit to stand unchanged during the entire period of his service with the company.

2. Employees in the service of the company when this system is inaugurated, will be allowed a certain number of points for each month's work [in the past], such to be summarized for each year as though this system had been in effect at the time the employee entered the service of the company.

3. The work performed by each man will be classed as Excellent, Good, Indifferent or Poor for each day's work, and his rating established accordingly; 100 per cent. being considered good.

4. Each day's work will be considered to have a value of 100 points of per cent. for conduct and efficiency. An infraction of the rules or failure to meet the standard of efficiency will involve the cancellation of from 1 to 100 points, while excellent service will entitle the employee to additional points of from 1 to 100 per cent. but in no case will more than 200 points be allowed for one day's work.

5. Conduct means the behavior of the employee on and off duty as regards drinking, fighting, disorderly conduct on one side; and especial courtesy and acts of heroism on the other. It is presumed, of course, that employees will observe general good behavior and therefore no special emphasis is placed on this phase of discipline. Efficiency would necessarily be subject to subdivision according to the conditions prevailing at different points, but generally speaking it should cover the salient points of each class of service. For instance, taking the train service (it being understood that both train and engine crews are considered as one unit in giving credit for train movement) a form of conductor's trip report is suggested below.

6. Conductors, enginemen, engine foremen, etc., should make a monthly report on character of service rendered by their brakemen, firemen, switchmen, etc., respectively, which report should be used in the interest of the brakemen, firemen, switchmen, etc.; that is, the report should lead to special examination regarding those rules or instructions wherein they have been reported deficient. Conductors should report as to the enginemen as well as other classes of employees.

*Extract from a paper by Mr. H. F. Cory, read before the St. Louis Railway Club, March 9, and published in the Proceedings of the Club.

7. Employees whose rating falls below a certain standard are subject to dismissal without further cause.

8. Employees will be entitled to a fair and impartial hearing concerning any entry made against their records and may appeal to the superintendent; and the superintendent will also have the right to charge demerits against the record of any employee for infraction of any rule or instructions, where said offense is not sufficiently serious to justify discharge; but such discipline shall not involve cancellation of more than the number of points said employee is expected to earn during the current year.

9. The violation of any rule which is essential to safety will be considered a dischargeable offence.

First of all comes the necessity of having an accurate check on all work, and a systematic and equitable award for good service. To secure the first result, the following forms of report are suggested, to be turned in by each employee in charge, for himself and crew for each day's work, the entire crew to be considered as a unit.

Train and Engine Service.—The following is the form suggested for reports to be made out by conductors, and on which place is provided for the engineer to make note of any special credit claimed by himself or fireman, or to note exception to the conductor's report in any part. This trip report should be signed by both the conductor and engineer, and carries a par value of 100 points, covering the essential features of road service with supplementary space providing for special features, such as "Good service at wrecks." "Repairs of defects in equipment, track or structures," etc., per sample form appended.

CONDUCTOR'S TRIP REPORT.

District..... Train No..... Date.....
Conductor..... Engineer.....
Brakeman..... Fireman.....
Brakeman.....

	Item.	Value	Claim.	Allowed
A.	Making schedule or better	40		
B.	Getting out terminal on call or better	20		
C.	Observance of signals	10		
D.	Handling of equipment	10		
E.	Protection of train (seals, etc.)	10		
F.	General conduct	10		

Supplement.

(May be Debit or Credit.)

H.	Efficient service at wrecks	1 100		
I.	Repairs of defects to equipmt, track and struc	1 100		
J.	Exercise of good judgment in emergencies	1 100		
K.	Special			
	Totals			

Remarks.....

(Signed).....

Each of these regular items has a specific value, emphasis being placed on the prompt movement of trains. The special items have no fixed value and may be 1 or 100 points, but the total allowance for one day's work must not exceed 200 points all told.

As stated above, the crews would be dealt with as a unit as far as the operation of the train is concerned; but this would not prohibit recognition of specially good service, nor would the crew suffer for the delinquencies of any member thereof, for which full charge should be made against the record of the party at fault, the conductor being required to make mention of this under head of remarks.

The point arises: Should a crew be held responsible for delays over which they have no control? The only delay over which there is no control is a wreck, and that is sometimes questionable. Delays for water should be figured in the time-table schedule of the train, and the crew required not to exceed the allowance made for taking water. Delays for break-in-two are strictly "up to" the crew. Delays for orders must be cut out by better figuring on part of despatchers; conductors should be stimulated to make use of telegraphones at blind sidings in endeavoring to get more time on opposing trains.

All employees should be encouraged in assisting each other, in performing work of any disabled member of the crew; and, with the exception of accidents, where disability is self evident, the disabled employee should have 5 or 10 points canceled from his record, and twice that number of points credited to relieving employee. This would eliminate collusion of employees to unfairly benefit another whose record is, perhaps, not very good.

Station and Telegraph Service.—These reports should cover all points concerned in the operation of an agency and may be equally divided between the telegraph service (giving this 50 points) and the station work (50 points) or a total of 100 points per day, the same as outlined in rule 6, with the allowance of 100 additional points for meritorious acts.

An agent and his telegraphers would be affected by the telegraph department and the agent and his clerical force for the station work outside of telegraph duties. This distinction is necessary on account of the telegrapher being classed as a "specialist," and no clerk can perform his duties, though the telegrapher can perform the duties of a clerk. Hence the necessity of dividing the credits for any station allowing each arm of the service equal share. Furthermore, it also frequently happens that the entire force consists of telegraphers, so that there is no unfair allowance in this proportion.

The following form is suggested for a daily report of the station work:

STATION AND TELEGRAPH SERVICE.

Station. Date.....1906.

Clerical Force.

Agent.....
Telegrapher.....
.....
.....

	Items.	Value.	Claim.	Allowed
A.	Handling of train orders	20		
B.	Handling of messages	10		
C.	Promptly answering calls	10		
D.	General conduct (telegraphers)	10		
E.	Reports to general offices	10		
F.	Reports to superintendent's office	10		
G.	Station records	10		
H.	Seal records	10		
I.	General conduct (station men)	10		

Meritorious service, 1 to 100 points, etc.

The agent should be responsible for and stand all demerits and credits that may affect his station both in the telegraph and clerical department. All of the telegraphers should share in allowance for the telegraph department and in the delinquencies of any number of the staff; this would encourage them to help each other out, check mistakes and prevent possible errors. The same idea should hold as to the clerical force and also be applied to failure to get off reports on time and correctly. It is expected that agents have executive ability in handling their men and apportioning their work fairly between them, but if such is not the case, the necessity of the men helping one another to avoid demerits will tend greatly to enforce a readjustment of the work, eliminate any member who may be careless or incompetent, and enforce a co-operation between employees in each class of service; to assure which ends the entire corps must be considered as one unit.

The latter part of rule 8 would be particularly applicable to station service where the infractions of regulations are not subject to classification in a daily report.

Despatching.—The question of applying this system to despatchers is debatable, but might be permissible to the extent of placing a premium on the prompt movement of trains with issuance of as few orders as possible. It is suggested, therefore, that the chief despatchers make a daily report on the work of each man along the following lines. (Let each despatcher be identified by initial):

REPORT OF SERVICE OF DESPATCHER FOR

Division. Date.....190....

	Item.	A	B	C	D	E	F	G	H
A.	No. of trains moved								
B.	No. of train orders issued								
C.	No. min trains delayed meets								
D.	Do. waiting for orders								

Remarks. (Note should be made of any delay on account of operators on line not answering promptly).

This would be on record and have no comparative value in points, but the actual figures in minutes delay, number of orders issued, etc., would stand for themselves.

Yardmen.—Each crew would be treated as one unit and dealt with apart from every crew, and the yardmaster share pro-rata with number of crews in the allowance made, that is with one day and one night crew, the yardmaster would receive one-half the allowance made each; for three crews, one-third, etc.

The following form for a daily report is suggested:

YARDMAN'S DAILY REPORT.

Station. Date.....190....

Foreman..... Yardmaster.....
Switchmen..... No. cars handled.....
..... No. cars damaged.....
..... No. trains switched.....

	Item.	Value.	Claim.	Allowed
A.	Delays to trains switching	40		
B.	Handling of equipment	20		
C.	Observance of signals	10		
D.	Blocking movements of trains	20		
E.	General conduct	10		

Meritorious services (1 to 100 points).....
.....
.....
.....

The latter part of rule 8 would apply to any individual cases where it is thought best to establish a system of discipline, allowing 100 points for each day's service and 100 points additional for meritorious acts and enforced cancellation for infraction of rules as per rule 8 as noted above.

The foregoing forms are given more with the purpose of illustrating Mr. Buehring's ideas, than as proposing them as well thought out forms to be placed in use.

This system, of course, would necessitate having a thoroughly experienced, level headed, conscientious man in charge of the records, upon whom would devolve the task of approving and changing the efficiency credits asked for by the employes making the reports. Not only that, but such official must also have the entire confidence

of the employees affected as knowing his business thoroughly and of being perfectly square. He would undoubtedly have his hands full in attending to such department, for as very little of his work would be routine in character he could not turn over much of it to a clerical force for even a few days; that is, he would have to be in his office a greater part of the time. Furthermore, he would in the course of a year have occasion to explain his decision to pretty much every one of the employees under his jurisdiction, which means he must be tactful and patient. In short, a satisfactory man to handle this branch of the service would be a high-priced official, and according to my ideas, be outranked by no one on a division except the superintendent himself. He should have his hands entirely free in the selection of his clerical force and be subject to only general regulations. It would be advisable for all such officials on a system to have frequent meetings, in order that practice on the various divisions be as uniform as possible. All of this means, in effect, that the carrying out of the proposed system in practice would entail a large expense and add to the enormous number of records and accounts now being increased almost daily on our American railroads. This fact undoubtedly constitutes a serious objection to it. Nevertheless, if by its use, the vast army of railroad employees in the train, engine, station and yard service in this country could be induced to take the personal interest in the work, which a very limited number of them now take, I believe the expenditure the system would entail would be but a drop in the bucket compared with the economies that would be effected.

Reinforced Concrete Bridges on the Chicago & Eastern Illinois.

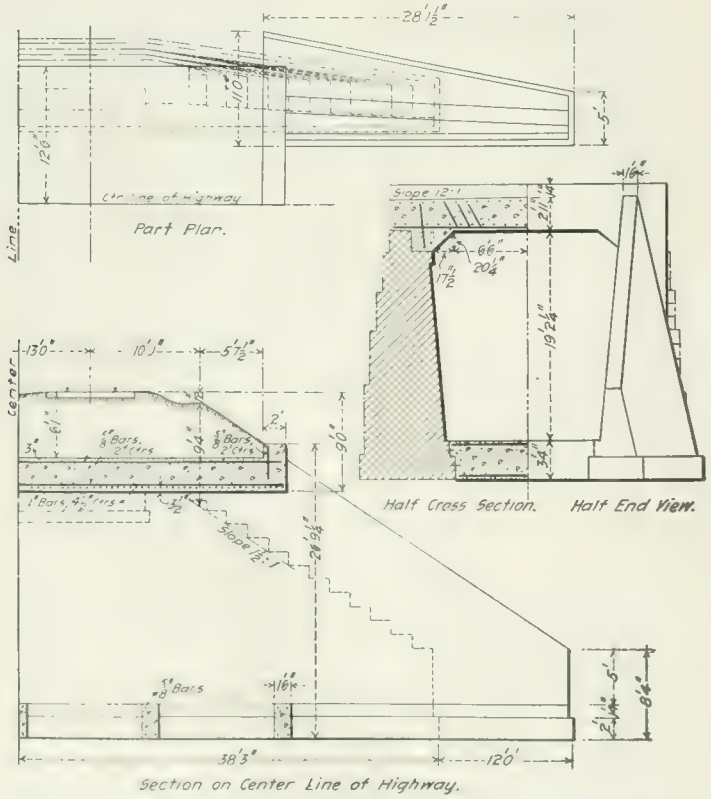
The third-track and other improvement work on the Chicago division of the Chicago & Eastern Illinois, described in the *Railroad Gazette* of March 16, while involving no heavy bridge work, includes several interesting reinforced concrete structures. Plans for two of the arch bridges and a highway under-crossing are shown herewith.

The Stony creek arch is a short distance north of Danville and replaces a double-track 75-ft. deck plate-girder bridge. The grade of the road had to be raised 9 ft. at this point to provide an under-crossing for the Indiana Harbor Railroad. Estimates were made for putting in new plate girder spans designed for heavier loading, as well as for the design adopted. One of the half-tone engravings gives a good idea of conditions prior to making the change, except that the northbound track had been raised to the new grade line, the girders resting on timber blocking on the bridge seat. The southbound track had not yet been disturbed. The masonry abutments were in fair condition and it was decided to use them in the new structure. A new girder bridge would have required these abutments to be built up to conform to the new grade line, but this was out of the question with the existing width of foundation as the additional fill would have imposed an excessive overturning moment. On the other hand, the old fill back of the abutment was thoroughly compacted and therefore capable of resisting part of the thrust from an arch. Conditions therefore were favorable for springing an arch between the abutments, and plans were made as shown herewith.

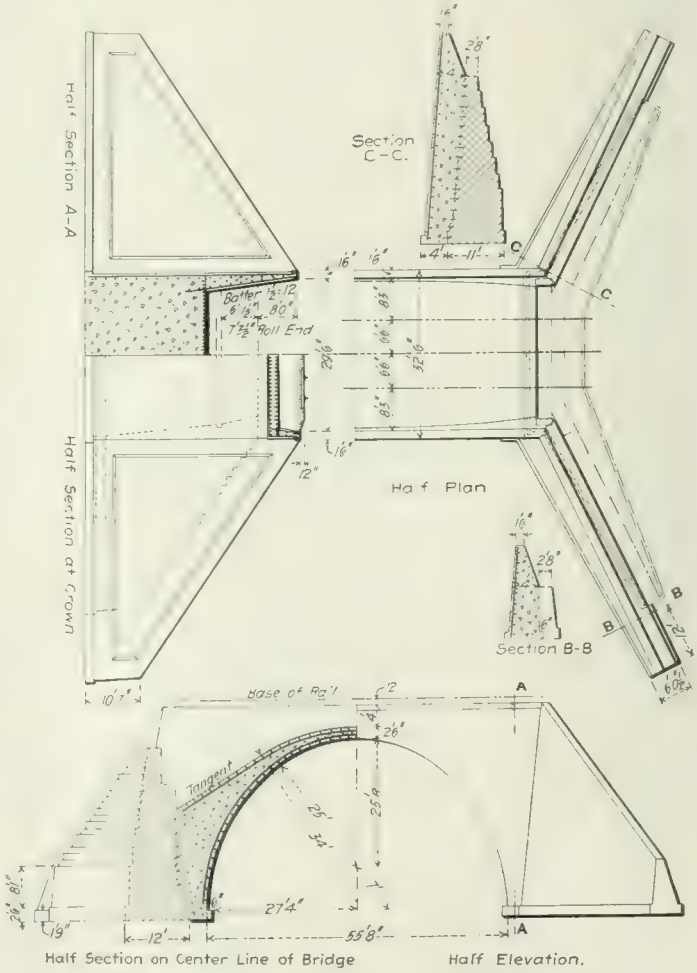
The primary consideration determining the design was to secure the largest allowable arch that could be sprung between the abutments without imposing an excessive unit pressure on the foundations and to keep the resultant of pressure near the middle of the base. The design used is a parabolic arch of 55-ft. 8-in. span, 2 ft. 6 in. thick at the crown and 32 ft. 6 in. wide over parapets. It is designed for Cooper's E-50 loading, with a factor of safety



Old Bridge Across Stony Creek, Showing Masonry Abutment; Northbound Track Blocked Up to New Grade—Chicago and Eastern Illinois.



Reconstruction of Highway Under-Crossing near Stony Creek—Chicago & Eastern Illinois.



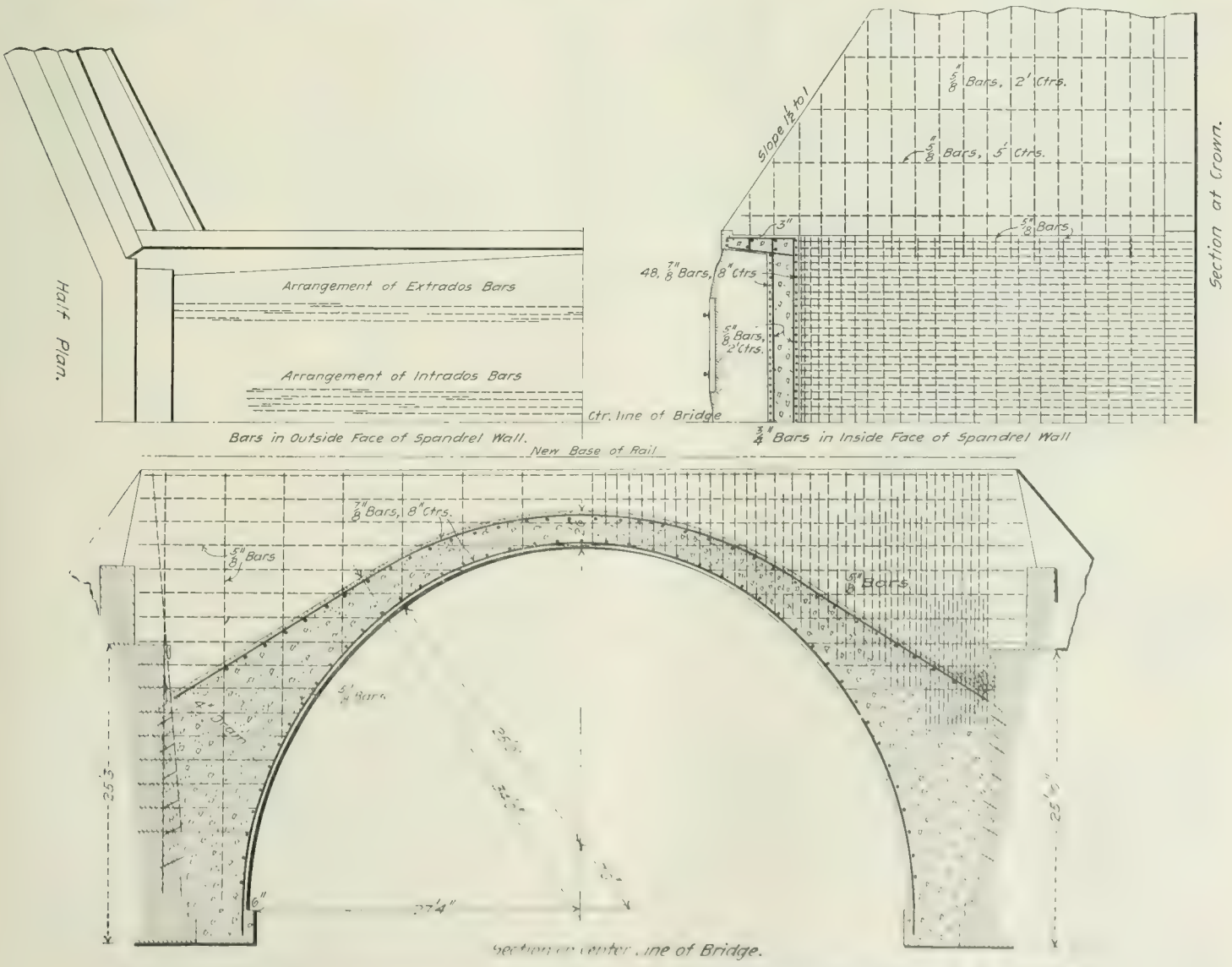
General Plan Showing Reconstruction of Stony Creek Arch—Chicago & Eastern Illinois.

of 6 under live load. As seen by the drawings, the face of each old abutment was notched to give a series of faces to receive the thrust of the arch normally. Steel dowels were inserted in each of these faces.

The wing walls for the new structure are one of the unique features of the work. The old wing walls were reinforced by addition of a thickness of 4 ft. of concrete on their faces, carried up from the foundations to a height conforming with the new fill, in which steel bars were imbedded. This concrete was tied to the old masonry by a large number of steel dowels. This is all clearly shown in the drawings. The plans also show in detail the reinforcing of the structure by Johnson corrugated steel bars, 17½ tons of which were used. The concrete was a 1:5 gravel mixture, the total for the bridge being 1,487 cu. yds. This cost $7.60



New 55-ft. Double Track Reinforced Concrete Arch Over Stony Creek—Chicago & Eastern Illinois

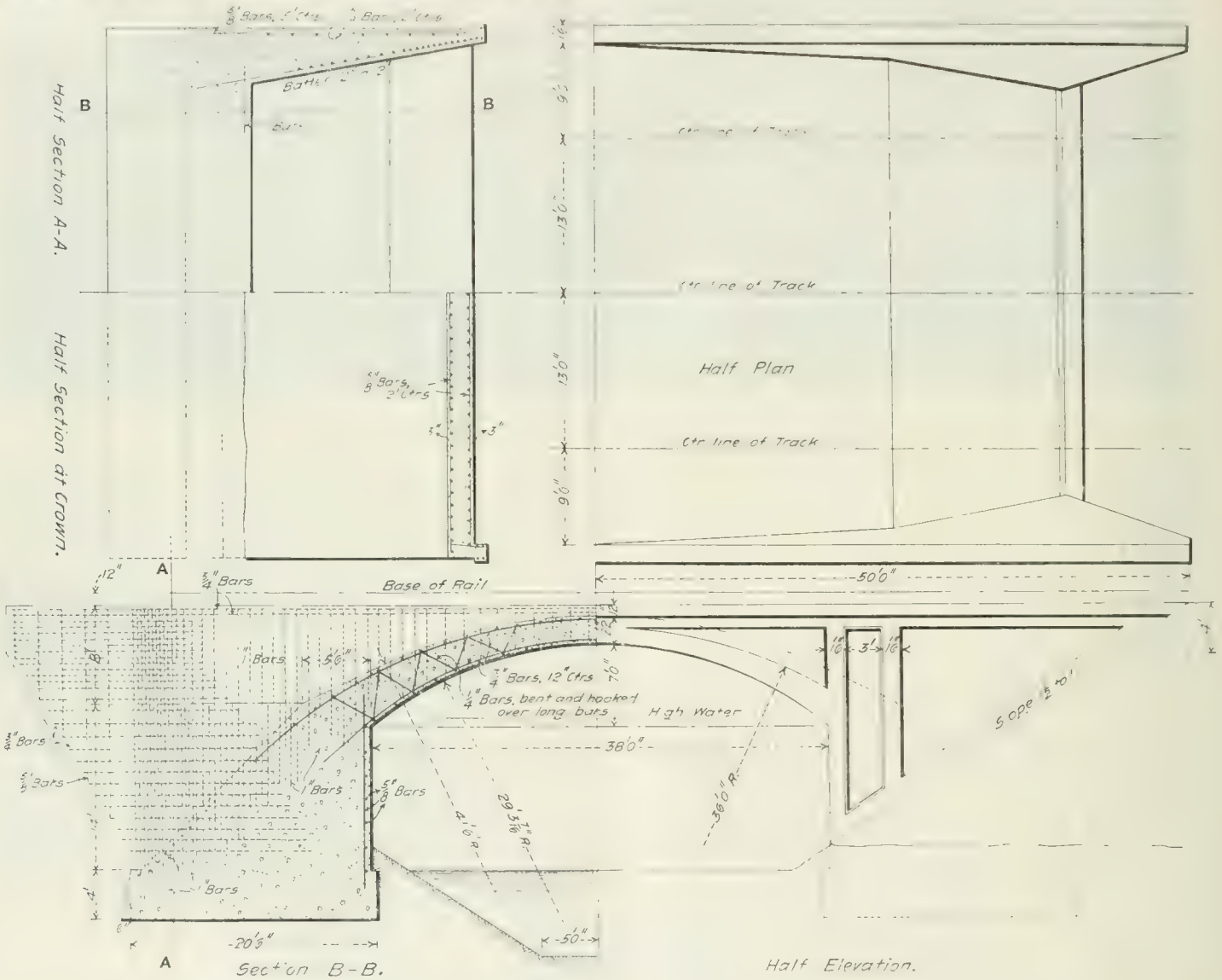


General Plan Showing Arrangement of Reinforcing Bars in Stony Creek Arch—Chicago & Eastern Illinois.

per cu. yd., including the steel reinforcing bars. The total cost was therefore $11,301.

The Trim creek arch is about 39 miles south of Chicago on the three-track line. It replaces a 45 ft. double-track deck girder bridge, the old masonry for which was removed to make room for an entire new structure. The arch is a flat parabolic type, of 38 ft. span and 2 ft. 2 in. thick at the crown. The barrel is 48 ft. long. The arch is founded on a firm clay, depth of foundation being 27 ft. below base of rail. All details of the design and of the reinforcing by corrugated bars are shown in the drawing. The total amount of concrete was 1,578 yds. and 18 tons of bars were used.

The highway under-crossing shown is about 100 ft. north of the Stony creek arch. The track previously was carried over this crossing on a steel I-beam span. This was replaced by a rein-



General Plan of 38-Ft. Reinforced Concrete Arch at Trim Creek—Chicago & Eastern Illinois.

forced concrete slab built between the old stone masonry abutments, the I-beams being blocked up while the slab was being built.

These structures were designed by Mr. T. L. Condron, Consulting Engineer, Chicago, under the supervision of Mr. W. L. Dawley, Chief Engineer of the Chicago & Eastern Illinois.

Washington Correspondence.

WASHINGTON, April 10.—The beginning of the end of the railroad rate debate in the Senate is in sight. Present indications are that an agreement by substantially all of the Republican Senators upon a form of amendment providing for a judicial review will soon be brought about. It is expected that the President will agree to the incorporation in the review amendment of the provision suggested by Senator Knox giving the reviewing court authority to determine not only whether the order complained of was beyond the authority of the Commission or in violation of the rights of the carrier secured by the Constitution, but also whether it was in violation of rights secured by the laws of the United States. It has been reported to-day that the President has already agreed to this, but it is not admitted at the White House that this is true and the report is probably premature. The so-called conservative Senators are very confident, however, that an agreement will be reached on this basis. The review amendment will then be expanded by incorporation of a provision that is being prepared by Senator Spooner for impounding the amount of the rate in controversy pending the review and for its payment to the carrier or to the shippers in accordance with the final determination of the court. Senator Spooner is endeavoring to so frame this provision that, in the event that an order reducing a rate is finally sustained, the money impounded shall go to the producers of the freight instead of the shippers in cases where the producer is not the immediate shipper. The theory on which he is seeking to do this is that the shipper who buys an article for shipment deducts the amount of the freight from the purchase price that would be paid if the article was purchased at the point of consumption, and that any excessive freight charge is borne by the producer and not by the shipper.

When the question of the form of the review amendment has been decided on the most important task before the Senate will be the amendment of the provision conferring the rate-making power on the Commission so as to remove at least some of the constitutional objections to it in its present form. The opinion of the United States Supreme Court in the Michigan railroad tax cases has served to direct attention sharply to the fact that this provision is certainly unconstitutional in its present form. It might be expected that Senators who do not favor the proposed legislation would rest content to allow the bill to go through in such shape as to insure its being declared unconstitutional and void, but this is not the case. The conservative Senators, who include most of the leading lawyers on the Republican side, will all co-operate in any movement to make the bill constitutional. Even Senator Foraker, who believes that the whole proposition is vicious in principle and that it cannot be made constitutional so long as it is proposed to give the rate-making power to the Commission in any form, will support every proposition tending to remove any constitutional difficulty.

With the exception of Senators Foraker and Morgan and pos-

sibly one or two more, the general opinion among this group of Senators is that it will be possible to fix up the rate-making feature of the bill so as to make it constitutional, and an effort will be made to change it so that it will not require the Commission to apply "its judgment" to the question of a rate and to exercise legislative discretion. Several proposals will be advanced for incorporating in the provision a standard by whose application to a specific freight situation the rate to be fixed can be determined. One of these is the provision contained in the Elkins bill empowering the Commission after hearing, "to make an order directing the carrier or carriers to modify such rate, fare, charge or regulation in such particulars as shall be specified in such order, and if such modifications shall require the change of any rate, fare or charge, the order shall specify the maximum rate, fare or charge that may be put in force by the carrier in lieu of that found by the Commission to be unjust and unreasonable or otherwise contrary to law, but the Commission shall not have power to modify any rate, fare, charge or regulation established by the carrier or carriers to a greater extent than shall be necessary in order to remove the injustice and unreasonableness or other unlawfulness thereof." It is contended that this fixes a definite standard by prescribing the limit below which the Commission cannot go in fixing a rate. It has also been suggested that the amendment proposed by Senator Bailey would fix a standard by requiring the Commission "to determine and prescribe a rate or charge which shall afford a just compensation to the carrier or carriers for the service or services to be performed," it being contended that the provision that the rate shall afford a just compensation fixes a standard by which it can be determined. J. C. W.

A Rational Method for the Introduction and Management of Piece-Work in Railroad Shops.*

BY WILLIAM S. COZAD.
Shop Specialist of the Erie Railroad.

In the management and operation of locomotive repair shops, two distinct and directly opposite methods of paying for work are in general use; one, the day-work or hourly system, which pays each particular class of labor a certain rate per hour, and each workman in that class the same rate regardless of ability, capacity or conditions; the other, a piece-work or piece-rate system, which considers conditions, time, the ability of the workman, and pays for output only.

The day-work method which really is the absence of all system, is adapted to shops where little attention is given to organization; where forces are divided into gangs and each gang with a foreman is given a number of engines or a mixed class of work to do. Where men work on shoes and wedges to-day, rods to-morrow, motion work the next day, and perhaps the next day operate machines, the day rate is probably the only method elastic enough to cover such cases.

Such an organization always results in higher cost for supervision and a much lower rate of individual efficiency than where the efforts of each workman are concentrated in perfecting himself in some particular line of work.

The contract system is well adapted to the requirements of the locomotive boilers, but a failure in repair work. The premium and straight bonus systems are no doubt the ideal thing for manufacturing concerns, but hardly practical for locomotive repairs. Piece-work has been stigmatized as "a lazy, haphazard method of shifting responsibility and direction from employer to employee; as working deception in the latter and giving us a long string of broken promises from the former; as hated by unions, as bringing on strikes," etc., but notwithstanding it is gradually growing in favor, and at the present rate of increase, ten years hence will be in practical operation in most, if not all, of the railroad shops of the country.

Price fixing is the difficult problem. Few, if any, foremen who have been trained in the atmosphere of the day shop and have given no particular attention to principles of shop operation or to cost of details, will be able to determine a fair price for a given operation. Prices fixed and put into effect on any other basis than a fair effort on the part of the workman under normal conditions will necessarily have to be changed, and in many cases useless and unfair prices in the past have resulted in more or less bitter feeling against piece-work among workmen. The introduction of piece-work requires men of special skill and experience; men who are fully informed as to the capability and physical endurance of workmen, the capacity of machines and the amount of product to be expected from men under certain conditions.

Fourteen months ago on the Erie Railroad we began to work out a piece-work organization in each of the 10 different shops on that road. To thoroughly organize a piece-work system and place it on a sound business basis in each of the different shops to conduct the management of the shops that the piece-work principle would appeal to all classes of the workmen as being fair in its application, we have perfected the following organization:

1. The Mechanical Superintendent.
2. The Assistant Mechanical Superintendent.
3. A shop specialist or piece-work expert.
4. The Master Mechanic of each shop.
5. The general foreman.
6. The time-keeping department.
7. A time specialist, with the title of assistant to the general foreman, for each shop.
8. A piece-work checker for each sub-department in shops large enough to justify it; in the small shops two or three departments are combined.

The Mechanical Superintendent finally approves each separate price before it is put into effect.

The jurisdiction of the Assistant Mechanical Superintendent extends in a general way over all shop operations. All appointments of general foreman, gang foremen and piece-work checkers are made by him, subject to the approval of the Mechanical Superintendent, recommendations for such appointments being first made by the different Master Mechanics.

The shop specialist reports to and receives instructions from the Mechanical Superintendent. All piece-work schedules are made and records kept in the office of the shop specialist.

The assistant to the general foreman is the man upon whom rests the responsibility for fixing the time upon which all piece-work prices are based. He is in many respects the most important factor in the entire piece-work organization. No piece-work expert, I care not how proficient he may become in the business, can handle all the details of rate fixing on a large railroad without relying more or less on the judgment of the man who makes the recommendations from personal observation of the work.

These positions are made attractive both in point of salary and in placing men in line for promotion to roundhouse foreman, general foreman, Master Mechanics, etc., and we aim to select the best young men in the service for this work.

The piece-work checkers in the different departments each perform exactly the same duties, which consist in carefully checking over the time and work of each employee who is paid by the piece. We depend largely, but not entirely, on these checkers to see that accurate division is made between day and piece-work time, and that the labor on the number of operations turned in by each workman is actually and accurately done. They report to the assistant to the general foreman all inaccuracies that may arise in the practical application of the schedules, also all operations of frequent recurrence in their respective departments which have no piece-work price.

The Master Mechanic and general foreman of each shop have the same general control over all the details of piece-work that they exercise over the shop in general. The Master Mechanic is held responsible for the output of his plant and reports to the Assistant Mechanical Superintendent in charge of shop operations on all matters pertaining to shop machinery and output, and to the shop specialist on all matters pertaining strictly to piece-work and piece-work prices.

The time-keeping department varies little from that of the ordinary day work shop, the only practical difference being that, instead of keeping all straight day work time, the same clerks keep part day-work and part piece-work time. No increase in the time-keeping force is necessary in a shop on account of the introduction of piece-work.

The card, form 2351, Fig. 1, used by the assistant to the general foreman in timing operations, calls for all the essential information necessary in price fixing. It is 4 in. x 6½ in., a convenient size for the pocket. The assistant to the general foreman is to note anything which would in any way affect the price, whether called for by the card or not, and this he does, under the head of "Remarks" or on the back of the card. As these cards are made out, they pass through the hands of the general foreman and, if satisfactory to him, are turned over to a typewriter, who makes out, in duplicate, card, form 2195, Fig. 2. These cars are then signed by the shop officials, as indicated thereon, and sent in to the general office of the mechanical department, where they are checked and signed by the shop specialist, the Assistant Mechanical Superintendent, and approved by the Mechanical Superintendent. After these cards are approved by the Mechanical Superintendent they are turned back to the office of the shop specialist and entered in the piece-work schedules (see Fig. 5), the schedule number placed in the upper left-hand corner (see Fig. 2) the original card filed in the file case, and the duplicate returned to the Master Mechanic as his authority to put the price into effect. When the duplicate is received by the Master Mechanic it is entered in the schedule opposite the schedule number which it bears (see Fig. 2 upper left-hand corner), and filed in a case exactly like the one in the office of the shop specialists.

The piece-work card (Fig. 3) is used by the piece-work checkers in all departments of the shop in making a record of the operations and time of all piece-workers. A record is made each

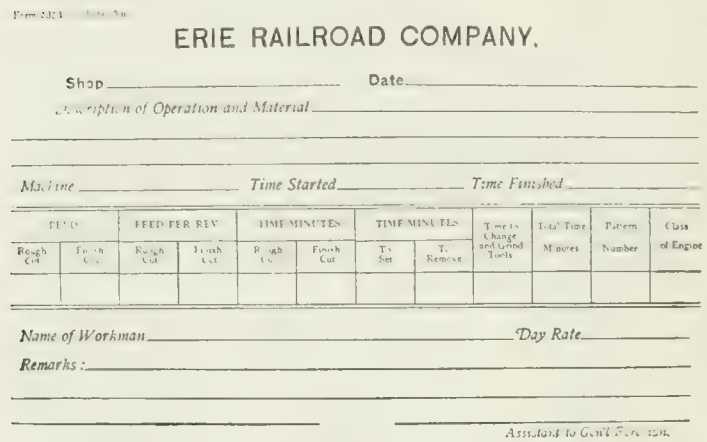
*Read before the New England Railroad Club.

day of the piece-work completed by each workman, and when the cards are full of items, or a certain amount of work is completed, they are totaled by the piece-work checker, properly signed and turned in to the general foreman's office, from which place they are sent to the time-keeping department.

The daily record cards (Fig. 4) are for the use of the workmen. They are delivered to employees as they enter on duty in the morning. They make a record of their day's work and deposit the cards in box at night. Changes from day work to piece-work, or *vice versa*, are recorded on these cards by the gang foreman in charge of the workmen. When these cards have been checked in the general foreman's office, they are turned in to the time keeping department and checked against the piece-work cards (Fig. 3), to see if differences exist in the two records.

The piece-work schedules (Fig. 5), are all made up in the office of the shop specialist and sent out to the Master Mechanics to be put into effect. They are bound in Shipman's cloth binders, and make a neat book. These schedules are put in the hands of the checkers and gang foreman and otherwise distributed about th shop so that the workmen and all concerned can have free access to them.

We attribute the marked degree of success which has rewarded


ERIE RAILROAD COMPANY.

Shop _____ Date _____

Description of Operation and Material _____

Machine _____ Time Started _____ Time Finished _____

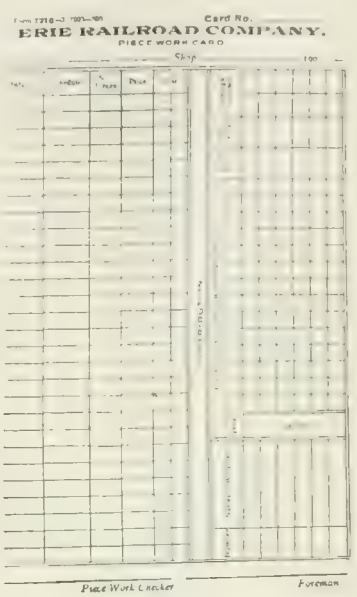
FEED		FEED PER REV.		TIME MINUTES		TIME MINUTES		Time to Change and Grind Tools	Total Time Minutes	Pattern Number	Class of Engine
Rough Cut	Finish Cut	Rough Cut	Finish Cut	Rough Cut	Finish Cut	To Set	To Remove				

Name of Workman _____ Day Rate _____

Remarks: _____

Assistant to Gen'l Foreman.

Fig. 1.


Card No.

ERIE RAILROAD COMPANY.

PIECE WORK CARD

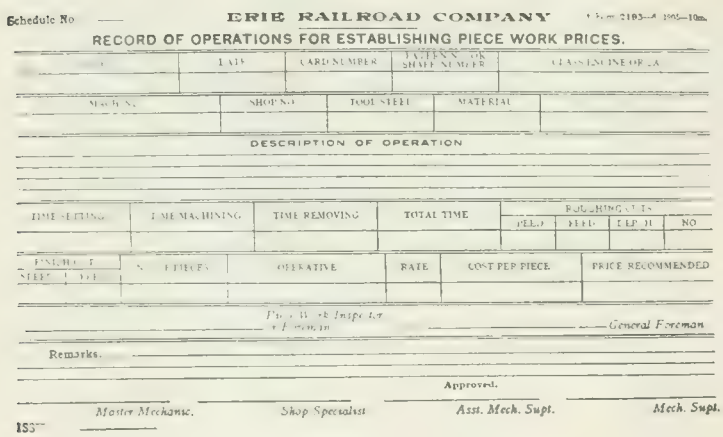
Shop _____ 190

Piece Work Checker _____ Foreman

Fig. 3.


ERIE RAILROAD COMPANY.

Fig. 5.


Schedule No. _____ ERIE RAILROAD COMPANY.

RECORD OF OPERATIONS FOR ESTABLISHING PIECE WORK PRICES.

	DATE	CARD NUMBER	PATTERN OR SHEET NUMBER	CLASS ENGINE OR CAR

MACH. NO.	SHOP NO.	TOOL STEEL	MATERIAL

DESCRIPTION OF OPERATION

TIME SETTING	TIME MACHINING	TIME REMOVING	TOTAL TIME	ROUGHING CUTS			
				FEED	DEPTH	DEPTH	NO.

ENGINE OR STEEL NO.	NO. PIECES	OPERATIVE	RATE	COST PER PIECE	PRICE RECOMMENDED

Piece Work Inspector or Foreman _____ General Foreman

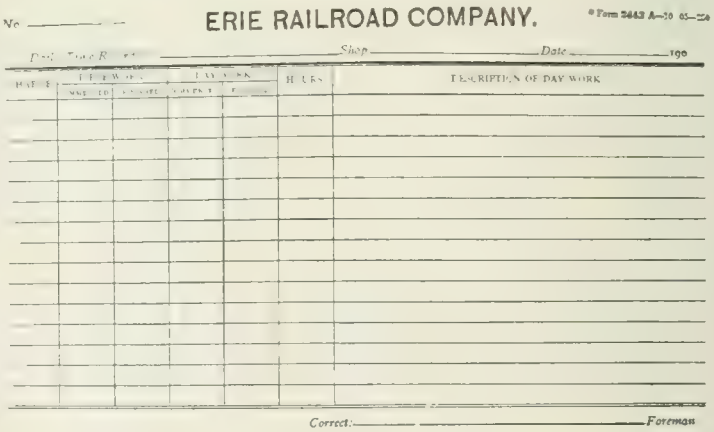
Remarks. _____

Approved.

Master Mechanic. Shop Specialist Asst. Mech. Supt. Mech. Supt.

18__

Fig. 2.


No. _____ ERIE RAILROAD COMPANY.

Shop _____ Date _____ 190

DATE	TIME TO	TIME FROM	DAY WORK HOURS	DESCRIPTION OF DAY WORK

Correct: _____ Foreman

Fig. 4.

Time and Cost Cards Used in Connection With the Piece Work System at the Erie Shops.

our efforts in the extension of the piece-work principle to the different shops of the Erie within the past 14 months to the perfectly free, honorable and open way in which we have placed the entire subject before our men.

If, on account of changes in conditions, or for any other reason it is necessary to alter a rate, the change is made in precisely the way in which new prices are fixed. After the change is approved by the Mechanical Superintendent, the duplicate card is returned to the Master Mechanic through the office of the shop specialist and price in shop schedule is changed to agree with the card. Our men know just what we are doing all the time. Our time specialists have received positive instructions not to time operations for the purpose of fixing piece-rates without the workman knowing for what purpose time is being taken. The old way was to get the employee on a "hurry-up" job, take the time in secret, deduct 25 or 30 per cent. and then fix the rate on the remainder—much on the same principle as an Indian would shoot his victim from ambush.

In the two or three shops of the Erie which have worked more or less piece-work for several years, we have found it necessary within the past year to make changes in the prices on hundreds of different operations. We do not say to our men that we will not change prices. We do not make promises to-day which we know will be broken to-morrow. What we do say is that we will not change a rate unless we can give a good and sufficient reason for it; and when the rate is changed, it will be so fixed that an honest effort on the part of a competent workman will be rewarded by a substantial increase in earnings over his day rate.

Thirty-three per cent. of the total earnings of all men employed on general locomotive repairs on the entire road are now on a piece-work basis. In the car department 56 per cent. of the freight and 92 per cent. of passenger repairing is piece-work. Besides this we also pay piece rates on a large part of the work of our heavy repair gangs in the roundhouses. Our engine wiping is all piece-work. We knock all fires, shovel all cinders, and handle all coal at fixed prices for each separate operation. Since the workmen have become thoroughly familiar with our methods of fixing rates, we have met no opposition whatever in the extension of the work, and our inability to rapidly change conditions, cut out bad practices, and install proper tools and facilities for making repairs in the most economical way are now the only obstacles which prevent a more rapid extension of the piece-work principle.

On the machine side of our shops operations are classified and certain machines do certain kinds of work. Our prices are, therefore, in many instances based on single machines, and if the work is changed to some other machine, we, of course, reserve the right to change the price. Each shop on the system is placed strictly on its own merits. As a whole, the schedules made for one shop are never put into effect in another shop. However, where conditions and day rates are the same, we frequently send prices on certain operations that have been carefully and accurately timed in one shop, to other parts of the road to be put into effect after the Master Mechanic and his official force are satisfied they will meet local requirements.

The piece-work system properly applied benefits alike employer and workman. Honestly administered, it offers greater possibilities for increasing earnings than any other method of remunerating labor. Under it, where time is honestly and faithfully applied in the interest of the concern by which workmen are employed the reward will be proportionate to the effort.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS. Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS. We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIALS:
- Rock Island Gulf Extensions 393
- Car Service Problems at Chicago 393
- The Duties of a Trainmaster 394
- The Gould System 394
- The Infirmities of State Railroad Commissions 395
- Rutland Railroad 396
- Pittsburg, Cincinnati, Chicago & St. Louis 397
- Trade Catalogues 397

ILLUSTRATED:
- New Outbound Freight House of the Wabash at Chicago 400
- "Horseshoe" Concrete Arches 402
- Key West Extension of the Florida East Coast 404
- Coal Loading Facilities of the Chicago Freight Tunnels 408
- Union Pacific Motor Car No. 7 410
- The Railroads of Cuba 411
- Cast-Steel Cylinders 416

CONTRIBUTIONS:
- The Muck Rake and the Canal 398
- To Prevent Wear of Driving Wheel Flanges on Curves 398
- Recent Controversy at Panama 398

MISCELLANEOUS:
- Washington Correspondence 399
- Italian Railroads. (Note) 400
- The Duties of a Trainmaster 401
- N. Y. Subway and Geo. S. Rice's Views 406
- Spanish Railroads 409
- Reply of Operators to Miners' Committee 410
- Electric Traction for Trunk Lines 414

GENERAL NEWS SECTION:
- Notes 117
- Meetings and Announcements 120
- Elections and Appointments 120
- Locomotive Building 121
- Car Building 121
- Bridge Building 122
- Railroad Construction 122
- Railroad Corporation News 124

VOL. XL., No. 16. FRIDAY, APRIL 20, 1906.

The Rock Island and Frisco Systems, as forecasted in these columns last week, are soon to reach the Gulf. Last Friday official announcement was made by the management of the Rock Island Company that there had been acquired a half interest in the Trinity & Brazos Valley, the short line bought not long ago by the Colorado & Southern to form part of its Gulf extension from Fort Worth, Tex., to Houston and Galveston, and that the St. Louis & San Francisco had acquired all the rights of the Colorado Southern, New Orleans & Pacific which is building a line, as described last week, from New Orleans to Houston. This means that the Rock Island Company, the nucleus of Rock Island control, is directly interested in railroad development on the Gulf of Mexico, which thus far has never been touched by either of its railroad systems. The new Fort Worth-Galveston line will apparently be owned jointly by the Colorado & Southern and one of the Rock Island companies—probably a forecast of the eventual taking over of actual control of the Colorado & Southern by the Rock Island Company. The value of the Trinity & Brazos Valley appears to be in its trackage contracts more than in its 77 miles of completed road. From Fort Worth south to Cleburne, its northern terminus, it owns trackage rights over the Gulf, Colorado & Santa Fe. As soon as the gap between Mexia, its southern terminus, and Houston, at present under construction, is filled in, it has the right to use the Santa Fe tracks from Houston to Galveston. Thus on completion of the 150-mile stretch north of Houston the Rock Island, the Frisco and the Colorado & Southern will be able to run trains directly into Galveston. The announcement also confirms that there is to be an extension of the Arkansas Southern, now part of the Rock Island, Arkansas & Louisiana, southward to a New Orleans connection, which the Colorado Southern, New Orleans & Pacific is to furnish. This will give the Rock Island a line from Little Rock on its Choctaw district south to New Orleans. Thus Yoakum influence is already reaching out for a hold on the highly competitive territory between Fort Worth and Galveston and a share in the traffic along the rim of the Gulf between New Orleans and Houston, so long monopolized by the eastern section of the Southern Pacific's main line.

The interchange of freight cars between different railroads is a feature of railroad business in this country which seems destined always to have its sorrows. The obstacles to orderly progress are not perhaps so big as those which trouble the Panama Canal, but they bid fair to be still prominent in the railroad world long after the canal has become a peaceful strait, with not a gravel bank in sight. The increase of the interchange car service rate from 20 cents to the more reasonable sum of 25 cents a day has been safely accomplished, and now we must resume the less pleasant task of thrashing out the diversion difficulty. There seems to be no diminution in the stream of complaints of diversion, and what to do about it will probably be the main car service question at the Chicago meeting next week. A true philosopher, sufficiently removed from the dust of the conflict—Sir Oliver Lodge, for instance—would no doubt assure us that there is no cause for despondency, even if we do have to tackle this question anew every six months or oftener. Who has ever claimed, or even supposed, that a frictionless rule for the interchange of freight cars could be devised to cover this great country, or even a quarter of it? To expect to do this business as smoothly now as it was done in 1880, would be to join the ranks of the childish optimists who think that they can establish a uniform freight classification for the whole United States. It has been proposed that every car sent into an enemy's territory be accompanied by a special notice (as is done with embargo and penalty notices) warning everybody not to divert that particular car. Why not? This seems a laborious task; but we do as much cheerfully for a shipper whenever he asks it. We talk about the fabulous sums that cars are worth when business is brisk—$5, $10 or more per car per day—and yet we hesitate to spend ten cents a day in keeping track of a car. It is unpleasant to think that "enemy's territory" is a term which sometimes means a place controlled by an amiable neighbor; but a sharp knife will cut any knot. The wholesale diverting—or defrauding—which is accomplished by dividing a road into two roads, or by sending cars on useless journeys to "break penalty" is a yet harder problem. It would not be impossible to agree on arbitrary rules to govern this matter in every important geographical district; nor, probably, to get the question before some high judicial body for a lasting settlement of the disputes which it involves. This might, however, be very slow, and there is one remedy always at hand: Send specific and determined complaint direct to the principal offenders. "Put up a fight, if necessary." With the "industrial" railroads there is still another hard nut to crack. The Illinois Northern, owned by the International Harvester Company, of Chicago, is said to owe the railroads $200,000 demurrage, and President Stickney, of the Chicago Great Western, thinks that it is best not to try to collect the money. The I. N. owns eight cars, all flats, and wants to pay at the per-diem rate instead of the regular rate of $1 a day. Surely the arbitrary car service rule has a hard road to travel. Even these difficulties need

not dishearten; but it is highly important, first, that they be settled according to the rules of equity, even if it be necessary to carry the matter to the courts, to get the benefit of trained judicial minds, and, second, that the grounds of the settlement be published in such fulness and with such clearness as to be instructive in the settlement of similar difficulties in the future. Nothing must be allowed to interfere with the stability of the general per diem rule for interchange, and its essential ally, the dollar-a-day (or higher) demurrage rule.

The trainmaster cannot praise the industrious men who are under his supervision, though he must be prompt and strict in censuring those who are lazy or blundering. This we read in a sketch on Trainmasters' duties by a New York Central trainmaster, which is printed in another column. We copy this part of Mr. Currier's article as illustrating how unquestioningly everybody takes it for granted that in railroad service commendatory words must always be weighed, sifted, cooled and revised before they are spoken aloud. The man quoted last week, who suggested otherwise, is ahead of his time. The question is whether he is so far ahead that ordinary trainmasters and superintendents cannot catch up with him. We believe not; if only those who desire to catch up will have the courage to take the step. Who has forbidden any trainmaster to commend the industrious? If the trainmaster makes his own position in the matter perfectly unassailable that is half the battle. He must be proof against the slightest word of just criticism. One superintendent of our acquaintance has been exceptionally successful in administering the seniority rule, to the advantage of the service; and good judges give, as one of the elements in his success, the fact that his men never doubt that they are going to have a "square deal." That feeling on the part of the men means much more than that the superintendent intends to give a square deal. He really carries out that intention. To do so he has to do a lot of plain talking and much patient explaining to men whom the square deal keeps down. As phrased in the article quoted, the superintendent or trainmaster who would succeed must "lay aside a law of nature," the law of sympathetic consideration for the inefficient, when they are amiable and well disposed. There is a higher law, a law of business; that if a man does not do his duties well he must make way for a better man. This, too, is a law of nature, but we do not sufficiently study this aspect of nature. One encouraging thing in this trainmaster's symposium is the statement that on the New York Central a perfunctory knowledge of the rules is no longer tolerated. A trainmaster who can say that concerning all the men on his division deserves a gold medal—at least that is the feeling that arises in the mind of one who remembers the opposite condition that prevailed among four-fifths of the trainmen nearly everywhere only a few years ago. Still another bit of trainmaster's wisdom is the clearly defined declaration of Mr. Slack that when a man is wrong he knows it. Of course he does, if he is intelligent. And the other side of this truth is that if the trainmaster does not make it plain that he also knows it he stultifies himself. And to give unmistakable evidence that you correctly estimate a man's misconduct you must punish him as the offense deserves, not as your tender feelings may dictate.

THE GOULD SYSTEM.

In past years we have devoted much space to describing the evolution of the Gould system of railroads; that curious collection of lines, rather ill assorted and ill connected, which was saved from bankruptcy in the early '90s on account of the very looseness of its organization and which now has the interesting distinction of bidding fair to own the first railroad, or group of roads under one ownership, to deserve the title "transcontinental" within the borders of the United States, while at the same time it is the worst financed and the least managed of all the great systems. The elements of strength and of weakness are so intermixed in the entire Gould situation that it is quite without parallel in its promise, on the one hand, and its defects on the other. Since 1901 the character and the aims of the system have undergone a radical change, and it is the purpose, therefore, of the present study to outline the history prior to 1901 rather briefly, in order that the connection of events may be established, and then to treat in greater detail of the events of the last five years.

In four issues of the *Railroad Gazette* in 1904 (July 29, August 19, September 9 and October 14) the growth of the Missouri Pacific system as the foundation of the Gould system was described. Jay Gould took hold of the property in 1876, when it was named the Pacific Railroad of Missouri, leased to the Atlantic & Pacific Railroad, and was in bankruptcy because the lessee could not fulfil its obligations. We need not be concerned with earlier events, from the incorporation of the original company which built the line between St. Louis and Kansas City in 1849, up to Mr. Gould's entry.

During the next 12 years the St. Louis, Iron Mountain & Southern was bought outright and the Missouri, Kansas & Texas, the Texas & Pacific, the International & Great Northern, and the Wabash were leased and then had their leases abrogated for non-payment of rental; but the Goulds kept their interests in each of these lines except the Missouri, Kansas & Texas, whether leased or operated individually, and it was doubtless this method of separate control, as we pointed out in 1904, that saved the lines from dissolution as Gould properties in 1892 and 1893.

The first period in the development of the system may thus be said to have terminated in 1892 with the death of Jay Gould and the succession of his son, George J. Gould, as the principal representative of the family. Of the four Gould roads in which Jay Gould had been a large stockholder, George Gould was made President of three: the Missouri Pacific, the International & Great Northern and the Texas & Pacific.

The second period in the development of the system, which began at this time, may be said to have ended with the purchase of control in the Denver & Rio Grande, in 1901. Between 1892 and 1901 a praiseworthy effort was made to better the deplorable physical condition of the old Missouri Pacific and Iron Mountain. The best energies of the management were devoted towards grade reduction and general betterment of the property, while at the same time certain new construction, such as the White River line in Arkansas, was began. Extensive changes of grade and alinement were made on the main line, through Arkansas, of the Iron Mountain, which had always carried heavy traffic, both of freight and passengers, but was one of the worst lines in the system to operate economically; also on the Valley division of the same road, between Little Rock and Arkansas City and between Pine Bluff and Little Rock, Kansas City and Little Rock, etc. The changes which were made resulted in the increase of the tonnage rating of engines from 800 tons to 1,300 tons between Osawatomie and Leroy; from 1,000 tons to 1,450 tons, between Leroy and Coffeyville, and from 775 tons to 1,300 tons, between Fort Smith and Little Rock.

The St. Louis Southwestern system was built up as a Gould property somewhat earlier. Edwin Gould became a director and Secretary of the St. Louis, Arkansas & Texas Railroad in 1889, and was made Vice-President and then President after the reorganization in 1891. The original property was split up into several parts, operated in harmony as the Cotton Belt. It need not be described in detail at present, further than to say that it is shown on the Missouri Pacific map as a portion of the network of southwestern lines, and adds about 1,300 miles to the system.

Russell Harding was Vice-President and General Manager of the Missouri Pacific system from March, 1900, to September, 1904, and performed his work efficiently, with entire charge of the reconstruction, which was placed under the direction of the operating department. But even with this task accomplished, the Gould system had no ends—it was all middle. There was a network of lines stretching first southeast and then southwest from Omaha through Kansas City to St. Louis and Memphis and thence into Arkansas, Indian Territory and Texas. Two long spurs ran out from this group, one of them the Texas & Pacific main line to El Paso, the other the Kansas & Colorado Pacific main line to Pueblo, Colo. But this was highly competitive territory, and the competitors had lines which stretched further east and further west. The Missouri Pacific had the Rock Island system to contend with for much of its central business; it had the Illinois Central as a strongly entrenched competitor for the north and south business, and the Union Pacific, the Atchison, the Rock Island and the Burlington all working against it for the traffic west. As the system existed in 1900, it was a tremendous possibility as yet disappointed of accomplishment.

The third epoch of development, beginning with 1901 and now in full swing, has been concerned primarily in adding legs and arms to the body of the system. The principal acquisitions and new work have been in three localities; west of Pueblo, around Pittsburg and west from Baltimore.

The first Gould names appeared on the directorate of the Denver & Rio Grande in 1901. It is probable that control was acquired gradually, as it certainly was acquired quietly, throughout a number of years. The Denver & Rio Grande and the Rio Grande Western were linked together in corporate ownership, affording a through line, such as it was, from Pueblo and Ogden, Utah, and north and

south connections from Denver and Santa Fe, N. Mex. Then, in 1903, the Western Pacific Railway Company was incorporated to build a main line some 935 miles long, with 400 miles of branches, from Salt Lake City to Oakland, Cal.

It will be recollected that the Harriman line from Utah to California starts at Ogden, 37 miles north of Salt Lake City, and proceeds west over the famous Ogden-Lucin cut-off across the end of Great Salt Lake. The old route lay around the north end of the Lake and was one of severe grades and curves. The new route is better, but there is a maximum grade of 116 ft. against eastbound traffic at Truckee, Cal. The Western Pacific goes around the south end of the Lake from Salt Lake City, crosses the Central Pacific at Palisade, Nev., bears well to the north, then turns south and crosses it again at Sacramento. The best possible route was sought carefully and painstakingly by an able body of engineers who had also the experience of the pioneers to help them. As a result, the ruling grade is understood to be 1 per cent., although the net distance between terminals is some 90 miles longer than by the Central Pacific.

In the entire conception and execution of this line Mr. Gould had to contend with the strongly entrenched Harriman interests. Even now the vital point of the Oakland terminal is being sharply contested in the courts. Six months ago it was fought out on the basis of first possession by armed bodies, as in the early days of railroad building. The cost of the work has been very great. Bonds to the extent of $50,000,000, of which the interest and a foolishly inadequate sinking fund are guaranteed by the Denver & Rio Grande system, were issued as a first mortgage on the main line. In the terms of the mortgage the Rio Grande Western Railway also agrees to purchase a sufficient amount of junior obligations to complete the work. The D. & R. G. properties receive in return a majority control of the $75,000,000 of capital stock which covers no construction cost, as the road is being built by the proceeds of bond sales. Thus at the very outset of the Pacific extension the company has thrown a great load of meaningless stock on the property, for it to carry for all time. Yet there can be no reasonable doubt that this western line is going to prove a strong and profitable adjunct to the Gould system. The recent growth and development of the Pacific States has surpassed all expectations, even of a few years ago, and the Western Pacific should amply pay for itself in local business, as the Denver & Rio Grande does, while the best energies of the other Gould roads, aided by the cordial co-operation of the Rock Island and the Burlington, will provide through traffic that cannot now be accurately estimated, but will surely be very great.

A year or so before the definite formation of the Western Pacific enterprise, steps were taken in the East to secure for the Wabash the long coveted connection into Pittsburg. The detail of the securing of this entrance was complicated, and expensive to carry out. The Goulds bought the Wheeling & Lake Erie; they organized construction companies to build a line 80 miles long through the mountains, and to bridge the Monongahela river. Then they incorporated the Wabash-Pittsburg Terminal Company to take over the securities of this aggregation. At the same time that they were fighting Harriman in the West they were fighting the Pennsylvania at Pittsburg, and every step of the Pittsburg entrance had to be bitterly contested. The desired result was finally achieved through the medium of the purchased railroads mentioned and of the West Side Belt Railway; but it was achieved at great cost, estimated to have probably amounted to $50,000,000. A contract was made with the Carnegie Company for 25 per cent. of its Pittsburg tonnage moving under certain conditions, and then was jeopardized by the actions of the lines further west in their treatment of allied interests. This, however, need not be gone into at the present time. From present appearances, the contract is going to hold good and the company will be in shape to profit by it with the completion of the West Side Belt connection, which should be effected by this summer.

The acquisition of the ancient Western Maryland was a project more novel, because separated from the Gould base of operations in the St. Louis territory. The Western Maryland, chartered in 1852 as the Baltimore, Carroll & Frederick, began building in 1857, aided largely, not only at the outset, but through many subsequent years, by the city of Baltimore, which fostered and cherished the project of an independent, paternally governed system. But the project never came to anything beyond a weak-kneed road that stretched out along Mason and Dixon's line and terminated short of the coal fields, its chance of usefulness. In 1902, Baltimore sold its interest to a syndicate that had also purchased control of the West Virginia Central & Pittsburg Railroad, in the Gould interest, and a connection was at once started across the gap from Cherry Run to Cumberland 50 odd miles of heavy construction to enable the coal mined in West Virginia Central territory to reach tidewater over the Western Maryland without dependence upon the Baltimore & Ohio.

It cannot be said positively that this purchase was or was not made primarily and solely with the intention of giving the Gould system an outlet on the Atlantic. To accomplish this, a line perhaps 100 miles long will have to be built, through country offering great engineering difficulties, to establish a connection with the Wheeling & Lake Erie. Even if this is done, the Baltimore & Ohio will have a competing line better, probably, in every respect, and the Pennsylvania, with its slightly longer route and far easier grades, will also be in the field. Surveys for such a connection have been made, but there would be considerable difficulty in financing this line at the present time. Ultimately, it probably will be built, and the Goulds will have their own rails from Baltimore to Oakland.

The Gould system of 1906 has a purpose, which was lacking ten years ago. It stretches across the continent, save one small link, and has reinforced its southwestern stronghold with lines north, south, east and west. The organization is still loose, and the management and financing are looser, but there are great possibilities ahead, if only there can be a steady hand at the wheel, capable of steering a safe course through the tortuous channels that are opening out. Diplomacy, skill in finance, conservatism and management are the needful things—and the greatest of these is management!

THE INFIRMITIES OF STATE RAILROAD COMMISSIONS.

In a rough way and with a number of defects in the analogy the development of the commission system in its relation to American railroads has followed the precedent of the states in their relations to the central government. We have, in fact, a kind of federation of commissions, albeit infinitely varied and bound by the loosest of ties. There is the central body, the Interstate Commerce Commission, seeking new powers, wanting existing powers defined and, in a broad fashion, needing accurate expression of what we may call its constitutional functions; and, outside of it, in three-quarters or more of our commonwealths, the state commissions, acting under most heterogeneous statutes that have sometimes collided with the federal constitution, and have been sometimes in harmony, sometimes in discord with the federal commission. Both the federal and the state commissions, mainly through the medium of decisions of the courts and new legislation, are groping toward the light and seeking the ideal *ratio vivendi* with the railroads. Both have their deep problems which, as in our national and state history, have been complicated by unlooked-for events. But we are limiting this analysis to the state railroad commissions and to infirmities which have obstructed their progress—infirmities which we hope and believe in the course of time and under the impact of civic intelligence will be outgrown. To obtain a text let us take for comparison and contrast two state commissions.

The first is a commission of long standing in an old state, a commonwealth highly capitalized, and with large railroad interests. The commission belongs to the "advisory" group, but to whose advice public as well as corporative assent has given wellnigh the force of law. It is not a "political" commission and, if partisanship has touched it at all, it has been only in remote and diluted forms. Its personnel is high, its integrity and motives unquestioned, and its chairman an able lawyer, who has held his place for many years. The commission has always laid down definite policies and, in the main, followed them consistently and successfully. As advisers its members are in contact with legislative committees and new law-making. It has well equipped offices, with an auditorium for public hearings. Its annual reports are significant and exhaustive. Described in a single word, the commission is positive. Contrast with such a commission the "negative" commission of an adjoining wealthy commonwealth. It is a political body all of one party; two members out of three, former chairmen of partisan state committees. It has never even expressed a policy, much less tried to enforce one. Given large powers under the statutes, it has habitually left them unused. It has dodged all legislative responsibility and "trims" between the railroads and the people—even, for example, some years ago leaving to the initiative of a private citizen the printing of street railway returns which the legislature had ordered but with the printing proviso omitted. Its annual reports are colorless, incomplete and defective. Of constructive faculty it has none, and, with an exception or two, the chief ambition of its members for

years appears to have been to secure their own selection to the position.

If the second of these considerations could be some touch of economic alchemy be introduced into the first and the type impressed on all the State commissions of the land, how much more easily and quickly would the transportation problem be solved! But the unfortunate fact is that the state commissions, whether advisory, regulative or critical, taking the country through, are sampled by the second rather than the first. The causes fall under two heads, defective statutes or defective personnel, one or both. If the creative statute is loose, weak or cloudy, the best of commissions personally becomes a vain thing. Similarly the best of statutes may be nullified by a weak, timid or selfish board. The best engineer and fireman can hardly run a decrepit locomotive and *per contra* the two, untrained or careless, may easily cripple the most modern machine of the locomotive shops.

Coming first to the flaws of mechanism, that is to say, the constructive statute, one finds its infirmities many. In a considerable number of western states it has been the product of something which, if not exactly demagogism, is near kin to it; and, although this feature has been amended and severity has been pruned either by later legislation or by the rulings of courts, enough remains to be an evil. In other states the creative statute goes to the other extreme and makes the board a mere body of clerks for the tabulation of returns—often on blanks imperfect or nebulous. As to ambiguities of statute there is hardly a state which defines the duties of its commission clearly. This flaw has continuously loomed larger as railroad consolidation has waxed, intra-state and inter-state questions become mixed and the rate question, for example, assumed new and puzzling forms. Lack of uniformity in the constructive statutes of more than forty states was, of course, to be looked for in view of divergency of local interest; but hardly the degree of it which has prevailed or the lethargy in rectifying it in so comparatively simple a matter as the organization of the boards. One must question, too, certain specific features apt to be copied by one state from another. Take, for example, the policy of imposing the cost of a commission on the railroads as a separate tax. It is, to say the least, an undignified tax, bears the earmarks of an imposition, and accents the idea of making the commission paid servants of the corporations rather than of the state—an idea which, no doubt, in some cases has had its effect on commissioners not endowed with morals or intelligence. Finally, mark the low pay of many commissions, ranging in some dozen states from $5 per day of actual work up to $2,000 a year—sums just large enough to tempt the office seeker, but far too small to command trained service.

Nevertheless, it must be said that, as regards the statutory mechanism in the states, there has been a slow but steady drift toward betterment. Partly due to the influence of the interstate commission, partly to national meetings of state commissioners and partly to the reformative pressure of evils, commission law-making has improved and moved toward uniformity. It would be a pleasure in the same degree to be able to chronicle the uplift of state commission personnels. Here the outlook is not so encouraging. Speaking in the broadest generalization the political and mere office holding motive is very much in evidence and easily enough understood. To men potent in party management the office of railroad commissioner has some very alluring charms. Saying nothing of political "influence," there are the picturesque attractions of railroading, the free rides, the family pass, the junkets of the observation car, the joy of mixing in affairs, and other and, sometimes, more sinister elements of personal vantage—all these to be sharply distinguished from the laborious, responsible and exacting detail work of the competent and conscientious commissioner. What wonder that, under existing conditions, the state railroad commission so often falls into the vat of party patronage and pelf—more so, perhaps, than other state commissions like those for banking, insurance or taxation, where required technical work is likely to be more in the foreground, perquisites fewer and less spectacular and individual responsibility greater. As secondary results, we have a number of types of the state commission—in the West too commonly the board that feels that it must answer only to popular agrarian appeal; at the East and in the midland the commission responsive to the corporation; and, in many states, a commission with the prime object of preserving a nice balance between the two and reducing itself to a cipher.

Of late years there has entered the state commission field a new set of theorems and problems imposed by the street railways question, bearing not only on the public interest but inter-related with the steam railroads and demanding from the commissions added labours and wisdom. Probably in the near future we shall find a large majority of the state commissions taking legal purview of both steam and electric lines with a few states yielding to the temptation to create separate electric railway boards. In the end there is little doubt that the duplicate function will improve the composition of the boards if for no other reason, because the traveling public itself, more closely related to the street railway than to the steam railroad, will be proportionately more exercised. The thousands who take the trolley car twice a day will be a more critical group to be reckoned with than the tens who take the steam line occasionally. Increased responsibility may thus beget a higher standard of commission work, and the case will not be much altered even when the steam companies absorb the street lines and electricity leaps the gap between the two systems, for public bodies, happily, must act when fronted by questions of public convenience and safety.

The directions of immediate betterment to be desired in state railroad commission bodies are two-fold: First, as regards the creative statute, clearness, uniformity among the states, enforced responsibility and the highest qualifications which the state can name. This should supply the mechanism. Secondly, and more important, are the forces which make for a higher personal standard, for eradication of politics and partisanship and for commissions trained, competent, in touch with legislation, versed in principles as well as practice, well salaried directly by the state, able and willing to initiate policies, brave enough to hold the scales equitably between the people and the railroad corporations and positive in temper, attitude and action. All this will doubtless, in our many states, differing much in the nature of their transportation problems, be slow and hard of attainment, touching, as it does, at many points the basic obstacles to reform encountered in the general struggle for civic purity and competence. But, with general tendencies gradually upward, improved mechanisms, methods and men in our state commissions are very far from impossible.

Rutland Railroad.

The thirty-ninth report of the Rutland is the first issued under the direct auspices of the Vanderbilt system. During the year ended December 31, 1905, which it covers, control of the road was taken over by the New York Central & Hudson River, and the authority of most of the higher officers of that road extended over the Rutland. The Rutland Railroad is made up of a number of short local lines originally independent, which were consolidated with the idea of making a through route. The road can be used both as part of a New York-Montreal line and as part of a Boston-Chicago or Boston-Montreal line. From a connection with the Harlem division of the New York Central at Chatham it runs across the international boundary line south of Montreal, which city its passenger trains reach by trackage rights. From Boston over the Boston & Maine to Bellows Falls, thence over the Rutland to Ogdensburg on the upper St. Lawrence river, and thence by the Rutland Transit Company, a lake line owned by the Rutland Railroad, to Chicago, a Boston-Chicago line is made. The weakness of the road for through traffic is that neither of these routes is the natural, shortest or cheapest way.

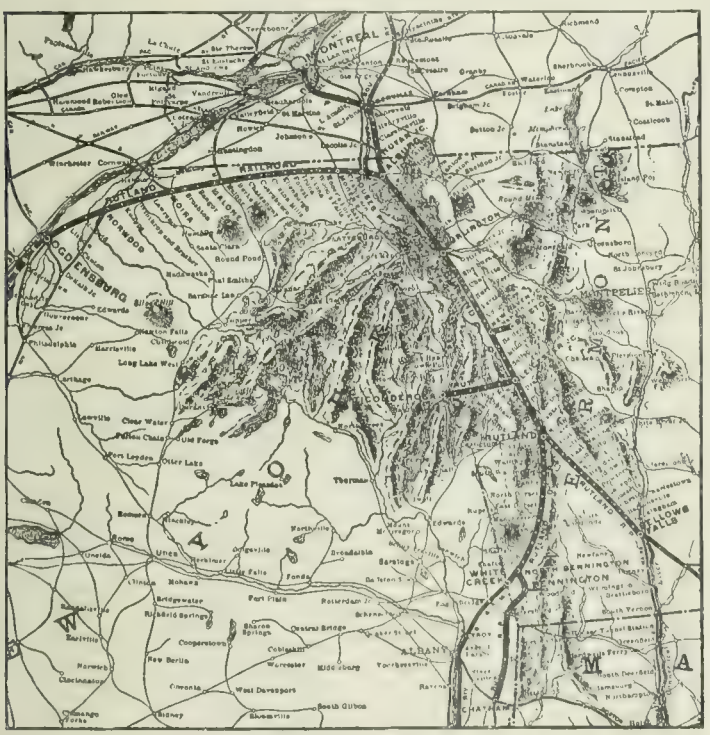
During its history the Rutland Railroad, a reorganization in 1867 of the Rutland & Burlington, has been controlled by two railroad companies which now have no interest in its ownership. From 1870 to 1896 it was leased to the Central Vermont. Default having been made in 1896, the lease was cancelled. Next the Delaware & Hudson bought control. In 1899 the Delaware & Hudson sold its interest, and, soon after, the expansion period of the road began under the guidance of Dr. W. Seward Webb. Control of the Ogdensburg & Lake Champlain had been held from 1884 to 1896 by the Central Vermont, and early in 1901 the road fell into the hands of the Rutland. In July of the same year the Bennington & Rutland was acquired, and in December the Chatham & Lebanon Valley, these two acquisitions thus bringing the road to Chatham and to within 30 miles of Troy and Albany. The Montreal connection was also built at this time and the road began to try to take a place as a through route. Dr. Webb, however, was never able to realize his ambitious plans for the road, and as a natural consequence of his relationship to the Vanderbilt family came the taking over of control by the New York Central.

The Rutland operates 415 miles of its own, and has trackage rights on 53 miles additional for passenger trains only. On this basis, freight earnings were $3,636 per mile of road, and all passenger earnings $2,158 per mile of road. No separate figures for through and local earnings are given, but these figures show how small must be the road's through traffic. With total earnings of $5,794 per mile of road, the passenger business furnished over 37 per cent. of the whole. Gross earnings for last year were $2,562,089, an increase of $125,052 over 1904. Operating expenses increased $80,283, leaving

an increase in net earnings, which were $846,486, of $44,769. Freight earnings increased $67,681, due mainly to increased tonnage of agricultural products, coal, marble and products of the forest. The increase of $38,198 in passenger earnings was due to larger local travel. After first charges and an appropriation of $100,000 for equipment bonds, there was $190,847 available for dividends, out of which 1½ per cent. ($135,864) was paid, the first payment on the capital stock since 1903, when 1 per cent. was paid.

The road's maintenance charges are low, corresponding to its freight density of 450,960 tons one mile per mile of road and passenger density of 83,354 passengers one mile per mile of road. Maintenance of way (415 miles) cost $913 a mile; repairs and renewals of equipment, $1,674 per locomotive, $370 per passenger car, and $36 per freight car. These figures show considerable changes from those of the previous year. Last year maintenance of way cost $146 more a mile, and equipment maintenance $15 less per locomotive, $116 less per passenger car, and $12 or 33⅓ per cent. more per freight car, than in 1904. The 1904 figure of $24 for freight car repairs and renewals is very low. While it is natural for maintenance of way to cost less per mile on a road with thin traffic, one freight car is very like another, and an average of $24 a car is not enough to keep equipment in shape. Even the 33⅓ per cent. increase to $36 a car in 1905 is a small figure for freight car maintenance.

The largest tonnage of any one commodity moved was of prod-



Rutland Railroad.

ucts of the forest other than lumber. Next was bituminous coal, 275,152 tons, a decrease of 14,518 tons from 1904. Apparently the New York Central has not yet succeeded in increasing from its own mines in Pennsylvania the coal tonnage of the road. The train load was 235 tons, an increase of 12 tons over the previous year. This includes company freight, and perhaps shows increased economy due to consolidation.

In general, it is difficult (and perhaps too soon) to trace advantages which have resulted from merging with the large system. General expenses show a slight decrease of $5,000, but this much was saved in the one item of insurance, while salaries of general officers increased from $19,300 to $21,000. Traffic returns, where benefits of the new control should sooner or later prominently appear, do not show any great gain. The trouble is that the large system has in each case its own through line better than the through line which the Rutland can afford. Apparently, as long as the New York Central is able to comfortably handle its own traffic, the Rutland will have to depend for an enlarged prosperity on increased local traffic and travel along its own line.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	415*	415*
Freight earnings	$1,509,282	$1,441,601
Passenger earnings	879,201	841,003
Gross earnings	2,562,089	2,477,037
Maint. way and structures	378,887	418,288
Maint. of equipment	329,476	319,077
Conducting transportation	923,101	908,477
Operating expenses	1,715,603	1,656,319
Net earnings	$846,486	$801,717

*468 miles in passenger service.

Pittsburg, Cincinnati, Chicago & St. Louis.

This road, commonly called the Pan Handle, constitutes the southwest system of the Pennsylvania Lines West. With lines directly operated, its working mileage is 1,427 miles. Its record for the past year tells the same story of general prosperity that is the keynote of the annual reports of 1905. Gross earnings increased $2,900,000, from $28,500,000 in 1904 to $31,400,000 in 1905. This is at the rate of $22,000 per mile of road, an increase of almost $2,000 per mile of road over 1904. Operating expenses increased $2,150,000, leaving net earnings of $7,897,710, an increase of $730,000 over the previous year. Net income was $3,574,200, an increase of $654,000, and surplus after dividends $1,277,000 against $635,212 in 1904. There was $1,000,000 spent out of income for extraordinary expenditures on the line, leaving a profit and loss balance of $277,000. The appropriation for betterments ($1,000,000) compares with $690,000 in 1904.

Earnings came, $22,317,917 from freight and $6,439,549 from passenger traffic earnings (not including mail and express). Freight earnings show an increase of $3,169,000, against a decrease in passenger earnings of $360,290, the latter due to comparison with the Louisiana Purchase Exposition year. Average earnings per ton per mile were 0.63 cents, a decrease of 0.04 cents from 1904; but expenses decreased 0.05 cents per ton mile, leaving an increase of 0.01 cents per ton mile in net earnings. The rate per passenger mile was 1.99 cents and the expense 2.18 cents, showing a loss of 0.19 cents per passenger per mile. The passenger figures are not absolutely conclusive owing to impossibility of pro-rating expenses on an entirely accurate basis, but they go to show why railroads in Ohio so strenuously objected to the two-cent-a-mile law recently passed.

To make up the total increase of over $2,000,000 in expenses, maintenance of way furnished $640,965; maintenance of equipment, $781,699; conducting transportation (traffic), $17,668, and conducting transportation (operation), $697,397. The largest increases under maintenance of way were in the ordinary up-keep accounts, such as applying track material, roadway maintenance, ballast, ties, buildings and grounds, etc. The rail account, however, shows a decrease of $223,168. Per mile, maintenance of way cost $2,735 against $2,291 in 1904—two very liberal maintenance figures.

Under maintenance of equipment, repairs of freight cars increased $754,787, or from $116 per car in 1904 to $124 per car in 1905. Repairs of locomotives cost $3,455 per locomotive against $3,748 in 1904, and repairs of passenger cars were nearly stationary at $1,462 per car in 1905 against $1,480 per car in 1904. These also are exceedingly liberal figures.

The number of tons carried during the year was 35,023,606, an increase of over 4,000,000 tons from 1904. The tonnage mileage at the same time increased 658,000,000 ton miles, to 3,482,500,000. Freight density was 2,440,000 tons one mile per mile of road, an increase of 456,000 over 1904. Correspondingly, freight earnings increased $2,186 per mile of road over 1904. The average train load also shows a notable increase of 44 tons, raising the figure to 350 tons; not a large figure in comparison with the Lake Shore, for instance, but, on the whole, a creditable showing.

Of the total of 35,000,000 tons hauled, there were 13,200,000 tons of bituminous coal and 9,000,000 tons of manufactures. Other mine products contributed 6,000,000 tons, and miscellaneous articles 1,700,000 tons. The traffic of the road seems well distributed, with a good-sized proportion of high-grade tonnage, which, most of all, has increased during the past year. For instance, bituminous coal carried increased 1,000,000 tons against an increase of 1,600,000 tons in manufactures.

The principal results of the year's working follow:

	1905.	1904.
Mileage worked	1,427	1,424
Freight earnings	$22,317,917	$19,148,917
Passenger earnings	6,439,549	6,799,839
Gross earnings	31,417,095	28,532,475
Maint. way and structures	3,902,858	3,261,893
Maint. of equipment	5,958,730	5,177,031
Conducting transportation		
Traffic	666,725	649,056
Operation	11,323,087	10,625,690
Operating expenses	23,519,386	21,761,664
Net earnings	7,897,710	7,166,811
Net income	3,574,199	2,920,278
Extraordinary expenditures	1,000,000	690,658
Year's surplus	277,203	85,000

TRADE CATALOGUES.

Track Drills. "Latest Improvements in Track Drills" is the title of a pamphlet issued by Cook's Railway Appliance Co., Kalamazoo, Mich. It illustrates and describes the line of track drills made by this company, including the standard track tool grinder.

Band and Circular Saws. The Crescent Machine Co., Leetonia, Ohio, sends its 32-page pamphlet catalogue on saw mandrels, band and circular types. The entire part is devoted to Crescent band saws, of which there are a variety of [illegible]. In the non

to the several designs of circular saw tables, the "Crescent" jointer is also shown. Two circulars accompanying the catalogue describe the "Crescent" angle band saw and a new model 36 in. band saw.

Steam Shovel News. This little trade magazine has for leading articles in its March number a general article on the Erie Canal and another on "The Erie Canal and Freight Rebates"; "Chinese Labor on the [Panama] Canal," and "What the Railroads Are Doing." There is also a brief description of the new interurban union station at Toledo, Ohio, and other miscellaneous matter of interest to steam shovel makers and users, contractors, etc.

Graphite Paint.—"Spring Painting" is the title of a small pamphlet issued by the Joseph Dixon Crucible Co., Jersey City. It is a seasonable talk on spring painting, particularly of bridges, viaducts, water towers, smoke stacks, gas holders, iron covered buildings, structural steel and steel cars. The protective qualities of the Ticonderoga flake graphite used only in Dixon's Silica-Graphite Paint are explained and the suggestion made that the renewal season of nature is a good time for renewing the coatings of man's handiwork.

Jacks.—Ratchet, friction, ball-bearing and cone-bearing jacks are described in a 40-page pamphlet recently issued by the Buda Foundry & Mfg. Co., Chicago. Additions to the lines previously shown are contained in the publication. Each style of jack is shown in a half-tone view and on the opposite page all of the detail or repair parts are similarly exhibited. A brief description of the jack is given, also a list of repair parts with prices.

Auto-Pneumatic Air-Brake.—A circular issued by the inventor enumerates the principal advantages claimed for certain features which he has added to the standard triple valve to improve greatly its service. The difficulties in present equipment, which his invention is devised to overcome, are given briefly, as well as an idea of its method of operation. Half-tone views of the improved triple-valve are shown. A. L. Goodnight, 115 S. 24th street, Omaha, Neb., is the inventor.

The Little Blue Flag for March, the journal issued by The Lowe Brothers Co., Dayton, Ohio, has as leading articles "Selling Paint for Profit," "Meeting Cheap Competition," "Valuable Testimony," "Varnish," and "Why Paint Peels." There are also a number of testimonial letters relative to "High Standard" paint, the company's product, and miscellaneous matter of interest.

Water Columns.—Bulletin No. 3,106 of Charles A. Stickney Company, St. Paul, Minn., describes the Johnson railroad water column. Half-tone and line engravings illustrate the device, the latter showing its design and all details. Besides a general description, instructions for setting up are given. On the final page is a repair price list.

CONTRIBUTIONS

The Muck Rake and the Canal.

Pittsburg, Pa., April 17, 1906.

To the Editor of the Railroad Gazette:

The President says in his "Muck Rake" speech: "Gross and reckless assaults on character * * * create a morbid and vicious public sentiment, and at the same time act as a profound deterrent to able men of normal sensitiveness and tend to prevent them from entering the public service at any price. As an instance in point, I may mention that one serious difficulty encountered in getting the right type of men to dig the Panama Canal is the certainty that they will be exposed * * * to utterly reckless assaults on their character and capacity."

This is quite true, and as time goes on some of the chickens of the Administration will come home to roost. When the Grand Vizir tried to destroy his Chief Engineer he said that he wished to make the situation so terrible that no other high officer would dare to resign. He was reminded that he had made it difficult for any man of self respect to serve under him. H. G. P.

To Prevent Wear of Driving Wheel Flanges on Curves.

Prescott, Ariz., April 19, 1906.

To the Editor of the Railroad Gazette:

I have noted recently reference in your paper to excessive rail wear in rails laid upon sharp curves, but nothing concerning an excessive wear of the drive wheel flanges on the locomotives running on such track, although such must occur at the same time that the rail is being worn. The great wear of drive wheel flanges is known to the mechanical department of every railroad where there is much curved track. Such wheels must be removed often for turning in order to overcome this wear. This is expensive, on account of the cost of removing and replacing the wheels, turning the tires, and also the loss of metal, as they will stand probably but four turnings, and then the tire is useless and must be replaced. Excessive rail wear, drive wheel flange wear and danger of the sharp wheel flanges climbing the rail, all occur at the same time.

It may therefore be interesting to owners and operators of lines laid with sharp curves to know that Mr. Harry Elliott, Road Foreman of Engines, Santa Fe, Prescott & Phoenix Railway, has perfected a steam flange oiler. By his device the engineman in the cab applies a film of fuel oil to the drive wheel flanges, this being done in such a way and so small a quantity being used that it does not attach to the tread of the wheel or the top of the rail, and in no way affects the locomotive drive wheel traction. This has been in use on some of the locomotives of the Santa Fe, Prescott & Phoenix Railway for 14 months, and at no time has the oil in any way conflicted with the wheel traction. The wheels of one locomotive have made 40,000 miles without perceptible wear or suggestion of tire turning on account of flange wear. Before the flange oiler was used tires were turned after running 20,000 miles. No estimate has been made of rail wear or decreased risks on account of climbing the rail. These results were noted upon the Crown King road, where more than one-half of the line is curved, and most of the curves have a characteristic of 16 deg.

This arrangement has not been applied to all locomotives, but it soon will be. Its use on this line has not been of sufficient length to make estimates of saving in dollars and cents, but it must be very great, and it should interest every Superintendent of Motive Power and those in charge of maintenance of way where curves over 5 or 6 deg. obtain.

Mr. Elliott will be glad to give further information on this subject to any who are interested. It is not likely that the ordinary lubricating oils can be used in this way. California fuel oil so far seems to be the only oil filling the requirements.

W. A. Drake,
Gen. Supt., Santa Fe, Prescott & Phoenix.

Recent Controversy and Conditions at Panama.

To the Editor of the Railroad Gazette:

In M. Bunau-Varilla's open letter to the President, published in the New York *Sun* of March 6, he says "I appeal from President Roosevelt badly informed to President Roosevelt better informed." This is a very significant sentence. The President's letter to Congress, dated February 19th, transmitting the reports of the Board of Consulting Engineers says: "It will be noticed that the American engineers on the consulting board and on the commission, by a more than two to one majority, favor the lock canal, whereas the foreign engineers are a unit against it. I think this is partly to be explained by the fact that the great traffic canal of the old world is the Suez Canal, a sea level, whereas the great traffic canal of the new world is the Sault Ste. Marie Canal, a lock canal. Although the latter, the Soo, is closed to navigation during the winter months, it carries annually three times the traffic of the Suez Canal. In my judgment, the very able argument of the majority of the Board of Consulting Engineers is vitiated by their failure to pay proper heed to the lessons taught by the construction and operation of the Soo Canal."

On such a subject, the President is hardly qualified to express a judgment. In the first place, the friends-in-council, William H. Taft, Theodore P. Shonts and William Nelson Cromwell, are not engineers. What they have to say carries weight with the public because Taft is Secretary of War, Shonts is Chairman of the Commission, and Cromwell is an exceedingly clever fiscal agent. Their opinion in engineering matters has no weight with engineers: it should have no weight with the President. Wallace, it is plain, has been done a grave and an unrectified injustice. His successor, John F. Stevens, is incontestably an able engineer, and his sobriquet, "The Sphinx," bestowed on him by canal workmen, amounts to a testimonial in these days when Government employees, as a rule, talk too much. Stevens went to work with his mouth shut, to carry out his orders, whatever his opinions may have been as to the preferable type of canal. As indicated in his letter of Dec. 19, 1905, to the Commission, and reiterated in his letter of January 26th, his judgment favors the adoption of the high-level type. On the other hand, the judgment of the ablest canal engineers in the world, as expressed in the majority report of the Board of Consulting Engineers, is in favor of the sea-level canal. Four of these engineers have had experience solely with lock canals. M. Quellenec, Chief Engineer of the Suez Canal, is the only member of the board whose judgment might be considered biased by the circumstance that his experience has been with a sea-level canal. More than this, our American engineers have not had the experience of the European engineers in canal construction. The verdict of the foreign engineers, then, deserves to have weight with

the President, rather than the uninformed opinions of men of less experience.

In the second place, the elongated lock at Sault Ste. Marie—the "Sóo Canal"—is not a canal at all; it is simply a lock connecting Lake Superior with Lake Michigan. Nor are the conditions analogous. The "Soo" is 2,330 yds. long, 108 ft. wide at the canal gate and 270 ft. at the basin above locks, and 25 ft. deep. The Poe lock, opened in 1896, is 800 ft. long, 100 ft. wide and 22 ft. deep. It accommodates vessels drawing 21 ft., and it can be filled and emptied in seven minutes. The Suez Canal is 90 miles long, with a depth of 31 ft. and a bottom width of 108 ft. The type of Panama Canal approved by the commission in its latest findings would be 48 miles long, with three locks, and would have a width of 1,000 ft. for 20 miles of its length. It is obvious that to institute a comparison between the "Soo" and the Suez Canal on the one hand, or the "Soo" and the Panama Canal on the other, might result in misleading deductions. The President's inference is illogical when he says in the same letter: "Moreover, what has been actually demonstrated in making and operating the great lock canal, the Soo, a more important artery of traffic than the great sea level canal, the Suez, goes to support the opinion of the minority of the Consulting Board of Engineers and of the majority of the Isthmian Canal Commission as to the superior safety, feasibility and desirability of building a lock canal at Panama."

The schemes for a lock or a lake canal at Panama depend for their accomplishment on big earthwork dams for the barrage of the great floods of the Chagres river. At Bohio the maximum depth to bed rock is 160 ft., through mixed and porous river detritus. The pneumatic process has not as yet been successfully operated to anything like this depth, and in the debilitating tropical service conditions it is unlikely that workmen can stand a greater depth than 100 feet. A resident engineer writes me: "The theory advanced by some that the head could be lowered by pumping is no doubt chimerical. At the site the elevation is practically sea-level, and the slight tide of the Caribbean backs up beyond it. The various schemes of Lindon W. Bates for lower dams, built after the scheme proposed by George S. Morison for Bohio and somewhat similar to the barrages of the Nile, would found the dams of earth and piling on the present valley floor, and have a great spread up and down stream with a less height, so that the filtration through the permeable material under the dam would be very slow and difficult. These plans deserve the greatest consideration, as they develop the lock scheme to the limit as the most economical and quickest of realization: but coming up at this late day it seems impossible to obtain for them the consideration they deserve—which is much to be deplored."

Another consideration not to be overlooked is the delicacy of handling necessary to get boats 700 and 800 ft. long through a lock canal. A daily object lesson is the docking of the big liners in the North river. The Isthmian waterway is not intended for a boat to *fit into*, like a hat in a hat-box, but for a ship, broad of beam, to navigate, and even (to a limited extent) to move about in. The advocates of the San Blas tunnel route seemed to be persistenly unable to comprehend that a ship foundered in a trench or a tunnel is not precisely easy of extrication. M. Bunau-Varilla's projected "Strait of Panama," to be evolved from his transformable 130-ft. level canal by dredging, has a width of 500 ft., as compared with the 200-ft. minimum (for seven miles) of the 85-ft. level lock canal of the Commission's present plan. The danger to a lock canal from malicious injury such as dynamiting has often been pointed out.

Messrs. Shonts, Magoon and Harrod, of the Commission, are not engineers; Messrs. Hains and Ernst have had no experience in canal construction or management. These five gentlemen constitute the majority which favors the 85-ft. level lock canal and dissents from the judgment of the majority of the Board of Consulting Engineers. They are scarcely qualified to choose definitely the type of canal to be decided on. What was the Board of Consulting Engineers appointed for?

The present muddle is due to "vaulting ambition that o'erleaps itself." The Commission has been in too much of a hurry; it has been too prone to count "the mortal years it takes to mould memorial forms." In consequence, Lindon W. Bates's great lake-country concept comes too late; M. Bunau-Varilla's transformable canal is pigeon-holed because for the good of "unimagined empires" he sacrifices immediate expediency to permanency.

The objection raised by opponents of the sea level plan, that *any* canal must have at least one lock in order to allow for the difference in tides, will hardly hold. The mean tidal range for the Atlantic side is 1.43 ft.; for the Pacific side 12.6 ft. It has been calculated that this variation, distributed throughout the canal length, would give a current of about 3½ miles an hour! Any boy who owns a canoe will admit that this is not a prohibitive current.

The United States has spent on the canal to date some $70,000,000. For this expenditure we have to show 1,000,000 cu. yds. excavated by ourselves and 40,000,000 dug by the French, that apply on the type of canal we have chosen. Any sensible person who reads the reports of the Department of Health under Colonel Gorgas will not be dissatisfied with the amount of excavation already made. There is neither rhyme nor reason in the jeremiads of those who think that because dirt isn't flying there's nothing doing. "If we haven't made the dirt fly we have made the filth fly," the Chairman of the Commission sagaciously remarks. The energies of 4,000 men are at present directed to the extirpation of *stegomyia* and *anopheles*, setting rat-traps and probing crab-holes, covering roadways with gravel, draining and petrolizing swamps, fumigating houses, and peddling drinking-water. The most captious of critics can find no fault with the thorough-going work of Gorgas and his men. It is too bad, though, that a lot of highly specialized labor has had to chafe in idleness on the canal zone while the preliminary work of sanitation has been going on.

Here is an extract from a letter written early in January by one of the better-paid instrument men: "At present there does not seem to be any effort made toward actual construction, but the sanitary people, carpenters and painters have been very active the past year, and have improved the appearance of the country wonderfully . . . We are busy making small surveys and taking topography, but it is expensive work, and should be done after they have adopted some type of canal. Of course, only part of our work will be useful for any one type of canal."

Not all of the technical employees of the Commission possess the engineering qualifications of the man who wrote this letter. From the base of supplies at Washington, 2,000 miles from the firing-line, a great deal of shuffling inefficiency has been drafted into the canal service. One man who for ten years had been a government clerk in Washington got an engineering job on the Isthmus paying $175 a month, involving supervision of track-laborers. Even the Jamaica "nigger" soon learns to detect the incompetency of some of those set in authority over him, and so he either "soldiers" and shirks or becomes disheartened. "At Culebra," a resident engineer said to me when I was on the Isthmus, "the negro trackmen were often far more valuable than many of the high-priced men sent by the Commission."

In his notable article on the Panama Canal in *The Contemporary Review* for March, 1889, forecasting the French *débacle*, Mr. Edward Whymper quotes the Isthmian saying: "Only poor men come to the Isthmus." To certain discouraged resident engineers in the last few months it has seemed as though the Commission was sending to the Zone the men who have failed to make ends meet at home, the incompetents who crowd the lower rungs of every professional ladder. No more of such labor is wanted. It is costly at any price. And, working under tropical conditions of about 25 per cent. efficiency, the price of 80 cents to $1.04 for a day's labor of the lowest grade is equivalent to $3.20 to $4.16 for a whole man working a whole day. The necessary surveying has been done—no government enterprise was ever initiated with more abundant or satisfactory data in hand, and there is at present a reducible surplus of engineering talent at Panama. Along with the double-tracking of the Panama Railroad and the other problems which Stevens, with his tremendous capacity for work, cheerfully faces, is the job of eliminating the unfit—the camp-followers and hangers-on of the undertaking.

FULLERTON L. WALDO.

Washington Correspondence.

WASHINGTON, April 17.—No definite agreement on the review amendment to be incorporated in the Hepburn railroad rate bill has yet been reached. Such an agreement seemed to be in sight early last week, but the premature announcement that the President had agreed to it and the action of certain newspapers in representing this as a surrender on his part has resulted in a temporary delay. There is no reason to believe, however, that an agreement will not eventually be reached along substantially the lines indicated last week. The advocates of a restricted review still cling to the hope that they will be able to secure a majority for their proposition, but the indications are that in the end a majority will be found for an amendment based on the incorporation of Senator Knox's provision for the protection of carriers in their legal rights in the Long amendment with the addition of a provision for impounding the amount in controversy pending the review.

The notable feature of the debate during the past week has been the declaration of Senators Bailey and Tillman in favor of flat mileage rates. Senator Foraker was not slow to take advantage of this and to point out how mileage rates would affect the fruit industry of Senator Tillman's state and the cotton industry of the entire South. As the debate progresses more will be heard of mileage rates. One of the contentions of the opponents of the Hepburn bill is that whether the bill, as finally passed, shall require the Commission to make rates on a mileage basis or not, the Commission will be forced to make them on approximately that basis. This argument is based on the theory that there is scarcely a rate that can be changed without changing the relation of rates affecting rival communities, and that, consequently, practically every order

issued by the Commission will meet with criticism from shippers in some quarter. It is contended that this would drive the Commission, in self defense, to endeavor to avoid charges of favoritism by adopting a uniform rate which is followed in all cases, and it is contended that the only such rule that could be adopted would be that of fixing rates on a given class or a given commodity at a uniform amount per ton per mile.

The mileage proposition has been brought to the front by the decision of the United States Supreme Court in the Michigan Railroad Tax Cases, indicating that the provision of the bill empowering the Commission to fix rates must prescribe some specific rule or definite standard so that, in theory, the rate will be made by Congress and the action of the Commission will be purely administrative and will be confined to the determination of the rate by applying the legislative standard to a specific freight condition. Of course, the simplest standard that could be devised would be one of mileage rates; but, despite the declaration of Senators Bailey and Tillman in favor of this standard, it is not at all probable that it will be seriously considered by the Senate. The chances are that the Senate will take the risk of the provision in its present form being declared unconstitutional or will endeavor to devise an amendment under which the courts can hold that the Commission is simply required to ascertain certain facts and determine the rate in accordance with them, eliminating the exercise of legislative discretion by administrative officials.

J. C. W.

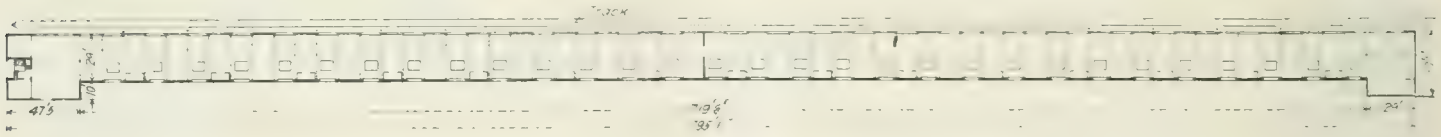
The new Italian Minister of Public Works has introduced a bill providing means for making the railroads adequate to the work demanded of them which calls for the expenditure of no less than $260,000,000, to be distributed over the next ten years. He has also submitted a bill for acquiring the only considerable railroad system (the Southern), which is still outside of the state system. The authorities have contracted with the Baldwin Locomotive Works for 20 locomotives, 10 for express and 10 for freight service, to be delivered by August next.

New Outbound Freight House of the Wabash at Chicago.

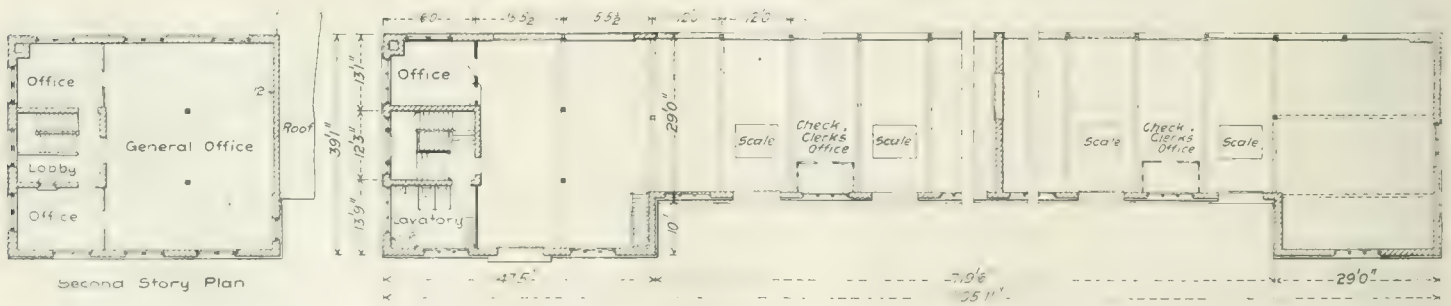
One of the most important of recent Wabash improvements is a new outbound freight house lately completed at Chicago. This is on property newly acquired on Clark street, extending from Polk to Taylor street and eastward to the alley. The old freight house of the Wabash is at Twelfth street and Plymouth Place, a short distance southeast of the new house. It was used for both inbound and outbound freight. But the business outgrew it, congesting it so that additional facilities were imperative. With the completion of the new outbound house, the older house will be used entirely for inbound business. The cost of the new outbound house is about $60,000.



New Outbound Freight House of the Wabash at Chicago.



General Plan: New Wabash Freight House at Chicago.

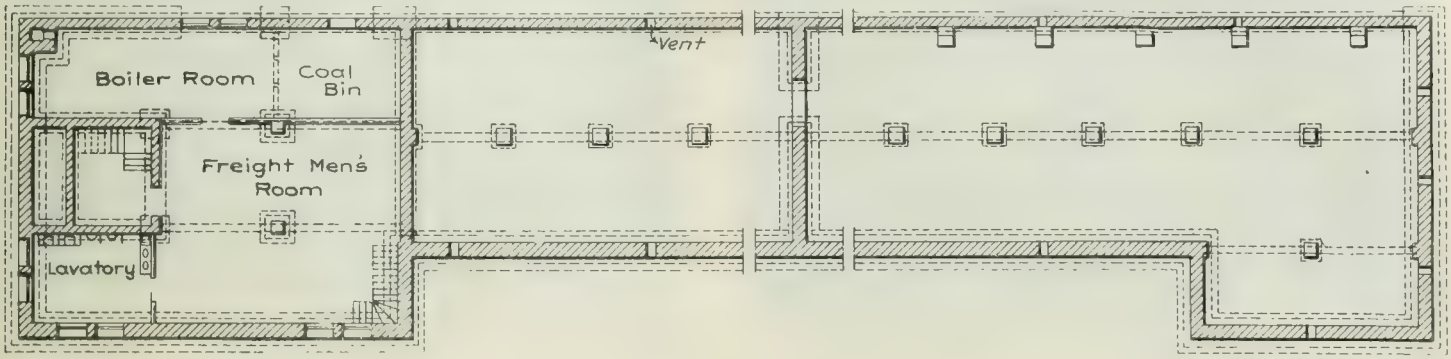


First and Second Story Plans; New Wabash Freight House at Chicago.

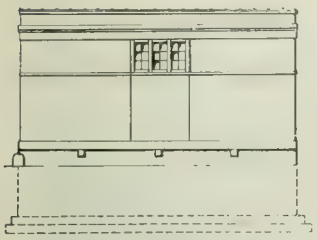
The new house is 796 ft. long, with a two-story office portion at the Polk street end. Plans and elevations are shown herewith. It is built of brick, the foundation walls and floor-supporting piers being brick on concrete footings. The roof is composition, supported by wooden roof trusses. The flooring is $1^1/_8$ in. x $2^1/_4$ in. maple, laid over a 3-in sub-floor. The basement, cold room and entrance to the lobby have concrete floors laid over a 5-in.

course of cinders. There are 30 doors each on the team and track sides and 30 scales—one for each door. There is a check clerk's office for every two scales, thus greatly expediting the handling of business. The freight section will be lighted with 17 Humphrey gas arc lamps of 500 candle power.

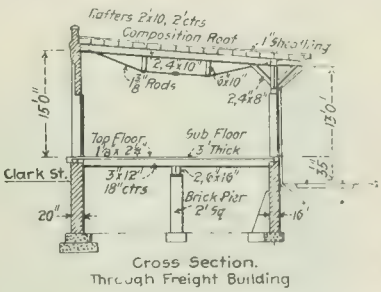
One of the most interesting features is the arrangement now being installed for service from the Chicago freight tunnels. There will be two connections from the Clark street bore, one at each end of the building, with elevators for raising and lowering the tunnel cars. A track will run lengthwise of the floor from one



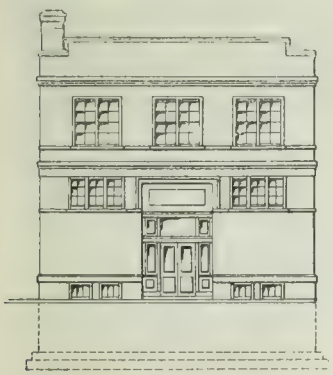
Foundation Plan; New Wabash Freight House at Chicago.



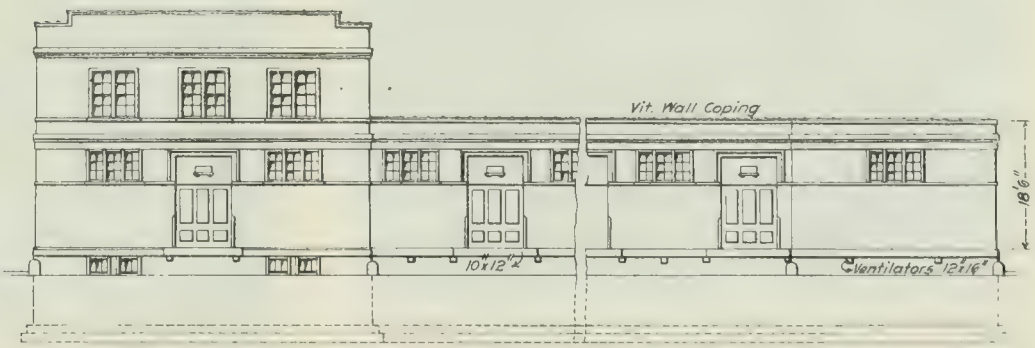
Elevation Facing Taylor Street.



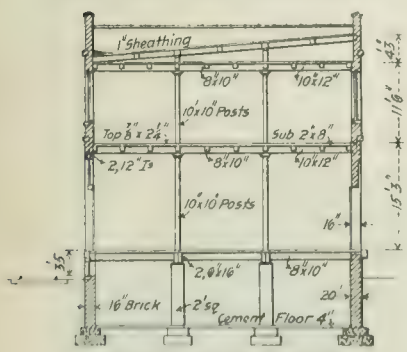
Cross Section. Through Freight Building



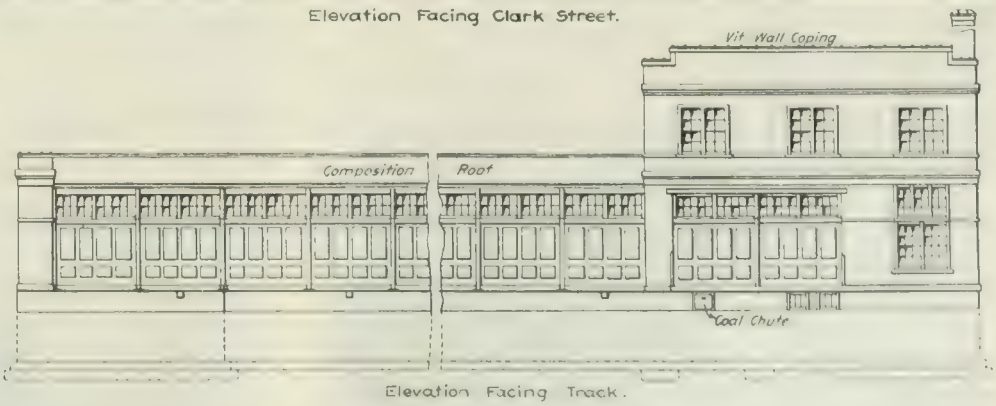
Elevation Facing Polk Street.



Elevation Facing Clark Street.



Section Through Office Building.



Elevation Facing Track.

Elevations and Cross Sections; New Wabash Freight House at Chicago.

elevator to the other. The loaded tunnel cars will be received ordinarily at the north or Polk street end, will be run out onto the longitudinal connecting track, unloaded onto the floor and continued to the south elevator for return to the tunnel. On the farther side of each elevator there will be track room to store eight or ten tunnel cars in case the elevator is not ready to handle them. There is also a runaround track by each elevator. The inbound house will have similar connections to the tunnel. The Wabash houses have the distinction of being among the very first freight houses in Chicago to have connections made for the tunnel service.

The Duties of a Trainmaster.*

He is the first one resorted to by the train crews when things do not roll along their way; he is the right hand of the Superintendent. He listens to complaints and grievances, regulates, adjusts or dismisses them, investigates sins of omission and commission resulting in poor service, and digs out evidence, fixing responsibility for accidents. To him are sent the complaints of passengers against the men, some of merit, many without, but all to be impartially investigated. He must exercise a general supervision over all employees, not only in train service but also in yard and station service on his division, keeping a watchful eye upon station buildings inside and out to see that they are kept up to a proper standard of neatness. He must be familiar with the actual conditions that govern yard and switching facilities in detail at terminals in order that no "song and dance explanation" as the boys call it be received in cases of derailment or other mishap; whether this train can get along with one less car, or the other train is being run without enough cars, watch the time and stops of trains to ascertain if they are doing the best they can, see that cars are properly and regularly distributed; keep in touch with the despatcher 24 hours a day and be ready on short call at night to get into his boots and breeches whenever there is a wreck on the line. It is a strenuous life and full of incident, but trainmasters as a rule are a healthy lot, and are generally promoted from the ranks where

*Railroad Men, the monthly magazine published by the Young Men's Christian Association, New York [illegible] contains a series of interesting brief biographical sketches of [illegible] connected with the New York Central System with portraits. [illegible] have written brief articles on the duties of their [illegible] published. Herein we give extracts from [illegible] articles. The author's name is given at the end of his article except that the name of the writer of the last one is not given.

they have learned that in order to do good work they must take good care of their bodies.

Informal meetings are frequently held where the Trainmaster catechizes his men as to their understanding of the rules, such meetings are productive of wonderfully good results, they keep the men on edge, and lots of animated discussions take place at these times. A much higher standard of train service is required, and given, than there was a few years ago, when a perfunctory knowledge of the rules of operation was considered to be sufficient. Nowadays, the men are not only required to know the rules, but to understand the fundamental principle that brought them individually into being, and it is part of the duty of the Trainmaster to make that clear to them. This, however, is not a difficult task for, thanks to a system that provides intelligent men to start with, the average man in train service to-day is of somewhat superior calibre to his brethren in the earlier days of railroads. He earns more money and works less hours for it than formerly and more is expected of him in a better standard of service.

Men as a rule, no matter what they may protest to the contrary, *know* when they are in the wrong, and what good discipline requires in the way of penance, and the quality of the service is the gage that shows whether the Trainmaster also recognizes this important fact. The points of contact between the Trainmaster and his men are many. Discussion of every day matters of operation frequently develops problems that require considerable thought to solve. This broadening process is of the greatest importance; it brings out the actual knowledge of his business possessed by each man. This close relationship between the Trainmaster and the men promotes an *esprit de corps* that *really* animates, and it tends toward perfect service.—F. T. Slack, New York Central, New York.

As a Trainmaster's duties bring him closer in touch with men in train service than any other official, he should make a study of the habits, disposition and peculiarities of each man in his charge, that he may be more able to assign responsibility for accidents, detentions to trains, etc.

Since May 1, 1905, I have personally instructed over 1,500 men in train service; this includes enginemen, conductors, firemen and brakemen. To accomplish this, we hold at least two meetings each month, at which practical talks are given by Assistant Superintendent S. R. Payne and myself, our subjects being train rules and train orders. We give practical illustrations of each rule, specifying the condition or accident which brought about the requirement of the rule; and, for our train orders, we give an illustrative lecture on a blackboard.

In addition to dwelling upon train rules and train orders, we have a heart to heart talk with our men, encouraging them to give us their confidence, and assuring them that we are all one large family, in which the welfare of one means the welfare of all.

A Trainmaster should be a student of human nature. In most cases, recommendations "cut no figure," as the greatest rascal generally has the best recommendations. A Trainmaster, who is a student of human nature, can pick out undesirable applicants from their manner of dress and general appearance.

A Trainmaster must be the arbiter between the conductor and brakemen, taking care that the report from the dyspeptic conductor does not deprive the company of the services of a man who will, if given a chance, become valuable. He must, on the other hand, see that the "smart Aleck" of a brakeman does not impose upon the easy-going and generous-minded conductor.

A Trainmaster must give special attention to the prompt and regular movement of traffic, carefully investigate detentions of trains, and make frequent inspections of train equipment, books, bulletin boards and train registers, and be responsible for their condition.—Charles F. Ray, New York Central, Syracuse.

The Trainmaster is responsible at all times to have enough men on hand who are qualified to fill all places in the train service. We have on this division 134 passenger conductors on regular runs, and 28 extra passenger conductors. In the freight service we have 98 regular freight crews on regular runs. We have 90 freight crews on irregular runs. There are 58 freight conductors standing extra at the different terminals. We have 10 railroads using the tracks of the New York Central in the vicinity of Buffalo and the Trainmaster has to see that these employees are qualified for running over the New York Central tracks and has to examine them on train rules, etc.—P. W. Resseman, New York Central, Buffalo.

One is supposed to exercise general supervision over all employees in the train, station and yard service, often examining passenger equipment as to cleanliness, and see that it is such as will make a journey comfortable and pleasing; that the schedules are accommodating; that required freight cars are supplied and distributed, promptly loaded and unloaded and moved with despatch; that the motive power is sufficient for prompt and regular service, and the maximum tonnage rating maintained, that the service is only such as will meet actual requirements.

The performance of these duties requires close application at all times, day and night, the traveling of many miles, and ceaseless vigilance. A familiarity with all existing conditions of whatever nature is essential that he may act promptly when necessary. He must lay aside that law of nature which sometimes creates a personal feeling, and act toward all with absolute impartiality. He is the medium between the men and the company, so to speak, and must safeguard their individual interests between themselves. He cannot praise the industrious, but must urge the indifferent. In the interest of a common cause the Trainmaster should be frank and equitable with his men, and they equally so and honest with the Trainmaster.—W. W. Currier, Putnam Division, New York Central, Highbridge.

The duties of a Trainmaster are multitudinous, and if he is located at a point somewhat distant from the Superintendent's office, he must not only attend to his train service and men, but also the municipal and commercial interests of the company he represents.

All new work and improvements of tracks in his territory are invariably referred by the Superintendent to the Trainmaster for a thorough investigation of the conditions on the ground, and he is asked for recommendations. Being the last official to whom such matters are referred, he must work the thing out because he has no one to turn it over to and ask to "Please investigate and advise," and as far as the Operating Department goes, he is the buffer between the railroad company and the public.

In the train service, the Trainmaster is again a buffer between the railroad company and the employees in his department. He must enforce strict discipline, and at the same time be fair and impartial with his men and command their respect. His position is something like the city fireman. He must be on call at all times, day and night, ready to respond to any call in case of trouble in his territory. On some of the large roads, there is a position designated as Chief Wrecker, but usually it is the Trainmaster who must proceed to the scene of the trouble and clear the way and keep traffic moving, if any possible way can be found. A passenger conductor on the "Big Four" once said to his Superintendent in reply to an inquiry as to how he would like to be Trainmaster, "I do not care for the position, as I am better off in charge of one train than 50, and when I get to my terminal I know that I am free until it is time to take my run out again. No, I'll hang onto a good passenger train." A good Trainmaster must be born for the position as everybody can't fill it successfully, and when a railroad company gets a good one they keep him there and make superintendents out of clerks and train despatchers because the Operating Department is like a locomotive—the throttle is simple and easy to work but the steam and machinery which it controls is complicated, and requires a lot of energy, experience and hard work to keep it in order. x.

"Horseshoe" Concrete Arches.

BY DANIEL B. LUTEN.

In designing arches of concrete considerable variety is possible in arranging the ends of the arch to fit the side slopes of earth and to afford easy passage of flood-waters. The usual forms are spandrel walls across the end of the barrel and wings extending far enough to hold the earth side slopes, the wings occupying any position from parallel to the stream to parallel to the track.

A more economical type of end for arch culverts has recently become popular on many of the railroads in Indiana and Ohio, and is called the "horseshoe" arch from its resemblance to a horseshoe, as may be seen in Figs. 1 and 2. The views shown in Figs. 1, 2 and 3 represent an arch of 20-ft. span and 9-ft. opening on the Big Four Railway between Danville and Greencastle, Indiana. Thirty-seven of these arches of spans from 3 ft. to 18 ft. have been built on the Indianapolis & Northwestern Traction Ry., and 29 of the spans up to 22 ft. on the Indianapolis & Western Ry.

As may be seen in Figs. 2 and 3, the "horseshoe" end is formed by cutting the barrel of the arch to fit the side slope of the earth fill, one and one-half to one in this case, then squaring the end of the arch ring normal to the intrados, and forming a shoulder over the crown to hold the toe of the slope. The end of the arch ring is thus a warped surface of helicoidal form such as may be generated by a line having two simultaneous motions, one about the axis and one along the axis of the arch.

This type of arch is of exceedingly simple construction. No forms are necessary except the drum of the arch, extended at its lower part to the extreme ends of the proposed arch. To form the "horseshoe" end to fit the proposed slope two lines may be stretched, as shown in black ink on Fig. 4, one on each side of the arch and a few feet away, transverse to the roadway and in the plane of the desired slope, that is ordinarily, at a slope of one and one-half to one. A workman standing in line with these two lines and sighting across the two can direct the placing of the concrete



Fig. 1—Horse-Shoe Arch on the Big Four.



Fig. 2—Diagonal View of Horse-Shoe Arch.



Fig. 3—Side View of Horse-Shoe Arch, Showing Fit of Shoulder to Side Slope.



Fig. 4—Forms in Place for Horse-Shoe Arch.



Fig. 5—Concrete Arch With Wings and Spandrel.



Fig. 6—Funnel-Shaped Horse-Shoe Arch.

so as to maintain the outer surface at the exact slope, the end can be trowelled to the curve of a true surface by working with fairly dry concrete over the lagging and its surface may be tested by applying a try square with one blade tangent to the lagging of the drum. It is sometimes advantageous in forming the part of the surface over the crown where it is nearly vertical, to build a short section of form as shown in Fig. 4, a view of drum erected and reinforcement in place ready for concrete. A section of the centering laid flat on the drum and faced with a few short upright boards is all that is necessary to hold the concrete for an hour or two until it has hardened enough to stand trowelling, when the form may be removed and the surface shaped with the trowel. A further guide in building the warped surface may be had by laying off on the drum lagging the inner curve of the face, by holding a rule normal to the drum and locating it at a point with the required thickness of face between plane of slope and drum.

The face may be made of uniform thickness from crown to springing, but presents a better appearance if thickened towards the springings. A massive appearance may be given to an otherwise light arch by increasing the amount of shoulder and giving to the warped face a considerably thicker arch ring than the actual section of the arch back of the shoulder. Thus in Fig. 1 the arch shows at the face a thickness of 24 in., while one foot back of the face the crown is but 13 in. and increases to 17 in. of crown under the 30 ft. of fill at the middle of the track.

An arch built with "horseshoe" ends does not present as handsome or finished an appearance as the type shown in Fig. 5 with wings, spandrels and copings; but it has a very decided advantage in cost, as the saving in forms, concrete and labor amounts to from 15 to 25 per cent. of the total cost of the structure. And after a foreman has once been carefully instructed in the building of one of these ends, he can make it quite an artistic structure by forming all lines and curves truly and accurately and relying on the very simplicity of the device for its merit. The beauty of this design rests in its common-sense.

As to the capacity of this arch for handling floods, it is quite as effective as the spandrel and wing type where the wings stand perpendicular to the track, but is not as effective as splayed wings. The wings of the "horseshoe" arch may also be splayed slightly, however, and an arch of this type which was built especially to accommodate an excess of flood water while limited to a given span and rise, near Lebanon, Indiana, on the Lebanon & Thorntown Traction Ry., is shown in Figs. 6 and 7. The arch was designed on the principle of the Venturi tube, in which a constricted waterway produces increased velocity of flow. Ordinarily, an arch is built with straight cylindrical barrel and heaviest section at the middle of its length and with the extrados conforming to changes of section. In this arch, the heaviest section is similarly at center of track, but the intrados is splayed outwards towards the ends, both at sides and at top and bottom. The arch is of span 18 ft. with 7 ft. 6 in. opening at center line of track, while at its ends the arch has a span of 20 ft. and opening of 8 ft. 6 in. The net result is that the end areas of waterway of the arch are 20 per cent. greater than at its smallest section, and the presumption is that the arch will handle all the water that will pass the largest section by increased velocity through the constricted section. The efficiency of this 18 ft. arch is thus increased about 20 per cent. by this device.

The cost of the structure is not increased in the same proportion, the amount of material required being the same as for an 18 ft. arch with straight barrel. But considerable complication of centering is introduced, although the added labor is almost entirely in the drawings necessary for laying them out. The arch was designed for 100-ton cars, and has since its erection in 1905 been subjected to the full load of some of the heaviest locomotives on the Big Four Ry. with ballast trains. The contract price of this arch complete was $570.

These culverts were erected by The National Bridge Company, of Indianapolis, and were all reinforced with their system of a single series of rods passing near the intrados over the crown and near the extrados at the haunches and crossing the arch ring at alternate points as shown in Fig. 7. A successful method of anchoring reinforcing rods in concrete is also shown in Fig. 1 (in the quarter-foundation plan), where the ends of the rods are bent sidewise in a gradual curve and hooked over the next adjacent rod.

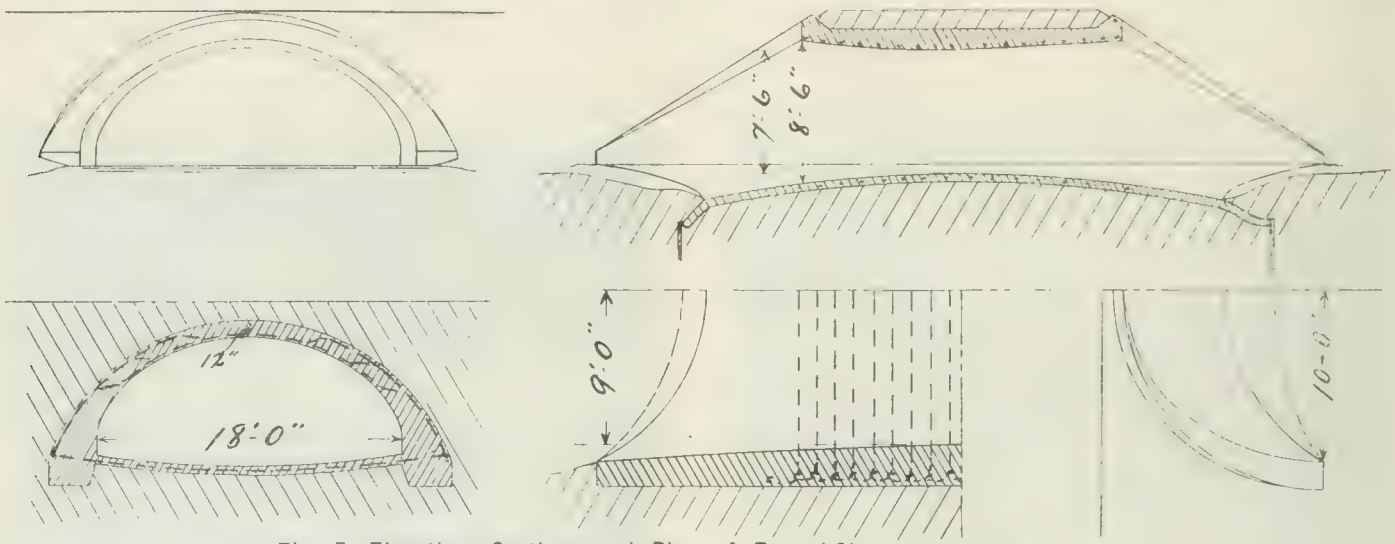


Fig. 7.—Elevation, Sections and Plan of Funnel-Shaped Horse-Shoe Arch.

Key West Extension of the Florida East Coast.

BY HARRY C. SMITH.

Unexpected progress has been made to date on the Key West extension of the Florida East Coast Railroad despite numerous difficulties, and indications point to the completion of the tremendous task much earlier than the most sanguine engineers predicted at the outset. A large share of the land work across the keys has been finished, although it is less than a year since construction was actually begun and hardly ten months have elapsed from the date that a large force began work. The construction gang is about to transfer itself to the water stretches, which, for the most part, do not interpose any decided obstacles. Of course, there still remains a good deal of land work to be done in spots, but it is desirable, if not absolutely necessary, to avoid the thickets on the keys during the warmer months when the mosquitos constitute a serious menace.

For rather more than half of the 165 miles between Miami and Key West, the railroad will be over water, but only at two or three points is there much depth. In fact, it is, as Henry M. Flagler says, as much like landscape gardening as it is railroad building. Building the reinforced concrete arches is not as great a problem as is their protection from the tropical storms at the few points not guarded by reefs, before and after completion. This difficulty caused contractors to be somewhat slow in bidding and it is not unlikely, therefore, that the Florida East Coast Co. will do part of the work itself.

Four long viaducts are to be built, the longest and most troublesome being for the seven miles between Boot Key and Bahia Honda. It will stretch over water from 10 to 30 ft. deep. It was originally intended to keep to the Florida mainland as far as Cape Sable and then cross by a viaduct 35 miles long, directly to Key West, but the depth of the water most of the distance ruled out that plan. Instead, the extension is being made from Homestead southwestward over a stretch of the Everglades called Big Prairie by dredges which throw up an embankment. This, in the opinion of the engineers, is the most noteworthy work ever attempted. Only a short span will be necessary from the mainland to Key Largo at Jew Fish Creek. But shallow water in the vicinity has caused much annoyance to the fleet of construction boats, so that a big dredge has been stationed there.

Soon after reaching Largo, the surveyors found a large lake to be crossed, which had never been mentioned on the maps. Accordingly it was christened Lake Surprise. A dredge is at work there sucking up the peaty bottom of the lake, which is dumped into a hopper and then forced through big pipes supported by



The Finished Roadbed Across the Keys.

pontoon bridges for a quarter of a mile to the point where an embankment for the railroad track across the lake is being built. The only foundation the key offers at this point is mangrove roots. The sections of pipe resting on the pontoons have leather elbows to permit of flexibility. Rattling can be heard in the big pipe as the pieces of coral rock are forced through. Occasionally a large jagged piece of rock will tear through a leather joint and then the mud spurts.

The first actual construction camp at which I stopped in making a tour on the launch "Nan" with William J. Krome, principal assistant engineer, was composed entirely of negroes. It was after



A Typical Scene in the Florida Keys.

dark and they mistook the launch for the pay boat, as is often the case. The whole camp began a rythmical clapping of hands in the tents, which, from a distance, seemed like the fervent devotions of a colored camp meeting. Negroes, with a few exceptions, clear the jungles as an advance guard. They are selected because they are commonly immune to certain poisonous plants frequently found. The work is done on contract, bids by the square foot or yard being received. Such contractors make better wages than ordinary laborers.

There is another all-negro camp on Key Vaca, the only other exclusively black settlement. With one or two exceptions, the whites and negroes are carefuliy kept apart. At Plantation Key there is a mixture, but the negroes are isolated on one side of the embankment.

The other camps are on Umbrella, Upper Matecumbe, Lower Matecumbe, Long, Crall, Vaca (two), Summerland, Ramrod and Cudjoe Keys and Key West. The average camp roll is from 200 to 250 men, there being a constant shifting from one to another, particularly within the same division, of which there are three or four, each under the general oversight of a section engineer. From Key Largo to the Matecumbe Keys the islands lie closely together. Between Lower Matecumbe and Long Key there is a decided gap, and the same is true between Long and Estetta Keys, but in th latter case the Duck Keys intervening—merely coral points projecting above the water—will serve as anchors for the bridge work. From Bahia Honda to Key West, 40 miles, the keys again lie closely together.

All winter the newspapers have been filled with stories of suffering and deprivation alleged by laborers from New York and Philadelphia, who went South to do the earlier construction work. Some of these complaints have already reached the courts. On the other hand, equally vehement denials have been made by officials of the Florida East Coast road. It is true that hardships existed at the threshhold of the work, but they have been so reduced steadily that the path ahead seems comparatively smooth. There was acute distress in December, because of a tremendous rainfall that month. Weather bureau reports show that the precipitation was 15.18 in., or 14.67 in. more than that of December, 1904. The average December rainfall for 18 years has been 3.13 in.

Many consumptives and infirm persons, anxious to spend the winter in a warmer clime, applied at the New York employment agencies and the same motive actuated a large percentage of the able-bodied applicants. A physical test was imposed, but it largely failed of its purpose, because many of the successful applicants either sold or gave way their tickets, while some of those who arrived at the keys had apparently exchanged good arms and legs for those of the wooden variety, during their journey. Some sort of photographic identification should have been tried.

A good many of the would-be laborers disappeared soon after the trains reached Florida. Now negroes are shipped by boat to Key West to avoid their exodus from trains at Jacksonville. Few of the arrivals brought more than a handful of baggage, and the coquina rock that covers most of the keys in the few days tore even the stoutest shoes to pieces. Living in tents during the December downpour was no joke. At the camp on the easterly end of Key West the men struck early. A big body of them marched to town, surrounded the city hall and demanded food. For two days the city fed them on the baseball grounds by public subscription. Then a local grocer offered to feed the force for 45 cents a day each, and the business men of Key West forced them to return to work. A few were kept busy on Key West streets as vagrants serving out terms. Some long ago worked out their service, but preferred to remain as boarders at the city lockup.

The construction gangs eat in long tents much in military fashion. The food while rather coarse and not served in appetizing style, has been wholesome and fairly well varied. One of the greatest problems has been the water supply. Wells on the



One of the Workmen's Camps.



Houseboat for Foremen.

keys furnish only salt water. At Key West rain water is exclusively used. So every drop has to be transported on lighters from Miami in tanks holding from 5,200 to 6,000 gallons. Eventually this water may be pumped in pipes, some of it the whole distance of 165 miles.

Several times there has been lively scurrying to prevent a water famine in some of the camps. In the same way, too, there have been dynamite and other shortages, owing partly to the fact that the railroad company was at first short of carrying steamers. Ordinary craft cannot navigate the shallow channels among the keys, so it was necessary to get hold of stern-wheel steamers quickly. An agent went up the Mississippi and bought boats at St. Louis and points further north. Several launches, pressed into service, were found to have slow and uncertain engines that had to be replaced, so the only wonder is that the confusion has not been greater.

As things stand at present, the commissary stores at the camps run by a Miami grocer offer the greatest field for improvement. There has been little sickness and few accidents considering the carelessness of many of the men. The money derived from the commissary privilege by the railroad company goes to the support of the camp hospitals and the general institution at Miami.

As something like ten tons of dynamite are used each week for blasting, the question of storing the explosive is important. One boat, so far, has carried all the dynamite from Miami to the two or three lighters, kept as magazines a couple of miles off shore with a watchman aboard.

A day's work consists of ten hours, starting about 6 a.m. and ending at 5 p.m. Many are put drilling for dynamite blasts by steadily dropping iron rods into the coquina rock. Others shovel, while still others work with wheel-barrows or drive mule carts. A channel wide enough for a small river is blasted along the surface. The rocks and gravel thus obtained are then thrown up at one side, forming the railroad embankment.

Liquor is strictly prohibited on the keys and the men get along without it surprisingly well. The conchs from Key West, however, have found it profitable to start "blind tigers" at several places, for which they were severely punished. Defying one of the camp overseers, these offenders came near having a floating bar dynamited.

Construction trains will probably be running from the mainland to Key Largo within a twelve-month, and inside two years the ends of this wonderful oceanic railroad are likely to be in operation, with temporary boat connections across the long water gap at Bahia Honda.

New York Subway and George S. Rice's Views.*

Of the New York rapid transit railway, 24.6 miles, only 18 miles at present are operated, and at this particular time it is carrying very nearly 500,000 passengers on week days, and at times as many as 530,000 passengers.

The great trouble found in operating the Subway railroad has been to accommodate the crowds in the rush hours, that is, from 7 in the morning till 9, and from 5 until 7 in the afternoon. At some of the stations during these hours it is an unusual occurrence for a passenger to secure a seat on entering a car.

The remarkable point about the operation of this railway is that in the rush hours eight-car trains are being run every two minutes. The express service continues all day long on week days, from 6 o'clock in the morning until 12 o'clock at night, during which time no interval of express train service is greater than five minutes. There is also a local travel on entirely separate tracks every two or three minutes. Of course, the schedule is made to fit the requirements of the travel. The Sunday travel is very much lighter, about one-half the ordinary day travel.

The local trains run all night, and on no branch is there an interval greater than 15 minutes. The four-track system, which comprises the lower six and three-quarter miles, has a train interval of about seven and a half minutes. This means that there are 760 trains running each way during the 24 hours, and that over 8,000 cars pass any station on the four-track section each 24 hours. The passenger miles per day equal 1,125,000; the car mileage is 108,860, and the train mileage is 19,106. The average express speed is 25 miles an hour. At rush hours it varies from 20 to 21 miles, and at other hours it reaches a maximum of 27 or 28 miles. The contract called for 30 miles, but the curves—and Broadway apparently it not very crooked—have cut down that speed. It is not considered safe at the present time, nor will it be, I think, to run those cars at a speed of 30 miles an hour. The average local speed is 16 miles an hour, including stops. The rush hour speed is 13 or 14 miles per hour, and at other times it is about 18, sometimes 20. From Brooklyn bridge to 157th street the schedule time is 27 minutes, and from Brooklyn bridge to 145th street in Harlem, it is 27 minutes, and on the four-track section it is 16 minutes.

When this plan was laid out in 1895 the transportation interests which were consulted and which were accustomed to handling large bodies of men, looked with suspicion upon the four-track system with reference to transfers. They said that the ordinary person would be inclined, if he entered at Bleecker street, and wantd to go to 103d street, to remain on the locals rather than transfer to and from an express train, although it would take him a little longer. The fact is that people will transfer to save two minutes, and this has made a good deal of trouble, for the reason that the movement from train to train has been so great that the service has been very much impaired.

The average stop of an express train at an express station has been about 45 seconds, and the average stop of a local train less than 30 seconds. An endeavor was made to get the contractor, when adopting the plans for the equipment to operate the road to have side doors, not the side doors you have here in Boston, which are central side doors. The New York man is "wedded" to a side seat; that is, to seats which run against the direction of the car. It was suggested to the operating company to adopt a door which would be 6 or 8 ft. distant from the end of the car, and have no vestibule, but this was not considered practical, from a question of operation, as it was thought too many men would be required to operate these doors; this view I am not in accord with. I think that to have a very wide door is something absolutely necessary in handling the trains in New York, so that the passengers can go in and come out in a very short time, as an average of 45 seconds is too great. In some cases the stop has been as much as 90 seconds at some of the express stations.

The track is 100-lb. rail, and is ballasted in broken stone with the ordinary tie. There is another difference which we had with our contractor. In the beginning, in studying this problem of the track, we laid out an entirely different kind of track. We did not want to use ties; we did not think it was necessary. We were underground, with no frost, and there did not seem to be any reason why we should use a tie or should use ballast; we wanted to use concrete. We had constructed in Long Island, near Jamaica, an experimental section of track which was used for one winter, and it showed up very well. My own idea is that we should have a solid track, and I think that we are coming to it now.

The track, however, is admirable. I do not know an easier running road. It has been a success, but, of course, the cost has been very great to maintain it under the traffic of heavily loaded express trains, eight cars long, and running at great speed almost continuously from the beginning of the year to the end.

The greater portion of the subway already built is constructed by the use of steel columns between the tracks. About three years ago we tried the concrete construction, reinforcing the concrete by steel bars, and this form of construction we have latterly followed. In the new subways about to be built we are going to use the reinforced concrete construction almost entirely, getting rid of the posts from one end of the road to the other. All trains going in one direction will go in a subway by themselves, and not only assist in moving the air, but in case of a derailment there will be solid walls at each side.

The largest station on the railroad so far built is the Brooklyn bridge station. That has something over 24,000 square feet of area of platform. At this station are collected every week day almost 60,000 fares, 135,000 people using the station daily, being at the rate of nearly 50,000,000 passengers a year. The Brooklyn bridge itself, which is almost over the station, has a daily passenger traffic of somewhere in the vicinity of 300,000 passengers a day. On the line of the subway in operation at the present time there are 48 stations, some of them elevated but most of them subway, and three of them with elevators. One has an escalator operated on the same movement, that is, the people going up will be on the upper part of the escalator, and those coming down will be on the under side.

Mr. John B. McDonald was the contractor for the road we call Contract No. 1, that is, the one in Manhattan and The Bronx. The Brooklyn extension is called Contract No. 2. Mr. McDonald bid for Contract No. 1, $35,000,000. He practically took the engineer's estimate of what the work would cost, and made his bid on those figures.

In the construction of that work there were over $2,000,000 worth of changes required in the sewers and in water pipes. The rock was over a million and a quarter cubic yards, and the earth over two million cubic yards, making over three million and a half cubic yards of excavation.

There were 62,000 tons of steel. The work was designed by the engineering force of the Rapid Transit Commission, laid out and superintended by it, and constructed by the contractor, through sub-contractors, very carefully selected amongst men who had had a very large experience in all classes of work. The inspection of the work was rigid. The steel and iron were very carefully tested by inspectors who spent their time at the mills. Not only were there chemical tests, but a complete inspection from beginning to end was carried through. The testing of the cement has, I think, done more towards the raising of the standard of Ameri-

*Extract from an address by George S. Rice, Chief Engineer of the New York Rapid Transit Commission, delivered before the New England Railroad Club at Boston, Feb. 13.

can Portland cement than any other enterprise in this country.

The contract time was four and a half years. The work was carried out within a few months of that time, with the exception of a section north of Fort George, where the contractor was delayed on account of the city authorities not giving consent to a slight change of route. When the work was originally designed in 1897 or 1898, the section of the city north of Fort George had not been laid out into streets. It was the purpose of the Commission to make the cost of the road as small as possible, and for that reason it was laid out through public property. When the route was deflected at Fort George to the west, it was so deflected because there was a street there. But after the contract was let, the city laid out the section north of Washington Heights (the Dyckman meadows) into streets, and the route was changed, and certain procedure followed as prescribed in the legislative act. The old route had to be abandoned, the new one required the consent of the abutting property owners, and it was then passed upon by the Board of Aldermen. When it went to the Board of Aldermen they were told that the city would save $75,000 by the change and that it would be a benefit to the road. The Aldermen waited nearly a year before giving their approval, and the work necessarily was delayed on that account.

The Rapid Transit Railroad in Manhattan includes three tunnels, one near 42d street underneath the present surface car tunnel, south of the Grand Central station; another under Central Park, and a third under Washington Heights. The Washington Heights tunnel is the longest two-track tunnel in this country, with the exception of the Hoosac tunnel.

In the operation of the road sidings have been provided at certain places, for instance, near 96th street, 72d street, 42d street, 14th street, Spring street and at Chambers street; and there is a loop for the local cars at Brooklyn bridge, called the City Hall loop.

An important feature of the road has been the storage track under Broadway, from about 138th street to 144th street. At that place there are eight tracks, where cars are stored, and easily handled for commencing service in the morning, the idea being to have a distributing point very near the middle of the line. Other yards for similar operation are at termini of the road, one at Van Cortlandt Park, another at Bronx Park, and one at the end of Lenox avenue, at 150th street.

Various new routes and extensions are now projected. The Commission last May laid out work to the extent of $300,000,000, embracing about 165 miles of new lines, principally subways. Within the next few months, three of those roads will have been presented to the Appellate Division. One of the necessary modes of procedure is to get the consent of the property owners. In Manhattan it is almost impossible to get 50 per cent. of the abutting property owners to so consent. That being the case, to protect the general public the Appellate Division appoints Commissioners who decide whether on account of such consents not having been obtained the road shall be authorized. That procedure is now being gone through in reference to the three routes, above referred to, which will incolve an expenditure of about $100,000,000. The operating company now interested in the merger, that is, the combination of the New York City railway, the subway and the elevated roads, will possibly supply the money for those three roads. Whether they will go any further or not in providing capital is a question. It is expected, however, that half of the $300,000,000 estimated for all contemplated new lines will be supplied by the companies bidding for the contracts.

The new construction, as I was saying, will be entirely different. Of the five lines which have been laid out in Manhattan, no line has a tangent less than 4½ miles long. The longest line has a tangent of about seven miles. Of course, in New York there are long avenues, permitting lines to be readily laid out. They will all be four-track roads, and constructed on the same principle as the present subway, as far as four tracks are concerned. It is probable that the express stations will be a mile or a mile and a half apart, which principle will be carried out because it has been found to be a success.

The present power house, at 59th street on the Hudson River front, has a capacity for running not only the present rapid transit system of 24.6 miles, but is also capable of handling some of the proposed extensions. Mr. McDonald when he made his original bid for the whole work, $35,000,000, estimated that his equipment would cost him about $8,000,000. The contractor was to supply his own equipment. The city merely had that portion under contract which would eventually come back to it, the principle being that the equipment would belong to the contractor and that he would give a lien on that equipment to save the city against any loss in case the enterprise did not turn out properly. The estimate, as I have said, was $8,000,000. The contracting company has already expended on the equipment $24,000,000, three times the amount that was originally estimated. It was, however, done for a purpose, as it was predicted that traffic in the future would be by underground travel. Therefore, the Commission has objected to any extension of the elevated lines; it considers that any elevated line in the central part of the city is a step backwards. Of course in the outlying districts elevated roads have been laid out, but not in the central part of the city.

DISCUSSION.

Professor Swain.—It is astonishing to consider the growth of street railway transportation. Just ten years ago this year the first subway operated by electric power was opened, that in Buda Pesth, and one year later our Boston subway was opened to Park street. All of us who have seen the New York subway have had occasion to feel very proud of that magnificent piece of work, and yet I think it is safe to say that the construction of the subway in New York is an easy piece of work to what it is in Boston. In New York there are not the crooked streets that we have. . . . In the matter of cars, it has always seemed to me that the best kind of a car was one with two doors on each side, as Mr. Rice says, about a quarter of the way from the ends of the car. I was interested to hear Mr. Rice say that the headway of their express trains was two minutes. I should like to ask him whether he thinks that it is practicable to operate either express or local trains at a smaller headway than that. In a report which the Boston Transit Commission recently made to the Legislature we assumed two minutes headway, that is, 30 trains to the hour. When the Washington street tunnel is open and the elevated trains are transferred to the tunnel they expect to operate eight-car trains, and they will probably be operated on as short headway as can be found practicable.

The growth of traffic in a city is something which is perfectly amazing. I noticed from what Mr. Rice said that the average number of trips that each inhabitant of New York makes in a year is about 300. The traffic grows a great deal faster than the population. The population will double, perhaps, in 30 years, and the traffic will double in 12 years. In other words, each year the number of trips that each person makes, man, woman and child, increases. That is natural, because the greater the facilities the more people travel.

The traffic in the rush hour is an important question in studying the problem of urban and interurban transportation, and I should like to ask Mr. Rice if he can tell us what in New York is the ratio between the traffic in the rush hour and the average hour during the day. We were accustomed in Boston to assume when we first studied the problem about ten years ago that the number of people carried in the rush hour would correspond to carrying the whole traffic in the day, in ten hours, that is to say, in the rush hour there would be one-tenth of the whole traffic in the day in one direction. I think that is perhaps a reasonable figure, and yet I notice in the recent report in regard to London traffic it was found there that in the rush hour there was about 16 per cent. of the total daily traffic; in other words, in one direction in the rush hour there was one-sixth of all that went in the whole 24 hours in that direction. That is a very large proportion, and I am interested to find whether that bears any relation to the size of the city, and whether it is increasing or decreasing as electric transportation is becoming introduced more and more.

Mr. Rice.—The headway on the New York express service is limited to practically two minutes; it may be a little less. I noticed about a week and a half ago four trains came in a little more than a minute and a half apart, but that was in the rush hour, and they lost their speed a little later as they went up the line. In our new alinements we have as straight lines as possible, and less headway can be had between trains, because we will have better control of the trains. The block system for express service is such that it is almost impossible for two trains to come together. If the motorman overruns his signal, his power is not only cut off, but the brakes are put on. Under such conditions it is not possible for a collision to occur for the reason that the blocks are so arranged that, with a train running at a speed of 35 miles an hour, the lap is sufficient when the train strikes a trip to stop before it can reach the next train. I think that in the operation of our new lines that lap can be very much diminished, and in that way the headway can be diminished, particularly as we have those long seven mile tangents, which I think will be one of the features of our new construction.

Replying to a question, Mr. Rice continued: The heat in the subway was the only part of the work for which we did not make any calculations. The temperature of the subway has been raised about 14 deg. on account of the liberation of heat, due to the use of electricity, and, of course, also to the braking of the trains on account of the friction, but it is mainly from the electricity itself. When the subway was designed we made no provision whatever except to look out for a system of ventilation or cooling, so that when we were to put that system in we would not be handicapped in the construction of the work, and therefore, made a point to have as few openings as possible so that we could draw the air in and force it out at the stations thereby by the movement of the trains. We have analyzed the air and have been making experiments since last June. Practically we are burning, by the liberation of heat from electricity, from 96th street to Brooklyn bridge, 18

tons of anthracite coal a day and to counteract that heat we have to institute some method of ventilation. We have several ways of doing it. I am to make a report to the Commission in a short time on this very complicated problem. When we reduce the heat, which is one of the chief ventilating mediums, we introduce some complications into our problem, which will have to be taken care of. We have found as much oxygen in the air in our New York subway that as far as the oxygen is concerned the outside averages 20.71. We have made in the subway a number of experiments, and the average is 20.6, a variation of about 11 parts in 10,000. There is practically as good air in the subway as there is on the outside. The lowest oxygen that we have found in all our determinations has been 20.25. In the carbon dioxide examinations, we have about the same result: subway 4.81, outside 3.67. The maximum was 8.89.

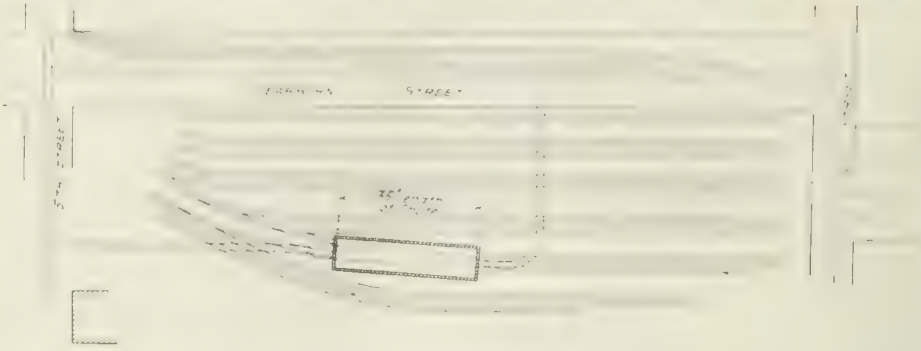
The dust problem is a serious one, though not so much now as it was in the beginning of operation of the road, when everything was new. We originally intended to have no ballast track, but to have a perfectly smooth concrete track, where it would be readily cleansed; is was a mistake, I think, to put in the ballast track. This last winter we have had very little trouble, but we have had some examinations made, and have found that of the dust which is collected 60 per cent. is iron and one part is oil.

The oil has been the cause, and, in fact, almost the only cause, of the odor in our subway. We used a mercantile oil which was not what it should be. All the machinery was new, and it was deluged with oil. There has been attention paid to that matter and the odor has almost entirely been eliminated.

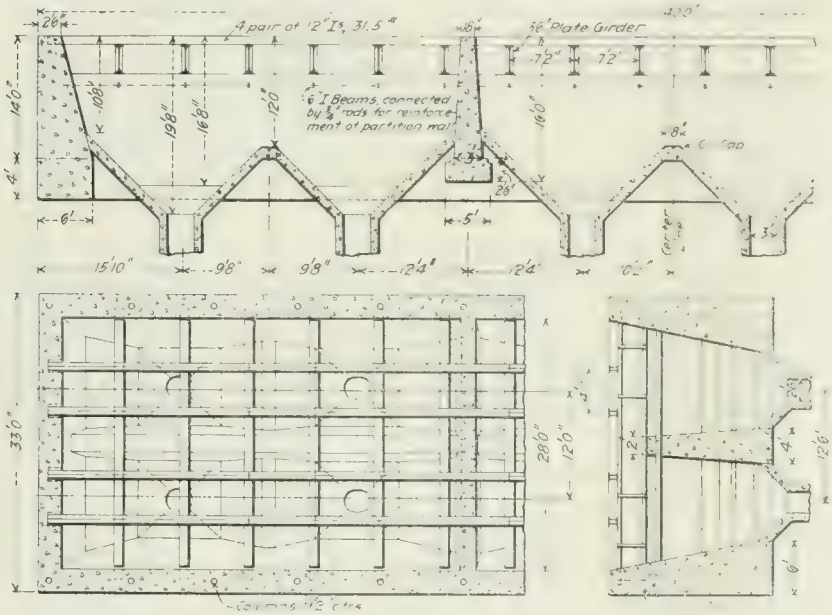
Coal Loading Facilities of the Chicago Freight Tunnels.

One of the functions of the Chicago freight tunnels will be the delivery of coal to the large down town office buildings, stores, hotels, etc. To obtain this coal directly and expeditiously requires special facilities at the yards of the important coal roads for delivering the coal from the railroad cars direct to the tunnel cars. These facilities consist of special chutes into which the railroad dump cars deliver their loads for discharge into the tunnel cars. The chutes for the Chicago & Alton and the Chicago & Eastern Illinois are illustrated herewith. The Alton chutes adjoin the freight house on Van Buren street just east of Canal, and the Eastern Illinois chutes are in the Fourteenth street coal yard, between Fourteenth and Fifteenth streets just west of Dearborn. Both are of 5,000 tons daily capacity and are similar in principle, differing only in the details necessary to adapt them to local conditions.

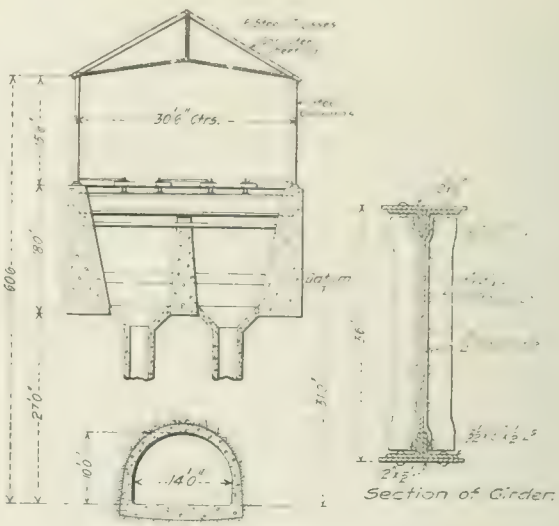
Taking the C. & E. I. yard as typical, it is seen to be a double track arrangement having under each track three large underground chambers, built of concrete, with concrete separating walls. The total length of the plant, out to out, is 140 ft. and each chamber is 45 ft. long. The width is 30 ft. 6 in. outside and the distance between track centers 12 ft. Each chamber is double hoppered at



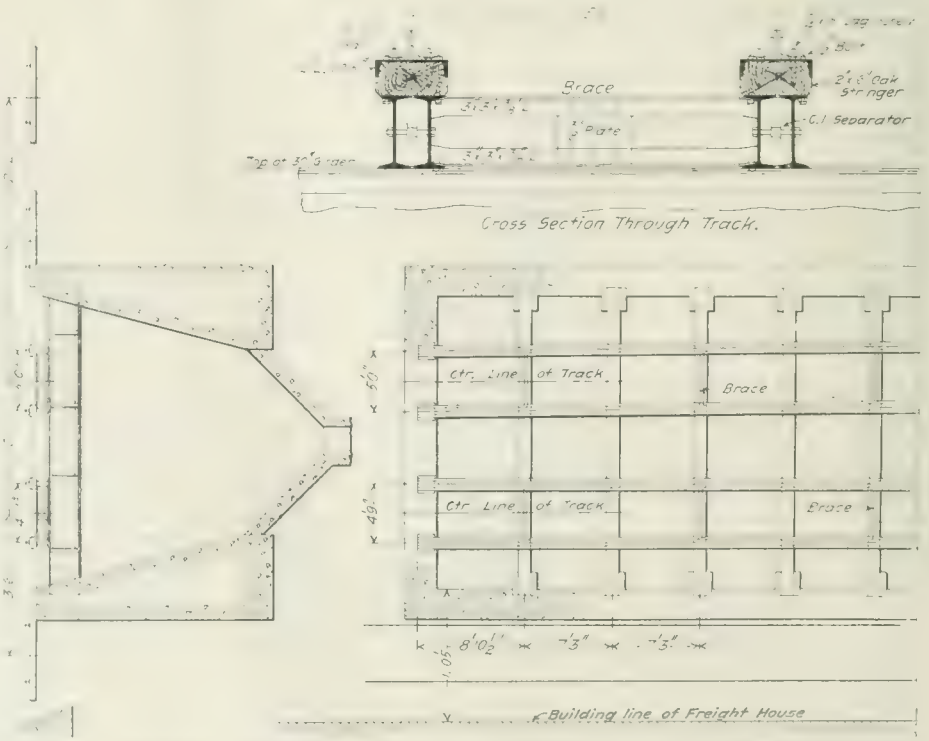
Plan Showing Location of Covered Chutes in C. & E. I. 14th Street Yard.



Plan and Sections Through Gravity Coal Chutes in C. & E. I. Yard.



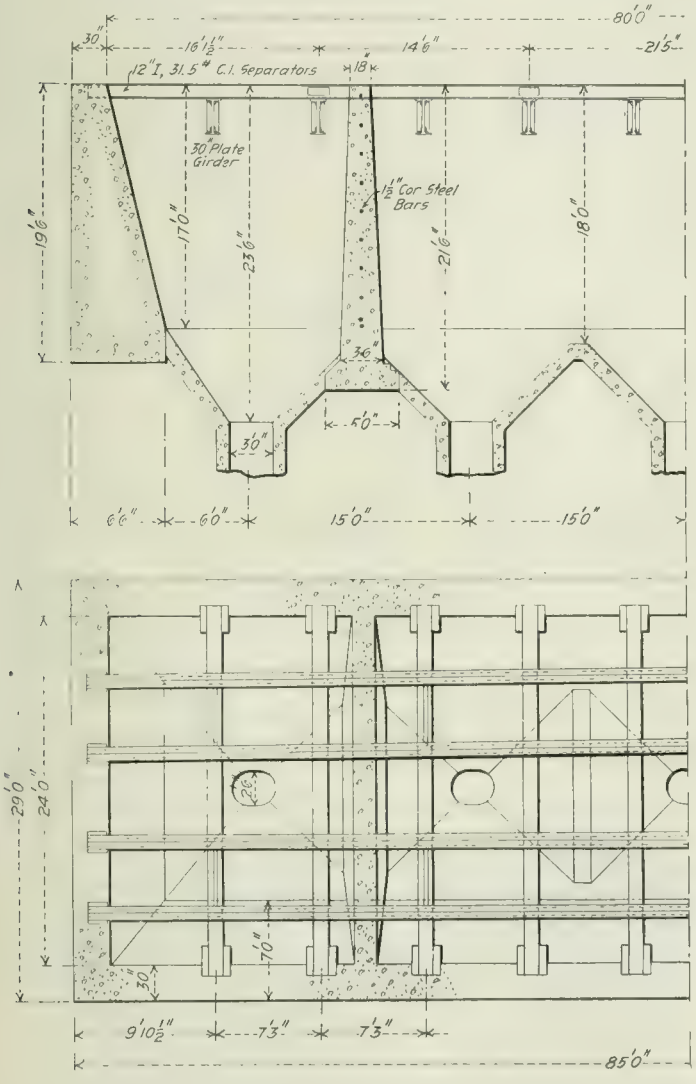
Cross-Section Through Shed in C. & E. I. Yard.



Details of Track Beams Over Coal Chutes in C. & A. Yards.

the bottom and from the bottom of each hopper a chute 14 ft. long leads down to the tunnel. These chutes are elliptical in section, 36 in. x 30 in. for the long and short diameters respectively. As shown by the location plan, a special tunnel connection is made for this yard, running from the Dearborn to the Fifteenth street bores and enlarging to a width of 14 ft. to provide space for two tunnel tracks where it passes beneath the chutes. The center line of the bore coincides with the longitudinal center line of the plant above and the elliptical chutes are given an inward inclination as they descend, to make connection to the tunnel. Delivery of coal to the tunnel cars is controlled by special automatically-closing valves at the bottoms of the chutes.

The track is supported on 36-in. transverse plate girders 7 ft. 2 in. on centers. These girders are 30 ft. long and have their ends embedded in the side walls of the chambers. They also rest on the top of the longitudinal concrete partition wall, which is reinforced by transverse 6 in. I-beams placed directly beneath the transverse girders and having their ends similarly embedded in the side walls.



Plan and Longitudinal Section of Chutes in C. & A. Yard.

These I-beams are connected together by ¾ in. rods embedded in the partition wall. On top of the transverse girders are 12-in. I-beams bolted together in pairs with cast-iron separators between. The ties rest on these I-beams and each track rail is directly over a pair. The distance from top of track-supporting I-beams to top of elliptical chutes is 19 ft. 8 in. All detail dimensions are given on the drawings.

The Chicago & Alton plans as shown represent an enlargement of the original plant put in some time ago, it being the first installation of the sort. There were formerly three chutes, and two more have now been added. This, like the C. & E. I., has two railroad tracks, but unlike the latter the conduit beneath is single track. There is no longitudinal partition wall and there are therefore five chutes for discharging the coal to the tunnel cars, against 12 for the other. Also, the chutes are circular instead of elliptical. The track-supporting girders are 30 in. deep, and instead of ties the rails are laid on longitudinal 6 in. x 12 in. oak stringers protected on top by a 12 in. channel, flanges down. The rail carrying 12 in. I-beams are connected across by stiffening braces or struts as shown in the detail. The transverse partition walls between chambers are reinforced by 1½-in. corrugated steel bars, anchored into the side walls by plates on their ends, as shown in the cross-section. The storage capacity of each of the double-chute chambers is about 300 tons, so that about 750 tons of coal can be dumped into the plant at one time for withdrawal by the tunnel cars. The storage capacity of the C. & E. I. plant is about 900 tons.

Connection to the Alton chutes is made from the Van Buren street conduit by a loop, one side of which passes directly beneath the chutes. The bore is only 6 ft. wide, providing therefore for a single tunnel track as already mentioned. From the inner portion of the loop a connection runs southeasterly to Harrison street, passing the plant of the Chicago Edison Company, for coal delivery. Because of the single-track bore, permitting only five cars to be loaded at one time, each chute branches at the bottom, giving two outlets for delivery at both ends of a car and thus enabling quicker loading. The C. & E. I. plant can load 12 cars at once. The cars have a capacity of about six tons.

Both plants are floored over between tracks. The plans contemplate in each case a shed overhead for protection. For the C. & E. I. this is shown as a steel-frame, corrugated galvanized iron construction. The Alton will probably put in an umbrella shed. The latter plant is practically completed and the C. & E. I. plant will be ready within a month. We are indebted to Mr. Geo. W. Jackson, Chief Engineer of the tunnel company, for the plans.

Spanish Railroads.

The Spanish nation has progressed considerably, beginning with the restoration of the monarchy in 1875, but more strikingly since the Spanish-American war in 1898 and the consequent loss to Spain of her colonies. The budgets show a yearly surplus of $10,000,000 to $12,000,000. Of the floating debt of the treasury to the Bank of Spain, amounting to about $280,000,000, only $80,000,000 remains unpaid. About $200,000,000 has been repaid out of the surplus and by means of issues of 4 and 3 per cent. treasury bonds, chiefly subscribed to by the Spanish people. The gold premium has fallen from 115 per cent. in 1898 to 23 per cent., with a present tendency toward par value. The 4 per cent. national debt bonds (consolidated) are quoted at about 93 on foreign markets, whereas they stood at about 29 during the American war. Spaniards have, since 1898, invested $40,000,000 in their own merchant marine, $45,000,000 in sugar factories, $150,000,000 in electric plants, mine development, and other industries. A new spirit of commerce has arisen all over the country, this being reflected in agriculture and industry, and the approaching marriage of the King with a Protestant princess, niece of the King of England, is a distinct departure from the old exclusiveness.

Spain begins to appreciate at last the enormous natural resources of her soil which have been permitted to remain dormant so long. In fact, a new era of push and enterprise has begun, but what stands in the way of quicker development is the lack of up-to-date means of communication, especially as far as railroads are concerned. Not less in importance is the question of irrigation and cheap power, such as electricity, steam, and water. Those three branches of business are, I believe, three great possibilities open to foreign technical experience and initiative, which qualities Spaniards do not possess, but which they are anxious to receive from other countries and to support with the money and everything else required.

All the main railroads radiate from Madrid, which is located nearly in the center of the Peninsula. To the north and northwest they run from the capital to Bilbao, Santander, Gijon, Corunna, Vigo and Irun; the last named place is on the French frontier and this road is the main line from which the other five roads branch. The main lines to the south and southeast go to Seville and Badajoz, which is near the Portuguese frontier, and from these branch roads run to Cadiz, Huelva, Malaga and Almeria. To the west, Madrid is connected with Caceres, near the Portuguese frontier, and to the east and southeast with Saragossa, Barcelona, Valencia, Alicante and Cartagena. There are also some important main lines between other cities. About 60 per cent. of the total mileage in the country is comprised in the North Spanish Railway Company, controlled by the Franco-Spanish Company, and in the Madrid-Saragossa Company, controlled by the Rothschilds. All the other systems are more or less tributary to and dependent upon these two groups whose control has always remained in Paris, the lines having been built largely by French capital. The North Spanish system is 2,291 miles long, and its annual gross earnings are about $25,500,000. The Madrid-Saragossa system is 2,187 miles long with gross earnings of $21,000,000. Of the other companies, the most important own the lines from Madrid to Caceres and Portugal, the Aragon Railroad and roads in Andalusia and southern Spain. These independent lines do not touch all the districts in their territory rich in mines and agriculture, the resources of which, in consequence in lack of communication, cannot be made available. According to official statistics 700 towns with 3,000 to 24,000 inhabitants are without any railroad service. This lack of railroad facilities is being remedied to some

degree, and English and Belgian initiative in this respect is gradually making itself evident by the railroad concessions that are being from time to time secured from the Government by representatives of those nations.

About 7,000 miles of the existing lines have a 5-ft. 6½-in. gage; there are 1,000 miles of 3-ft. 8-in. gage track, mostly in the northern provinces. These narrow gage roads are managed entirely by Spaniards, but, although prosperous, their gross earnings amount to only 5 per cent. of the total for all the roads in the country. Since the standard gage on other European roads is 4 ft. 8½ in., all freight and passengers coming from any part of Europe have to be transshipped at the Spanish frontier. With the exception of a few miles all Spanish railroads are single track. Most of the trunk lines need a double track and a considerable increase in the service and in the rolling stock and locomotives. The total rolling stock is: 1,890 locomotives, with a total of 849,280 horse-power; 5,548 passenger cars; 15,700 freight cars (covered), and 20,483 freight cars (open trucks).

The total amount of gross earnings is about $57,000,000, out of which $54,000,000 is earned by normal-gage systems, and $3,000,000 by narrow-gage systems. The operating expenses amount to about $26,000,000, 48 per cent. of the gross earnings. The number of passengers transported is about 37,500,000, or 4,800 per mile. The total freight amounts to about 20,000,000 tons, about 2,560 tons per mile. Gross earnings have increased about 50 per cent. in the last 10 years. The rates of passengers' fares vary from 1½ cents to 4¾ cents per mile, according to each of the three existing classes of cars. Freight rates vary from 2¾ cents to 10¾ cents per mile, according to tariff rates on each of the six existing classes of goods.

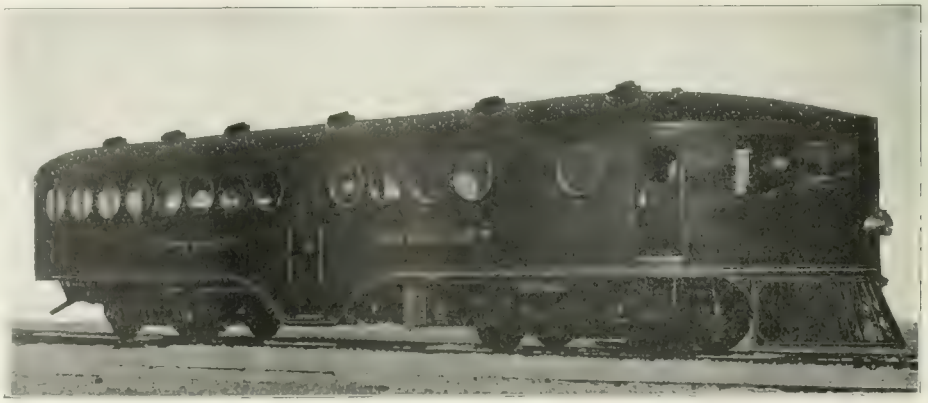
The operating expenses in Spain are lower than those in England and France. The Madrid-Saragossa Company has an operating ratio as low as 40 per cent., and, as a rule, all the other systems should be worked at the same rate. Materials also, such as ties, timber for buildings, wagons, etc., are cheap. Labor is considerably cheaper than in almost any other European country. Though some improvements have been realized in the last few years, under the growing pressure of traffic in passengers and freight, they are still much below needs of the public which is constantly demanding better facilities, more rolling stock and quicker deliveries of goods. Some great improvements, such as the cheap kilometric passenger tickets, have shown that the Spaniards are ready to avail themselves of all facilities offered to them. The reduction of the present high freight rates would be equally advantageous to the companies and the public.

Among the various trunk lines whose construction has become a great necessity the most urgent is undoubtedly the direct trunk line from Madrid to Burgos and to the French frontier, which shortens the present circuitous route from the Great Harbor, on the Bay of Biscay, Bilbao, and from France to the capital of Spain, by about 90 miles. This road, whose construction has begun, is to be of modern European gage, and will thus permit Spain to enter for the first time into through European railroad transport, avoiding the present trans-shipment of all merchandise and passengers crossing the Franco-Spanish frontiers. This road will be double track, thus assuring rapid traveling. According to a report of the United States consul at Bilbao, "this road will bring Bilbao within seven hours of the Spanish capital, a reduction of about 90 miles and a saving of eight hours as compared with the present time.—*Consular Report.*

Union Pacific Motor Car No. 7.

The Union Pacific has just turned out of the shops at Omaha its seventh gasolene motor car. As shown by the photograph reproduced herewith, the design has been much enlarged and considerably improved in general appearance, as well as in many details, since the first one was built last year. (*Railroad Gazette*, March 10, 1905). All of the cars since No. 1 have been much longer, with seating capacity for 57 passengers. No. 7 differs from those preceding it in the provision of a side door to facilitate receiving and discharging passengers, and in the form of the windows, which carry out still further the likeness to an inverted racing yacht, which was the model for the lines of the roof and forward end of the body.

Improved hill-climbing ability was sought in the present design and we understand good results in this respect were shown on trial trips. A speed of 40 miles an hour was easily developed and vibration and noise from the engine were little noticeable.



Union Pacific Motor Car, No. 7.

Reply of Coal Operators to Miners' Committee.

TO MR. JOHN MITCHELL, AND OTHERS, COMMITTEE OF ANTHRACITE MINE WORKERS.

Gentlemen.—In 1902 you assented to the proposition of the operators that "all questions at issue between the respective companies and their own employees, whether they belong to a union or not," should be decided by the Anthracite Coal Strike Commission; accordingly the award of the Commission covered and decided all such questions; therefore, we have heretofore proposed to you that the relations thus established by arbitration be continued for a term of three years—the same period as that fixed by the Strike Commission. This offer you have rejected.

Your present proposition is that all relations between every employer and his employees shall be fixed and controlled by a single instrument. Originally you suggested that this should be a form of contract with the "United Mine Workers of America"; now you suggest that it shall be with your committee as "representatives of the anthracite mine workers." Inasmuch as the authority and standing of your committee as representing anyone depend wholly upon its designation by a convention of the United Mine Workers as the representatives of that body, it is clear that the change proposed is not substantial, but merely formal, and raises no new question. This is evident also from the fact that your proposition contains numerous provisions for action by "the organization" and "the district officers" of the United Mine Workers of America.

This proposition restricts production by strictly limiting hours of labor and providing that no miner can work in more than one chamber or have more than two laborers; it seeks to equalize wages with reference merely to the name of the employee's position, and not at all to his capacity or the work which he actually does; provides that no new veins or collieries can be opened without an arbitration as to wages, and that no contract of employment can be terminated without an arbitration; it makes the employers the agents of the union to aid it in levying upon the wages of the employees the dues fixed by the union; it provides for increase in wages and rates of payment which would approximate 21.6 per cent., and would increase the cost of the domestic sizes of coal about $1.20 per ton, and it suggests diluting the present Conciliation Board into three boards having co-ordinate powers. It provides still further that the arrangement proposed shall continue in force merely for one year.

The above provisions, other than those regarding wages, and the adjustment of complaints, concern radical and fundamental principles in reference to the management of the business which are vital to its success. These questions have all been settled by the award of the Strike Commission, which has established the existing conditions.

So far as concerns the matter of wages and adjustment of complaints, we have offered to submit to the members of the Strike Commission the question whether any changes in conditions have occurred since the award of the Commission requiring that the award should be modified as to those matters and, if so, how it should be changed. Those are the only subjects in regard to which you have made the least suggestion that the conditions have changed since the award of the Commission, and as to those no facts in support of that suggestion have been made public. But the claim for a change in the existing relations must obviously rest upon some change in conditions since those relations were all established by arbitration. You have rejected this proposition of arbitration. You now propose that it shall be submitted to the Strike Commission to decide whether the terms contained in your amended proposition, which are stated above, shall be adopted. In other words, you seek to have every subject which has been already settled by arbitration reconsidered, and every issue retried which was settled by the Strike Commission three years ago, pursuant to the President's injunction "to endeavor to establish the relations between the em-

ployers and the wage earners in the anthracite region on a just and permanent basis, and so far as possible to do away with any causes for the recurrence of such difficulties as these which you have been called upon to settle."

You say that "it is not a sufficient answer to say that because a question was arbitrated three years ago, the same question would not be a proper subject for investigation at this time." If any new facts have arisen in the meantime, these might properly be investigated. Nothing new is suggested to us by your communications. But it can scarcely be seriously claimed that questions already fully considered shall be re-examined because one of the parties thinks it may upon a rehearing secure a different decision. If that were so, controversy would never end. Indeed, in the present case you propose that in order to make an arrangement for only one year's duration, the Strike Commission shall re-examine questions which it took six months to decide.

To resume, the fundamental principles regarding the conduct of this business have all been established by the Strike Commission. No reason is suggested why they should be retried. As to the only matters regarding which you have made the least suggestion that conditions have changed, we have suggested that the existence and effect of such change be considered by the Strike Commission, and that its award be in force for three years so that political considerations may have as little influence as possible upon these business questions.

You are responsible for the suspension of work. There was no good reason for ordering the men to stop work pending our negotiations, which had been delayed by you, especially in view of the fact that we were willing to continue to pay the wages fixed by the Strike Commission.

We have no other suggestions to make than those contained in our former propositions, and we regret that you have declined both of them. We have nothing further to offer.

Yours respectfully,

GEORGE F. BAER, E. B. THOMAS, DAVID WILLCOX, W. H. TRUESDALE, MORRIS WILLIAMS, JOSEPH L. CAKE, JOHN B. KERR, Committee.

The Railroads of Cuba.

The railroad system of Cuba consists of a single trunk line from Havana to Santiago, supplemented by a number of transverse sea-to-sea roads which, in the western part of the island, have been developed into interlacing local systems. This situation, however, is not the result of the building of the trunk line first and then constructing feeders; the history of the railroad development of the island shows that the exact opposite was the case. The first roads were built by plantation owners to connect them with the nearest seaport. As Cuba is a narrow island and has for some centuries been active in foreign commerce, there was always some port within a comparatively short distance of the plantation, so a number of short and disconnected lines were built. It was not until the last decade of the nineteenth century that the amalgamation of groups of these odds and ends of road into anything like important railroad systems began. Most of the railroads in the western half of Cuba were, between 1892 and 1899, acquired by three companies, controlled by English capital.

The first of these companies to be incorporated was the Western Railway of Havana in 1892. This road runs southwest from Havana through Pinar del Rio to San Juan, 125 miles, over rolling country south of the Sierra de los Organos Mountains.



Cuban Railroads.



Palm Avenue near Guanajay—United of Havana.



Old Spanish Bridge—United of Havana.

The track is standard gage and construction was started in 1857, the first 10 miles being opened for traffic in 1861. This part of Cuba was the scene of some of the hardest fighting in the last rebellion against Spain before the war of 1898, and the railroad suffered heavily during that period. Trains were attacked and dynamited and much of the roadbed destroyed. Stations and several whole towns were burned, but have now been restored and the road is in much better condition than before the uprising. The traffic is mostly sugar and tobacco, but the land is fertile and abundantly watered and is suitable for cattle raising and most tropical fruits and vegetables. It is interesting to note that in this district an excellent quality of Sea Island cotton can be grown. On account of the absence of frost it is unnecessary to replant each year, and it is probable that the Cuban production of this staple will compete with the United States grown cotton.

The United Railways of Havana was incorporated in 1898 and, aside from its railroad property, owns land, warehouses, and does a banking business. The system consists of about 463 miles of line lying mostly in the Provinces of Havana and Matanzas, 210 miles



San Cristobal River—Western of Havana.

Near the Main Line to Matanzas—United of Havana.

Falls of the Taco Taco—Western of Havana.

of which represents the Cardenas & Jucaro, which was taken over a few months ago. The first section of the lines now operated by this company was opened for traffic in 1837. The part of its road which runs eastward from Havana through Matanzas and Jovellanos to Esperanza, in the Province of Santa Clara, constitutes the first link of the through line from Havana and Santiago. Another important road goes from Havana to Batabano directly south of Havana on the south coast, and there are other branches and connecting lines between these roads. The country served is comparatively flat and is rich and fertile. In the western part of the Province of Havana there is an important tobacco raising district, which is reached by the lines of this company, while the center and southwest portion is particularly suited to the raising of sugar cane as



Falls of the Hanabanilla—United of Havana.

well as tobacco. The bulk of the freight traffic is sugar, either in the cane or partly refined. This is shipped from Havana to New Orleans and other ports in the United States. The traffic in fruit and vegetables is rapidly growing in importance, truck farming being carried on on a large scale especially around Guines, about 45 miles south of Havana. This produce gets a ready market in the United States, the low rates prevailing by steamer from Havana favoring export to this country.

The Cuban Central was incorporated in 1899 to take over the Cienfuegos & Villa Clara, the Sagua La Grand and the United Caibarien Railways, a total of about 217 miles. One of the roads runs from Sagua La Grande across the island to Cienfuegos, and another runs from Caibarien westward to a connection with the first line. There are also several branches and cut-offs and one road from Esperanza to Santa Clara makes a link in the trunk line by connecting at the last named town with the Cuba Railroad.

The western part of Cuba is much more thickly populated than the eastern part. It can be compared in railroad development to the Atlantic states of this country. There is little, if any, new country to be opened up by a railroad and branches or extensions are built only to existing towns to take care of the traffic in sight, rather than to create traffic by running a line through unsettled regions. The Western of Havana is building an extension from its western terminus to Guane, and the United of Havana is building 20 miles of road from points on the old Cardenas & Jucaro.



United of Havana.

The eastern part of the island, consisting of the provinces of Puerto Principe and Santiago de Cuba, was, until a few years ago, without railroads of any importance, there being a few short lines built from seaports a few miles into the interior. There was only one line running across the island, this being the Jucaro and San Fernando, which was built by the Spanish Government for military purposes. This is now leased by the Cuba Railroad.

The Cuba Rail- starting from Santa Clara on the Cuban Central, completes the trunk line to Santiago. Its mileage, including leased lines and branches, is about 500. It was built by Sir William Van Horne, Chairman of the Board of the Canadian Pacific. The company was incorporated in 1900, and the line through to Santiago was opened in December, 1902. It got its entrance into Santiago by buying the Savinalla & Marota, which ran from San Luis to Santiago, 30 miles, taking the only practicable route to the coast through the Sierra Maestra mountains. A large part of the Cuba Railroad was built through virgin forest, and many new towns have sprung up along it. A branch has been completed from Alto Cedro, on the main line, northeast to Antilla on the Bay of Nipe. This "branch" will eventually be the eastern part of the main line, as it is plannedto make Antilla the seaport for all the exports which are now shipped from Santiago. The Bay of Nipe is a perfectly protected harbor 20 miles



Bottle Palms, Herradura—Western of Havana.



Orchids—Western of Havana.

long and is nearer New York than Havana is. Extensive terminals are being built and ships drawing 18 ft. will be able to come up to the docks. Work is also under way onabranch from Cacocum north to Holguin, 15 miles, to connect with the Gibara & Holguin, Gibara being a port on the north coast. The principal traffic of the Cuba Railroad is in sugar, mahogany and other timber.

The four companies mentioned operate between 1,200 and 1,300



Typical Scenery—United of Havana.

miles of the total 1,600 miles of road in the country. Nearly all is standard gage. The Matanzas is the longest of the smaller independent railroads; it runs from Matanzas south to the center of the island and then east to Colon, on the United of Havana. It is about 200 miles long, including branches. The Guantanamo runs north from Caimanera through Guantanamo to Soledad, 35 miles, and is building 40 miles more. The Cuba Eastern runs from Boqueron on the Bay of Guantanamo, northwest to San Pre, and is planning an extension to San Luis on the Cuba Railroad. This will develop a sugar district now without transportation facilities.

We are indebted to the United of Havana and the Western of Havana for their courtesy in supplying information and the accompanying illustrations.

Electric Traction for Trunk Lines.

The following extracts are from a report made by Mr. K. de Kando, Chief Engineer and Electrical Director of Ganz & Co., to his company on impressions received by him on his recent trip to America.

The development of electric traction on trunk lines has an entirely different history in Europe and in America.

In America the first electrification of trunk lines was forced through the competition of street railways which prolonged their lines outside of the city limits (as early as 1897 the New York, New Haven & Hartford R. R. electrified its Nantasket Beach branch). This electrification on trunk lines was in the nature of things a mere copy of street railway operation on a larger scale.

Just as have been all American developments, this was a rapid one. The advantage which electrification showed over steam service was so attractive as to lead not only to electrification of such steam lines as were suffering through competition of electric street railways, but several new lines were built, more particularly for suburban traffic, where heavy trains composed of numerous cars were operating similar to service on electric trunk lines. (Chicago, Aurora & Elgin, etc.)

It is only natural that in this rapid development experiments with new systems could find no place, all the more so since the continuous current system itself had to pass through experimental stages of several years duration until it reached the present point of perfection. Purchasers as well as manufacturers were therefore afraid to try new systems when they were exposed to a repetition of the bitter experience which had marked the first years of continuous current operation.

Nevertheless both the General Electric company and the Westinghouse Electric & Manufacturing company made tests with polyphase and single-phase motors ten years ago, as is shown by the patents of that time (Steinmetz and Armstrong). These experiments proved to be failures, partly because the development of the induction motor was at that time not advanced enough to fulfil the requirements of electric traction, and partly because the attempt was made to operate the new system simply by replacing the continuous current motor by a polyphase motor and the series connection by cascade connection. The polyphase motor used in this manner was not a very good substitute for the continuous current motor. The really valuable features of the polyphase motor, its use of high tension, etc., were not made profitable. In addition, the mistake was made of exaggerating the importance of the air gap between rotor and stator which, following continuous current street railway practice, was taken several times larger than the air gap which is possible with polyphase motors through the use of correct design of the bearings.

The failures of these experiments on polyphase motors and the scientific arguments against this motor in the publication of Berg produced a public opinion among American engineers which was against the three-phase motor as a railway motor. (Berg's calculations were based on three-phase motors with much larger air



Long Steel Girder Trestle—Western of Havana.

gaps than is possible in good practice and the result was that the comparison between continuous current and three-phase motors was unfavorable to the latter.) It was therefore natural that the single-phase commutator motor was preferred as a substitute for the continuous current motor. I had no occasion to see the single-phase motor of the General Electric Co. in operation, and I made no special attempt inasmuch as public utterances of General Electric Company's

engineers showed that they do not consider the question of single-phase traction as important as do the engineers of the Westinghouse Electric & Mfg. Co., which has placed upon the market a series of single-phase motors. I have seen in operation the largest of these motors and also some of the small ones, and as far as a cursory inspection permits drawing decisive conclusions these motors appeared to be equal to the best continuous current motors in regard to working of commutators and brushes.

The Westinghouse single-phase system is the best developed among the single-phase systems known to me, and as far as I know, Mr. Westinghouse is thus far the only one who has built large single-phase locomotives.

In order to judge of the chances of the three-phase system for future work, it is necessary first of all to make a comparison with the single-phase system. We will not be wrong in using the results obtained by the Westinghouse company with its single-phase motors as a basis of comparison inasmuch as these motors are probably those which have been most perfected. The details will be mentioned later.

As regards the development of electric traction for trunk lines, in Europe this problem was presented in an entirely different form than in America. There were really two problems. The first was the one taken up by the German "Investigating Committee" appointed to look into the question of high-speed electric traction. The results of the Zossen experiments carried out by this committee will be a valuable inheritance for the future.

The second problem was that which was placed before Ganz & Co. by the Societa per le Strade Ferrate Meridionali in 1897. Inasmuch as Italy has no coal, but has large unused waterpowers in the neighborhood of the railroads, and since these roads pay to-day many millions of lire for English coal, the Italian Government requested the two largest Italian railroad companies, the Societa Meridionale and the Societa Mediterranea, to carry out experiments which would lead to the use of electric power for their lines.

The Societa Mediterranea chose as a trial line their line from Varese to Milan, which line is almost in its entire length without curves and without gradients and which has a dense traffic. The equipment of this line was intrusted to the British Thomson-Houston Company, which installed a plant according to the well-known American continuous current system. The result was an increase of passenger traffic, as might have been expected judging from American examples of development in suburban systems, and this increase in traffic sufficed to cover the considerable increase in operating expenses. The electrification of this line was therefore a success in technical as well as commercial respects.

The Varese-Milan line was, however, not a solution of the given problem. The only problem solved was that of handling dense suburban traffic, but not the substitution of steam locomotives throughout the entire network of a trunk line. It is necessary to say that on this Varese-Milan line all freight trains and also all through passenger trains are handled as heretofore by steam locomotives.

The Societa per le Strade Ferrate Meridionali laid the problem before Ganz & Co. in its entire extent and demanded a proposition whereby all steam locomotives on the Valtellina line could be replaced by the energy of the Adda River.

The well-known continuous current system with 500 to 600 volts appeared inadvisable on account of the long distances, the size of train units, the gradients and the resulting large capacity of the locomotives and the comparatively sparse traffic which would have made a continuous current installation very expensive. A new system had therefore to be found which was low in first cost of installation and efficient even over long distances and with heavy train units, and the new system had to produce a locomotive which in its capacity was superior to the present day steam locomotive, since the designers of the latter were making every possible exertion to increase the power per weight unit, and the electric locomotive had therefore to improve on this ratio.

To solve the problem, a high pressure for the contact line had to be chosen and the motor had to be built for this high pressure in order to avoid the carrying of a transformer on the locomotive. This condition is only fulfilled by the induction motor or by the repulsion motor. Of the two types the polyphase induction motor is superior in efficiency as well as in power per weight unit, and it was therefore chosen for the Valtellina line.

Shortly afterward the German "Investigating Committee" chose the polyphase system for its experiments at Zossen, which in a way confirmed the correctness of choice of system in the Valtellina line. After the Zossen experiments had produced the desired results as regards speed, and after they were concluded we find, however, that German opinion changed somewhat and began to favor the single-phase system. It almost appears as though engineers thought that the polyphase system had not been proved a success in Zossen. Should this actually have been the case, I could account for it principally by the two following reasons:

First: The arrangement of three contact wires in a vertical plane which made a real switch impossible and therefore the installation of this system in terminal yards impracticable.

Second: The use of a simple rheostat without other regulating devices, such as cascade connection or different number of poles made necessary an excessive amount of energy wasted at the start, an amount equal to the energy used by the train running at full speed.

It would have been advisable to use three or even four synchronous speeds to reach 200 Km. (about 120 miles) per hour. Thus the rheostat losses could have been reduced to one-third or one-fourth, and at the same time the maximum peak could have been reduced to one-half through correct choice of acceleration at the various starting points, even without increase in time of run.

During the last few years almost every large electrical concern has studied the design of a suitable single-phase traction motor. The best work in Europe in this line is shown in the Winter-Eichberg motor. This motor is not as perfect, as far as commutation is concerned, as the Westinghouse motor, but it is not as delicate, inasmuch as it can (according to the statement of Dr. Eichberg) be short circuited during 30 seconds, giving the full torque standing still without burning out the short circuited armature coil. The largest motor which I saw in Berlin was a 115 h.p. motor built for the Hamburg-Altona Ry. The data which was given me in Berlin will be discussed further on.

The problem of electrification of the Italian roads was similar to the problem placed before the Swiss roads and also before the Swedish and Norwegian roads, with the difference that the two latter used trains of much less weight and used lower speeds and therefore required locomotives of less capacity than were used by the Swiss and Italian roads.

In Northern Germany the electrification of trunk lines is not yet of actual importance, but in Southern Germany, as well as in Austria and France the electrification of the mountain railroads may be expected in a comparatively short time.

In the United States the electrification of railroads in the shape in which this problem presented itself in Italy has never yet been discussed. But if we consider the enormous exertion made by American railroads to increase the capacity of their lines, it is certain that electric traction will play an important role in this endeavor to obtain greater capacity and that that electric system will prove to be victorious, which can present the most powerful locomotive and the locomotive which will possess the greatest capacity for a given weight.

First of all are to be considered the pusher locomotives which are used on long grades that could only be reduced by enormous expenditures. In all these cases the three-phase locomotive has a tremendous advantage on account of its great capacity per weight unit and furthermore on account of the possibility of recuperating energy on down grades.

I have had occasion to go over the Susquehanna-Deposit grade of the Erie Railroad several times and to watch the traffic on this line. I have seen a freight train composed of 62 cars weighing together 4,923,000 lbs. handled by five locomotives, one in front and four as pushers in the rear. The weight of each locomotive with its tender was 144 American tons, and the weight of the five locomotives is 655 metric tons, making the total weight of the train 2,895 metric tons. The operating engineer of the railroad told me that similar trains were generally handled with three pushers and that the train above, which I saw, was really a special one inasmuch as the fourth locomotive made its first trip and was only to be tried out on this occasion.

The importance of electric traction for such a line is given first of all by the increase of capacity on account of the more powerful electric locomotives and then by the economy in operating expenses.

As regards the first point, the increase of capacity per weight unit, it may be interesting to note the following data:

The above mentioned line has a total length of 15.3 miles, and the annual traffic is about 170,000,000 gross ton miles. In order to handle the entire pusher service by electric locomotives it would be necessary to invest $600,000 in power stations, line equipment, sub-stations and locomotives. As a basis of calculation we take the above mentioned train using three locomotives only, instead of four, with a total weight for the three of 3 x 131 = 393 metric tons, which is 17.5 per cent. of the gross tons. If we add to this about one-third for locomotives returning empty, the number of yearly ton miles which correspond to the weight of the pusher locomotives, is equal to 40,000,000 ton miles.

Using three-phase locomotives, Ganz system, the three steam locomotives could be replaced by two electric locomotives each weighing 60 tons, with all the weight on drivers. The steam locomotives at the head of the train can haul on this grade 650 American or 590 metric tons and the pushers have therefore to haul 1,650 tons which corresponds to a drawbar pull of about 25,000 Kgr. (about 55,000 lbs.). This would reduce the number of ton miles to 12.2 million ton miles per year, or, in other words, in the case of electric traction there would be a saving of 27.8 million ton miles merely on account of the lesser weight of the electric pusher locomotives.

This figure speaks for itself, and it is not necessary to point

out how important it is to have the smallest possible weight for a given capacity and how necessary it is to use the weight of adhesion to the fullest extent in all such heavy traction problems.

As regards the savings which can be effected through the use of the three-phase traction system, a few figures are given below merely for the purpose of showing the approximate extent to which such savings may be expected.

Electric traction will allow savings to be made in the cost of coal, in the cost of train hands, in the cost of repairs to locomotives, in the expense of providing for water, and if three-phase traction is used with recuperation, in the omission of a great part of the mechanical braking and in the small cost of wheel tires and brake shoes. In the following I shall only deal with the first three savings which are in most cases of greatest importance.

Electricity as motive power will permit a great saving in coal. As shown by European railroad statistics, 0.08 to 0.1 Kgr. of coal is burned for each gross ton Km. as an average (about 0.25 to 0.30 lbs. per ton mile). On the lines such as the above mentioned, with heavy grades, the coal consumption will be greater and will certainly not be overestimated by taking 0.16 Kg. (0.35 lbs.) per ton mile. If the work done by the pusher in the above instance is taken on an average, at three-fourths of that done by all locomotives, then the coal consumption of the pusher locomotive will be equal to three-fourths of the coal consumption, or: $\frac{3}{4} \times 170{,}000{,}000 \times 0.35 = 44{,}600{,}000$ lbs. $= 22{,}300$ tons. If we take the price of coal at $2.85 per ton the total cost of coal for one year will be $63,600. As against this, the cost of production of electric energy will be considerably less. In the case of three-phase current, the consumption in one year will be about 4.25 million Kw. hours. If we take the cost of one Kw. hour at the switchboard on the average, including all expenses, at 1c. (the cost at the New York Subway power house is 0.8c.), then the cost of electric energy in one year will be $42,500, or $21,100 less than the cost of coal for steam locomotives, which represents therefore a saving equal to 3.5 per cent. of the first cost of installation.

Further savings will be made in the wages to train hands inasmuch as cleaning of fires and steaming up of locomotives are entirely absent. This saving can be estimated at $30,000 to $35,000 which corresponds to about 5 to 6 per cent. of the first cost of installation.

A further saving is possible through the reduction of cost of repairs. Experience has shown that the cost of repairs on large electric locomotives such as those used on the Valtellina line or the New York Central can be taken at about 1.7c per locomotive mile. The cost of repairs of steam locomotives is about 5c. per locomotive mile (the pusher locomotive will work as a rule at full capacity of their boiler and engine and the depreciation will therefore undoubtedly be higher than with the ordinary locomotives). If therefore the total locomotive mileage is taken at about 370,000 miles the cost of repairs of steam locomotives will be at least $18,500. In the case of electric pushers where the number of locomotive miles will be only two-thirds of 370,000 (instead of three steam pushers only two electric pushers will be necessary) the cost of repairs for 250,000 locomotive miles will be about $4,270. This represents a saving of $14,270 per year, equal to about 2.3 per cent. of the first cost of installation.

In order to judge the value of the recuperation feature, I submit the following approximate data: The pusher service on the above line requires, without recuperation, about 5,000,000 k.w. hours per year. The total number of k.w. hours which could be recuperated works out to be about 1,500,000 k.w. hours at the switchboard of the power house. Provided the electrification of other lines or the sale of electric energy to other consumers would always provide a useful load for this recuperated energy, these 1,500,000 k.w. hours could be counted in full, taking the cost of energy at 1c. per k.w. hour and assuming that about 0.5c. of this corresponds to that part of the cost per k.w. hour which is proportional to the output of recuperated energy. This effects a saving of $7,500 per year, which corresponds to about 1.2 per cent. of the first cost of installation. Even if no other consumers can be found it has been shown through detailed calculations made in similar instances that the trains running up the grade and the general loss of the system will make use of at least about 50 per cent. of the recuperated energy, and it will be seen therefore that the recuperation will contribute at least 0.6 per cent. to the general charges against the first cost of installation.

The total amount saved in operating expenses will in all events correspond to more than 10 per cent. of the total cost of the electric plant.

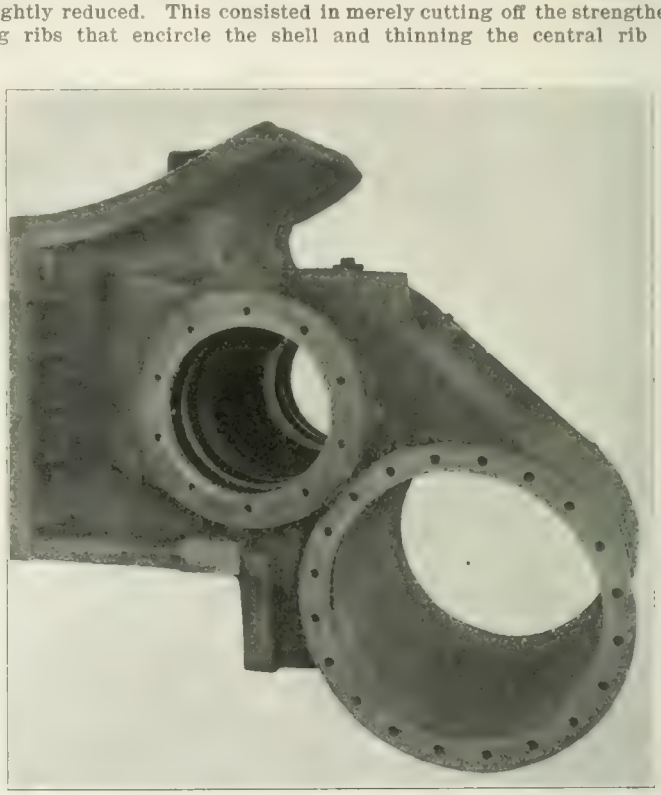
If we consider that in America locomotives are put out of service and replaced by new ones in much shorter time than in Europe, and that therefore the steam locomotives which would be replaced by electric locomotives may be used immediately on other lines, it will become evident that we are justified in taking as first cost of installation for the electric traction only the difference between the entire cost of the electric equipment and the value of the replaced steam locomotives. This will increase the percentage of interest paid by the saving, and it can be asserted with absolute security that the three-phase system can count on a great future, not only in Europe but also in America.

(To be continued.)

Cast Steel Cylinders.

The motive power department of the New York Central Lines has been making investigations and done some preliminary work in the way of ascertaining the possibility of obtaining steel cylinders for heavy locomotives. Thus far no attempt has been made to design a cylinder with the special object of having it cast from steel. The question to be solved in the first place was whether so large, heavy and complicated a casting could be made of steel.

The Penn Steel Casting & Machine Co., of Chester, Pa., which agreed to undertake the work, was furnished with the patterns of the ordinary cast iron cylinder, having a diameter of 23 in. and a piston stroke of 32 in. No change whatever was made, and the work was successfully done on the first pair. These weighed 7,810 lbs. The result was so satisfactory and the castings were apparently so sound that a second pair was ordered from the same pattern after a few changes had been made by which the weight was slightly reduced. This consisted in merely cutting off the strengthening ribs that encircle the shell and thinning the central rib by



Cast Steel Cylinder for New York Central Locomotives.

which the two cylinders are bolted together. Nothing was done that could not be done easily and cheaply without mutilating or seriously altering the pattern, and no change at all was made in the core boxes. The cylinders are, therefore, in every sense experimental—mere reproductions of the cast iron, and not what would have been designed for steel; the idea having been to ascertain whether a steel cylinder could be made at all, and, if so, whether it would be feasible commercially. The second pair of cylinders weighed 7,740 lbs.

The tests of the metal of the two sets give an average tensile strength of 73,600 lbs. per square inch of section, an elastic limit of 34,500 lbs., elongation of 29 per cent., and a reduction of area of 39.55 per cent. with a silky fracture.

To those who are familiar with the difficulties of making large steel castings, especially of a design complicated by core work, as in the case of locomotive cylinders, the advance that has been made and the skill required to produce these cylinders will be most evident. The solution of the problem will place this stronger metal at the disposal of designers who will now be able to reduce the weight of these heavy front castings, that usually add little or nothing to the adhesive weight of the engine, by a considerable amount.

The cylinders will, of course, be bushed with cast iron and used on freight engines. The results that they give in service will be watched with great interest, for it will be upon this that an extension of their use will depend.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

CONTENTS

EDITORIAL:
The San Francisco Earthquake..... 417
Bond Purchases by Savings Banks..... 417
Compound Locomotives on C., M. & St. P. 417
Superheater on American Locomotives.. 418
The Hepburn Bill 418
March Accidents 420
The North Carolina Commission..... 420
Texas & Pacific 420
Vandalia Railroad 421
New Publications 421
Trade Catalogues 421

ILLUSTRATED:
New Passenger Station at Grand Junction, Colo. 422
Wabash Eastern Improvements 427
The Betts Car Reporting System..... 434
New Station of the Great Northern at Sioux Falls. 439

MISCELLANEOUS:
Superheated Steam on Can. Pac. Ry... 423
Electric Traction for Trunk Lines. 425
Injuries to Passengers Caused by Their Own Carelessness. 432
Tie Treating on the Southern Pacific and the Santa Fe 436
Washington Correspondence 437
Train Accidents in the U. S. in March.. 437
Tunnel Under the English Channel..... 439
The New Haven's Proposed Joint Steam and Electric Service 439
The Earthquake 440
Foreign Railroad Notes:
Russian Storage Charges.....
Iron Ties in Germany 440
Prussian Locomotives .....
Italian Earnings .....

GENERAL NEWS SECTION:
Notes 125
Obituary 126
Meetings and Announcements..... 126
Elections and Appointments 127
Locomotive Building 127
Car Building 128
Bridge Building. 128
Railroad Construction 129
Railroad Corporation News 130

VOL. XL., No. 17. FRIDAY, APRIL 27, 1906.

The San Francisco earthquake and fire loss, although it will never be precisely known, seems at present writing to be likely to amount to between 250 and 300 million dollars, but a material portion of the burden is distributed by insurance in England and Germany. By other less direct methods the losses are shared by other countries; so that we may say there has occurred within a period of a few days a tremendous international calamity, a destruction of material and of the results of labor as absolute as the wastes of a long war. It is a loss to the whole country, and although it is unequally distributed, it is a hindrance in progress on the Atlantic Coast as well as on the Pacific and in the broad country between the oceans. The loss of property by the Southern Pacific and the Atchison is small in amount, and one might think, carelessly, that the roads leading into San Francisco would benefit by the carriage of material and persons during the progress of reconstruction. But this is not the lesson learned from the Chicago and Boston fires of a generation ago, or of the more recent Baltimore fire. It does not work out in that way. The San Francisco destruction of property is greater than our losses during the Spanish war, comparable to the English costs of the Boer war, something like one-third the cost to Japan and one-fifth the cost to Russia of their desperate campaigning. Nevertheless, it should be borne in mind that the amount of money needed to replace the destruction at San Francisco is only about one-quarter of one per cent. of our national wealth; a tax, but not a heavy tax, and not equally levied. There is another view, and an interesting one: Our country's wealth is increasing by as much as five billion dollars a year. At this rate, in May next the San Francisco loss will have been covered by the natural increment of growth in wealth. Or, put in another way, the nation loses by this disaster four weeks' time.

Some time ago, using as a basis for final comparison the savings bank returns for the year 1904, then the latest at hand, we pointed out the great and increasing degree to which the eastern savings banks were becoming absorbents of railroad bonds. The returns for 1905, now coming in, repeat the tale. The savings banks of Massachusetts and Connecticut combined had at the end of the fiscal year covered by the new reports the great sum of $953,676,617 as assets distributed among some 300 banks. The Massachusetts banks increased their holdings of railroad bonds during the year by $12,230,728 and the Connecticut banks by $8,062,765 the latter sum representing almost two-thirds of the total increase of assets of $12,896,930. In two New England states alone there were thus taken by savings banks last year $20,293,493 in railroad bonds, or a sum within about 20 per cent. of all the other investments of the year of the savings banks of the two states. It should be said that, in the Connecticut returns, railroad shares are merged with bonds, but the amount is so small that it may be ignored. Going outside of the banks the extent to which conservative institutions are taking up progressively railroad bonds may be illustrated by Harvard University, which ten years ago, out of total investments of $8,381,581 held railroad bonds amounting to $2,125,898, rising now to $6,241,828 in a total investment of $18,036,025. Of its total funds it had about a quarter in railroad bonds in 1895, now more than one-third. It is to be remembered, too, how the increased railroad bond investment has come in the face of the competition of industrial and other bonds during the last few years. The general subject broadens when we reflect on the great volume of railroad bonds of various kinds now pouring into the market—for improvements rather than new enterprise—and which, as offering high security at reduced prices, are likely to make the present a record year for conservative bond investments. They connote, however, fresh attempts in the legislative lobbies of highly capitalized states to secure for certain special classes of bonds savings bank legislation—attempts fraught with considerable investment dangers, saying nothing of legislative morals.

The Chicago, Milwaukee & St. Paul has at the present time, we believe, the largest equipment of compound locomotives (all Vauclain four-cylinder) of any road in the country, the number being 250—about 25 per cent. of its total locomotive equipment. And while most other roads have been changing over to simple such of this design of locomotive as they owned, the St. Paul is contemplating an increase in the number already on hand. The Union Pacific is second only to the St. Paul in the number of these locomotives in operation, using them in both passenger and freight service on certain divisions, where they are reported to show decided economies over simple engines in like service. It should be borne in mind, of course, that the most favorable operating conditions for compound locomotives are those which approximate most nearly to continuous running at constant speed and load, with the greater relative advantage at the slower speeds. Therefore, the physical character of the division over which they run and the tonnage back of them are the principal factors determining the quality of their performance. In the test in freight service on the St. Paul, which was described in the paper read at the April meeting of the Western Railway Club, and which was conducted as a thesis investigation by students of the University of Wisconsin, the final figure for fuel saving of the compound over the opposing simple engine was only 4.35 per cent. This was after rejecting runs of each where the engine was underloaded and the speed was high—obviously uneconomical conditions for either kind. The test was made between Chicago and Savanna, Ill. In discussing the small advantage shown by the compound, Mr. Manchester, Superintendent of Motive Power of the road, gave some figures from a 14 months' record on 11 compound and an equal number of simple engines on

this same division, which was very much in favor of the simples. They showed a less cost of coal per hundred ton miles, and the repair cost per mile run was less than half that of the compounds. Neither kind was in the shops for repairs during the period. On the other hand, on the La Crosse division, which is a slower division, and on which, we presume, the engines can be loaded more nearly to capacity, the records showed a coal economy for the compounds of from 7 to 10 per cent. It was evident from Mr. Manchester's experience that for certain divisions of the St. Paul and the service possible thereon the compound is best adapted, while conditions on other divisions enable simple locomotives to make the better showing. He further said that the compound is a locomotive on which the "stitch in time" is of greatest importance. The road using it must maintain a thorough and efficient roundhouse organization to assure its receiving continuous and proper care, otherwise it is much better not to have it. In this, of course, he was voicing the generally admitted cause for the commercial decline of the compound locomotive; for the lack of proper roundhouse facilities and of the proper skill and care in maintaining them has been the principal difficulty which caused the discarding of the compounds in so many cases. But the existence of practical difficulties of this nature, or the deficiencies of mechanical designs through which the endeavor has been made to take advantage of the compound principle, is no reason for condemning the principle itself. It is therefore encouraging to observe the interest that is being manifested in the latest application in American locomotive practice of the compound principle—the four-cylinder balanced type.

THE SUPERHEATER ON AMERICAN LOCOMOTIVES.

To say that history repeats itself is trite. Nevertheless, it is often interesting to call attention to repetitions, especially when they are as marked as in the case of introduction of the superheater in America. When the compound controversy was on there was a marked indifference to the results brought out in the reports of other roads. There seemed to be a prejudice against the type born of that conservatism inherited from the old schoolmaster mechanic who was averse to trying any experiments, and abnormally afraid of anything that added even in the least degree to the complication of the locomotive. Meanwhile the Germans and the French were hammering persistently at the compound problem until they achieved a success that warranted them in formally adopting the compound to the virtual exclusion of the simple type.

Hardly had these results been accomplished when they were offered another improvement that bid fair to cut down coal consumption still more. Recognizing the theoretical advantages of superheating, the Germans attacked the problem of designing and applying a suitable apparatus to work in connection with the locomotive boiler. There were discouragements without number. It was the unexpected that was continually happening, but each change of detail brought a measure of relief, until the superheater demonstrated that with its aid, on a simple engine, the coal consumption is less than upon a compound without it. This proven, there seems to have been no hesitation in adopting the superheater as a standard of construction, and thus introducing a new order of things. This is a perseverance that has been rewarded with success. But in America we are repeating the same old story of indifference.

In the compound controversy there was scarcely a superintendent of motive power in the country who took the slightest interest in making it a success; while the hostility in all quarters was intense almost to bitterness, as those who were interested in the introduction of the type fully understand. The compounds that were built were almost forced upon the railroads by the rival builders, for at that time, before the amalgamation of the locomotive works each concern was striving for business and anxious to make a record for its product.

Now comes the superheater, offering even greater theoretical advantages than the compound. It has won golden opinions from all sorts of people who have tried it. Its record for saving in boiler repairs is unsmirched. It permits the use of lower pressures, it involves but little extra complication, and in every way seems to be a desirable adjunct to the simple locomotive. Yet what is the American superintendent of motive power doing about it? Almost nothing. He is "letting the other fellow do the experimenting." He is quite comfortable in his willingness to wait and see, and since the competition of the locomotive builders has, to a great extent, been removed, they have not the same incentive to push the superheater that they had to develop the compound, and so there is not the same prominence given to it in discussion and the press. In this, history is not repeating itself, but it is repeating in the apparent indifference of the railroad man to an improvement that promises to effect a saving in fuel and boiler repairs, and thus increase the efficiency of the locomotive. That we will come to it in time there is no doubt, just as we have come to the Walschaert gear; but American progressiveness seems to be wanting when radical changes in locomotive practice are concerned.

The paper read at the April meeting of the New York Railroad Club, together with the discussion that followed should certainly have an educational influence. One road, the Canadian Pacific, that was the most advanced in the adoption of the compound, has come to the front as the most prominent advocate of the superheater, and the results there obtained must be most gratifying to the management. There the superheater has apparently come to stay, even to the exclusion and discarding of the compound, just as was done in Germany.

It does not seem likely that the superheater will be extensively used upon the compound, as the composite saving of the two systems is not enough in excess of the superheater alone to make the combination of the two worth while. As to the final form that the superheater will take, there is, as yet, no certainty. It seems now as though it would be of the smokebox type, though the tube superheaters are rendering a good account of themselves. This statement is based more upon the results obtained abroad than upon any evidence forthcoming in this country. Abroad, the tube superheaters were tried in order to avoid the troubles experienced with the smokebox type, with a reversion to the latter after the tube type had been well tried. But that our experience will be the same does not necessarily follow.

There is one lesson to be read out of all these experiences, and that is that the superheater has now been put into such shape that its economy has been demonstrated, and it behooves every superintendent of motive power who cares to maintain or attain a reputation for progressiveness to give it a trial—not a trial by simply putting one on a locomotive and then relegating the machine to the tender mercies of the hostler and the wiper, but a trial in which an intelligent interest is aroused in all who have to do with it—a personal interest in the results obtained that will show to subordinates that the head of the department means business, and that their co-operation is demanded in a way that will make for success and satisfaction.

THE HEPBURN BILL.

There are two strong economic reasons why Congress should pass what is commonly known as a rate bill this session. The first of these is that the small shipper under the present system suffers a grievous wrong in the delay of the law and the cost of litigation. If he is unjustly overcharged for the transportation of his freight, he has recourse to justice under the provisions of the Interstate Commerce Act, which provide that railroad rates for all such traffic as comes within the jurisdiction of the general government shall be just and reasonable, but so many delays are thrown in his path and the expense of court procedure is so great that to right any small injustice, or any pretty big injustice, which he has suffered, he will have to spend far more than he can hope to receive. The other reason is the existence at the present time of a strong public feeling against corporations in general and the railroads in particular, a public feeling which does not differentiate between wrongs for which the railroads are responsible and economic evils unavoidable in the growth of any great transportation system. As we have pointed out in these columns, this feeling cannot be disposed of by a policy of doing nothing. If a bill be not passed it seems sure that a national party will grow up, having as its principal platform a basis of hostility to railroads and to corporate interests which will do far more harm than any legislation now contemplated.

The difficulty with most of the earlier rate regulation measures has been that, aimed at rebates and discriminations, they failed to fully enlarge the powers of the Commission as to extortionate rates. Relief of rebate giving has nothing to do with the making of rates, for rebates are secret evasions of the rates as established, punishable by law; yet it is no exaggeration to say that this important fact is scarcely comprehended at all by the masses of voters at the present time. To enable the man who gives a rebate and the man who accepts a rebate to be punished, no long and elaborate act of legislation is necessary. The Elkins law allows the Interstate Commerce Commission to proceed by injunction against rebates and discriminations, but not against extortionate rates. The Foraker amendment to the

Hepburn bill adds to this the provision that the commission may also proceed by injunction against an extortionate rate.

If a clause similar to this Foraker amendment had been incorporated in the original Elkins bill, it seems probable that the present agitation would never have existed, at least along the present lines. Under existing law, if a shipper is charged an extortionate rate he can obtain redress under the common law, or before the commission, but the railroad is the defendant in the action, and it is to its interest to delay the proceedings. Under the amendment allowing the commission to proceed by injunction against an extortionate rate, the railroad is the defendant, but is enjoined from further charging that extortionate rate, and its interest lies in hastening instead of in retarding action. The difference between the two ways of adjusting a rate is extremely simple in its plan, yet it carries all the difference that there is between success and failure, and offers a far better remedy for the law's delay than can be given by any increased and complex system of special courts, or hearings before the commission.

It is unfortunate that this addition was not made to the Elkins bill. Since it was not, it can probably best be brought into effect through the medium of the Hepburn bill, and it is most desirable that it should be brought into effect, because it reaches a genuine evil in a simple and effective manner. But along with this good feature the Hepburn bill contains several bad features, and it is surely to the interest of all that these bad features should be amended or stricken out rather than that the good ones should lose their usefulness by being incorporated in a bill which contains unconstitutional provisions.

First of all, it is necessary to so frame legislation that the commission as constituted shall exercise constitutional functions; that it shall not attempt an impossible mingling of administrative, executive and judicial powers. The function of the commission is, of course, an administrative one. Congress has fixed a standard of rates—a broad standard it is true, but a standard nevertheless—in requiring that they be just and reasonable. The function of the commission is to see to it that they are just and reasonable, and to apply to the court for an injunction against them when they are not, or to decide the question itself after hearing. But in Section 15 of the Act to Regulate Commerce as amended by the Hepburn bill, it is provided "that the commission is authorized and empowered, and it shall be its duty whenever after full hearing, upon a complaint made as provided in Section 13 of this Act, or upon complaint of any common carrier, *it shall be of the opinion* that any of the rates or charges whatsoever demanded, charged or collected by any common carrier, subject to the provisions of this Act for the transportation of persons or property as defined in the first section of this Act, or that any regulation or practice whatsoever of such carrier or carriers affecting such rates are unjust, or unreasonable, or unjustly discriminatory, or unduly preferential or prejudicial, or otherwise in violation of any of the provisions of this Act, to determine and prescribe what will, *in its judgment*, be the just and reasonable and fairly remunerative rate or rates, charge or charges, to be thereafter observed in such case as the maximum to be charged; * * * and to make an order that the carrier shall cease and desist from such violation to the extent to which the commission finds the same to exist, etc." Now, there are two expressions in this paragraph as quoted which invalidate the chance that the commission can do good, because they require it to be judicial and legislative as well as administrative. As an administrative body the commission can do but one thing, and that is to see that rates comply with the standard set by Congress; to wit, that they be just and reasonable. The Act is clearly wrong in authorizing the commission to act *when it shall be of the opinion* and to prescribe what will, *in its judgment*, be just and reasonable. It may seem a simple point that Congress merely authorizes the commission to act when rates are unreasonable and not make their unreasonableness a matter of its judicial opinion, and to prescribe a rate which, *in its judgment*—a legislative act—will be reasonable, but on these distinctions apparently hangs the constitutionality of the paragraph and the usefulness of the Act.

The same point is further emphasized in the subsequent clause relative to joint rates, which prescribes that whenever the carrier or carriers shall fail to agree among themselves upon the apportionment or division of such joint rates, the commission may, after hearing, make a supplemental order prescribing the portion of such joint rate to be received by each carrier party thereto; and, after hearing on complaint, establish through routes and joint rates as the maximum to be charged and prescribe the terms and conditions under which such through routes shall be operated, etc. Bearing in mind always that the commission, being an administrative body, has its sole function in carrying out the expressed will of Congress that a rate shall be just and reasonable, and that, under the constitution, it can be neither an executive body nor a judicial body, the unconstitutionality of this paragraph is evident. Enforcing the standard of Congress with regard to the reasonableness of rates has no connection with prescribing "the terms and conditions under which through routes shall be operated." As a matter of fact, carriers always decide these matters among themselves; but, if they did not, the commission has no standard to go by, for no standard has been fixed by Congress, and therefore it would clearly be powerless and would exceed its constitutional functions if it attempted to make an order prescribing terms and conditions, for the operation of through routes includes the number of trains which may be run, the speed at which these trains must be run, and a host of other particulars for which Congress has given no standard. The clause, therefore, confers the entire absolute legislative power of Congress on the commission, and this cannot be done. It is true that it is prescribed in the same paragraph that the commission is to perform these acts when "the carriers complained of have refused or neglected to voluntarily establish such through routes and joint rates, provided no reasonable or satisfactory through rate exists." This limits the provisions but does not save the constitutionality.

Another clause doubtless unconstitutional in itself, but which would presumably not render the whole bill unconstitutional, is that providing that any carrier, any officer, representative or agent of a carrier, etc., who knowingly fails or neglects to obey any order made under the provisions of Section 15 of this Act, shall forfeit to the United States the sum of $5,000 for each offense, and in case of a continuing violation each day shall be deemed a separate offense. In the case of a contested ruling it is easy to see that this provision might pile up a tremendous fine against a railroad acting with honorable intentions, and that, under these circumstances, the courts would adjudge the penalty a cruel and excessive one, and thereby unconstitutional.

Apparently as a result of the careless and hasty change in the bill as presented, a curiously objectionable paragraph appears on page 16 of the Hepburn bill as printed, lines 18 and following. In the original bill formulated by the Interstate Commerce Commission, it was provided, properly, that if a carrier did not show grounds of objection to a ruling of the commission within 60 days after the ruling was promulgated, the carrier was subsequently to be estopped from making objections to the enforcement of the ruling on any other grounds than those of improper form in making and serving the order. Now, the Hepburn bill is, of course, the commission's bill, with certain modifications. One of these modifications, made by the pending bill, was to strike out the court review provision. This was done in such a way that the act now prescribes that when a carrier fails or neglects to obey any order of the commission, other than for the payment of money, while the same is in effect, any party injured thereby or the commission in its own name may apply to the circuit court in the district where such carrier has its principal operating office or in which the violation or disobedience of such order shall happen, for an enforcement of the law. With the provision for court review and the 60-day period stricken out, it now reads that if it appears to the court upon hearing that the order was regularly made and duly served, and that the carrier is in disobedience to the same, the court shall enforce obedience by a writ of injunction and the carrier shall be prohibited from showing any objection except in the form of the order and the way in which it has been served. It seems clear that this provision, owing to this careless striking out of a clause, is an unconstitutional one, involving the taking of property without due process of law.

One other clause of the Hepburn bill is very objectionable, not so much on the ground that it is unconstitutional as on the ground that it is foolish. It is prescribed, very properly, that the commission shall at all times have access to all accounts, records and memoranda kept by carriers subject to the Act. It is also prescribed, most absurdly, that it shall be unlawful for such carriers to keep any other accounts, records or memoranda than those prescribed or approved by the commission. It is obvious that each railroad has its own special forms of traffic that need special ways of accounting. It is highly desirable that uniform accounts covering the main transactions should be faithfully kept and open at all times to the commission, but it is most childish to prohibit the roads from keeping records of branches of their business which may not have occurred to the commission at all in laying down their prescribed forms. The statement is actually so sweeping that if the Philadelphia & Reading, for example, should keep a special

record for its own information of the amount of coal business done by one of its competitors, say, the Lehigh Valley, and if the commission did not specifically provide for this record, it would thereby be illegal. Such a provision has a Russian sound and bears no analogy to American customs and practice.

Let us grant, then, that a bill must be passed, and that the Hepburn bill comes as close to what is necessary as any measure which can be enacted under the present congressional situation. Does it not seem wholly wise and expedient that the clauses which are objectionable and unconstitutional should be amended or stricken out in order that actual good may be done, especially in removing the evil of the law's delay? An unconstitutional bill will harm no one directly, but in the present state of tension seems sure to lead to hasty and dangerous action, not only by the law making bodies of the country, but by a body of voters who cannot discriminate between justice and revenge.

March Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of March, printed in another column, contains accounts of 28 collisions, 20 derailments, and two other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

Mar.	Place.	Killed.	Injured.
2d	Wendover, Wyo.	1	2
2d	Thurmond, W. Va.	1	0
7th	Saratoga, N. Y.	4	10
7th	Binghamton, N. Y.	0	2
11th	Fostoria, Ohio.	3	2
16th	Adobe, Colo.	22	22
17th	West Windham, N. H.	3	3
19th	Lockbridge, Ia.	5	8
25th	Carthage, Texas.	3	12
26th	Casper, Wyo.	9	12
30th	South Whitley, Ind.	0	19
31st	Gaffney, S. C.	3	0
31st	Fulton, N. Mex.	0	16

Thirty-one of the 54 killed in these 13 accidents were the victims of the two worst, Adobe and Casper. Adobe was the subject of editorial comment in our issue of March 23, and of comment by a correspondent in the issue of April 6, page 348. While not insensible to our correspondent's plea for more charity, we cannot see that his view differs materially from our own. He recognizes the need of a reasonable degree of age and experience in an operator who is to attend a train-order office at night, and that, no doubt, is just what was the trouble. The force of our correspondent's phrase "criminally indifferent" depends on the operator's age and experience. One can imagine an operator so young that he does not realize the gravity of his responsibilities, and such a condition tends to relieve him of the burden of guilt and to throw it on the superintendent or employer, who is bound to realize. But it is difficult to imagine a person capable of learning to read and write and telegraph, and secure a position under a competent superintendent, who is so young or so dull as not to realize the wrong of claiming to have been even partly awake when he knows that he has been partly asleep. The operator who sits at his desk, sleeps several minutes, awakes, and does not realize that he has been asleep, does so, we believe, only after he has made a number of experiments in that line. On his first experience he is alarmed. It is after repeated trials that he becomes sufficiently hardened to do it without being alarmed. Therefore we call such conduct morally vicious.

The number of electric car accidents reported in the newspapers of the United States as occurring in the month of March was five, in which one person was killed and 31 were injured.

The State of North Carolina, while not among the foremost of the railroad states of the Union, ranks well in the list with her main trackage of 3,859 miles. The fact gives added interest to the constitution and functions of the body that serves as her railroad commission and which are set forth in the last commission report, for the year 1905, which contains the railroad statutes as revised and brought down to the present date, including the legislative session of 1905. The state has not a railroad commission properly and exclusively. It has, instead, a "corporation commission," so called and named in the statute as a "court." It consists of three officers whom we may call either commissioners or judges, elected by the people and thus, by that fact, thrown into the limbo of caucuses, conventions, general politics and pulls. No member of the commission can "jointly, severally, or in any other way, either directly or indirectly, hold any stock or bond or be the agent, attorney or employee, or have any interest in any way in any steamboat, canal, navigation, express, telegraph, bank, building or loan company or association," and under heavy penalty must get rid of any such interest if he happens to acquire them by inheritance or otherwise. The commission thus, so to speak, divested of investments, is given most extensive and varied powers. It is a body advisory, supervisory, judicial, regulative and clerical all in one. It takes purview of railroads, street railways, electric power companies, banks, telephones, transportation and public service corporations generally. Its powers are too ample to be described herefully, but they reach out and pretty radically into almost every branch of up-to-date questions relating to public service corporations, including freights and fares; and, besides, the body is constituted a board of "state tax commissioners," with the usual functions of such a body. The tasks, duties and responsibilities which states much smaller than North Carolina distribute among several bodies, that state loads on a single commission with such multiplied and varied offices as would make the best trained economist dizzy. And we cite the case of North Carolina, not so much as an exception, but as a type of the way other states, by their creative and organizing statutes, establish "overloaded" commissions to handle grave railroad problems and metaphorically make up such a heavy train as no locomotive can pull. Incidentally one is tempted to ask why North Carolina, after cutting off her commission from so many forms of corporation investment, didn't push consistency further and, as tax commissioners, cut them off from property owning entirely and create a commission *in forma pauperis*.

Texas & Pacific.

This company, operating 1,826 miles of main line in the Southwest, the stronghold of the Gould system, furnishes an arm reaching through Texas as far west as El Paso. Its eastern terminus is New Orleans. In the eastern half of the distance between the two termini there are several hundred miles of branches and connecting lines. On the other hand, over the 613 miles between Fort Worth and El Paso the main line constitutes the whole of the company's property, with the exception of a six-mile branch to coal mines. Judged either from a tonnage or revenue standpoint, through freight traffic is more important than local tonnage. Competitive freight furnished 2,374,125 tons out of the total tonnage of 4,156,701 tons carried. Competitive freight earnings were $4,487,385, against $3,355,844 revenue from local freight traffic. Of the 2,044,309 passengers carried, only 285,417 were local passengers, showing that the through line of the company is much more important for freight than for passenger traffic. Of course, the great handicap of this Gould spur to El Paso is that its western connection at El Paso is the Southern Pacific, which has its own line between El Paso and New Orleans, and which consequently could hardly be expected to turn over a great proportion of traffic to its rival. On Mexican business, however, the Texas & Pacific further fortifies the strong position of the Goulds, since it gives a connection for the Mexican Central's traffic at El Paso, just as the International & Great Northern interchanges with the National of Mexico at Laredo.

As a local line, the territory through which the Texas & Pacific runs in Louisiana and northeastern Texas furnishes cotton and lumber traffic. The western half of the line between Fort Worth and El Paso has been largely until recently unsettled prairie country. It is now, however, being steadily taken up by new settlers, who are finding the land rich in agricultural possibilities. During the past year the passenger traffic of the road, although not quite as large as in 1904, was swelled by the large number of settlers carried westward; this business, of course, not adding to earnings to the extent that first-class business would do. The freight traffic was at the same time increased by large growth in shipments of fruits and vegetables, particularly on this formerly undeveloped Rio Grande division west of Fort Worth. On this division alone there was an increase of 1,743 carloads of oranges, lemons, green fruits and vegetables carried.

A season of heavy rainfall in the last half of the year decreased the yield of small grains and cotton. This was followed by the yellow fever epidemic in Louisiana, which seriously interrupted passenger traffic, delayed greatly the movement of merchandise, and to some extent increased the cost of transportation. As a result, gross earnings decreased $302,757, or 2.43 per cent., and net earnings $401,230, or 9.27 per cent.

The record of the Texas & Pacific's earnings shows that the past 10 years may be roughly divided into two equal periods. Gross earnings from 1896 to 1899 showed considerable gains; in 1900 there was an increase in gross of $1,450,000, and in 1901 of over $2,000,000. In the five years since then there have been in three of the years comparatively small increases in gross earnings, and in two years decreases. Gross earnings in 1905 were $12,130,391 ($6,643 per mile), operating expenses $8,210,166, and net earnings $3,290,225. Freight earnings decreased $164,763, or 2 per cent., and passenger earnings $146,861, or 5 per cent. In view of the almost complete suspension of passenger traffic on the Louisiana lines during the three months of July, August and September owing to the quarantine, it is remarkable that there was not a larger decrease in total passenger earnings. It is probable that in common with the other Gould lines in the Southwest the passenger earnings in 1904 were considerably swelled by travel to the St. Louis Fair.

Damage to the cotton crop is reflected in the total number of bales moved, which was 720,993, compared with 830,012 in the pre-

vious year. The revenue received per bale was also less than in 1904, being $1.23 against $1.34 in the earlier year. Of the cotton carried, Texas furnished more than half, Louisiana the rest. There was also a decrease in the tonnage of cane sugar moved and in the shipments of rice, but an incerase in shipments of sugar and molasses. Out of the total of 4,156,701 tons carried, 909,737 tons were manufactures, merchandise, etc., a larger figure than that of the tonnage of mine products, including coal.

The road is fairly well, but by no means liberally, maintained. Maintenance of way cost $707 per mile, which is perhaps not too small for a road so much of whose line runs through Texas prairies, with one, or, at most, two, passenger trains a day each way. In 1904 the figure was $729 a mile. Repairs and renewals cost $1,624 per locomotive, against $1,819 in 1904; $955 per passenger car, against $940 in 1904, and $47 per freight car, against $46 in 1904. These amounts are probably sufficient to keep the equipment in repair, but hardly represent any equity in concealed earnings. Of the $783,286 spent on improvement account during the year, $557,595 was charged to income.

There has been another increase in the average car load and train load, as uniformly for the past few years. Ten years ago, in 1896, the average car load was 10.37 tons, and the average train carried 153 tons. Last year the car load was 13½ tons and the train load 215 tons, the latter an increase of four tons over the preceding year. These are small increases compared with those on most Eastern trunk lines.

There were 20,498,474 bushels of corn exported from the port of New Orleans during 1905. The Texas & Pacific elevators at Westwego, eight miles from New Orleans, handled 7,809,304 bushels of corn. As compared with the 549,356 bushels of wheat exported through New Orleans, there were 627,224 bushels handled at T. & P. elevators. Much of this grain, of course, was not exported.

The branch line mileage in Louisiana was increased during the year by the extension of the Avoyelles line, 22 miles beyond its former terminus to a junction with the main line, thus making a complete loop through this agricultural region of Louisiana. In spite of this fact main-line mileage operated and the length of the Avoyelles branch are given in the mileage statistics the same as in the preceding year.

The principal statistics of operation are given below:

	1905.	1904.
Mileage worked	1,826	1,826
Freight earnings	$8,243,229	$8,407,992
Passenger earnings	2,714,881	2,861,742
Gross earnings	12,130,391	12,433,148
Maint. way and structures	1,290,685	1,331,901
Maint. of equipment	1,371,413	1,373,451
Conducting transportation	5,124,373	5,018,288
Operating expenses	8,210,166	8,111,692
Net earnings	3,920,225	4,321,455
App. out of income for impvmts	557,595	700,584

Vandalia Railroad.

On January 1, 1905, the Terra Haute & Indianapolis, the St. Louis, Vandalia & Terre Haute, the Terre Haute & Logansport, the Logansport & Toledo, and the Indianapolis & Vincennes railroads, Pennsylvania allied lines radiating from Indianapolis and Terre Haute, were consolidated as the Vandalia Railroad Company. This consolidation had for years been delayed by litigation, during which time some of the advantages of union were gained by operation under the informal title of the Vandalia Line. With the ending of the important suits at law, formal merger was made and the report of the first year's operation of the consolidated company, with its 658 miles of line, is now at hand. In this, comparisons are made with the totals of the lines as operated separately during the preceding year. The results of operation of the Terre Haute & Peoria, with 145 miles of line, operated separately, are included under separate tables.

The Vandalia earned gross $7,195,877, a decrease of $400,000 from the preceding year. There was an increase of $353,300, or 8 per cent., in freight earnings, the decrease in gross resulting from a loss of $692,200, or 28 per cent., in earnings from passenger traffic, due to comparison with an abnormal year, when these roads carried so large a proportion of traffic to the Louisiana Purchase Exposition at St. Louis. Operating expenses decreased $264,381, leaving net earnings of $1,642,210, a decrease of $135,000. The Terre Haute & Peoria earned $649,346 gross and $52,958 net. The rental of the road (30 per cent. of gross earnings) was $194,804, leaving a loss to the controlling company of $141,845 on the year's operation.

Maintenance of way cost the Vandalia $1,383 a mile, against $1,197 a mile in 1904. Repairs of equipment cost $2,460 per locomotive, against $3,553 in 1904, a decrease of over $1,000 a locomotive; $1,064 per passenger car against $821 in 1904, an increase of over $200 per passenger car, and $76 per freight car against $75 in 1904. Apparently heavy expenditures for repairs of passenger cars came after the Exposition closed, when there was chance for a general overhauling.

The principal articles of traffic were bituminous coal, lumber, manufactures, grain and livestock. There was a large increase in the tonnage of manufactures carried, which totaled 1,197,548 tons, an increase of 208,120 tons over 1904. The train load increased 20 tons over 1904 to 264 tons. The number of tons carried one mile per mile of road was 959,668, an increase of 105,933.

Passengers one mile per mile of road decreased over 50 per cent., from 204,132 to 125,606. Passenger earnings per mile of road were $2,697, against $3,766 in 1904, a decrease of $1,069 per mile. The number of passengers carried one mile decreased 38 per cent., while the average rate received per passenger mile, 2.06 cents, increased, being 1.84 cents in 1904.

The Vandalia furnishes the Pennsylvania Lines with entrance into St. Louis and on that account can always count on a large and steady through traffic. The local lines of the system are much less important, but as a whole the road gets a fair share of local traffic in Illinois and Indiana.

The principal statistics of operation for the Vandalia Railroad follow:

	1905.	1904.
Mileage worked	658	658
Freight earnings	$4,675,742	$4,322,431
Passenger earnings	1,775,291	2,467,579
Gross earnings	7,195,877	7,594,946
Maint. way and structures	909,785	787,518
Maint. of equipment	1,228,049	1,334,132
Conducting transportation:		
Traffic	198,767	202,280
Operation	2,833,683	3,108,822
Operating expenses	5,553,667	5,818,048
Net earnings	1,642,210	1,776,899
Net income.	1,676,481	2,066,815

NEW PUBLICATIONS.

The Heart of the Railroad Problem. By Frank Parsons, Ph.D. Little, Brown & Co., 254 Washington St., Boston. 364 pages. $1.50.

Professor Parsons' book, in which he takes up in great detail and with commendable thoroughness all the more conspicuous abuses connected with railroad practice, might be described as a lamentation without a remedy. A book of 364 pages is a substantial document and the writer has evidently spent much time in securing a vast number of instances of iniquitous rates and rate making practice. On this account his book has considerable historical value and will be of interest in future years to the man who wishes to find out the way the railroads secured competitive business in accordance with the law, behind the law, and in spite of the law. Unfortunately the author's attitude of mind is not impartial. It does not pretend to be impartial. In treating of the long and short haul clause Professor Parsons is apparently at once puzzled and dissatisfied by the provision that similar conditions must exist to render the law effective as to two transportation routes under consideration. He cites with the greatest length cases where long hauls are cheaper than short hauls, but can either see no reason why they should be so or does not care to explain this reason. This is only one instance to show that the book is not going to be a helpful one in arriving at any solution of the difficulties which actually exist. He clearly holds the view that one of two things must be true; either that the long haul charge is the fair one or else that the higher short haul charge makes up deficiencies in the rate for the longer haul, and seems unable to grasp the fact that long haul business which keeps cars moving and secures some traffic to help pay fixed charges on an existing line, thereby reduces the short haul rates which it is necessary to charge. This lack of judicial balance and this confusion of thought makes it natural that the author should be unable to suggest any remedy for the evils he mentions. As a matter of fact, he has none to suggest, except the very pleasing and very visionary one that the railroads all unite into a national system under a great leader, like James J. Hill or A. J. Cassatt, who would operate the roads on business principles untrammeled by the spoils system or any political control, backed by a public interest that would not tolerate favoritism, managing the roads for the whole people as stockholders, etc. We have not counted the specific kinds of injustice which Professor Parsons enumerates in his book. We imagine there are about a hundred, and we are old fashioned enough to think that Professor Parsons' remedy, working at its best and most impractical summit of efficiency, would not remove more than possibly three of these kinds of injustice.

TRADE CATALOGUES.

Noiseless Brake Hanger.—A well illustrated catalogue describing the "Brill" noiseless brake hanger is being sent out by the J. G. Brill Company, Philadelphia. The principle feature of the device is a ball and socket joint with the cap socket held firmly in place by a wedge which, as the socket becomes worn, is advanced by a pair of springs.

The Northern Pacific is advertising itself in a very appropriate and modest way by circulating samples of the bill of fare which was issued for the Easter day dinner in its dining cars. Whether the passenger department will care to be complimented on the modesty of an advertisement we do not know; but a modest menu is always appropriate. This one is handsome as well though we

have never been able to find any suggestion of either high speed or low prices in the Northern Pacific coal and black trade mark. That the Northern Pacific [illegible] all right goes without saying; and there is an Easter [illegible]. On a separate souvenir card is a striking picture of a Yellowstone Park scene.

Steam Shovel Notes.—The April number of this journal has for its leading [illegible] a reproduction of that portion of Mr. Jno. F. Wallace's address to the Illinois Manufacturers' Association at Chicago on March 2 (*Railroad Gazette*, April 13) as pertained to the Tehuantepec Railroad. There are also notes regarding Lake Shore improvements and "Nickel Plate" betterments; railroad extensions to the Gulf; an Alaska railroad, and other information of general interest to contractors and railroad builders.

Quarrying Machinery.—The Ingersoll-Rand Company sends a small illustrated pamphlet showing track channelers and drills; the heavier channelers can be driven either by steam with independent boilers or by air from a central compressor.

Graphite Paint.—"Preservation of Structural Steel and Iron" is the title of a 20-page pamphlet of pleasing design sent by the Chicago Graphite Manufacturing Co. A discussion of the merits of various pigments considered desirable for protecting iron and steel structures is given, with a presentation in detail regarding this company's product. There are also a number of half-tone engravings from photographs of various structures, the steel and iron in which is protected by its paint.

Turntable Tractors.—The designs of locomotive turntable tractors made by Geo. P. Nichols & Bro., Chicago, are described and illustrated in a neat pamphlet just issued. The most satisfactory form is stated to be the electric, and a number of photographic views of their application on tables for different roads are presented. A brief description of the design is given, and of the dead-engine haul provided when desired. Gasoline tractors are supplied where electric current is not available. Mention is also made of transfer tables for rectangular engine houses and a view of an installation shown.

Pneumatic Turntable Motor.—A 14-page pamphlet issued by the Draper Manufacturing Co., Port Huron, Mich., describes the McGrath pneumatic turntable motor and shows a number of half-tone engravings from photographs of its application on several well known roads. A list of other roads is given, including 16 of the most important in the country.

New Passenger Station at Grand Junction, Colorado.

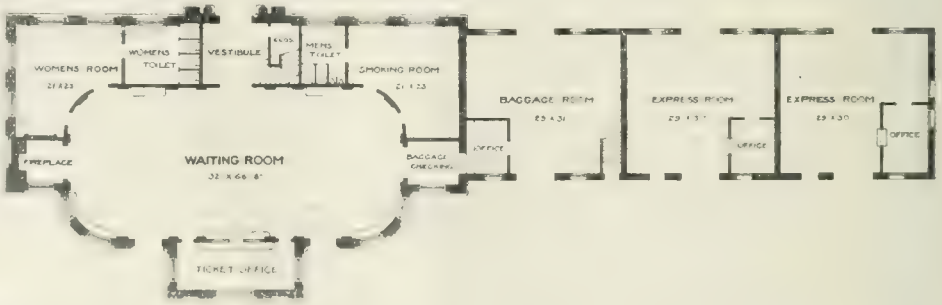
A new station at Grand Junction, Colorado, was on April 17 opened for service by the Denver & Rio Grande Railroad. It is illustrated herewith by a photograph and floor plan. The new station emphasizes in a striking way the progress of Colorado and the efforts being made by the Denver & Rio Grande to provide for its patrons comfortable, convenient and even luxurious facilities. Although Grand Junction, according to eastern standards, is not a large city, it is the center of a large and productive territory, and the center of the Denver & Rio Grande's east and west system. The management therefore decided that it was appropriate to provide a distinctive style of station rather than the stereotyped style so familiar to the traveling public.



New Station of the Denver & Rio Grande at Grand Junction, Colorado.

The design of the exterior of the building is a fine example of the French renaissance style. The whole is built in the best and most durable materials. The foundation is of concrete resting on Raymond concrete piles driven to hard-pan and the construction throughout is largely fireproofed with reinforced concrete. Hard burned, rich colored buff brick is used for the body of the exterior walls, and trimmings of light terra cotta to match the brick are liberally used. The roof is covered with clay tiles of a rich red color, blending agreeably with the light warm tones of the walls.

The buiding consists of a large two-story central portion containing the waiting rooms, etc., and a single story addition at one end containing the baggage room and two express rooms. It is proposed to make a similar extension on the other end of the central portion at some future time to provide a lunch room, kitchen and a large open pavilion. The front of the building is at present provided with large ornamental iron canopies with wire glass roofs.



Floor Plan of New Passenger Station of the Denver & Rio Grande at Grand Junction.

The plan of the interior was evolved after much study and is of a type likely to become popular for buildings of this class. It provides generous light and convenient and airy

facilities for the accommodation of travelers. The doors on each side of the building open into the magnificent general waiting room 32 ft. x 67 ft. in size and running up through two stories to a height of 25 ft. The finish of the waiting room is elaborate, the walls being divided into panels by pilasters which support a richly modeled cornice and paneled ceiling in plaster. Stained glass has been much used in this room; wall decorations are of stained burlap, and ceilings of fresco. The ticket office opens from the main waiting room toward the track front of building, forming the one-story porch shown in the photograph, making a convenient arrangement both for the public and for the operating force. The checking alcove is conveniently situated at one end of the waiting room and the retiring rooms for men and women are easily accessible from the rear corners of the waiting room. A commodious lobby at the rear of the waiting room contains the stairs leading to the second story rooms, which are provided for the Division Superintendent's offices, trainmen's rooms and the despatcher's and telegraph offices, with the necessary toilet and locker rooms. The wood finish of the various rooms is of quartered oak throughout and the floors are of tile and cement. The artificial lighting is done by electricity, many incandescent and Nernst lamps being used. The heating is by the vacuum system of steam circulation, the steam supplied from a central plant in the Grand Junction yards.

The design of the building was furnished by Mr. Henry J. Schlacks, of Chicago, and the general contract for the building was carried out by the William Simpson Construction Company, of Denver, Colorado.

Superheated Steam on the Canadian Pacific Railway.

At the April meeting of the New York Railroad Club, Mr. H. H. Vaughan, S.M.P., of the Canadian Pacific Railway, read the paper of the evening. From this it appears that during the past year a number of locomotives have been equipped with superheaters in addition to those in use at that time, all of which are of new construction. The types of superheaters used are the Schmidt fire tube, a modification of the Schenectady, which may be called the Schenectady B, and one designed by Mr. A. W. Horsey, Mechanical Engineer of the Canadian Pacific, and the writer which will be called the "C. P. R." The complete list of engines so equipped follows, those marked X being on order and not yet delivered.

Type of superheater.	Class of engine.	No. equipd.	Weight of engine.	Size of cylinders.	Size of drivers.	Type of engine.
Schmidt.....	700	10	190,000	21x28	63 ins.	10-wheel simple
Schenectady B.	710	55	190,000	21x28	63 "	10-wheel simple
C. P. R.....	740	30	190,000	21x28	63 "	10-wheel simple
C. P. R.....	820	1	164,000	20x26	69 "	10-wheel simple
C. P. R.....	780	5	190,000	21x28	63 "	Do., W. F.
C. P. R.....	1,150	3	215,000	21x28	69 "	Pacific.
X C. P. R.....	7,000	15	190,000	21x28	63 "	10-wheel simple
X C. P. R.....	1,100	3	215,000	21x28	75 "	Pacific.
X C. P. R.....	1,640	20	185,000	21x28	57 "	Consolidation simple.

This makes a total of 186 engines built or being built of the superheater type.

In the case of the Schmidt fire tube superheater, the only alteration made in the "Schmidt" design has been the substitution of separate bolting for each flange connecting the superheater pipes to the header in place of using clips as in the original design. This has entirely overcome the trouble from leakage previously experienced, and while a small change, is a considerable improvement.

The "Schenectady" superheater used on the 1621 class employed the "Field" tube type of superheater pipe in which steam is led from the saturated steam header through the small tube to the rear end of an inch and three-quarter tube attached to the superheated steam header. The fire-tubes are 3½ in. in diameter, and each contains one 1¾-in. superheater pipe. In the "Schenectady B" type of superheater, with which the 710 class engines are equipped, the well known design of "Schenectady" header is retained, but the superheater pipe and fire-tube arrangement is the same as in the "Schmidt" and C. P. R. design, namely, 22 fire-tubes 5 in. in diameter, each containing four 1½-in. superheater pipes of which the back ends are connected in pairs by return bends while the front ends are connected in pairs to the saturated and superheated steam headers respectively.

The arrangement of the front end and the superheater tubes of the "C. P. R." superheater is shown in the illustrations. Steam from the dry pipe enters the top or saturated steam header, as shown in detail, and flows through the fingers of the header into 1¼ in. solid drawn weldless steel tubes, inside diameter [illegible] in. These tubes are upset at one end and are forged and bent by a bolt header and bending machine to the shape shown. They are connected by bronze union nuts to special cast steel fittings which screw into the header; a [illegible] in. copper wire gasket being used in the union nut. As shown, these small tubes extend into large 5 in. superheater fire-tubes to within about 30 in. of the back tube sheet, where they connect with the heavy cast steel return bends. The steam returns from the return bend through 1¼ in. tubes, which connect through union nuts and special cast-steel fittings, similar to those mentioned above, with the fingers of the bottom-header, which is shown in detail. The steam pipes which connect this header with the cylinder casting are necessarily very short; however, there has been no difficulty in making the joints tight. Each large superheater fire-tube contains two of the small tubes from the top header and the corresponding return tubes to the low header. The return bend has lugs cast on it, which spaces it properly from the sides of the large tube and the other set of small tubes so that there is a uniform circulation space about the small tubes. The cast-steel return bend is made especially heavy at that part which comes in contact with the smoke and gases from the firebox.

It will be seen that the "Schmidt," "Schenectady" and "C. P. R." superheaters now being applied on the Canadian Pacific are identical in every respect with the exception of the arrangement of the headers and the connection to them to the superheater pipes. The primary object sought in the design of the "C. P. R." type were the separation of the joints from the heater pipes to the headers, the location of these joints in a position where they could be conveniently inspected and an arrangement of the superheater pipes that would permit any individual element being removed or applied without disturbing the others. These objects appeared desirable after the experience on earlier engines, and it is evident they have been very satisfactorily obtained. The first is also satisfactorily met in the "Schmidt" by the separate bolting of the superheater pipe flangers to the header, and its need did not develop to any great extent in the earlier engines with the "Schenectady," although later experience would suggest its necessity, as more or less trouble is developing with the joints between the superheater pipe and main headers.

Both the second and third requirements are also partially met by the "Schmidt," but not as thoroughly as in the "C. P. R." design, and in both respects the "Schenectady" is deficient. It must not be understood that either of these types give especial trouble in service or are difficult to maintain, in fact, the reverse is the case, but the points mentioned are conveniences and advantages which are believed to have been obtained by the modification illustrated and their value will be appreciated from the roundhouse point of view.

The most important question in connection with superheaters is naturally that of the coal economy obtained, and this is not easily determined, as all who have followed the effect of different improvements or proportions of locomotives will appreciate. Tests are open to the objection that they do not represent general service conditions and coal records on account of their inaccuracy and lack of definite results. Tests on superheaters present, however, an additional difficulty over those directed to ascertain the relative economy of simple versus compound engines, or of wide versus narrow fireboxes, where the efficiency of either the boiler or engines alone is involved, in that they must necessarily include the efficiency of the machine as a whole. The determination of the water consumption per unit of work is not sufficient, as it is quite possible for any advantage shown in this respect to be neutralized by less efficient boiler performance. Even with equal boiler efficiency, the additional heat in the superheated steam would represent a reduction in the water evaporated of one-twentieth of 1 per cent. for each degree of superheat, or 5 per cent. for 100 deg. and 10 per cent. for 200 deg. superheat. In other words, if an engine with 100 deg. superheat showed a saving in water consumption of 5 per cent., in comparison with an ordinary engine, and the boiler were equally efficient, there would be a saving in coal, and there must in addition also be some loss in boiler efficiency on account of the necessarily higher temperature of at least a portion of the smoke-box with any design of superheater.

It is, therefore, necessary in comparing superheaters with other engines to measure the coal consumption per unit of work. To do this a rather extensive series of tests are required to average the influence of the efficiency of the firing with a dynamometer car to measure the work done, and owing to the latter not having been available during the past year it has been impossible to undertake them. During the past winter a car has been [illegible] which will enable some experiments to be made, but at present the only figures available are those showing the [illegible] and coal consumed on the various sections of the road and these after all are the final arbiters of economical working. They afford so far as they are susceptible of proper comparison the most satisfactory evidence that can be obtained. Such [illegible] are not of great value when applied to individual engines but when obtained from a number of engines, without specially [illegible] working together in regular service they must certainly be considered as reliable.

The two general classes of superheater [illegible] and 10 wheel freight engines can only on the Canadian Pacific be compared with compound engines as there are no [illegible] engines in use on that road at all similar [illegible]

pounding has during the past few years become firmly established for freight service, and on account of the high cost of coal there would be no question as to its continuance had not the use of superheaters been introduced. Of compound engines there are, however, two classes which afford excellent comparisons; the 1,200 class consolidation, of which there are 11 in use, and the 1,300 class 10-wheelers, of which there are 37. Both these classes are modern "Schenectady" compound engines, and although the 1,200 class is rather lighter than the 1,600, it has the same grate area and is a good engine for comparative purposes, while the 1,300 class is practically identical with the 700 class, with the exception of the change from compound to simple superheaters.

The dimensions of the various classes are given in the following table.

	Class				
	1,200	1,300	1,600	1,621	700, 710 & 740.
Boiler pressure, lbs.	200	200	200	200	200
Firebox, width, inside, ins	65⅝	70¼	65¼	65¼	69⅞
Firebox, length, inside, ins.	96	102⅛	96⅝	102⅛	..
No. of ordinary tubes	281	378	244	255	244
Diameter of ordinary tubes	2 in.	2 in.	2 in.	2 in.	2 in.
No. of special tubes	..	..	22	55	22
Diameter of special tubes	..	..	5-in.	3-in.	5-in.
Length of tubes	14′ 2″	14′ 6 9/16″	14′ 1⅝″	14′ 2⅜″	14′ 2⅞″
No. of superheater pipes	..	..	88	55	88
Diameter superheater pipes	..	..	1¼ in.	1¾ in.	1¼-in.
Heating surface tubes, sq. ft.	2,084	2,885	2,216	2,705	2,233
Heating surface firebox, sq. ft.	134	180	165	165	180
Heating surface total, sq. ft.	2,218	3,065	2,381	2,870	2,413
Superheating surface	..	..	375	340	378
Grate area, sq. ft.	43.6	50.0	43.6	43.6	50
Cylinders, ins.	22x35	22x35	21x28	21x28	21x28
Driving wheels, ins.	57	63	57	57	63
Total weight of engine, lbs.	159,500	190,000	186,200	186,200	190,000
Weight on drivers, lbs.	140,500	142,000	163,700	163,700	141,000
Weight of tender	114,000	122,000	121,500	121,500	122,700
Water, Imperial gals.	5,000	5,000	5,000	5,000	5,000
Coal, tons.	10	10	10	10	10

In comparing road coal records a good many difficulties are met with, some of which are usual on all roads, while others apply particularly to the Canadian Pacific Railway. The easiest figures to arrive at, those based on general averages, are not by any means reliable, and considerable study is necessary to ascertain the actual result. The consumption per 1,000 equivalent gross ton-miles, or as it may preferably be called per unit miles varies considerably on different sections on account of the difference in profile, the consumption on the same section varies with the weather conditions, increasing from 25 per cent. to 50 per cent. in winter over that required in summer; and also varies under the same weather conditions with the proportion between east and westbound traffic. Engines are on account of the peculiar traffic conditions moved from one section to another more than is usual on most roads. Most engines have assigned crews and in consequence those engines doing the greatest amount of work on any section as a rule give better relative results than those making fewer trips, as the latter are extra crewed and the men are not so interested with the results. Taking these points into consideration it will be found that the records of the summer work afford the most reliable results. According to these, and using the 1,200 compound consolidation class as a basis, it has been found that the saving effected by the 1,600 class with 375 sq. ft. of superheating surface, varied from 15 to 24 per cent., according to the division on which the engine was run and the amount of work done. On one division, between White River and Schneiber, the consumption on the engine with the superheater was 1 per cent. more than on the compound. The other two classes, namely, the 1,300 class, which was a 10-wheeled compound, and the 1,621 class, a consolidation simple, gave results between the other two.

Assuming these comparisons to be accurate, the superheater locomotive has evidently shown itself to be rather more economical than the compound with the amount of superheat obtained, on the "Schmidt" and "Schenectady B" design, and from the good results obtained from the C. P. R. engines there is every reason to believe that still further economies will be reached. The results from these engines were entirely unexpected as the design was developed from a mechanical standpoint entirely, and they are not by any means easy to explain, except that they must be caused by the steam being heated to a higher temperature than in the "Schmidt" or "Schenectady" engines. Since this was not discovered until December it has been impossible to carry out proper temperature tests, on both types, but one made on one of the 740 class engines would indicate a higher superheat of 40 deg. In view of the superheating surface being identical, this can only be explained by the peculiar arrangement of the headers, which prevents any abstraction of heat from the steam, after it has been superheated, by the entering steam, by the tendency to a more equal flow of the steam through the various superheater pipes in passing from one header to another. In support of the first reason the poor results obtained from the "Schenectady" A type are of interest. With 340 sq. ft. of superheating surface against 375 in the "Schmidt" engine, the superheat was only about 20 deg. as against 100 deg. This would show that any reduction in the temperature of the superheated steam by transferring its heat to the entering saturated steam is not as might be expected compensated for, and that the degree of superheat finally obtained may be seriously diminished by such action. The reason for this is not very clear, but a key to it may be found in the following diagrams which have been worked out on the following data:

(a) Firebox temperature 2,000 deg., smoke-box temperature 800 deg., flue 16 ft. long (at point 1. from firebox) = 2,000 − 200 nl.

(b) Radiation from superheater tubes equal to that from blackened copper in vacuo = .0854 B.t.u. per min., per square foot per deg. F.

(c) Boiler with 88 superheater pipes 1¼ in. O. D. 12 ft. long using 20,000 lbs. steam per hour with 150 deg. superheat without abstraction of heat after superheating.

(d) Specific heat of superheated steam 0.6.

The full lines show the temperature of the superheated steam on its passage from the header through the tubes and back and the dotted lines the increment of temperature per ft. (Fig. 10) shows the form of these curves when the steam enters the tubes at boiler temperature, and Fig. 11 where its temperature has been raised 100 deg. by contact with the superheated steam, which in its turn is lowered 100 deg. by this action.

It will be seen that there is a loss of 50 deg. by the transfer of heat on account of the increased radiation from the superheater pipes to the boiler and the decreased transmission of heat from the flue gases to the superheater tubes.

These diagrams are not presented with the idea that they are quantatively accurate but to illustrate the actions which accounts for the loss when heat is transferred from the superheated to the saturated steam.

The results obtained from engine 820 in passenger service have been very encouraging as have also those from the Pacific type. A graphic record of a test made on No. 820 shows that the superheat obtained varies from 160 deg. to 200 deg. at the steam chest. This engine has been in service since last June on the Lake Superior division between Chalk River and North Bay, and the results for five months, June to October inclusive, compared to those obtained from two other identical engines on the same section were as follows:

	Tons. consumed.	Lbs. coal per gross ton-mile.	Relative consumption.
Engine No. 823	763	160.0	111.5
Engine No. 820	734	143.5	100.0
Engine No. 838	913	199.0	138.5

There is a difference in the runs in which these engines are employed, all making three stops, but engine 820 having 11 flag stops against two for the other engines, which would, of course, increase the relative consumption of 820 so that while unsatisfactory on account of these figures referring to one engine there is still but little doubt that the superheater is very satisfactory and economical in passenger service, and its relative economy does not decrease with increase of speed as is the case with compounds. The repair question is so far unimportant and nothing has developed to show that superheater engines will exceed appreciably simple engines when expenses that are fairly due to experimental construction are excluded. Lubrication on a superheater is identical with that in a simple, with the exception of the additional cylinder connection required, and what is wanted is simply to deliver the oil to the required spot.

In conclusion the writer sees no reason to change the opinion previously arrived at that the superheater steam locomotive attains equal or greater economy than the compound without any of its disadvantages, and would now add to this by stating that the employment of higher temperatures with the still further economy is relatively practical and to that on engines now under construction the proportions of superheating surface will be increased to attain this result. It is especially advantageous in passenger service and so far no counter balancing disadvantages have been developed which are worth considering. Whether this is due to special conditions on the Canadian Pacific Railway or not superheating is certainly successful on this road, and there is so far no inclination to discontinue it.

DISCUSSION.

It was prominently set forth early in the discussion that the simple locomotive is especially adapted to the use of superheated steam. It has been found that where the engine is complicated by multiple cylinders, condensers or other auxiliary apparatus the saving effected by the use of superheated steam is not as great as in the case of what may be called primitive engines. In fact, while the saving may well drop to 5 per cent. in the former it may rise to 30 per cent. in the latter class.

Yet, while the engine itself is well adapted to the use of superheated steam, it is difficult to design an apparatus to do the work on account of the form of boiler that is in universal use. The difficulties that may arise due to the elimination of a certain amount of the heating surface is of no account and may be disregarded. It is the space and form that gives the trouble.

In reality the steam generator should be a three-stage affair

and should consist of the boiler, the superheater and the economizer. The latter utilizes the waste gases at their lowest temperature to heat the water at its lowest. The superheater uses the hot furnace gases as they escape to add heat to the steam, and it is thus protected from the intense heat of the firebox. The boiler is constructed to withstand the high temperatures of the gases immediately after and during the process of combustion and thus convert the water into steam.

A superheater has the peculiarity that it is always economical, which may not be the case with other auxiliary apparatus; the condenser, for example. There are cases where a condenser not only may effect no saving but may even be the cause of an increased water consumption, but this is never the case with a superheater.

Another advantage of introducing the superheater lies in the fact that the pressure can be reduced on old boilers and the same amount of work obtained as before. In fact, where the superheater has been introduced there is a tendency to lower the boiler pressure. On some new engines for the Canadian Pacific the pressure will be 175 lbs. instead of 200 lbs. on similar engines. The cylinders will be slightly larger, and it is expected that the superheated steam will do as much work and more economically at this lower pressure than the higher pressure on the other engines. Should this expectation not be realized, the cylinders will be bushed and the pressure raised to 200 lbs., as the boilers will be strong enough to carry it.

An important matter to be borne in mind in the designing of a superheater is the means employed for the regulation of the gases, for it is upon this that the efficiency of the apparatus largely depends. Another point is the desirability of securing a uniform flow of steam through all parts of the superheater, and this, it is thought, is accomplished to a marked degree in the C. P. R. design; a fact that accounts to a great extent for its very satisfactory efficiency.

There was some criticism of the results given in the main paper in that the coal records were probably inaccurate, as they are upon most roads, and to this was added a criticism of the heating surfaces given, in that the flat areas of the receivers were omitted, which increased that of the C. P. R. type very materially, and did not greatly affect the others. The speaker, however, rather weakened his criticism of Mr. Vaughan's percentages in that he ended by giving the savings that had been effected on the Belgian roads. These engines using the superheater had saved 30 per cent. in water; 24 per cent. in coal, and hauled an increase of 6 per cent. in tonnage as compared with a four-cylinder compound of the same calculated tractive power. In Sweden, again, a simple engine with a superheater had saved 26.7 per cent. in coal as compared with another simple engine of the same design.

These results have been obtained only by a persistent trial, for five years ago the prospects of success with the superheater were most discouraging in Germany.

As for the amount of superheat, it was considered useless to raise the temperature beyond a point where cylinder condensation is prevented, and 200 deg. Fahr. will do this. With such an amount of superheat the pressure can be reduced from 30 to 50 lbs. This is a matter that should receive most careful attention, since there is no doubt that in the struggle for savings with the compound engine the pressures have been carried too high, and the result has been excessive boiler repairs.

While there is some doubt still as to the effect of compounding on engine repairs, there seems to be none that the introduction of a superheater does cut down boiler repairs, and so it was urged that this alone was reason enough for proceeding rapidly with the introduction of superheaters on locomotives, for they certainly add to the capacity.

It was urged that the value of the superheater depends largely upon the cost of coal, and that where this was expensive, the apparatus was good to use, but where fuel was very cheap it would not be worth while to make the application. The reply to this was that unless the price of coal was less than a dollar a ton the saving of 15 per cent. that could well be depended upon fully justified the extra expense.

One of the principle points to be considered in the superheater is its value to the fireman, who appreciates it most if it relieves him when he is called upon to work the hardest. It was, therefore, claimed by one speaker that inasmuch as fully 20 per cent. of the fuel used was burned when the engine was standing and the superheater of no use, that the real efficiency of the latter would not amount to more than 5 per cent.

On the Chicago, Rock Island & Pacific there are six locomotives with the Cole superheater, but the results obtained have not been altogether satisfactory. The Illinois coal that has been used contains quite an amount of iron, and this forms hard pieces on the ends of the tubes that clogs them and is very difficult to remove. This accumulation takes place so rapidly that it sometimes fills them on a single trip. For this reason the trial has not been altogether satisfactory, though, in spite of the trouble thus experienced, very fine results have been obtained, and with a coal that leaves no deposits the other troubles that have arisen can probably be cleared away in time.

In lubrication a number of experiments have been tried with a positive feed, the results of which have not been very satisfactory. This was partly due to the mechanism used and partly to a misunderstanding of what was required. As a consequence of the experience thus obtained, there has been a reversion to the sight feed lubricator and two connections, one to the cylinder and one to the steam chest, for it is essential that the oil should be delivered to the point where it is to be used. It is now proposed to use a five-section lubricator.

The figure of .60 for the specific heat of the steam was criticized as being higher than the generally accepted .48. The reason given for this choice was that the specific heat varies with the temperature rising from .48 to .75, and that .60 is a fair average between the two. When the cut-off is long the amount of superheat is low, and *vice versa*.

Finally, in the consideration of the various types of superheaters, it should be remembered that Herr Schmidt is not the pioneer in the introduction of the superheater, but of high superheat, an end that is not needed, as already shown. Neither is it desirable or necessary to resort to a special construction of engine, as advocated by Herr Garbe. This engineer suggests the use of cylinders of such dimensions that a uniform cut-off at one-third stroke can be obtained, and that the speed be regulated by the throttle. It is hardly necessary to call attention to the inadvisability of imposing such a condition on American locomotives. The over-cylindering would be such that they would spin themselves to pieces. It is far better to disregard any such suggestions as this and so design the engines that the proportions of cylinders and weights on the driving wheels are such that they will always keep their feet.

Electric Traction for Trunk Lines.

(Concluded from page 416.)

Voltage on Contact Line.

Engineers of the Allgemeine Electric Co., as well as those of the General Electric and Westinghouse companies, have expressed their opinion that 3,000 volts is not sufficiently high. Mr. Lamme is of the opinion that 10,000 volts may not be sufficient and that 15,000 may have to be adopted.

The idea of increasing the pressure in the contact line is justified with the single-phase systems, because with single phase current a pressure of 3,000 volts only permits taking from the contact line one-half the power which can be taken from two contact lines with three-phase current. Then, too, the single-phase system uses a transformer on the car which permits higher pressure without serious decrease of efficiency. Furthermore, the increase in contact line pressure will obviate the use of double transformation in comparatively short lines which will feed directly from the central station. The omission of transformer sub-stations has however disadvantages. It is impossible to choose the pressure at the power stations so that it will suit each particular case. Even if the pressure in the contact line is chosen at 10,000 to 15,000 volts there may be cases where the location of the powerhouse is determined by outside conditions (water power, etc.), which may make necessary higher pressure, say 30,000 or 40,000 volts.

Then, too, it would not appear permissible to have very long sections which cannot be switched out electrically, and in cases of very high contact line pressures this will make necessary separate transmission lines. It would therefore appear preferable to have the transformers between the transmission and contact line rather than on the locomotive in order to choose the pressure for the transmission line as will best suit the particular instance.

There are also other points which speak against having the transformer on the locomotive. First of all this would increase the weight of the locomotive, not only by the transformer's own weight but also by the difference in weight of the parts which have to carry the transformer. Second, the high tension winding of the transformer cannot as well be protected against vibration.

With 3,000-volt three-phase current two normal contact wires each of about 80 square millimeters cross section (two fifths of an inch in diameter), a contact device such as we use on the Valtellina line will collect from 1,500 to 1,800 h.p., which is quite sufficient for all European railroads. Should we care to double this pressure the capacity of the motors of our present locomotives would have to be decreased about 20 per cent. This difference in capacity is explained by the greater space reserved for insulation used with the higher pressure, which leaves less space for copper.

Altogether I see no reason for increasing the safe and well tried pressure of 3,000 volts which we have thus far been using for all of our European projects.

Power of Locomotives.

The data which I have collected in my trip has substantiated

my former opinion that with a given maximum pressure per axle and with a given number of axles a three-phase locomotive will have double the capacity of the present single-phase systems. The motor of the Hamburg-Altona type, which I have had occasion to see, due to the courtesy of the A. E. G., has a rated hourly output (75 deg. C. temperature rise with ventilation) of 115 h.p. at 600 revolutions per minute, and it weighs 2,350 kgs. (about 5,170 lbs.). Three of these motors, one reducing and regulating transformer which weighs 2,500 kgs. (about 5,500 lbs.). Our Canada motors, which can be used on three-phase as well as on continuous current have an hourly rating of 120 h.p., and one of these weighs 1,750 kgs. (about 3,850 lbs.). If the motor were built simply for three-phase current the weight would be 1,300 kgs. (about 2,860 lbs.), inasmuch as these motors do not need any transformers, but have a starting rheostat which per motor does not weigh over 200 to 300 kgs. (440 to 660 lbs.). It is evident that one horse-power capacity weighs, for three-phase, about 16½ kgs. (about 36.3 lbs.) (for motor and rheostat), and in the Hamburg single-phase about 27⅓ kgs. (about 60.5 lbs.) (for motor and transformer). I have taken the transformer as a specific regulating device, together with the motor, and in the other case the motor and rheostat. In all other parts of the equipment there is no special difference in weight.

Still more favorable for three-phase is the comparison if made with a view to determining what capacity could be had in three-phase motors with the weight of the Hamburg single-phase motor and transformer.

A motor which we designed for the London & Brighton Ry. (Canada) weighs 2,800 kgs. (about 6,150 lbs.), which corresponds to the weight of the Hamburg motor with its transformer weight, and this motor has a rated hourly capacity of 360 h.p., which is three times as much as the Hamburg motors.

Still more interesting and important is the comparison which can be made as regards weight and capacity between heavy locomotives of the two systems.

I have seen a Westinghouse single-phase locomotive weighing 62 American tons, having three axles equipped with three motors of 225 h.p. hourly rating each. The motors had a gear ratio of about 1 to 5. Each single motor weighs approximately 12,000 lbs., and the corresponding reducing and regulating transformer about 15,000 lbs., about 23 metric tons in all. The motor equipment of our new Italian locomotives for three speeds, including water rheostat and water, is about 26.5 metric tons, and has an hourly rating of 1,500 h.p. The three-phase equipment weighs therefore about 17.7 kg. per h.p. (about 38.9 lbs.), and the single-phase equipment 29.3 kgs. (about 64.5 lbs.), and it must be remarked that the motors for the three-phase locomotives work without any gear, while the motors for the single-phase locomotives have a very high gear reduction, so that the latter have about five times the number of revolutions at the same schedule speed as the three-phase motors. In addition to that, the output of 1,500 h.p. of the three-phase locomotives is obtained by the use of only one of the motors on each locomotive.

Had we built this three-phase locomotive for one single synchronous speed, the weight of the motor and rheostat would have been 14,800 kgs. (about 32,500 lbs.) for 1,500 h.p., or about one-third of the weight of the above mentioned single-phase locomotive. Both locomotives have about the same diameter of driving wheels. The additional weight of 6 tons over the three-phase locomotive (this locomotive weighs about 62 metric tons) is the result of two special pilot axles. The maximum drawbar pull of both locomotives is the same (25,000 lbs. for the single-phase locomotive, and 11,500 kgs. for the three-phase locomotive). This drawbar pull can be developed for the three-phase locomotives up to 25 km. (about 16 miles) per hour with the new locomotive of three different speeds, and up to 32 km. per hour (about 20 miles) per hour with the small locomotive for two different speeds. The single-phase locomotive has only 10 miles per hour, or about one-half the speed, when it develops this drawbar pull. The maximum speed corresponding to the maximum safe number of revolutions of the motors is about 30 miles per hour. The three-phase locomotives, however, can develop their full capacity at 64 km. (about 40 miles) per hour, or at a speed one-third higher than the single-phase locomotive.

My data with reference to the New York, New Haven & Hartford locomotive is not complete, but what I have is sufficient to compare a high-speed single-phase locomotive with a direct current locomotive or with our three-phase locomotive. The New York, New Haven & Hartford locomotive has four motors of 250 h.p. the three-phase locomotives work without gear transmission, while the motors for the single-phase equipment have a very high gear each, and each of these motors weighs about 11,000 lbs. If we take the corresponding transformer in about the same ratio to the total weight, as we found with the other single-phase locomotive, it will weigh about 22,000 lbs., and motor and transformer together about 78,000 lbs., or 35.5 metric tons, which corresponds to 35.5 kg. per h.p. or almost exactly double the weight of that of the motor and rheostat in our Italian locomotives. The single-phase motors of the A. E. G., as well as the Westinghouse company, represent a result of several years' study, and are to-day already in such a state of perfection that future improvements will hardly be able to offset the advantages of the three-phase locomotives.

Full Use of Weight and Adhesion.

This is one of the most important problems, and in order to obtain the maximum drawbar pull with a given weight of adhesion four main conditions have to be fulfilled. First, motors must give as constant a pull as possible; second, the drawbar pull must be regulated as slowly as possible, and the steps must be as numerous as possible; third, the distribution of the drawbar pull on the driving axles must be proportionate to the pressure on axles; fourth, the motors must be capable while standing still to develop the full torque for a certain time without injury.

Continuous current and polyphase induction motors have practically an almost constant torque. Single-phase commutator motors, however, have a torque varying between zero and the maximum, if no special devices are employed. In the latter case about 0.7 times the torque of continuous current or three-phase motors can be obtained.

The above mentioned single-phase locomotive of the Westinghouse company demonstrated that with 25 cycles per second it is sufficient to have a spring suspension for the motor in order to ameliorate this condition. As a matter of fact, I have been told by engineers of the Westinghouse company that this locomotive will surely give one-fifth of its adhesion weight as drawbar pull.

With direct connection motors it will be necessary to have either an elastic coupling between the motor and driving axle or an elastic suspension for the motor casing, which will allow an oscillation of the casing around the axle.

I have been informed that with the New York Central locomotives it was necessary to reduce the drawbar pull, which was originally stated at 20 per cent. of the adhesion weight to 15 per cent. Whether this was caused by the difference in pressure of the axles or by the difference in torque of the motors or by the few steps of the controller, I could not find out. In any case, the coupling rod and the water rheostat used on the Italian locomotives are an ideal solution.

A few words with reference to the fourth condition regarding our adhesion weight in cases where a heavy train is hauled on a heavy grade, that is when the locomotive works near the limit of its adhesion weight and where this locomotive must be stopped, as is the case on all of our European railroads going through mountainous countries where we have heavy gradients immediately in front of stations. It is necessary that the locomotive must give its full drawbar pull standing still for a certain time, inasmuch as the brakes cannot be opened before the locomotive has developed its entire pull.

A continuous current or a three-phase motor can give its full torque standing still, for some time without injury. Not so the single-phase motor, where the coil which is short circuited will have a heavy current. The temperature of this coil will soon rise so as to destroy it.

In the Westinghouse motor there are metallic resistances inverted between commutator and armature windings, and these resistances would be fused by the short circuiting current. An increase of the size of these resistances would increase the temperature capacity, and thus the time which the motor can be placed under torque while standing still could be increased also. But this is not a radical solution of the question, not any more than the incandescence of the brushes in the Eichberg motor, because even an increase from 10 to 30 seconds would not give any really satisfactory length of time.

Making Up Lost Time.

It has often been called a disadvantage of the three-phase system that it would not be able to make up delays. The possibility of making up time is not so much a question of the system but rather one of the schedule or time-table. The change of time which is necessary to make a given distance is given with each system, and it is a matter of adjustment in time-tables to decide what difference in time will be allowed between schedule time and the shortest possible time which will be reserved for making up delays.

With a continuous current system more than with the three-phase system, economy will be poorer if the schedule time is so adjusted as to leave too much of a reserve for deviation from the time-table. With the single-phase system a change of ratio of transformation will increase the speed and therefore reduce the minimum time, and the limit in this case is only given by the maximum speed which can safely be allowed for the motors; but it is not influenced by any regard to economy.

This is an advantage of the single-phase system over continuous current and three-phase systems, and may be important in cases where trains are despatched without fixed time-table, for instance in suburban rapid transit systems, in such cases especially during rush hours a delayed train will interfere with all trains following it, and it is therefore necessary to make up even small delays as much as possible. In such cases it is permissible to raise the aver-

age speed of all trains proportionately. This could only be done with continuous current and three-phase current if the entire system were projected for a higher average speed than the normal speed which, as stated above, would affect the economy. With single-phase current, however, a few additional taps on the transformer will give a reserve higher speed without badly influencing the economy at normal speed.

For trunk lines with comparatively long distances between stations this advantage of the single-phase system must not be overestimated, inasmuch as trunk lines have no such special demands for making up time under all circumstances. The present steam roads have a time-table very near the limit of the capacity of the steam locomotives, and there is only a comparatively small reserve time which can be made up. With the three-phase system, as we use it on the Valtelina line, it was easy to create a similar reserve without influencing the economy of the normal schedule runs. The special advantage of the three-phase system in this case was that this time reserve was always at the disposal of the engineer, inasmuch as three-phase motors are not in any way influenced in their speed by overloads, strong counter winds or extra heavy trains, while with steam locomotives and with continuous current locomotives similar overloads will usually occur at the same time as delays and therefore tend to decrease the speed and to augment the delay.

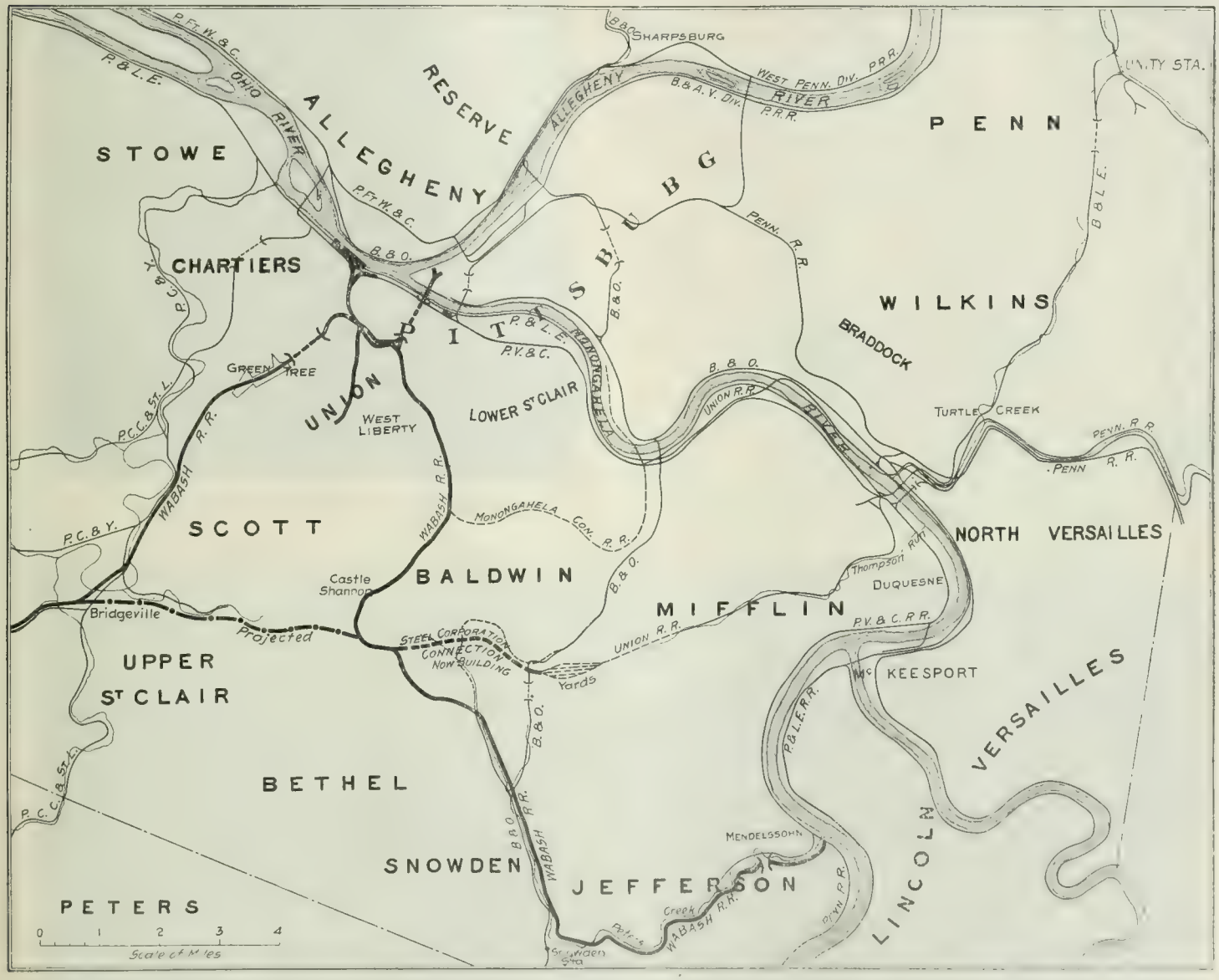
Energy Consumption.

It was my purpose to compile the data which I received during my trip, and I have therefore not given a complete criticism of the various systems. I mention, however, one of the most important points for comparison, which is the energy consumption. The scientific treatise of Mr. Frank Waterman, which he read before the Asheville convention of the American Institute of Electrical Engineers, makes detailed discussions by myself unnecessary at this time. Mr. Waterman based his paper on calculations and experiments made by him on the Valtellina line, and he proves that the three-phase system is the most economical of all known systems for the various traction problems.

Wabash Eastern Improvements.

WABASH-PITTSBURG TERMINAL.

The first efforts of the Wabash management in the Pittsburg district were taken up with the serious problem of effecting an entrance into the city. The accomplishment of this plan, after it was made feasible by the requisite legislation and permission of the Federal Government for the necessary bridge over the Monongahela river, has been followed by the development of facilities within the city of Pittsburg. Through the courtesy of Mr. B. A. Worthington, First Vice-President and General Manager of the Wabash Pittsburg Terminal and the Wheeling & Lake Erie, we are enabled to review the various improvements under way on these two lines.



Region About Pittsburg Showing Wabash Lines and Connection to Plants of United States Steel Corporation.

The accompanying maps show the general situation of the railroad lines about Pittsburg and the district in which the Wabash freight and passenger terminals are situated. The [illegible] include the passenger station and office building and the new freight station recently opened. The freight station, as will be seen, is a four-story building with the tracks on the top [illegible] transfers from the track level to the [illegible] by elevators. It is 145 ft. wide by 572 ft. long and [illegible] First avenue to Fourth avenue, lying between Reynolds alley and the passenger terminal. The [illegible] are of steel and concrete construction and enclose a total floor space of [illegible] sq. ft. A drawing showing a cross section at two points of the freight station is shown herewith. There are five [illegible] plunger elevators of extra large size and capacity, which [illegible]

rapid and convenient means of communication between different floors of the station. Of the four floors, the two intermediate ones are chiefly used for storage and as a means of communication with warerooms, 22 of which are now being built for the use of commission merchants and for other purposes, thereby avoiding storage and rehandling in the freight station. They face on Ferry street and Fourth avenue underneath the passenger terminal. On the ground floor of the freight station 40 extra large doors aid in quick handling of freight. The freight terminals are in the heart of the business section of Pittsburg, the main entrance facing Fourth and Liberty avenues, the latter of which is the principal teaming thoroughfare of the city. A great point of economy in the operation of the station will be the handling of freight from cars to trucks, running trucks on elevators, and lowering to wagons or into the warerooms. A power plant for electric light, steam heat and refrigeration is now being built. This is to supply the terminal office building, passenger station, freight station and warerooms. There will be two 50-ton refrigerating machines. The four tracks of the freight terminal will hold 10 cars each, and can be loaded simultaneously. There are also tracks for storage and shifting. In the passenger station there are seven tracks. Baggage and express matter is handled on the floor below the track level.

About a mile from the terminal station and within the city of Pittsburg there was originally a small tunnel 400 ft. long known as the Bigham tunnel. This has recently after about two months work been converted into a cut, material from the excavation being used for filling in additional ground at the two yards in the terminal territory—the West Liberty yard and the Rook yard. The West Liberty yard is used entirely for weighing and classifying coal by gravity tracks. The Rook yard is a much larger yard with repair shops, and is about four miles southwest of the terminal station. Further west, the numerous tunnels are being lined and a large wooden trestle approaching the cantilever bridge over the Ohio river at Mingo is being filled in. At Hickory, Smithfield and Young new stations are being built, and it is planned to build a new station also at Virginia, near the east bank of the Ohio river.

At the time when the Wabash was trying to get an entrance into Pittsburg an agreement was made with Mr. Andrew Carnegie by which the Wabash line was to be given one-quarter of the in- and outbound tonnage of the Carnegie works. Soon after, the Carnegie Company was absorbed by the United States Steel Corporation and there was some doubt as to the legal responsibility of the larger corporation for carrying out this agreement. This, however, appears to have been settled satisfactorily, for the Wabash-Pittsburg Terminal is now building a four-mile line from the track of the West Side Belt Railway, a controlled local switching road, at a point one mile east of Castle Shannon to the head waters of Thomp-



Wabash Passenger Station at Pittsburg.

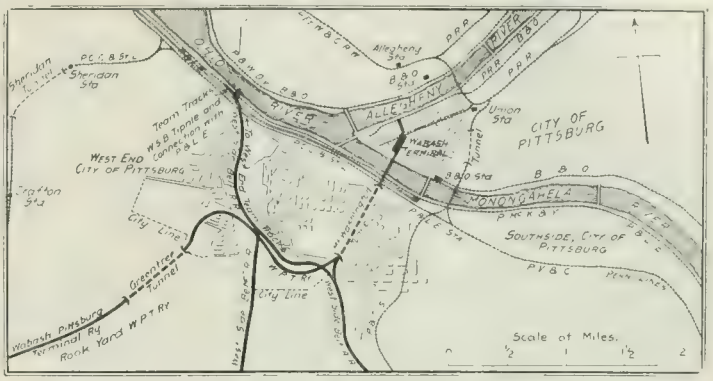


Wabash Freight Terminal at Pittsburg; Looking North Toward Passenger Station.

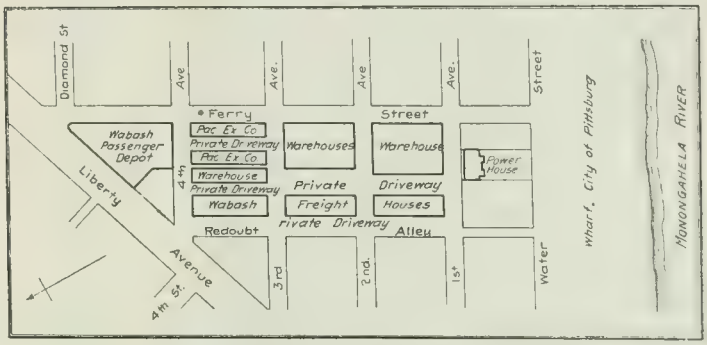
son's Run, where a 2,000-car yard is being built at the junction of this new line with the Monongahela Southern Railroad, a subsidiary company of the United States Steel Corporation. The Monongahela Southern is seven miles long and extends to a connection on the Monongahela river at Duquesne with the Union Railroad of the United States Steel Corporation. The railroad map of the Pittsburg territory published herewith shows this new Wabash connecting line. Completion of the four-mile gap will make a connection between the Wabash line and the principal plants of the United States Steel Corporation. Large yard facilities are being provided in contemplation of the great volume of business to be received from the Steel Corporation. The Homestead, Bessemer and Braddock mills of the Steel Corporation, the works of the Westinghouse Electric & Manufacturing Company and the Westinghouse Air-Brake Company will be reached. The Steel Corporation's mills at McKeesport are also to be brought into connection by build-



Wabash Freight Terminal at Pittsburg; Looking South Toward the Monongahela River.



Map of Terminals in Pittsburg—Wabash-Pittsburg Terminal and West Side Belt.



Vicinity of Wabash Terminal in Pittsburg.



Wabash Freight Terminal at Pittsburg Looking South Toward Monongahela River.

ing a short connection [illegible]. The following statement shows the large amount of traffic of [illegible] plants during the year 1905:

	Gross tonnage	
	Outbound	Inbound
[illegible]	2,[illegible],000	5,[illegible],000
[illegible]	1,000,000	4,000,000
[illegible]	1,000,000	4,000,000
[illegible] & Wire Co.	135,000	870,000
[illegible] & Tin Plate Co.	25,000	50,000
[illegible]	50,000	100,000
National Tube Co. McKeesport	125,000	1,900,000

The new connection is expected to be in operation not later than the middle of May. Its completion and the beginning of shipments by the various plants is expected not only to give a large volume of traffic to the local lines of the Wabash system, but to increase the general traffic of the whole road.

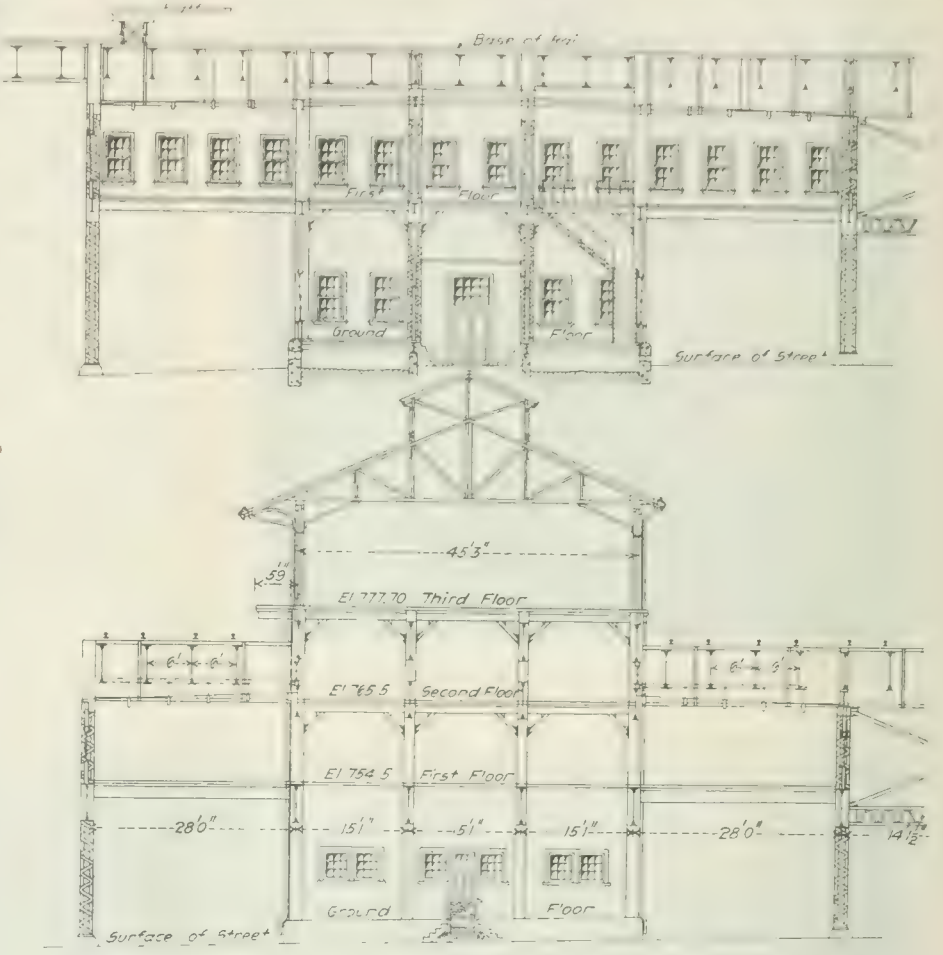
Another connection is being built; this one at Clairton, between the West Side Belt and the St. Clair Terminal Railroad of the United States Steel Corporation. This will make it possible for business from the great Clairton plant to be handled to and over the Wabash lines. The Clairton steel plant is scarcely more than in its construction state, but the tonnage was 375,000 tons outbound and 1,500,000 tons inbound during 1905. The Steel Corporation has made large purchases of land in the vicinity and proposes to enlarge the Clairton plant so that it may be brought up to about the size of the largest plant, that at Homestead.

WHEELING & LAKE ERIE.

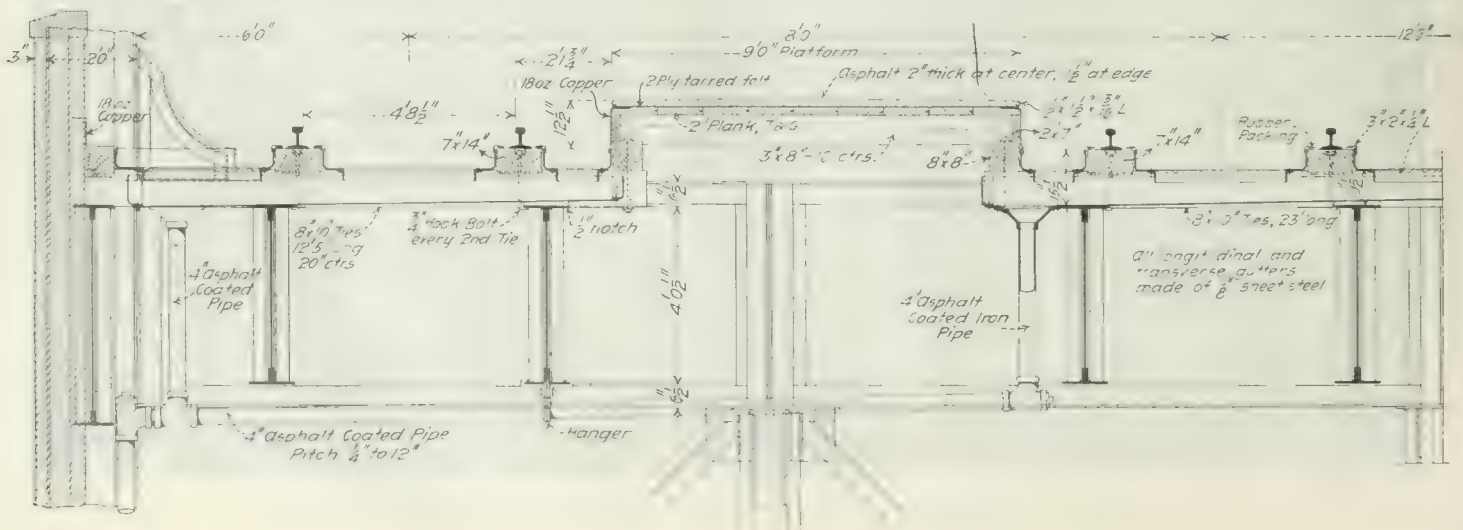
At Jewett, Ohio, the Wabash-Pittsburg Terminal connects with the Wheeling & Lake Erie, the Wabash connection between Toledo and Pittsburg. Between Jewett and Toledo, 185 miles, all 56-lb., 60-lb. and 70-lb. rail is being replaced with standard 90-lb. section, and it is expected to have the whole line relaid with 90-lb. rail by the end of 1906. The lighter rail taken up is used in yard extensions and the 70-lb. rail on the Wheeling and Mingo division, where it replaces 56-lb. rail. Rails for about 40 miles of track are now distributed and are being placed in the Toledo division main track. Ten thousand tons additional 90-lb. rail will be received shortly. A great deal of gravel ballasting is to be done during the present season. Steam shovels have been put at work in the Stringer gravel bank on the Ohio river, the Warrington gravel pit at Warrington, at Coshocton on the Cleveland & Zanesville division, and at Belleville on the Toledo division. At the same time tracks are being relined and all curves relaid with transition ends. Much attention is being paid to increasing the capacity of the Toledo division. Twenty new 80-car passing sidings are being laid and 20 other sidings are being extended so as to hold 80 cars. When these are all built there will be passing sidings at an average interval of about four miles. Many of these are built as "lap" sidings, with the purpose of eventually using them in the double tracking of the road.

The capacity of the Homestead yard, near Toledo, has been increased by about 500 cars during the past year. It is now proposed to build a large yard at South Huron, Ohio, and to increase the track facilities at North Huron in order to take care of the improvements now under way there. The South Huron yard is to be a gravity and classification yard of 1,000 cars capacity. These yard developments will make it necessary to change the position of the main line for about one mile to the eastern boundary of the company's property along the public highway.

At North Huron, Ohio, there is to be installed a more powerful engine to operate the present efficient car-dumper; all the existing ore conveyors are to be rebuilt and reinforced, so that two-ton clam-shell buckets can be used; the track arrangement is to be remodeled; an additional slip 1,400 ft. long, with 20 ft. draft of water and 200 ft. wide, is to be dug; there are to be installed four additional five-ton Wellman-Seaver-Morgan ore conveyors and an additional McMyler car-dumper, all to be provided with suitable track facilities; a 400-ft. ore conveyor bridge to the ore stock pile is to be built, the capacity of which will be about 1,500,000 tons; a complete rope haulage system for handling cars to the ore conveyors and stock piles is to be put in; the streets and other highways are to be changed from their present locations to the southern limits of the yards, and the principal street at the south end of these tracks



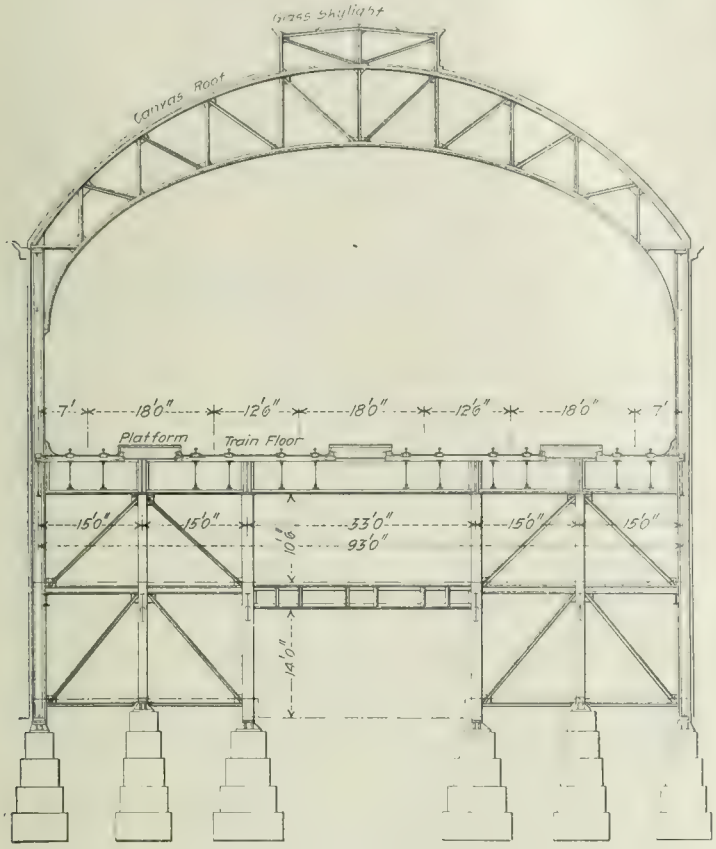
Cross Sections Looking North from First Avenue; Wabash Freight Terminal.



Details of Floor; Wabash Passenger Terminal.

is to be built parallel to the Lake Shore & Michigan Southern tracks across the Huron river and into the town of Huron.

At Cleveland a new lift bridge over the Cuyahoga river has lately been finished and plans are being developed for greatly improving all bridges and track facilities in that city, to accommodate much larger business. Contract has been let for a McMyler car-dumper, which is now under construction. It will be necessary to rebuild about 900 ft. of dock at this location to conform to a change in line of the Cuyahoga river, recently made by the city of Cleveland, and also to build new tracks and increase yard capacity. The city of Cleveland, in conjunction with the Wheeling & Lake Erie, is to do away with another grade crossing at Jefferson street and rebuild several small bridges at other points in this city to accommodate the heavy rolling stock now operated on this division.



General Transverse Section of Wabash Passenger Terminal.

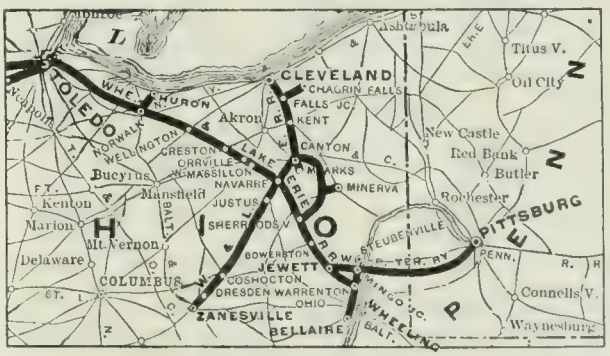
There is also in contemplation the building of a large yard at the summit of the grade four miles south of Cleveland, but final plans have not yet been settled. The yard at Kent, on the Cleveland & Zanesville division, has been doubled in capacity and now holds about 400 cars. A new wye has also been built at this point.

Several grade reductions will be made on the main line of the Wheeling & Lake Erie during the present year, with the purpose of ultimately cutting out all grades on the Pittsburg and Toledo division that exceed four-tenths of 1 per cent. compensated. New freight stations are being designed for Zanesville, Fremont and Dillonvale, and a plan is now under consideration for establishing docking facilities on the Maumee river in the city of Toledo.

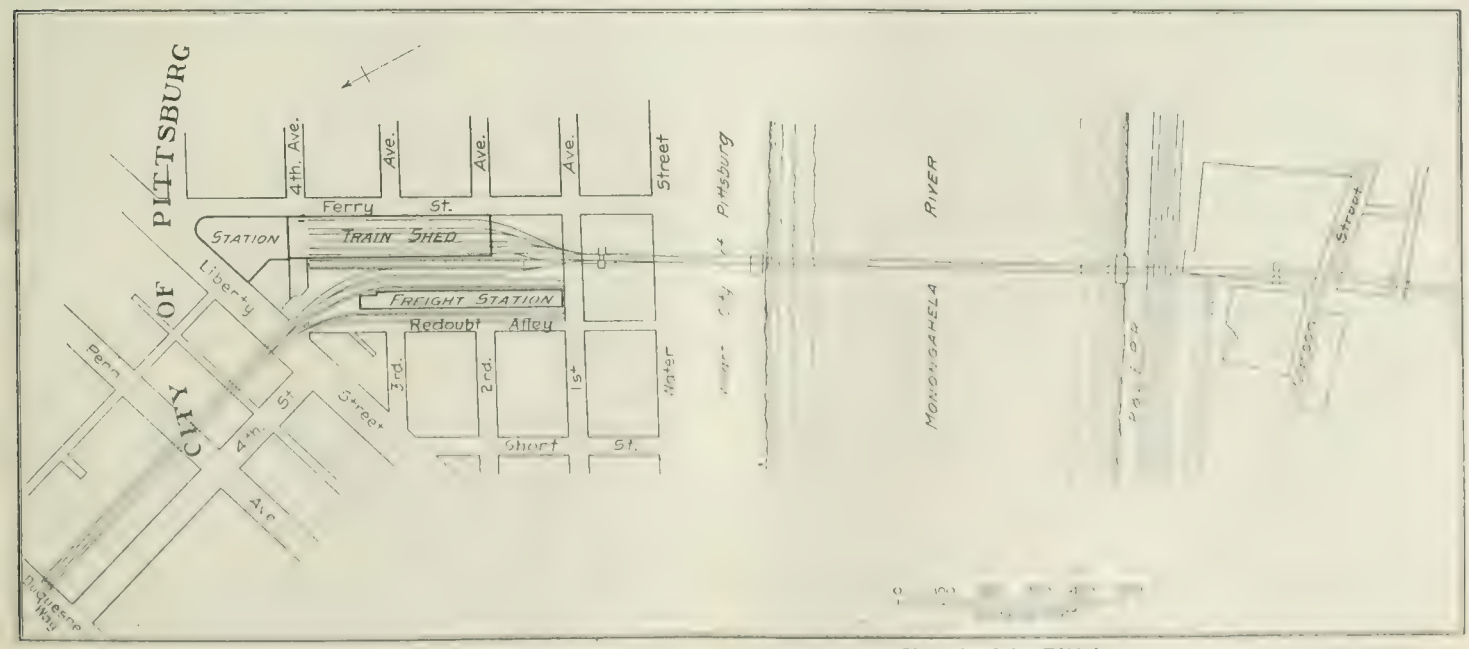


Map of the Point District, Pittsburg.

The construction of the Orrville-Bolivar cut-off, known as the Sugar Creek & Northern Railroad, is now under contract. It is to be 22 miles long and will do away with excessive curvature, save six miles in distance and reduce the maximum grade from 1 per cent. uncompensated to four-tenths of 1 per cent. compensated, with 3-deg. maximum curvature. This will make it possible for heavy consolidation engines to haul the maximum train load single-header. Ninety-pound steel rails on white oak cross ties with 12 in. of ballast and steel and stone bridges are to be used, and all through freight trains operated over this cut-off. The new line leaves the present line of the Wheeling & Lake Erie at Bolivar, Ohio, crosses the Zanesville division at Justus and again meets the main line at Orrville. At Justus, the Zanesville division junction point, much ground



Wheeling & Lake Erie.



Plan Showing Situation at Track Level; Wabash Terminal in Pittsburg.

has been acquired, on which a 2,000 car yard is ultimately to be built, with modern roundhouse and shops. The new cut-off is expected to be finished by November 1st, with sufficient yard and shop facilities to meet present requirements.

At Columbia, Ohio, near the junction of the main line and the Cleveland and Zanesville division, the Wheeling & Lake Erie's principal yard is located. Here trains are made up for both the Cleveland and Toledo divisions. The capacity of this yard has been increased during the past year by 200 cars, and to the full limit of possible development. It now covers all the area between the tracks of the Cleveland, Lorain & Wheeling (B. & O.) and the river.

At Canton shop facilities have been increased and modern machinery and appliances installed.

At Terminal Junction, near Wheeling, W. Va., a 200-car yard is now being built and general facilities are being bettered to meet increased business.

The estimated cost of the improvements made and under way on the Wabash-Pittsburg Terminal, West Side Belt and Wheeling & Lake Erie, as furnished us by Mr. Worthington, is shown in the following table:

Passenger station, Pittsburg	$1,500,000.00
Freight terminal, Pittsburg	450,000.00
Warehouses	300,000.00
Power Plant	100,000.00
Bigham Tunnel cut	30,000.00
Rook Yard	18,000.00
West Liberty Yard	18,000.00
Ballasting	530,000.00
Homestead Yard	100,000.00
North Huron Docks	800,000.00
South Huron Yard	150,000.00
Cleveland Docks	85,000.00
Yard near Cleveland	60,000.00
Zanesville freight station	15,000.00
Fremont freight station	4,000.00
Dillonvale freight station	4,000.00
Orville-Bolivar Cut-off	820,000.00
Columbia Yard	25,000.00
Canton Shops increased facilities	75,000.00
Terminal Junction Shops	10,000.00
Union R. R. connection	186,500.00
Justus Shops	600,000.00
Norwalk Roundhouse	25,000.0
New passing sidings on W. & L. E.	150,000.00
Total	$6,055,000.00

Injuries to Employees Caused by Their Own Carelessness.*

Lastly, I shall call your attention to a few of the accidents in which employees are injured by their own carelessness, thoughtlessness or recklessness, and frequently it is the latter. If we could eliminate them and one-half of those caused by the carelessness of other employees much of the unfavorable criticism of railroads would cease, as the cause would no longer exist.

We will take up some of the most common accidents of this class, caused by coupling cars, getting on or off, or falling from, trains or engines, moving or standing. The following cases will serve to illustrate how frequently unnecessary chances are taken and the result.

Can anyone imagine a reason why a man of common sense who is old enough to be out of school should stand on a footboard and when the couplers are almost together put his hand in between them to pull them over or try to kick them over with his foot; walk backwards between the rails fixing a Jenney to get ready to couple, instead of stopping the car or engine and getting the coupler in position; why they should stand in the middle of the track and wait for an approaching engine or car to reach them and then step onto the footboard or brake-beam, when they could just as well get on the side or other end, and do it with safety; why men jump on an engine pilot, which Rule 761 prohibits, or on a moving car to ride a few feet to a switch, when the same is going so fast as to make it dangerous, unless they want to show how expert they are; why they should get off moving cars or engines under the same circumstances; why a man should not get off a standing car or engine without getting hurt; undertake to climb from car to car when unnecessary; cross the track in front of moving cars or engines, when they are so close to them that to the uninitiated it looks like suicide; or cross between cars, when they could just as well climb over? But rather than take the time, which the company pays for, they take the chances, and then if they get across, like the man who drove over in front of the engine at the last highway crossing and waited on the other side to see the train go by, they wait until the tail end comes along and get on there, but if they get caught blame the engineman for coming too fast, or the company for not having the track nickel plated, or for having a hand hold in the wrong place.

Why they should allow themselves to be struck frequently in broad daylight by overhead obstructions, for which tell-tales are erected to warn them; by building close to the track, with the location of which they are familiar. Yet rather than work their gray matter a little, they get hurt. Why a man sent out to look after broken rails or defects in the track shouldn't watch for trains from both directions or take the trouble to ascertain before starting whether trains are on time. And yet you all know that just such chances are taken every day with results shown in the following cases, which are such as happen all the time; the only reason or excuse that can be given for them, that I can imagine, is, that the men injured never should have been employed; that instead of being employed on trains and engines and drawing—not earning—more pay than principals of schools, and frequently than school superintendents, they should be working in a barn or shoveling dirt instead of on a railroad, where their recklessness, carelessness, and failure to realize the dangers of the business and the necessity of complying with the rules and taking no unnecessary chances, not only endangers their own lives, but those of others. They are of the same class that the railroad organizations, for the protection of their desirable membership, ought to help get out of the service, not try to keep in until someone is seriously injured or killed, and then complain and say the company is liable because they keep such a grossly careless, incompetent man in the service; and if you will think for a minute, you will know that none of the careful, forehanded men—the men who own homes and have a little money in the bank—are in this class; I never saw one of them in my office on such business and never will.

I will first refer you to some cases caused in coupling cars, and by getting on and off cars, of which the following are fair samples, each of which not only could, but should have been avoided by the exercise of a little common sense by the injured person:

G. L. Penston, collector, injured at Wanley, May 10; went in to uncouple hose after getting train onto track; did not tell anyone he was going in between the cars; other cars were switched onto train and his head was caught between the cars.

Henry Kendrick, switchman, injured at Mertonville, March 13; was standing on front footboard of engine, which was about to couple onto a car; drawbar on engine was too far to one side to make the coupling and Kendrick attempted to kick it over with his foot, but missed it and his foot was caught and crushed.

M. T. Bowers, fireman, Fairmill, Jan. 6, was trying to jump from the running board of engine to footboard, when he fell and was injured.

L. B. Gorky, conductor, Panitoca, Aug. 14; was standing on top of car, gave engineer a stop signal, and when slack came back, fell off car.

P. F. Newton, conductor, injured Oct. 3, at Durham; got off head end of train, and tried to get on way-car as it came along, and was thrown to the ground and badly injured. Train was moving about 15 miles an hour.

Then comes the class of injuries caused by crossing between cars or in front of moving cars or engines, and those caused frequently in broad daylight by obstructions with the location of which employees are perfectly familiar, but fail to take any care to avoid, such as the following:

H. M. Tupper, switchman, injured at Murferton, March 21, ran ahead of moving car to throw switch; after throwing the switch he attempted to cross the track again ahead of the car, was struck and badly injured.

David Spurton, switchman, Olivia, Dec. 12; while hanging on side of car, was caught between car and viaduct, and severely injured.

L. Q. Laffin, switchman, Ruthervillle, Oct. 4; was sitting on top of car riding backward his head struck viaduct, and he was knocked off and injured.

Among other classes, altogether too frequent, as well as unnecessary, are those caused by leaving cars too near a switch to clear a man on a car on the next track; by going under cars to repair them, or under engines to clean the fires, without putting out a flag; by cutting steam hose without first knowing the steam is turned off.

Now why a man switching cars will not take the trouble to put them far enough in on the track to clear himself riding the next cut in on the adjacent track, or why a man will go under an engine or car to repair it or for any other purpose, without protecting himself from injury by putting out a flag as required by Rule 153, passes my understanding. Whenever you find the rule disregarded, report it, so that it will not happen with the same man in the future; why a man should undertake to cut the steam hose before he knows the steam has been turned off, the devil himself could not tell, and yet the following cases would seem to show that a man with a big stick is needed all over the system.

William Jacobson, switchman, injured at Delavia, May 19; he left caboose on side track too near the lead, and then rode some cars down the lead, and was struck by the caboose.

H. J. Calpine, car repairer, killed at Mestigo, June 3; was under car making repairs; did not put out flag or tell anyone that he was going under the car; the car was moved and he was killed.

J. P. Alton, switchman, injured at Wolton, July 13; cut hose between sleeper and coach and failed to turn steam shut-off cocks; was badly burned by steam.

The number of injuries to bridgemen, carpenters, freight house, dock, coal shed and track men is increasing every year.

And lastly I will refer to a few cases of injuries which cannot well be classified, so we will say from other causes. They are a miscellaneous lot, none of which ought to have happened, or indeed would have happened if the first rule of nature, self-preservation, had been observed. But I will give you several examples and you can then judge for yourselves:

A. F. Ford, barkeman, injured at Lenopa, Sept. 3; hanging on side of stock car instead of ladder, cow kicked him and broke his wrist.

B. L. Pomeroy, brakeman, fatally injured at Schuyler, Oct. 29; in attempting to oil a hot box while train was running, he fell under the wheels.

John Leveridge, fireman, injured at Worthington, May 8; passing through

*From a paper prepared by the Claim Department of the A., B. & C. Railroad, parts of which appeared in the *Railroad Gazette* of Dec. 15, Jan. 5, Feb. 23, and March 2.

town, waved hand at trainmen standing on side track, struck mail crane, and injured his arm.

Richard Manville, switchman, injured at Poulsville, June 17; stood on top of car giving signals and when slack ran out fell off of car; left leg broken.

K. T. Morrison, brakeman, Homerton, April 26, went back along the track, to flag his train, went to sleep on the track was struck and killed by another train.

And so I might go on for hours detailing to you the various accidents that have occurred from the carelessness of employees, but I believe you will agree with me in thinking I have enumerated enough of them to illustrate the point I wish to make; that is, the employee is too careless, thoughtless and negligent; and I hope also to satisfy you that the larger part of them could be avoided and that a united effort should and will be made by us all to prevent them in the future. It does not require any argument to demonstrate that the many accidents occurring every day, and the resulting injuries and destruction of property, ought to be reduced, and that, if the rules were complied with and proper care and supervision exercised in transacting the business of the company, their number and consequent money loss would be materially reduced; and it is up to you men to do your share to bring about this necessary result. A company that advertises that it has the best of everything—including men—that goes to make up a first-class railroad and that has spent not thousands but millions for safety devices and appliances, as the A. B. & C. has, ought to be able to make a better record; indeed, it ought to make the best record and I believe when you understand the matter we will be where we belong—at the head of the procession, not only so far as freedom from accident is concerned, but in everything else.

Blackstone, in his Commentaries on the Common Law of England, said that the great beauty of the common law was that under it "there was no wrong without a remedy," and so I say that there must be some remedy which, if properly applied, would prevent the happening of a large proportion of these casualties; and I suppose that the man who says there is a wrong or criticises results —and I believe I have demonstrated that there is something wrong —ought to be able to at least suggest some remedy which will sound plausible, even if it is not practicable.

In addition to the suggestions which I have made in discussing the different classes of accidents herein mentioned, there are several others which, in a general way, I submit to you and to the management of the company.

One of the most, if not the most, necessary things in securing good results and as few casualties as possible is to hire good, competent, careful and sober men to do the work, and when we have a bureau of employment properly conducted to secure the best men and a school in which to instruct them as to what the rules under which the road is operated are, what their duties are, and how to perform them, in conjunction with the physical examination of applicants for employment, we will have taken the most important step to do away with accidents and when we clear our roundhouses, repair yards, coal stations, gate houses and all other branches of the service connected with the transportation of persons and property of men with whom neither other employees nor the public can communicate because of their inability to understand or talk the English language, we will have taken the next one.

When labor organizations and employees generally do what they can to keep incompetent, careless men out of the service, not in it, and when they are discovered in some careless act, or cause some accident, and are discharged or suspended, instead of trying, through the influence and power of their organization, to have the discharge or suspension set aside, do all they can to sustain the order of suspension or discharge, we will not have the list of casualties staring us in the face that we do now, and the organizations will not have so many crippled members asking for assistance, and the proportion of employees killed and injured to the whole number won't be 21 and 81 per cent. respectively.

Read the newspapers, railroad as well as brotherhood, so that you will get some of the theory of the business to fit you for a better place. Familiarize yourself with the advertisements of the company, train schedules, maps, names of the officers and where they are located, so that you can answer questions of patrons and others. Treat everybody politely and decently, as by your conduct and manners the corporation and management will be judged. Take advantage of what others have learned by the greatest of all teachers —experience.

After getting good competent men we need good track and equipment and sufficient and intelligent inspection to see that not only the track and equipment are kept in good repair, but also that the men keep in good physical and mental condition.

A method of inspection and repair by which the man who inspects will be required to have some mechanical experience and will at least know by name the different parts of the car, engine or structure he is supposed to examine, who can talk and understand English and comprehend what the result will be if he fails to discover defects and have them remedied, and who will report, not to a foreman whose duty it is to repair the defect, but to a superior whose business it is to find them. This is the sort of inspection necessary to prevent injury and loss. And when we do this the record will be different from the one above shown.

Then we want good rules and instructions (the fewer and simpler the better) telling how the trains shall be run and the business of the company conducted, and if it is true, as has been said, that one of the worst evils from which our country is now suffering is the failure to enforce all the laws on the statute book, I am afraid the same saying will apply to the operation of railroads. Too many rules, orders and bulletins are disregarded by employees, and that disregard not discovered or overlooked until some accident occurs. If there are any rules that are impracticable they should be cancelled, but until they are their observance by officers and employees should be insisted upon. The quickest and best way to get a bad rule or law cancelled or repealed is to enforce it.

And if you do not owe it to yourselves, your families, your fellow employees, consider whether you do not owe it to a company which has always paid you well and regularly for what you have done for it, that is noted for giving every man a square deal.

And last but not least, we want sufficient and efficient supervision. Poor Richard, the philosopher, never said a truer thing than that "The eyes of the master will do more work than both his hands." And as the business of a railroad increases and grows more complicated every day, it requires more and better, and not less, supervision. If the number of employees and the tonnage of trains increase five fold, so should the supervision increase, in order that the business be conducted in accordance with the rules and that safe and economical operation be secured, and there should always be enough supervision to obtain this necessary result. The more independent the labor, the lower the class of labor, the more and better the supervision required.

After we get the men, the track, equipment, rules and supervision, we should see that all the employees know and understand the rules and their duties and how to perform them. Some day we will have a training school for this purpose, just as the Government has for its soldiers and sailors, and many municipalities for their police. But you should study and familiarize yourself with the time-table and rules, the same as you have done with your pay schedule—you all understand that. The rules were made by men who have come from the ranks, who know from actual experience what the failure to observe them means to our patrons, to yourselves, and the company, and if you don't understand them, have someone who does explain them to you until you know them by heart and exactly what they mean, and when you have done this, comply with them and things will go better; there will then be few accidents, suspensions and discharges.

Do the company's business the same as you would your own. If the time ever comes when you are unwilling to do this, quit. Think before you act, not afterwards, as then it will be too late. And remember that other lives, perhaps that of some one near and dear to you, may depend upon your acting and doing immediately, and not to-morrow, the right thing and in the prescribed way.

Make it your first duty to always look after your employer's interest, to protect the lives and property intrusted to your company, as well as the lives of those crossing over its tracks and those of your fellow employees, then will come to you not only the knowledge of duty performed, but promotion in position and increase in salary. That is why your president, general manager, and the whole push are where they are now, instead of working in the ranks.

Never go out without sufficient rest. Don't try to get in too many miles or hours for the pay there is in it, as you may get hurt or killed doing so, or injure someone else. Don't undertake to run an engine over a piece of track which you have never been over without a pilot. If called for such a run, don't be afraid to ask for a pilot, and then make the run with the greatest care.

When an order is given you in writing, or verbally, if you don't understand it, ascertain exactly what it means before you undertake to execute it, and if you understand what is wanted, but don't know how to do the thing, find out from someone who does before, not after, you have made a mistake, as it will take you less time to learn to do it right than it will to explain why you did it wrong, and by so doing you may prevent yourself or someone else getting hurt.

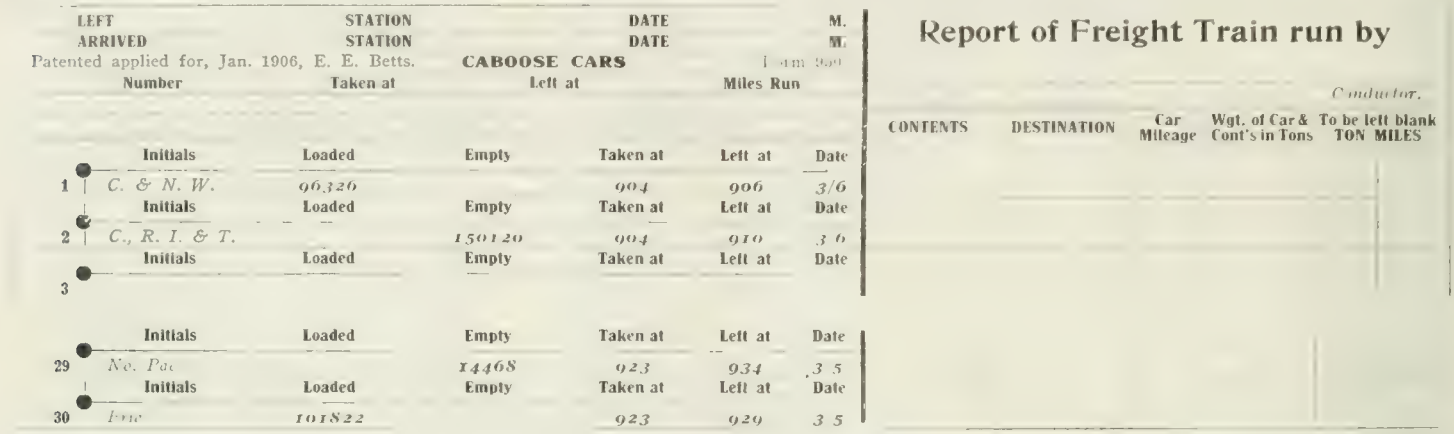
Someone said that "Few things cost less than encouragement and commendation and fewer still are worth more." So I say to you, division officers, remember that occasionally and see if it won't help to get good service, and when you have occasion to call a man down don't do it in public, as it only humiliates and makes him sore.

With additional care on your part and that of your fellow workers, together with more and better supervision, based on the theory that it is equally as important to see that rules and orders are observed as it is to issue them, that men are more important in the running of a railroad than things, the next time I visit you I will be the bearer of the good news that our accidents and consequent losses have been reduced one-half and that you men have done your share in bringing about that beneficent result.

The Betts Car Reporting System.

A new system to do away in making up accurate car records has recently been installed on the Chicago & North-Western Railway by E. E. Betts, Car Service Agent, whose invention it is and who has applied for a patent covering it. The Betts system is a further development of the process of car recording. The car transcribing system was described in detail in the *Railroad Gazette* of February 2nd as in use on a number of railroads, including the Chicago & North-Western. Under that system, conductor's, agent's and interchange reports, instead of being passed about among the record clerks, are transcribed by typewriters on a perforated stiff paper ribbon, on each tag of which are written the essential facts of one car movement. The tags are torn apart, sorted, and each sorting turned over to the proper record clerk. The book records are then made up directly from the transcribed tags. This system makes a great saving in time and efficiency, since it avoids the necessity of passing reports about from clerk to clerk, each of whom enters on his book only the numbers which belong to his assignment. Under Mr. Betts' new system, this advantage is retained and, at the same time, an additional saving of time and labor is brought about by doing away altogether with the transcribing process. As shown in the accompanying illustrations, the original forms for the reports are made up in such a way that one copy of each report can be cut up without transcribing as soon as it reaches the office of the Car Service Agent. By using the round perforation in the end of the record for each car, the records, after being separated, can be filed on a peg, just as under the transcribing system.

There are three kinds of report blanks in use on the Chicago & North Western. The freight conductors' wheel report, the daily interchange report of cars received, and the daily interchange report of cars delivered. The wheel report is printed on white paper the received interchange report on yellow paper and the delivered interchange report on pink paper. The forms are bound in books with a paper cover. They are, on the C. & N.-W., in sets of three, one narrow sheet, the original, and two wide sheets, with 50 sets or 150 individual sheets to the book. The original narrow blank of the conductor's train report is sent to the office of the Car Service Agent, who keeps a running record of the cars; the duplicate is forwarded to the Auditor of Car Accounts for statistical purposes, and the triplicate to the local Division Superintendent. The original, which goes to the Car Service Agent, does not include the latter half of the record left blank in the illustration of the conductor's report, the information given ending with the date column. The same is true with the original of each of the two interchange forms. The copy sent to the Car Service Agent is immediately cut up into separate slips, each covering one car movement. On the Chicago & North-Western the average day's work of from 50,000 to 75,000 records can be cut up in an hour and a half, and it is the exception to have a single record spoiled. After the reports are cut up into separate records, the records are sorted on spindles, each covering the series assigned to a record clerk, just as under the transcribing system, and the record clerks are thus able to devote all their time to effective work, instead of having to spend a great deal of it in searching out the particular cars which come under their particular books. Information as to car initials,



LEFT STATION DATE M.
ARRIVED STATION DATE M.
Patented applied for, Jan. 1906, E. E. Betts. CABOOSE CARS Form 950
Number Taken at Left at Miles Run

	Initials	Loaded	Empty	Taken at	Left at	Date
1	C. & N. W.	96320		904	906	3/6
2	C., R. I. & T.		150120	904	910	3 6
3						
29	No. Pac		14468	923	934	3 5
30	Erie	101822		923	929	3 5

Report of Freight Train run by

Conductor.

CONTENTS	DESTINATION	Car Mileage	Wgt. of Car & Cont's in Tons	To be left blank TON MILES

Chicago & North-Western Freight Conductor's Report Used Under Betts Car Reporting System. Filled in Portion Is Original Sheet Sent to Car Service Agent; Blank Portion Represents Additional Spaces on Duplicate and Triplicate. Round Perforation for Filing Shown on Original.

Report of Delay.

Report the exact time in hours and minutes your train is delayed. State where detention occurs and cause.

REMARKS.

INSTRUCTIONS.

In reporting cars which belong to this Company, you will please be careful to give the initials "C. & N. W." and not "N. W." or "C."

"C., St. P., M & O." cars should be reported as such and not "O."

Whenever Baggage, Mail or Passenger cars are taken in Freight Trains, a special report should be made on Blank, Form 957. Original to be sent to Car Service Agent, Chicago, duplicate to be sent to Division Master Mechanic.

In addition to reporting Passenger Equipment cars on Form 957 you will also report them on this blank, Form 950.

Be careful to write the Initials and Numbers plain, and be sure to report them correctly. When cars are set out of trains on account of being disabled or heavy train, report the same.

The weight of loaded cars and contents must be reported in Tons. If the car weighs 20,000 lbs., and contains 22,450 lbs. of freight, it should be reported as 21 Tons, because it weighs nearer 21 Tons than 22 Tons. If the car weighs 22,000 lbs. and contains 41,620 lbs. of freight, it should be reported as 32 Tons, because it weighs nearer 32 Tons than 31 Tons. The stenciled weight of empty cars must be reported in like manner. For instance, a car is stenciled as weighing 22,600 lbs., it should be reported as weighing 11 Tons; if 23,500 lbs., it should be reported as weighing 12 Tons.

ACCIDENTS.

When accidents occur, causing cars to get off the track, give initials, number and contents of all cars off, also give numbers of such cars left at the wreck. If the contents of any cars are transferred, give the initials and numbers of such cars.

TO WHOM THIS REPORT SHOULD BE SENT.

Original or narrow sheet to be folded *once only* and sent to Car Service Agent. Duplicate to Auditor Car Accounts. Triplicate to your Superintendent. Report to be made at end of each run without fail.

W. E. MORSE,
General Superintendent.

950

Chicago & North-Western Railway Co.

MADISON DIVISION.

FREIGHT CONDUCTOR'S REPORT.

Train No. ..... GOING.....
Left..... Station at.....M.
....190...
(Name of month must be written.)
Arrived at..... at.....M.
.....190...
(Name of month must be written.)
..... Conductor.
..... Brakeman.
..... Brakeman.

CABOOSE CARS.

Caboose No.	Taken at	Left at	No. Miles Run

Report ALL Caboose Cars in train in above spaces extra Caboose Cars, as well as the Regular Caboose.

ENGINES.

Engine No.	Taken at	Left at	Mileage	Engineer	Tons Coal Used

Report ALL Engines used en route, Helpers or Pushers, as well as the regular engine, and show where each is taken and left, and mileage made by each.

Reverse Side of Freight Conductor's Report Used Under Betts Car Reporting System—Chicago & North-Western.

Form 286.

CHICAGO & NORTH-WESTERN RAILWAY CO.

DAILY INTERCHANGE REPORT OF CARS

Delivered to _____ R. R.

at Station _____ Date _____ 190 .

FROM _____ M. TO _____ M.

Patent applied for. E. E. Betts. This sheet to be sent to Car Service Agent, Chicago.

I certify that these Cars were delivered,

_____ Agent

_____ R. R.

Agent C. & N.-W. Ry.

	CAR NUMBER					BILLED FROM	BILLED TO	
	INITIALS	LOADED	EMPTY	Del'd by C. & N.W. Ry. to	AT STATION	DATE	Original Point of Shipment	Final Destination	CONTENTS
1				R.R.					
2				R.R.					
3				R.R.					
28				R.R.					
29				R.R.					
30				R.R.					

Delivered Interchange Report, Betts System; Chicago & North-Western. Original and Latter Half of Duplicate and Triplicate.

car number, where taken, where left, whether loaded or empty, and the date, is here recorded. Records of foreign cars can be sorted into accounts or books, and all local cars into ending numbers, books or any combination of methods which is desirable. The rest of the information as to contents, destination, car mileage, etc., is included only in the reports which go to the Auditor and Superintendent.

The interchange reports are printed in similar form, showing initials, number, loaded or empty, name of railroad received from or delivered to, date, and on the duplicate and triplicate, original point of shipment, final destination and contents. An innovation in the delivered interchange report is that each of the individual records contains complete information showing the delivering line and to whom delivered, thus making it possible to send out these records, after they have been used for record purposes, instead of junction cards, a feature which means a saving of one or more clerks in the average large office. All that is necessary is for the reporting line to put the separate slips covering cars of one road after they have been passed through the records of the home office, in an envelope and mail them to the line which owns the cars. To the roads also which transcribe junction cards received, there is a saving of time, as slips received from a road using the Betts system may at once be sorted without the necessity for transcription.

There is also in use, in addition to these three reports, a report to be furnished by stations and yards within large switching terminals, where cars are handled from yard to yard or station to station within switching limits, and no regular train reports made out, as on road trains. This is arranged on the same principle as the other three records.

The additional work required from conductors and agents under the new system is small. At first it takes a short time for men to get accustomed to any new system, but after they get used to it, the new forms work as smoothly as the old. Particularly because there is more space on the new form, a great many conductors on the Chicago & North-Western, where the Betts system has been in use less than three months, prefer it to the old form. The latter half of the form, including the information in regard to contents, destination, car milage and weight, can be dittoed, as under the old form.

The advantages claimed for the Betts system are, first and most important, accuracy. All errors in transcribing (and errors are sure to be made) are eliminated, since the record which comes to the clerks is in the conductor's or agent's original handwriting. It is easy to see that this makes for accuracy, for it is an axiom that the fewer handlings, the fewer errors. With this system one handling is saved. Next in importance, the Betts system saves time. From actual use on the Chicago & North-Western it has been shown that car records are entered in the record books under the Betts system from 24 to 48 hours earlier than with the use of the transcribing system. This means all the more when it is taken into account that the transcribing system was a gain of considerable time over the previous system, or lack of system, without it. Cutting the records can be done by a boy, separating 2,000 records to the stroke, and the cost of cutting records is about 1¼ cents per 1,000. The advantages of any saving in time in car recording are obvious, particularly in view of the fact that the shipping public is coming to appreciate more and more the desirability of being able to get

Form 286A.

CHICAGO & NORTH-WESTERN RAILWAY CO.

DAILY INTERCHANGE REPORT OF CARS

Received from _____ R. R.

at Station _____ Date _____ 190

FROM _____ M. TO _____ M.

Patent applied for. E. E. Betts. This sheet to be sent to Car Service Agent, Chicago.

I certify that these Cars were delivered,

_____ Agent

_____ R. R.

Agent C. & N.-W. Ry.

	CAR NUMBER					BILLED FROM	BILLED TO	
	INITIALS	LOADED	EMPTY	RECEIVED FROM R. R.	AT STATION	DATE	Original Point of Shipment	Final Destination	CONTENTS
1									
2									
3									
28									
29									
30									

Received Interchange Report, Betts System; Chicago & North-Western. Original and Latter Half of Duplicate and Triplicate.

prompt information about shipments. The third advantage of the Betts sytem is economy. With its use the entire cost of transcribing records is saved on railroads which now have the transcribing system and on railroads where transcribing is not being done, the new system makes possible an increase in the assignment of work to record clerks of approximately 50 per cent. This, as already explained, is because the records are assigned to each clerk, and no others, go directly to the cards, thus doing away with the skipping difficulty.

The best proof of the advantages of the Betts system is its success in actual operation. It was put in effect on the Chicago & North Western February 1st, when all machine transcription of records was discontinued. The new system is working with great success. As a practical result of its use there is obtained a better car record, a more current record and a more economical record. The total cost of transcribing in a large car record office amounts to perhaps 10 per cent. of the total pay-roll expense, and under the Betts system in addition to its other advantages there is a money saving to this extent in wages, stationery and typewriters.

Tie Treating on the Southern Pacific and the Santa Fe.*

Mr. Kruttschnitt. I think some stress should be laid on the fact that no one method of treatment can be prescribed that will suit all kinds of timber, different woods require entirely different treatments, as is evidenced by the fact that we are not able to adopt a standard treatment that will do for all of our lines; for instance, for the Wyoming mountain or lodgepole pine, and for the Louisiana and Texas yellow pines, we prescribe 90 days for air-seasoning and find that this reduces the time of treatment and is in every way beneficial, while on the Pacific Coast it is found that the Douglas fir, which we use to a great extent for tie timber, takes the treatment best without seasoning.

We doubt whether bolts, "S" irons, or other devices will be of any benefit to prevent ties that are badly checked from checking further. We think the specifications should be rigidly enforced, and would not attempt to treat badly shaken or checked ties.

All machine work to be done on timber should, without doubt, be done before treatment.

We have found it best at all of our works to apply a vacuum before admitting live steam. We think it promotes the seasoning of the timber by removal of the fermentable sap, the retention of which serves to promote decay.

We raise the steam pressure to 25 lbs., but prefer to specify the temperature above which the timber shall not be heated rather than the steam pressure.

We have found with Pacific Coast timbers that they are not injured if the (upper grade of) temperature be limited to 280 deg. Fahrenheit, and the eastern yellow pines are not injured if the temperature be limited to 250 deg. Fahrenheit.

We use a pressure of 125 lbs. to 145 lbs. per sq. in. for forcing the chloride into the ties.

We use only one-half the amount of dry chloride per cubic foot (our specifications call for ¼ lb.) that the Committee recommends, and we never allow the solution to go as high as 5 per cent. Our standard solution is 1.7 per cent., and we do not permit it to rise above 2.5 per cent. as a maximum.

While the heating of the solution is all right, we see no reason in burnettizing why the cylinders should be provided with steam coils. It is an added expense, and an added device to rust out and be corroded by the chloride of zinc.

Creosoting.—The amount of creosote per cubic foot of tie seems to us ample. While we do not use this treatment for ties, we have used it extensively for trestle timbers and bridge ties and have never had any trouble with timber impregnated with this amount of oil. We heat the oil rather higher than the Committee recommends before admission, using a temperature of from 170 to 180 deg. Fahrenheit.

The method of measuring the solution absorbed, by gage readings on the tank holding the stock supply of the solution, is fallacious, unless the coefficient of the measuring tank is obtained for correction. The apparent injection of both zinc chloride and creosote may be simply evidence of compression of bubbles of air, gas, etc., in the timber.

I quote clauses of our specifications bearing on this subject:

"At regular intervals of about 30 days during operation and whenever there is a change in the character of the timber to be treated, make a coefficient for the measuring tank as follows:

"When injecting, pump from the measuring tank into the retort the exact net number of inches theoretically required for the timber, without coefficient of any kind; let off pressure from bottom of retort through a pipe into and over top of measuring tank; note exact inches returned; subtract this from the theoretical number of inches. This gives the inches remaining in the retort. Then the ratio of 100 times the inches flowing back to the inches remaining gives the percentage to be added, in every case, to the theoretical inches required. Example:

60 in. required theoretically;

12 in. flowed back;

48 in. remaining; then $\frac{100 \times 12}{48} = 25$ per cent., the coefficient required

This coefficient is the addition to be made to the theoretical amount to be pumped from the measuring tank into the timber.

"This must be corrected at intervals not exceeding two days (preferably each day at noon) by taking stock of material used in a given interval and the amount of timber treated in the same interval. These pounds of preservative material divided by the cubic feet of timber treated should correspond to the amount of preservative per cubic foot desired."

In creosoting, the individualities of the timbers treated must be consulted. The method given in the proposed specifications is that long in use in the east, but it is absolutely inapplicable to Douglas fir.

With Douglas fir, our standard method of treatment is to run the trucks into the cylinder, close the door, fill with creosote (120 deg. to 140 deg. Fahrenheit), open up the vents and allow the vapors to pass out under atmospheric pressure through the condenser, which is only for use in measuring the rate of vaporization and recovering a certain amount of light oil which is carried over mechanically during the process. When the timber is properly dried, fill the tanks with creosote, close the vents, and put on pressure, injecting oil from the measuring tank.

At our works in Texas we use the method outlined by the Committee, heating the oil up to 170 or 180 deg. Fahrenheit before admission.

A standard analysis for the oil is much to be desired, but we do not know that there is one.

Mr. Faulkner.—In regard to the proposed specifications governing method of piling ties before treatment, as also the several different forms of the treatment itself—it seems to me the Committee is undertaking quite a task in attempting to frame specific rules governing these matters in such a wide territory as that covered by the Association, and they probably will not be followed excepting where they agree with local conditions or practice.

Take the question of piling ties to start with; we have given some attention to this matter, and for that reason fully realize its importance, but find that for the climate and woods of eastern Texas, where the rainfall is heavy, and at certain seasons of the year the atmosphere very warm and humid, the form most suitable there is not suited to the climate and woods of the Rocky Mountain region. In east Texas our ties are hauled to the right-of-way, inspected and brought into the Somerville storage yard as quickly as possible after making, and there piled on the 1 x 8 plan, so as to give the best opportunity for quickly drying out and for the rain to fall off. We tried the same plan in New Mexico, but found the hot sun and dry air seasoned the outside of the ties so fast that they checked badly, so we make piles 7 x 7, with the outside ones on edge where the shape will permit, just as suggested. In the case of cypress ties, we pile them as solid and close as possible in order to hold the water or sap in the wood. As to the time of drying; this, too, depends somewhat on local conditions. In Arizona a certain lot of ties cut in June lost 33.1 per cent. of their weight in the first 30 days and in the next 90 the total additional loss in weight was only 1.6 per cent. Ties cut in December were held six months before the loss in weight equaled 30 days in the other case, and until the warm spring days, practically no decrease in weight occurred after the first month.

If we expect the best results out of treated inferior woods, we must give them a fair show, and this is not done in putting them in the track just as soon as they are received after treatment, when they have probably 70 or more pounds of water in each tie; and when some of this water will squirt out as the spike is driven. What can one expect from a soft pine tie under such conditions, but rail-cutting, loose and damaged spikes and unsatisfactory service? A year ago one of the leading roads in the west noticed their treated ties were corroding spikes. After full investigation I reported that, in my opinion, where the ties were allowed to properly dry out before insertion, the damage from corrosion was scarcely noticeable, but where the contrary was the case, then some corrosion took place; but, even then, nothing like so serious as to give concern. Now that so many roads are using Burnettized or Wellhouse ties, special attention should be called to the necessity of seasoning after treatment, even if more ties are ordered to admit of this, as I believe it would pay good interest on the investment.

Now as to treatments; as the Committee knows, we are adopting the Rueping process at Somerville, while continuing Burnettizing in New Mexico and Arizona. We use half a pound of dry zinc-chloride to the cubic foot; the Southern Pacific uses a quarter of a pound; the Union Pacific four-tenths; the Great Northern, I believe, something over a pound. I hardly think these roads will

*Being discussion from Mr. James Kruttschnitt, of the Union Pacific and Southern Pacific, and Mr. E. O. Faulkner, of the Atchison, Topeka & Santa Fe, published by the American Railway Engineering & Maintenance of Way Association, in connection with the report on ties, presented to the Chicago meeting March, 1906. The report of this meeting was published in the *Railroad Gazette* of March 30, page 332.

change their methods simply because the Committee says half a pound is the correct quantity. If the Committee is going into this subject, I would suggest that it be in the nature of a recommendation rather than as an absolute proposition. Twenty pounds steam pressure is provided for. Where cylinders are well jacketed, this may be sufficient, but where they are not, I think allowance should be made for outside temperature. From one to five hours' steaming is laid down, depending upon the character of the timber and its conditions; would this be sufficient in the case of Oregon fir? I do not know, and have asked the Government officials if they have any tests on Pacific Coast timbers, but they say not. The period covers the time of our steaming, as we pile the timber long enough for good seasoning beforehand; but there are portions of the year where 90 days does not accomplish much. The Committee also stipulates that the solution should be heated to 140 deg.; is there any special significance in this temperature, or is it simply such as might be expected to accomplish results? It is possible in some of the oldest plants there are no heating coils in the cylinders, neither thermometer flanges, nor sap drums, and I believe the Committee should recommend that in new plants hereafter put up these appliances should be provided.

Creosoting Treatments.—One hundred pounds pressure is required; this is seldom necessary in the case of loblolly pine with 10-lb. treatment, as the wood will take up almost that quantity under the vacuum; it would be better to say the pressure must be continuous and such as will give the desired absorption. I also think the timber should stay in the cylinder long enough after treatment to take care of the drip, and that the final gage reading should not be taken until after this has been forced back. I would not allow anything like 10 per cent. water in the oil before having steps taken to reduce it; I believe with proper appliances it is quite possible to keep it out, and for this purpose would require a sap drum under the cylinder to take care of any water or condensation at the end of steaming and vacuum periods. I think the working temperature of 140 deg. is too low and that it should be at least 175. I saw a sample of oil sent in by a treating plant for analysis, which showed that it began to solidify at 153, it being fully liquid at 160; I know this is an extreme case, but I think 140 is too low. Again, in creosote, where the treatment is in weight pet cubic foot and the tank gage shows gallons, the weight of the oil per gallon is an important feature, especially as creosote expands, so that a gallon at a low temperature weighs more than it would at a higher temperature; sometimes more than half a pound difference, which, on a 10-lb. treatment, equals 5 per cent. In our commercial treatment we therefore require the temperature of the oil to be taken at time of forcing it into wood, and after forcing back; then strike an average of the two in case there is any appreciable difference.

Washington Correspondence.

Washington, April 24.—No progress whatever has been made with the railroad rate bill during the past week unless getting Senator La Follette's three-days' speech out of the way can be called progress. This speech, which was probably delivered chiefly with the view to its circulation in Wisconsin, has had no effect in the Senate and has attracted little attention in Washington. There has been some discussion among Senators of the review propositions that have been submitted, but the conservative leaders have been disposed to allow things to drift until after Senator Spooner's reply to Senator Bailey's speech on the power of Congress to deny to the courts the right to enjoin temporarily the enforcement of an order of the Commission. Senator Spooner's reply will probably be delivered to-morrow, and it is expected to be a complete answer to the speech of the Senator from Texas. When this speech has been delivered the principal arguments of the conservative Senators will all be before the Senate and the effort will then be made to get together on an amendment that will provide for broad review and will leave the courts free to suspend an order pending the review proceedings.

Many estimates as to how Senators will line up on this amendment have been made, but it is still too early to make any positive predictions. The only thing that can be said with reasonable certainty is that the Bailey proposition to deny to the courts the power of suspension will be defeated by a very substantial majority, and that the review amendment that will be framed by the conservative leaders will be adopted. There are various estimates as to the majority that this amendment will have, but many Senators are still in the doubtful list, and while there seems to be ground for the belief that there will be a majority for the amendment it will take the votes of these doubtful Senators to settle the question whether it shall be a small majority or a large one.

There are some Senators who profess to believe that the difficulty of securing a majority of the Senate in favor of any important amendment will be so great that the Hepburn bill will finally be passed in substantially the form in which it reached the Senate from the House of Representatives. Such a result is extremely improbable, however, for the reason that many of the Senators on both sides of the chamber are convinced that the bill in its present form is unconstitutional, and that it would not stand a test in the United States Supreme Court. It is probable that a majority of the members of the Senate believe that, whether a review amendment is adopted or not, if the bill is to be made constitutional the provision conferring the rate-making power on the Commission must be amended so as to provide a specific rule or definite standard for rate making.

The advocates of amending the bill so as to provide for broad review and for the suspension of an order of the Interstate Commerce Commission pending review have had their arguments much strengthened during the past week by the presentation by Senator Lodge of a compilation showing that the members of the Interstate Commerce Commission, collectively, in their annual reports and in the bill prepared by them, and individually, as witnesses before the committees of Congress, have uniformly and unanimously advocated legislation that would give them the power to make rates subject to broad judicial review and to the right of the courts to suspend an order pending such review. The Commissioners have advocated review going not only to the question of the constitutionality and legality of an order but extending to the question as to the reasonableness of the order. They have gone even further than this and have advocated giving the courts authority to inquire as to the reasonableness of the original rate sought to be set aside by the Commission. It is contended that the recommendations of the Commissioners, especially as to the extent of their own powers, ought to have great weight with Congress, and that the legislative branch of the Government ought to be reluctant to confer on administrative officials autocratic powers and freedom from judicial restraint in excess of what they themselves are seeking.

J. C. W.

Train Accidents in the United States in March.[1]

bc, 1st, 2 a. m., Michigan Central, Bay City, Mich., butting collision of freight trains; one brakeman killed.

bc, 1st, Pittsburg & Lake Erie, Belle Vernon, Pa., butting collision between a passenger train and a freight, due to a misplaced switch; both engines wrecked; three trainmen injured.

bc, 1st, 9 p. m., Union Pacific, North Platte, Neb., butting collision between a westbound passenger train and an eastbound freight, due to a misunderstanding or misreading of orders. Both engines and three cars were wrecked. There was a blinding snowstorm at the time.

2nd, Colorado Southern, Wendover, Wy., a passenger train broke through a bridge and the engine and first two cars fell into the canyon. The engineman, fireman and one mail clerk were injured, the fireman fatally. It is said that the derailment was due to the weakening of the birdge by a fire which had been set by tramps.

xc, 2nd, Chesapeake & Ohio, Thurmond, W. Va., a freight train consisting of two engines and 34 cars became uncontrollable and ran at high speed down grade three miles, and collided with some freight cars; one engineman killed.

bc, 3rd, Delaware, Lackawanna & Western, Lyons, N. J., butting collision between a passenger train and an empty engine; one fireman killed, one other trainman and several passengers injured.

eq, 4th, Southern Pacific, New England Mills, Cal., a freight train was derailed by a broken wheel, making a bad wreck. A man riding on one of the cars was killed and another injured.

dr, 5th, Southern Railway, High Point, N. C., a passenger train was derailed at a defective joint and two passenger cars and a freight car fell down a bank. Twenty persons were injured.

dr, 5th, Atchison, Topeka & Santa Fe, Tolpec, N. M., a passenger train was derailed by spreading of rails and five cars were ditched. Seven passengers were injured.

*eq, 5th, Pennsylvania Lines, Londonville, Ohio, a train consisting of an engine and a caboose was derailed. The engine fell into the mud at the side of the road and the caboose caught fire and was burnt up. The fireman was killed and two other trainmen were scalded. The derailment is said to have been due to a broken flange.

unx, 5th, Baltimore & Ohio, Smithfield, W. Va., a locomotive was derailed and overturned and the engineman, fireman and a brakeman were burned to death.

[1] Accidents in which injuries are few or slight and the property damage apparently small, will, as a rule, be omitted from this list. The fuller record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

re Rear collisions
bc Butting collisions
xc Miscellaneous collisions
dr Derailments; defects of roadway
eq Derailments; defects of equipment
dn Derailments; negligence of employees
unf Derailments; malicious or criminal
unx Derailments; unclassified
o Miscellaneous accidents

An asterisk at the beginning of a paragraph indicates that the train was wholly or partly destroyed by fire. A dagger indicates an accident resulting in the death of one or more passengers.

dr, 6th, Southern Railway, Frost, S. C., passenger train No. 9 was derailed by a broken rail and six passengers were injured.

†xc, 7th, Delaware & Hudson, Saratoga, N. Y., a passenger train, unexpectedly stopped by an accident to a freight train ahead, was run into at the rear by a following passenger train, and the rear car was wrecked. Two passengers were killed and 12 injured, two of them fatally.

†unx, 7th, 1 a. m., Erie road, Binghamton, N. Y., passenger train No. 7, second section, was derailed and wrecked. The wreck quickly took fire, but the flames were extinguished by the city fire department. The engine and first three cars fell down a bank. The engineman and fireman were injured, the former probably fatally.

bc, 8th, Kansas City Southern, Bon Ami, La., butting collision between a passenger train and a freight, due to a misplaced switch. One fireman was killed and both enginemen were injured, probably fatally.

xc, 10th, Southern Railway, Philadelphia, Tenn., collision of freight trains, wrecking 15 cars. One fireman was killed and five other trainmen were injured.

*rc, 11th, Baltimore & Ohio, Fostoria, Ohio, an eastbound freight train which had been stopped for water was run into at the rear by a following freight, and the caboose and some of the cars were thrown upon the westbound track. A westbound passenger train, coming along a moment afterward, ran into the wreck and its engine and first four cars were piled up. One fireman and one mail clerk were killed and another mail clerk was fatally injured. The engineman and one passenger were also injured. The wreck took fire and was partly burnt up. A number of persons were badly burnt by the flames while trying to rescue the imprisoned passengers and a number were also scalded by steam.

bc, 11th, 4 a. m., La Marque, Tex., butting collision between a southbound freight train of the Missouri, Kansas & Texas and a northbound newspaper train; one brakeman killed, two other trainmen injured.

bc, 11th, Chicago, Burlington & Quincy, Akron, Col., butting collision of passenger trains, due, it is said, to the failure of an operator to deliver an order. A mail clerk was killed and four trainmen were injured.

xc, 12th, Lehigh Valley, Pittston Junction, Pa., collision between a passenger train and a freight; one trainman killed.

*†bc, 16th, 2 a. m., Denver & Rio Grande, Adobe, Col., butting collision between westbound passenger train No. 3, drawn by two engines, and eastbound passenger train No. 16, making a bad wreck. The wreck quickly took fire and many passengers were burned to death. The total number of persons reported killed in the collision is 22, and of injured the same number. There was a blinding snowstorm at the time, accompanied by intense cold. The collision was due to the non-delivery of a meeting order to the westbound train at Swallows, a station a short distance east of Adobe. The operator at this station had been asleep and afterward, when asked by the train despatcher if No. 3 had passed, replied that it had not. He then took the meeting order, but the train had passed. This collision was reported in the *Railroad Gazette* of March 23, page 315.

bc, 17th, 5 a. m., Boston & Maine, West Windham, N. H., collision of freight trains wrecking both engines and 10 cars. Three trainmen were killed and three injured.

bc, 17th, Louisiana & Arkansas, Long Springs, La., butting collision of freight trains, due to the overlooking of an order by the men in charge of one of them. Both engines were wrecked and several cars were damaged; one fireman was killed and two other trainmen were injured, one of them fatally.

xc, 17th, Baltimore & Ohio Southwestern, Washington, Ind., a passenger train ran over a misplaced switch and collided with some freight cars standing on a side track; three passengers injured.

unx, 17th, Chicago, Indianapolis & Louisville, Bedford, Ind., the tender of the engine of a passenger train was derailed at a curve and, with several cars, fell down a bank. Five passengers and one trainman were injured.

unx, 18th, Missouri Pacific, Willis, Kan., the locomotive of a freight train was derailed and overturned, and the fireman was killed.

†xc, 19th, 1 a. m., Chicago, Milwaukee & St. Paul, Davis Junction, Ill., collision of freight trains in the yard, due to mistake in or misunderstanding of hand signals; and two cabooses and eight cars were wrecked. A drover in one of the cabooses was killed and one trainman was injured.

eq, 19th, St. Louis & San Francisco, Jasper, Ala., a freight train was derailed by a brake beam which fell on the track and 12 cars broke through a trestle bridge and, with most of the bridge, fell to the ravine below.

dn, 19th, Chicago, Burlington & Quincy, Lockbridge, Iowa, a mail bag thrown from a car in a passenger train struck a switch-stand, broke it, and thereby loosened the switch rails, so that several cars of the train were derailed and thrown against the cars of a work train standing on a side track. One employee on the work train was killed and 12 were injured, four probably fatally.

unf, 19th, Mobile & Ohio, Fletcher, Ala., a freight train was derailed at a washout and the engine was overturned. The engineman and fireman were injured, the former fatally.

rc, 21st, 4 a. m., Southern Railway, Bath, S. C., rear collision of freight trains; engineman and fireman injured.

unx, 22nd, West Jersey & Seashore, Atlantic City, N. J., a mixed train was derailed and one passenger car was thrown against a freight car on a side track, making a bad wreck. Two passengers and one trainman were injured.

unx, 22nd, Lehigh Valley, Honeoye Falls, N. Y., the engine of a passenger train was derailed and overturned, and the engineman and fireman were killed.

rc, 23rd, Lake Shore & Michigan Southern, Goshen, Ind., an eastbound freight train standing at a water tank was run into at the rear by a following freight, and several cars were wrecked. A part of the wreck fell on the westbound track and was run into by a westbound freight train. Five trainmen were injured.

xc, 23rd, New York Central & Hudson River, Rochester, N. Y., collision of empty passenger trains; one engineman fatally injured.

rc, 24th, Chesapeake & Ohio, Salt Lick, Ky., a freight train which had been stopped by reason of a defect in the locomotive was run into at the rear by a following freight. The caboose and four cars were wrecked. One engineman was killed.

rc, 25th, Chicago, Rock Island & Pacific, Shawnee, O. T., a freight train was run into at the rear by a following freight, and the caboose was wrecked; four trainmen were injured.

†xc, 25th, 11 p. m., Texas & Gulf, Carthage, Tex., a passenger train collided with a freight train and 15 passengers were injured, three of them fatally.

dn, 25th, 1 a. m., Alabama & Vicksburg, Hickory, Miss., passenger train No. 2 was derailed at a switch and the engine and first two cars were wrecked. The engineman was killed and four trainmen were injured, one of them fatally. It is said that the switch had been out of order and had been spiked and that a freight train had run through it in this condition, thus leaving it insecure.

rc, 26th, 5 a. m., Philadelphia, Baltimore & Washington, Patuxent, Md., a northbound freight train which had for some reason unexplained run beyond a block signal which was set against it, was set back into the block section just vacated and was run into at the rear by a following passenger train, making a bad wreck. One fireman, one brakeman and two postal clerks were injured.

26th, Chicago & North-Western, Casper, Wyo., a work train broke through a bridge which had been weakened by a freshet and nine employees were killed and 12 injured.

*unx, 26th, 2 a. m., Atlantic Coast Line, Coosawatchie, S. C., a freight train was derailed and 10 cars were wrecked and destroyed by fire.

rc, 28th, Atchison, Topeka & Santa Fe, Riberia, N. M., passenger train No. 10 ran into the rear of a preceding freight train, wrecking the engine, caboose and several freight cars. The fireman of the passenger train was injured seriously, and several passengers slightly.

dr, 28th, Louisville & Nashville, Perth, Ky., northbound passenger train No. 2 was derailed at a curve in consequence, it is said, of spreading of the rails, and the engine and first three cars were overturned and wrecked. Three trainmen were injured.

rc, 29th, Louisiana & Arkansas, Hope, Ark., a freight train ran into the rear of a preceding freight; four trainmen injured, one of them fatally.

bc, 30th, Texas & Pacific, Escota, Tex., butting collision between a passenger train and a freight, badly damaging both endines. Six passengers were injured.

dr, 30th, New York, Chicago & St. Louis, South Whitley, Ind., a passenger train was derailed by a broken rail and the whole of the train except the engine and baggage car was ditched. The first passenger car was overturned and fell off a trestle, landing upside down in a stream, and the six cars following this fell down a bank. The reports say that no passenger was killed and that only 19 were injured. All of those in the smoking car, which fell into the stream, escaped with slight injuries.

xc, 31st, 2 a. m., Southern Railway, Gaffney, S. C., collision between a string of freight cars which had escaped control in the yard at Blacksburg, wrecking ten cars. The wreck occurred on a bridge and most of the broken cars fell to the stream below, but without doing serious damage to the bridge. Three trainmen were fatally injured.

dr, 31st, Atchison, Topeka & Santa Fe, Fulton, N. M., eastbound passenger train No. 10 was derailed by a broken rail and all of the cars except one sleeping car fell down a bank. One trainman and 15 passengers were injured.

unx, 31st, Southern Railway, Holton, Ga., the tender of the engine of an express train was derailed and, with a club car and three sleeping cars next following, fell down a bank. The club car was wrecked. Two trainmen and eight passengers were injured, one of the trainmen fatally.

Tunnel Under the English Channel.

Members of the London Municipal Council who recently visited Paris for the purpose of studying the public transportation service, were addressed by M. Sartiaux on the subject of the proposed Channel tunnel. According to M. Sartiaux, dread of the sea voyage is the reason why the passenger travel is so small. Although the total population of the Continent and the British Isles is about 150 millions the actual annual exchange of traffic over all lines between France and England is scarcely 1,200,000, while between France and Belgium, with a total population of hardly 50 millions, the annual exchange is about 4,000,000. Hence M. Sartiaux recommended to the London County Council a project for a tunnel with a total length of 33.5 miles under the Straits of Dover.

Several years ago preparatory work for such a tunnel was brought to an abrupt end by English public sentiment under the agitation of Lord Wolseley, who declared that it would threaten the territorial security of England. He preferred a bridge because it could be seen. But a bridge would obstruct navigation. Later there was a plan for a combined bridge and tunnel, by which about one-third the distance (on the English side) was to be traversed by a bridge and the balance by a tunnel. Such a plan would overcome the trouble about navigation and quiet patriotic solicitude.

It is to be hoped that the representatives of Great Britain in Parliament will see more clearly to-day than they have in the past the desirability of closer connection with the Continent, and that the great obstacle to communication between England and France will soon be removed.—*Le Journal des Transports.*

New Station of the Great Northern at Sioux Falls.

The new station which the Great Northern built at Sioux Falls, S. Dak., to replace the old frame station, burned down, is said to be the finest in South Dakota. The half-tone view published herewith shows that it is a good example of a design that is being used by a number of roads in towns of moderate size. The walls are granite up to the window sills and Menominee brick above that. The roof is slate. The two waiting rooms are each 30 ft. square, and the baggage room, adjoining the men's waiting room, is 30 ft. x 34 ft. Beyond this is an express room 24 ft. x 30 ft. The floors of the waiting rooms are made of Italian marble, the wainscoting, white enamel tile, and the ceilings pressed steel. Red birch is used throughout for finish, including the settees. Electric lights and a hot water heating plant are included in the station's equipment.

The building is surrounded by a vitrified brick platform 30 ft. wide on the track side and 12 ft. wide on the other three sides. The area between the building and Eighth street, the approach to the station, will be parked, with suitable driveways for carriages and express and baggage wagons, and the brick platform will be extended to the street.



New Station at Sioux Falls, South Dakota Great Northern Railway.

We owe the engraving and information to the courtesy of Mr Archibald Gray, Assistant General Freight and Passenger Agent of the Great Northern at Sioux City, Iowa

The French opened their railroad in their province of Tong King from the harbor of Hai-phong southwest to the Chinese border at Lao-Kai, about 300 miles, March 12. It, and a good deal more in the same quarter of the world, has figured in statistics of the mileage of Asia for three years or more. In 1901 the Chinese government granted a concession for the extension of this line some 300 miles in the same general direction through the province of Yun-nan, not to a corporation, but directly to the French government. It was estimated at first that this extension would cost $12,000,000 to $14,000,000; when work was fairly started on it the estimate was raised to $20,000,00. Now the company which is building it says that this will not be nearly enough. The French Minister of Colonies affirms, however, that, cost what it may, the road must be built, or France will lose all influence in China.

The New Haven's Proposed Joint Steam and Electric Service.

An excellent example of method in securing desirable relations between the railroad and the population which it serves was given in the conference between Mr. Mellen, President of the New York, New Haven & Hartford, and the citizens of Hartford, on March 20. After an address on subjects other than local ones, Mr. Mellen said:

I have been advised this is a good time and place to put in a little special pleading upon local matters, and I want to suggest a thought to you and see if I cannot secure your support and co-operation in a matter that seems to me of large interest to Hartford and its immediately surrounding country tributary to it commercially.

You are aware we have invested very largely in electric lines (and let me say here our operations have not been haphazard, nor to eliminate competition, but rather upon a well- defined plan), and in this particular district we are now better prepared to take the second step in the carrying out of our plans than anywhere else.

Here the arrangement of our lines is such we would like to make the experiment on a large scale to determine whether the two systems of traction—steam and electric—may not be worked in common, each supplementing the other; and we would like to electrify our steam tracks between here and Waterbury, and on the Central New England Railway between here, New Hartford and Springfield, and on the east side between here and Rockville, Melrose and Springfield, and upon the Valley Line between here and Middletown.

Instead of running to and from our stations through our yards, with all the switching and delays incident thereto, we want to connect at convenient points with the street railway tracks, and for interurban service make a circuit of the principal streets, collecting and delivering suburban shoppers at the store doors, and we believe both the city and the railroad will be greatly the gainers thereby.

No city on our lines is so favorably situated as is Hartford for the development of this idea. There is no question but a frequent and cheap service will prove to the great advantage of us both. Now, will you "get together," as your name implies, put your shoulder to the wheel, and help?"

In order to do what we desire and feel is essential to a satisfactory result, we must run fast from the time we leave the connection on the present steam tracks and maintain a more moderate speed upon the street tracks, and to make the speed necessary with safety upon the steam tracks we must use a deeper flange the

M. C. B. flange on our wheels and we cannot use it on the street tracks with the grooved rail which we are bound by contract to use in your streets. Now, what we want is that you shall permit us to use on the streets where this suburban service will naturally go the "T" rails we use in other cities. New Haven, for instance, and, waiving none of your rights under your contracts, see how it will work, ascertain if the objections are real or imaginary, and years' trial, we will take up the "T" rails, restore the grooved rails, and go back to the old order of things. I am not afraid of your decision. I will trust you, and if you are afraid to trust me I will secure the performance of my part of the agreement by a good and sufficient bond to your satisfaction.

Let me suggest right here that I am advised the contract requiring the use of the grooved rail is not binding in law, but I have none the less required its observance on the part of our company, and shall continue to until we can agree amicably upon its modification.

I am still claiming to be worthy of your confidence, that I am "making good" in the handling of this property from day to day as fast as any human being can, and I am living in the hope that some day you shall believe, as I do, that the best policy is for us to work hand in hand in a common cause and share with each other the burdens of bad and the benefits of good times. I am acting on this belief at the present moment, and shall be most seriously disappointed if you force me to go elsewhere to try an experiment the conditions here favor beyond any other place, and it will be your fault if it must be so.

Now, get together, help me help you, and be the first city to have the most complete, efficient and cheap suburban service of any city in New England. The proposition is knocking at your doors—such an opportunity as no other city has to-day. Must I go elsewhere and prove how greatly you stand in your own light, or will you have everyone come here to see how it is done and envy you your advantages?

Both in opening and closing Mr. Mellen invited his audience to put to him any and all questions they chose.

ANSWERS TO QUESTIONS.

E. L. Steele asked what streets would be used by the proposed interurban service which would require the T-rail. Mr. Mellen said it would call for only a small proportion of the trackage. Everybody would save five cents now spent in taking a trolley at the station, and much time would be saved, too. Hartford, he said, is particularly well situated for this service. There are no competing railroad interests here to offer objections, and this city has suburbs in all directions. New Haven has the Sound on one side, and so less outlying territory to serve.

F. C. Sumner asked when this service could be expected, if the arrangement was made. Mr. Mellen said the Rockville bonding was now going on, but it was useless to hope for much until the bridge was ready. Until then suitable cars could not be run. But he would agree to have such a service between Hartford and Middletown during 1906.

Being told that to do business in Providence, only ninety miles away, a Hartford man must start the day before and lay off unfed forty minutes at Blackstone on the return trip, Mr. Mellen said the service might not be as good as desired, and he was glad to hear a real objection. He would look into the matter.

To a complaint that there was no evening service between here and Middletown, he said the proposed trolley on T-rails would give what was wanted.

He said nothing would be discontinued; the proposed business was an addition.

A traveler on the Central New England asked why 500-mile books were not good on that line when 1,000-mile books were. Mr. Mellen said he could see no reason why, and he would look into that, too.

"Phil" Hansling, superintendent of streets, was called up to give the objections to T-rails. He said there were many. These were reduced where Belgian blocks were used between the rails, but drivers of vehicles who did not turn at the right angle to cross were liable to accident and loss. He said the paving between the rails in Main street was probably the most expensive in the country and unnecessarily costly.

Mr. Mellen said he did not ask the city to waive any rights, but simply to let this experiment be tried. He said there were objections to many things, and it was always a question of balances. It was objectional to have the steam cars rush into and through the city, but the advantages exceeded the annoyances. Similarly he had confidence that, once tried, the proposed plan would prove to have advantages far overbalancing the disadvantages. He said there were many cities that would sit up nights to get the chance that is now offered to Hartford.

The talk throughout was good natured and abounded in quick hits which were much appreciated. At the close of the meeting the club, by a rising vote, on motion of Mr. Sumner, gave Mr. Mellen a vote of thanks.

The Earthquake.

The material damage done by the California earthquake of April 18 to the railroads, outside of San Francisco, appears to have been comparatively small. The most serious report was that of the subsidence of the roadbed for a number of miles, but later official reports indicate that the damage, not the complete destruction, of an aggregate of two miles of track, in different places, was the only real basis for this report. This damage is said to have been quickly repaired. None of the railroad companies' boats in San Francisco Bay appear to have been damaged, and the large and costly ferry house at San Francisco escaped fire. The papers say that the tall tower on this ferry house is to be taken down. The track and buildings of the Coast Line division of the Southern Pacific, which enters the city from the south, are presumably badly damaged within the limits of the city, though the terminal buildings at Third and Townsend streets are said to be usable.

The railroads and express companies are all carrying food and clothing to San Francisco free, and are pursuing the same course with refugees leaving the city. By Tuesday of this week, six days after the earthquake, many thousands of people had left the city for temporary homes in other places. Considerable numbers of refugees had to be fed by the public authorities or charitable persons as far east as Salt Lake City. The telegraph companies are serving the people of the city without charge, and the San Francisco postmaster accepted letters to be forwarded without either envelopes or stamps.

Carloads of food, clothing and other necessary supplies were sent from scores of cities in the East. West of Chicago these shipments were made into full trains. These trains were run at express speed, regular passenger trains being sidetracked where necessary. It is understood that the Southern Pacific and the Atchison, Topeka & Santa Fe will reduce their regular rates on building materials going to San Francisco. A Chicago reporter estimates that the free service given by the railroads will amount to $3,450,000 during the first month following the disaster. The Secretary of War probably will order 2,500 additional troops to San Francisco.

Mr. E. H. Harriman, President of the Union and Southern Pacific roads, started from New York for San Francisco on the day of the disaster, taking a 25-hour train to Chicago and a special from that city; and he crossed the continent in about 87 hours, making the trip from Chicago in about 62 hours.

Foreign Railroad Notes.

In Russia the railroads collect storage on freight received at stations and not removed after a certain short time. During the recent railroad strike, when the railroad employees refused to unload the cars and made it impossible for consignees to take away their freight, the storage bills ran up to considerable sums, and the consignees protested. But the railroad authorities have refused to abate the storage charges.

On the main lines of the German Railroad Union in 1903 there were 11,621 miles of track laid on iron sleepers, which was 16 per cent. of the total track. Thousands of miles of this have existed for 20 years or more and they offer an experience unequaled elsewhere in the world. In many cases the iron ties have not lasted as long as the wooden ones, but the advocates of iron claim that this has been due to improper form and construction.

The Prussian Ministry of Public Works calls the attention of the several railroad directories to certain defects which have been found in the superheated steam locomotives and of the means taken to remedy them. In the steam chest of the Schmidt superheater the projecting ends of the steam tubes rust easily, and the crown-plates of the superheating chamber become distorted and leak. To prevent rusting of the tube-ends one directory has introduced drainage channels with valves into the steam box, and these valves open when steam is cut off. It has also strengthened the crown plates. Other directories are advised to experiment with these methods on several engines and to report the result at the end of the year.

The earnings of the Italian State Railroads for the first half year of their operation by the government, that is, for the last half of 1905, were about 6 per cent. greater than in the corresponding half of the previous year. Great complaints are made of the irregularity of their working, which is largely charged to a totally inadequate equipment; the operating companies not having provided for the growth of traffic after their contract expired, and the government apparently not appreciating that fact. The government in January was negotiating with the four Italian works which build locomotives for 305 new engines, they, the works, accepting the prices for which 50 engines were contracted for with foreign works, plus the duties.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Hepburn Bill Catechism 441
- Locomotive Efficiency 441
- Transcontinental Grades 441
- Pointers in Street Railway Capitalization 442
- The Chicago Traction Situation 442
- Rebate-Mileage Tickets 444
- Fine Points in Rate Cutting..... 444
- Cumpulsory Attendance at Instruction Car 444
- The Neglected Telephone 445
- A Judge Who Commends Trespassers.... 445
- New York Central & Hudson River..... 445
- Trade Catalogues 446

ILLUSTRATED:
- Silvis Freight Yard of the Rock Island 448
- Ruling Grades on Transcontinental Lines 451
- Three New Railroad Shop Tools..... 455
- 100-Ton Flat Cars for Allis-Chalmers Co. 456
- Increase in Size of Ocean Steamships... 458
- Removal of Bulger Tunnel 462

CONTRIBUTIONS:
- Improving Discipline by Recognizing Good Service 447
- Is the M. C. B. Air-Brake Hose the Best for All Service Conditions?..... 447

MISCELLANEOUS:
- American Railway Association 448
- An Aggregate of Electric Ry. Earnings... 450
- Washington Correspondence 450
- The Chicago Subway 454
- Canadian Railroad Notes 458
- The Revised Standard Code 458
- Actual Efficiency of a Modern Locomotive 460
- Railroad Decisions in April..... 464
- Pacific Coast Railway Club 464
- Foreign Railroad Notes..... 464

GENERAL NEWS SECTION:
- Notes 131
- Obituary 132
- Meetings and Announcements 133
- Elections and Appointments 133
- Locomotive Building 133
- Car Building 134
- Bridge Building 135
- Railroad Construction 136
- Railroad Corporation News..... 138

VOL. XL., No. 18. FRIDAY, MAY 4, 1906.

Q.—Will Congress pass a "rate regulation" bill this session?

A.—It will.

Q.—What are the useful ends to be accomplished by such a bill?

A.—First, expedition and simplification of the processes of the law so that the wronged shipper may obtain justice without its costing him more than it brings him. Second, extension of the law so that the burden of proving a rate "just and reasonable" will lie on the carrier. Third, free access by the Interstate Commerce Commission to railroad accounts and memoranda that should be known.

Q.—How about rebates and discriminations?

A.—Already covered by existing law. The pending legislation neither adds to nor subtracts from it.

Q.—Will the Hepburn Bill accomplish the desired things?

A.—Not in its present form.

Q.—Why not?

A.—Because it requires the Commission to perform legislative acts, which it cannot do under the constitution.

Q.—How can this be remedied?

A.—By so amending the bill that the Commission is confined to administrative acts.

Q.—What would such an amendment provide?

A.—It would provide that the Commission, after investigation of a rate, should declare what is the just and reasonable maximum rate, thereby administering the existing law that rates must be just and reasonable.

Q.—In what way does the bill, as it now reads, differ from this?

A.—It provides that the Commission shall proceed when *it shall be of the opinion* that rates are unreasonable, and that it shall determine and prescribe what *will in its judgment* be the just and reasonable rate. By the exercise of its opinion, it is compelled to become a law-making body instead of a law-administering body.

Q.—Are there other unconstitutional provisions in the present bill?

A.—Yes, but they would probably not invalidate the whole.

Q.—What are these provisions?

A.—The bill provides that, in failure of an agreement between the carriers concerned, the Commission may prescribe the terms and conditions under which through routes may be operated. This, of course, includes the number of trains that may be run, etc., and vests the Commission with the entire, absolute power of Congress; power which it cannot constitutionally hold. The bill also provides cruel and excessive penalties, which is unconstitutional. It also provides, through a blunder due to striking out the original court review provision, that the carrier is prevented from showing any objection to an injunction served upon it for violation of an order, except objection to the form of the order. This involves the taking of property without due process of law, which is unconstitutional.

Q.—With these clauses changed, would the bill serve its purpose?

A.—There still remains a provision, probably constitutional, but excessively foolish, which forbids carriers from keeping any other kinds of records than those ordered by the Commission.

Q.—Change this clause and the unconstitutional ones—will the Hepburn Bill become workable?

A.—It will be well worth trying.

It is seldom that so clear and complete an analysis and comparison of the work of any department of a railroad is given as that of the paper on "Actual Locomotive Efficiency" recently read before the Pacific Coast Railway Club and reproduced in another column. It is especially interesting and valuable in that it shows the relative advantages that have accrued of recent years from the introduction of the larger locomotive and incidentally of the large car, though the car does not enter into the consideration of the paper. It is not to be expected that the cost would fall in a direct ratio to the increase of tonnage hauled, and this, of course, does not occur, but it is significant that, as the tonnage is increased, so in almost every case has the cost of transportation fallen away. The records show, too, that the large locomotive is economical from the standpoint of the cost of repairs per 1,000 ton miles. If these figures are compared with the increase of tonnage hauled, it will be seen that they are accompanied by an increase of cost per engine miles, as has often been stated before. But this is by no means in proportion to the work done. Undoubtedly much of this is due to improved shop facilities, since there can be no doubt but that, with those available twenty years ago, the cost of maintaining the modern large locomotive would have risen beyond all bounds. This, however, is a matter that can well be left to those interested in shop management.

Of quite unusual interest are the tables printed in another column which show the ruling grades of all the transcontinental lines at present in operation except the Great Northern. In several instances it has been possible to make an interesting comparison with the situation as it existed in 1893. Thus, the Canadian Pacific has reduced its ruling eastbound grade from 116 ft. to 52.8 ft., between Vancouver and Revelstoke, and its ruling westbound grade from 116 ft. to 66 ft., between the same points. Grades on the Harriman route from Omaha to Portland, via the Union Pacific, Oregon Short Line and Oregon Railroad & Navigation have been reduced, eastbound, from 91 ft. to 43 ft., between Cheyenne and Laramie; from 63 ft. to 43 ft. between Laramie and Granger, and from 90 ft. to 66 ft. between Pendleton Junction and Portland. Westbound, they have been reduced from 66 ft. to 43 ft., between

Laramie and Granger: from 66 ft. to 44 ft. between Granger and Ticeska, and from 74 ft. to 26 ft. between Pendleton Junction and Portland. From Granger to Omaha, 854 miles, eastbound traffic now encounters no grade in excess of 43 ft. to the mile. The maxima from each of the reports furnished are as follows: Omaha to San Francisco, 116 ft., eastbound, 106 ft. westbound; Omaha to Portland, same; New Orleans to San Francisco, 117 ft. east and westbound; Montreal to Vancouver, 116 ft., east and westbound, except for single pusher grade of 242 ft., between Hector and Field, B. C.; St. Paul to Tacoma, 116 ft. east and westbound; Chicago to National City, 175 ft. eastbound, 185 ft. westbound. Of the new lines, the Western Pacific announces a maximum of 52.8 ft., but says nothing of the ruling grades further east, on the Rio Grande Western and Denver & Rio Grande. The existence of a ruling eastbound grade of approximately 116 ft. on five routes from the coast, the Union Pacific, U. P.-O. S. L.-O. R. R. & N., Southern Pacific, Canadian Pacific (except for the single pusher grade noted) and Northern Pacific, is noteworthy.

POINTERS IN STREET RAILWAY CAPITALIZATION

The prolific subject of street railway capitalization which, in the form of "hindsight," grows in prominence during an epoch of corporative criticism, cannot, unfortunately, be subjected, in any large and general degree, to accurate tests of figures. The best we have are the annual reports of the state railroad commissions or of those other bodies—or single officials—to whom the annual blanks of street railway companies must be returned. Often those blanks are defective and their specifications obscure. Some commissions insist on corrections; others do not; and not seldom one will find errors—in one case, which we have in mind, reaching a mistake of more than $10,000 a mile—in the clerical footings after the blanks have been handed in. Still one must do the best possible with the new material on hand such as it is, and from such new material contained in the reports of Pennsylvania and Maine for the fiscal year ending in both cases June 30, 1905, one can distill some striking facts absolute and contrasted. The Pennsylvania report is made by the State Secretary of Internal Affairs; that for Maine by the state railroad commission of three members.

The secretary of the former and larger state speaks as the Irishman said, "straight from the shoulder," on the subject of overcapitalization of electric railways. Listen to some of his words: "Financiers have almost gone wild in the way of investing money in these methods of local transportation. . . . Many of them have been failing from a financial standpoint but this has not been due entirely to a failure to receive a requisite amount of remuneration but too often it has been due to excessive capitalization"—that is to say, large fixed charges on railways built on bonds eating up income. The secretary also indulges in regretful retrospect. He is sorry that rigid laws were not passed early to check fictitious capitalizing so that "many of the citizens of the commonwealth would have been relieved from the frauds which have been committed as a result of fictitious capitalization which has so generally characterized the financial affairs of street railway corporations." Then comes an amusing *non sequitur* which may indeed be called an anti-climax. The secretary, while disclaiming the idea "that it is ever too late to do right," thinks, as the existing street railway companies have been allowed to over-capitalize that "to pass a law now which would restrict corporations hereafter incorporated would seem unjust discrimination." This unique theory of making the best of a vested evil by perpetuating and expanding it, as propounded by a high officer of the second state in the union, is commended to the prayerful attention of the economic moralists.

An analysis of the returns for Pennsylvania street railway capitalization is attended with some difficulty owing to uncertainties of statement and lack of summaries. But, taking the secretary's own return of $387,112,703 for total capitalization in stock bonds and other debt with an operated milage of 3.169 for 117 corporations controlling many subsidiary lines, the approximation of $122,125 per mile is reached. The figures certainly are not pigmy. But they do not bulk so enormous when compared with about $148,000 in a group of Eastern states which, besides Pennsylvania includes New York, New Jersey, Delaware, District of Columbia, Maryland, Virginia and West Virginia; nor the $112,000 in the southern states; nor the $109,000 in the United States, taken as a whole, as returned last year and probably about the same now. As a brief palliating clause may also be mentioned Pennsylvania's many and somewhat costly city lines—though her mileage capitalization hardly squares with the $50,772 per mile in the emphatically urban commonwealth of Massachusetts, which, under the long enforced replacement value rule, may be accepted as a kind of limit by honest capitalization for states with large urban communities.

By way of contrast to Pennsylvania we turn among the new state commission reports to that of the state of Maine where eighteen operated street railway corporations return a total mileage of a trifle more than 380 miles and total capitalization of only $38,649 per mile. While including a considerable number of cities, Maine contains none that can be reckoned large and the state is essentially non-urban and with population scattered. On the face of the returns, for causes not apparent, she seems to have escaped the general tempest of trolley infection or at any rate has not felt its stronger gusts. The situation there, by the way, has some localized meanings. President Mellen, in financing through southern New England his great aggregation of between 600 and 700 miles of electric lines under the Consolidated Railway Company as a holding corporation has had to pay high prices for original water. President Tuttle, of the Boston & Maine, if he secures legal sanction for a similar policy in Massachusetts and northern New England will be largely spared the hydrostatic experience—though he will be lucky if he finds his electric ventures as profitable in ratios as the earlier and greater enterprise of his Connecticut colleague.

As the reports come in of those state commissions which have cognizance of the street railways, while one finds an occasional novel utterance or suggestion, the leading feature is the new impressiveness which old facts assume. Passing such odd and inconsistent happenings as the latitude allowed to electric railway inflation in western states which have been so eager to "raid" the steam lines, the conclusion must be reached, as a general truth now of national dimensions, that it is too late to "dessicate" the electric lines originally dropsical. Consolidation has blended watered and unwatered stocks inextricably. The quick and keen original promoter has often shifted holdings to the innocent investor and new obstructive legislation has been piled up on the first statutes on which the earlier evil was based. We face too the telling fact of railway history that if the first promoter was both forethoughtful and sharp he played successfully on a public weakness which in the first stages of the electric railway demanded the new service at any price—and in certain regions is still making the same demand. If the unwatchful public makes a fool of itself it must expect to be fooled, to find the men who who will fool it and to pay the final penalty. But it by no means follows that because the public has been fooled once it ought to be or will be fooled again; and the time is probably near, if it has not already come, when Lincoln's famous proverb fits the electric railway situation. However that may be it is certain that, as regards new construction, most of the ills of electric railway stock watering are past—not only because legislators have awakaned to facts and to perils but also because the conditions which made electric railway hydraulics so profitable in popular centers have been exhausted.

THE CHICAGO TRACTION SITUATION.

Although two recent events have added fresh complications to the already over-complex traction situation in Chicago, the street car using public is possessed of the belief that present conditions point to at least a temporary solution of the transportation problem. This belief is based, in part, on the feeling that the conditions could not be worse and that any change will be an improvement. Another basis of the belief is the fact that the recent events have weakened the positions both of the traction companies and of the municipal ownership propaganda, and that each will be compelled by public sentiment to make concessions. Still another reason is the apparent willingness of the traction companies to build their lines and improve their service. They have finally come to realize that the most effective method of allaying the municipal ownership agitation is to minimize the causes for complaints against the transportation facilities.

The more important of these events was the decision of the United States Supreme Court which wiped out franchise claims estimated at $60,000,000 to $70,000,000, and caused a slump in Chicago traction stocks aggregating $20,000,000. It made the street car companies occupants without legal rights of streets in which 30 per cent. of their lines were being operated, these lines including their most important trunk roads. In its decision the court passed on the validity of the so-called "ninety-nine year" claims which were

based on an act of the legislature meant to extend grants made to the original companies by the city in 1858 and 1859 from 25 to 99 years. These grants covered nearly all the trunk lines entering the business district and the claims of the companies placed them in a strong position in their negotiations with the city for the expiring franchise on other lines. The Supreme Court sustained the validity of the act of 1865, but held that by reason of the ambiguity of its terms it did not extend the life of the grants made by the city to the companies. A petition for a rehearing will be filed, but the chance of the Supreme Court reversing itself is regarded by the lawyers as exceedingly remote.

The financial effect of the decision is to leave the companies without a basis of substantial value for half their capitalization. Aside from tangible property, estimated to be worth $28,000,000, the companies have unexpired franchises running from a few months to ten years on a large mileage of the outlying lines. In addition to these lines the companies have the right under the decision of the Supreme Court, to remain in possession of and operate 43 miles of single track, covered by the ninety-nine-year grants, until the city exercises the right to purchase.

The companies estimate that these unexpired rights cover 70 per cent. of their mileage, but they admit that the 30 per cent. of the mileage which they are operating without legal right includes the most important parts of the traction systems. The unexpired franchises cover disconnected lines, many of them cross-town roads, which are valuable principally as feeders for the trunk lines. Many of these franchises expire this year, about 50 per cent. of them within the next five years, and all of the remainder by 1916. No satisfactory estimate of the value of these rights can be made, but practical railroad men have placed on them valuations ranging from $10,000,000 to $20,000,000.

The Union Traction Company, which operates the lines of the North and West divisions of the city, is largely over-capitalized and the Supreme Court's decision leaves its stock issues without tangible values beneath them. The bond issues of its underlying, constituent companies, the North Chicago Street Railroad Company and the West Chicago Street Railroad Company, about equal the tangible assets plus the unexpired franchise values.

Assuming that these franchise values aggregate $10,000,000, the Union Traction Company's financial condition is as follows:

Assets.	
Tangible property	$15,000,000
Franchise rights	10,000,000
Total	$25,000,000
Liabilities.	
Union Traction Company, stocks	$32,000,000
West Chicago Street Railroad, bonds	17,903,000
West Chicago Street Railroad, stocks	11,224,200
North Chicago Street Railroad, bonds	7,800,000
North Chicago Street Railroad, stocks	6,169,900
	$75,097,100

The Chicago City Railway Company, which operates the principal system in the South division of the city, has no bonded indebtedness. It has outstanding stock issues of the par value of $18,000,000. A little more than a year ago a syndicate, headed by J. Pierpont Morgan, paid $200 a share for 92 per cent. of the stock, which fixed the market price capitalization at that time at $36,000,000. Assuming that the franchise rights of the Chicago City Company are worth $5,000,000, the following will indicate the financial condition of the company:

Assets	
Tangible property	$13,192,231
Franchise rights	5,000,000
Total	$18,192,231
Liabilities	
Capital stock	$18,000,000
Excess of market price over par value	18,000,000
Total	$36,000,000

These figures indicate that against a par and market price capitalization of $111,000,000, there are tangible assets of only $28,000,000. It must be noted, however, that Union Traction stocks never sold at par, the $20,000,000 of preferred shares selling from around 60 to 18, and the $12,000,000 of common from 16 to 6. Chicago City stock sold for $200 only a short time, the outside price prior to and since that time having been around $190. Since the slump the shares have sold at $150. The valuation of the tangible properties given above are estimates submitted to the City Council by Bion J. Arnold, the well-known electrical engineer and traction expert. The estimate on the tangible property of the Union Traction Company was made in November, 1905.

Elements of speculative importance have prevented the stocks from dropping to the basis of tangible property values. These elements are: Present possession and operation, possibly for years, until the city is ready to buy; large prospective profits during this time arising from the enormous earning powers of the companies, and the possibility of ultimately obtaining new franchises. With all possible expedition the city cannot take over the properties for more than a year, and the probabilities are it will be five years before municipal ownership could be brought about. In the meantime the companies must operate their roads. A majority of the members of the council favors giving the companies short-term franchises, and that majority may become large enough to override the veto of Mayor Dunne, who is forcing the municipal ownership issues.

The companies are offering to accept a 20-year franchise, which will give the city the right to purchase their properties at any time after five years, which is agreed to be the shortest period in which rehabilitation can be accomplished. The traction people undoubtedly believe that the municipal ownership sentiment will die out within the next five years, and that their possession for twenty years will not be interfered with by the city. The result of the city election on April 3 furnishes some foundation for this belief. Comparing the vote at that election with previous expressions of public opinion at the polls on municipal ownership, a radical change of sentiment on that question becomes apparent. In April, 1904, the question whether the city should refuse to grant franchises to the companies and compel them to operate under the police powers of the city was submitted to the voters. The vote in favor of the proposition was 120,863, and again, 48,200, in a total vote of 236,810, showing that 67,747, or nearly 25 per cent., of the voters did not express their opinions on the subject.

In April, 1905, the question was presented whether a franchise should be granted to any street railway company. At this election the vote for granting a franchise was 59,013; against, 152,135, the total vote being 330,935. Although it was a hotly contested election, with municipal ownership the principal issue, 119,789 voters, or 36 per cent. of the total number, failed to cast their ballots on the issue. These figures show that a large percentage of the voters were indifferent concerning municipal ownership.

At the previous elections the municipal ownership propositions had been academic in their nature. The vote had no binding effect on the city council further than the moral obligation created by the expressions of opinion of less than half the voters who cast their ballots at these elections. Two concrete propositions were presented at the last election. Affirmative votes would give them a legal, binding effect. One was, "Shall the city proceed to operate street railways?" On this question the affirmative vote was 121,916; negative, 110,323. The law requires a three-fifths vote to authorize operation. The affirmative lacked 17,428 of the 60 per cent. or 139,344 votes required, and the proposition was defeated. The other question was, in effect, "Shall the city issue $75,000,000 of street railway certificates for the purpose of purchasing or constructing street railways?" The affirmative vote was 110,225, negative 106,859, showing a majority for the proposition of 3,666.

The defeat of the operation proposition is a serious embarrassment to the municipal ownership movement. During the campaign Mayor Dunne and his followers argued that municipal ownership without operation was no improvement on private ownership. They cited the experience of the city of Toronto to prove that divided ownership and operation is a failure. Urgent appeals to voters swelled the vote, but did not secure the adoption of the operation ordinance. The result will be that Mayor Dunne will be compelled, if he buys the properties, to lease them to the present companies or some new corporation, otherwise he must procure the approval of operation at some future election. In view of the falling off of the municipal ownership vote from nearly 3 to 1 in its favor to a bare majority, the success of such an effort appears doubtful.

The first move on the part of the city administration to accomplish public ownership will be to obtain a test in the courts of the validity of the street railway certificates. The constitutionality of the Mueller law under which they are to be issued must also be tested. The law makes the certificates a lien solely on the property purchased or constructed and prohibits them becoming an obligation of the city. Whether the city can issue bonds, limit the mortgage securing them to a specified class of property and escape liability itself is a new question in municipal jurisprudence, and the lawyers are divided on it. Not less than six months, and probably a year or more will be required to test these questions. If the courts sustain the validity of the law and the certificates, then will follow the marketing of the securities. Time is required to negotiate a $75,000,000 loan, even if there are no prejudices against

it. Financiers are not likely to encourage municipal ownership of public utilities in which they have millions invested. The new field of investment opened by this loan will be closely scrutinized. Before these questions can be settled a new mayor must be elected, new conditions may arise and further delay result.

In the meantime the people are clamoring for relief from the present inadequate street car service. The companies say that they stand ready to improve the service if given franchises, even for short terms. Some local capitalists have agreed to put money into reconstruction and equipment on franchises terminable at the will of the city if the municipality will guarantee the return of their investment with a fair opportunity for profit. This eagerness to obtain some sort of right to operate street cars is due to the desire to secure something from the wreckage caused by the Supreme Court's decision and obtain an opportunity to abate the municipal ownership sentiment by improving the service. Experiments in this direction made by the Chicago City Company last year have awakened the traction people to the fact that adequate, up-to-date transportation facilities constitute the most potent argument they can make against public ownership.

Some plan must speedily be agreed upon to give the companies the legal right to operate their lines in the streets in which they are now trespassers, but numerous difficult problems must be solved before the city and the companies can reach an agreement. In the first place, neither side is united and acting in harmony. Mayor Dunne's municipal ownership plans will be opposed by a majority of the new city council, which includes some of its strongest members. This majority has already started a movement toward the passage of franchise ordinances. Mayor Dunne will probably be able to prevent their adoption by the use of his veto power, and a deadlock appears inevitable unless concessions are made.

Antagonistic interests divide the traction companies. The Union Traction Company is operating the systems in the north and west divisions of the city under leases from the North and West Chicago companies. The latter are asking the courts to annul these leases on the ground that the rentals have not been paid for a year and a half, and that the company has failed to pay a floating indebtedness of $3,416,000 it assumed with the leases. The underlying companies are also asking the courts to give them 205 miles of trackage operated by the Chicago Consolidated Company, which, they assert, was built out of their earnings, and order cancelled $6,750,000 of bonds that are a lien on the property. Attempts are now being made to bring about an agreement between the Union Traction and its underlying companies that will enable them to act as one company. When this has been done the receivership of the Union Traction Company, involving taking care of $6,000,000 of receivers' certificates, must be disposed of by the Federal court. Financial troubles are likely to follow this action, including a possible assessment on the Union Traction stocks.

After all these lawsuits have been disposed of and the Union Traction interests are united, negotiations may be expected to be inaugurated for the merger of the traction system of the three divisions of the city. With the Union Traction Company loaded with $75,000,000 of securities on 305 miles of trackage and the Chicago City with $18,000,000 on 220 miles, one of the difficulties in the way of a consolidation is apparent. Negotiations for a merger were opened several months ago, but they failed because the Chicago City Company demanded that the $32,000,000 of Union Traction stock be wiped out on the ground that it represents so much water. The Union Traction people will endeavor to obtain an agreement that will give some value to these shares.

A side issue between the city and the Union Traction Company, but having an important bearing on the question of improving the service, is the removal of the river tunnels. The Federal Government has ordered them removed on the ground that they are obstructions to navigation. The company uses these tunnels for the operation of its cables. Pending the reconstruction of the tunnels the company has asked for permission to electrify its cable lines. Once the trolley is installed the public will not submit to a restoration of the cable service. Realizing this, Mayor Dunne has refused to grant the permits until the Supreme Court has passed on the petition for a rehearing, and the 99-year claims are finally and forever settled. The court is expected to decide the question in May, and, if favorable to the city, the first step will be taken toward a radical improvement in the service.

The drummers of Philadelphia who object to paying $30 for a $20 mileage ticket and getting their $10 back again when the ticket is used up, and who have been blowing hot air (through the newspapers) at the Pennsylvania Railroad for many weeks, have at last got the Attorney-General of the state of Pennsylvania to take action—or to say that he soon will do so; but the only really formidable argument that he offers is that the railroad takes the passenger's money to protect itself from the scalpers. Even if we assume that this is true, the basis of the claim is still hard to substantiate, for the sum extorted from each ticket buyer is not over 10 or 15 cents; and if the drummers love the mileage book as warmly as they seem to think they do, they ought to consider this trifling sum a small expenditure for such a great business advantage. The report of the Attorney-General's proposed action says that he will file a bill in equity in the Dauphin County Court against the Pennsylvania, the Delaware, Lackawanna & Western, the Lehigh Valley, the Cumberland Valley, the Buffalo & Susquehanna and the Erie roads, asking in the name of the Commonwealth for a perpetual injunction to restrain these roads from collecting a rebate of $10 on each $20 interchangeable mileage book sold. His chief arguments are that "the present practice forces the passenger to give bail for his conduct; takes the passenger's money to protect the railroads against scalpers; imposes all chances of loss of ticket on the holder; subjects the holder to unreasonable expense and annoyance; gives the railroads the use of the public's money without interest, and discriminates against one class of passengers." As the agitators of this alleged extensive public demand have from the first employed many words for few ideas, this elaborate analysis of their grievance is not surprising; but the real issue can be stated very briefly. They charge discrimination and oppression. As, however, the whole of the alleged abuse would be fully offset by a money allowance of the size mentioned above, it comes down to a question of over charge; ought the $20 ticket to be reduced to $19.90 or $19.85, or some such figure? A passenger gives bail for his conduct when, instead of forcing the conductor to depend on the passenger's honor to pay, he buys a ticket. The chance of the loss of a ticket must necessarily fall on the passenger, whatever kind it may be. The other specifications in the argument are even more shadowy than these; and the charge that there is discrimination against the mileage-ticket holder, can be nothing but a boomerang, for the discrimination is the other way; it is in his favor. The passenger with a single-trip ticket costs no more to carry than does the drummer; why should the drummer pay less? Mileage tickets are supposed to be justified by the wholesale principle, and there is much solemn talk about the economic justification of the use of this principle for the benefit of traveling salesmen; but as these salesmen do not travel in carloads, or even in dozens, the argument has but the flimsiest kind of foundation. There is no justification for the mileage ticket but expediency; and every traffic officer knows that other considerations of expediency demand its abolition. What a heap of bother would be saved if we could only agree to let some Ohio legislature make all passenger rates! Then we could have a flat rate for all passengers.

Eight prominent Chicago wool buyers complain to the Central Freight Association that for several years the traveling freight agents representing roads east of Chicago, in the wool territory west of that city, have been in the habit of exceeding their duty in order to secure shipments of wool over their respective roads. "While we do not object to these freight agents soliciting wools when ready for shipment, we do object to the unfair solicitation, in which the acts enumerated below form a good basis for complaint: Providing printed invoice blanks; buying wool from grower, weighing, loading and marking wool for buyers, paying for wool with dealer's draft; using telegraph blanks for dealers' business and using dealers' code books for frank messages; using railroad transportation, expense money and paying for livery to hunt up growers and keep Eastern buyers posted on whereabouts of same, prices asked and quantities for sale by them. In fact acting as representatives for Eastern concerns without remuneration and thus working against the dealers of this city." We print this merely as an illustrative example for the benefit of people who think that the Interstate Commerce Commission has an easy task when it sets out to suppress rebating. Here are a dozen different services which a railroad has done or can do for shippers or consignees, any one of which may have a substantial value, and yet which all together may be so shadowy as to thwart the most strenuous attempts to punish the offender in court. What does a two-day speech by Senator Spooner in Congress amount to, as against a two-day trip with a "livery" among the wool farmers of Utah?

The New Haven *Register* says that General Superintendent Shepard, of the New York, New Haven & Hartford, has issued a circular which "comes down on the men hard." Attendance at the instruction car has not been what it should be and the General Superintendent raises the query whether the efforts of the company to improve the means to fit men for promotion are appreciated. He is of the opinion that the men ought to acquit themselves of the inference that they are not ambitious and enterprising. To the out-

sider this circular raises the question whether the go-when-you-please method is the right way to educate trainmen. Why not make school attendance compulsory? Is there not an inconsistency in spending days and months of valuable time in the work of refining the rules of the standard code, or the air-brake rules, as though it were necessary to make of train-running an exact science, and then leaving to chance the settlement of the question whether or not the men know the rules? Either a man needs the knowledge or he does not; there can be no half way work about it. If attendance at lectures is voluntary, the dullest, who are most needy, will be the surest to stay away. Why should not every fireman be made to fully qualify himself in the air-brake art before running an engine on the road? "Fully qualify" means 100 per cent. in that branch of the catechism which deals with questions of safety—that is to say, almost all of the questions. What superintendent can go into court and for one moment justify a scheme under which, by the deliberate pre-arrangement of the company itself, enginemen take a part of their lessons in the safeguarding of trains after they have been for months entrusted with trains? To state it baldly, firemen become enginemen first, and learn air-brake refinements afterward. We notice Mr. Shepard's so-called "trimming" in this place because the principle applies not only to air-brake instruction but also to other things that trainmen should know. It is true that lecture-car instruction does not embrace the sum of all wisdom in this matter; a considerable percentage of the men are perfect in the car but need watching when on the road. But the lecturing is all-important in its place.

A "blower" went out of business in the Third avenue power house of the Brooklyn Rapid Transit Railway a few minutes after 10 o'clock on Sunday night, and as a consequence traffic on the Brooklyn bridge and on the cars running through the old section of Brooklyn became monotonously slow. The light furnished to the cars was inadequate, and much discomfort and annoyance to passengers were caused. The unsatisfactory conditions prevailed until about 11 o'clock.—The foregoing, from a New York city paper, forcibly suggests the query why we do not make better use of our telephones and other electrical facilities. Hundreds or thousands of passengers were kept in suspense for three-quarters of an hour. For that length of time a majority of the people in the cars were exercising their minds in fruitless debate—each within himself—of the question whether the failure of power would or would not be so complete as to warrant abandoning the cars and finding some other way to get home. As the delay was less than an hour we need not here consider the other hundreds of people waiting in suspense at home. And though this suspense of the passengers was complete, unrelieved by even the chance to indulge in plausible guesses as to the cause of the trouble, it is probable that every delayed car was within one minute—or at most two minutes—of a telephone. A telephone message sent from the power house, 10 minutes after the accident, in such cases to, say, 50 or 100 places along the lines, could be made the means of settling every passenger's anxiety. By proper prearrangement such telephone messages could be distributed as readily as the single message is sent to the superintendent's or despatcher's office. By the use of the telegraphone all the hundred messages could be sent at once. By the use of the telautograph all could be recorded at destination without human intervention. When a railroad train is stalled in the woods five miles from a town the passenger's impatience is usually a good deal mollified by the knowledge that he cannot liberate himself without the help of the locomotive, however hard he may try. But when civilization slips a cog in the heart of a great city, the gap between theories and results is painfully conspicuous.

Of judges who openly express their contempt for the law—such parts of it as do not please their individual fancy—New York City seems to have more than its share. Instances of judges rebuking policemen instead of the prisoners whom the policemen have brought into court are familiar to all readers of the daily newspapers, and poorly veiled expressions reflecting on other judges are not unheard of. The latest instance of contempt observed is an approval of trespassing on freight trains by Magistrate Crane. According to the published report, Judge Crane, on hearing the cases of four men arrested on the New York Central, said: "I think the New York Central is getting about all that is coming to it from the city." The men were charged by three representatives of the New York Central with stealing rides on freight cars coming from Albany. "I don't think," said the Magistrate, "that the road will become bankrupt through the free transportation of people who utilize their empty freight cars for free rides, even if the people are hoboes, and these men are evidently not hoboes. I admire their earnestness in the pursuit of work which brought them to this city." He discharged George Bissert and Joseph Zerrenner, both of Albany, and fined their companions, George Christy and Henry Dawson, of New York, $3 each. The danger to the lives of the trespassers themselves seems to have had no more weight with the judge than the danger to trains generally, and the vicious example set for boys and others who make of the railroad a pedestrian's highway. The earnestness of the judge in his effort to thwart the police officers of the railroad is equaled only by his innocence in regard to "earnestness" in the pursuit of work which the prisoners professed.

New York Central & Hudson River.

The past year has been one of more than ordinary importance in the history of the New York Central Railroad. There has been a great growth in earnings, several small independent companies have been absorbed, additional electric properties have been acquired, and large progress has been made on the pioneer work of electrifying the New York terminal.

In the earnings' account there was an increase in 1905 of $7,522,393 over the preceding year. This brings gross earnings up to over $86,000,000, and again makes the New York Central second as an earner only to the Pennsylvania Railroad and the group of roads controlled by the Southern Pacific Company. The freight earnings alone were $52,000,000, a figure exceeded by the total earnings of only seven other companies. Freight furnished more than $5,000,000 of the larger earnings, a gain due to a large increase in tonnage hauled and in the average haul of each ton, two influences which together overcame a decrease of 45/100 of a mill (0.045 cents) in the earnings per ton-mile, this decrease in the average rate being due to increased proportion of grain, coal and other low class commodity tonnage. Passenger earnings, $25,761,387, showed the large increase of $1,587,353, due to a larger volume of all classes of traffic. Mail and express earnings also increased by $445,820, reaching the large sum of $5,580,286.

Of the great gain in gross earnings, a large proportion went for expenses of operation, which increased $5,398,663. Maintenance of way contributed $496,754, maintenance of equipment $2,277,250 and conducting transportation $2,262,771, of the new working cost. Also more than $1,500,000 was appropriated for addition betterments, leaving net earnings of $24,594,851, an increase over 1904 of $2,144,028. Charges on new debentures issued and adjustments of the tax account raised fixed charges and reduced the gain in net earnings by $1,177,681. After payment of the 5 per cent. dividend there was a surplus of $2,113,348, from which there was deducted $1,500,000 as a special fund for new equipment and betterments, the exact amount similarly appropriated during the six months ended December 31, 1904, covered by the previous report. Thus the New York Central in its earnings strongly reflects the great prosperity of the past year, and at the same time, similarly to that great system which alone is comparable to it, the Pennsylvania, used a large share of the gain in increased expenditures, many of them by no means chargeable to ordinary expenses of operation.

Early in the last fiscal year a fraction more than half of the capital stock of the Rutland Railroad and all of the capital stock of the St. Lawrence & Adirondack were purchased for the New York Central & Hudson River. Results of operation of the St. Lawrence & Adirondack (65 miles) are included in the figures of the report. The Rutland, however, though shown on the accompanying map of the New York Central Lines east of Buffalo, issues a separate report which has already been reviewed in these columns. In February, 1905, the New York & Ottawa and the Ottawa & New York Railroads were acquired, adding 128 miles to the operated mileage and giving the New York Central an entrance into the capital city of Canada. Extensions in the Clearfield bituminous coal region of Pennsylvania added 66 miles more to the working mileage. In this territory, also, there was a consolidation of several small lines which had been organized in the New York Central interest. The Beech Creek Extension, the Clearfield Southern, the Pittsburg & Eastern, and the Curwensville & Bower were consolidated into a new company called the Beech Creek Extension Railroad, which, with a mileage of 128 miles, was united to the parent road under a 999-year lease.

Following the example of the New York, New Haven & Hartford, a company has been created to take control of the electric lines held in the New York Central interest. This was done, however, not by making use of the charter of an already existing electric road, like the Consolidated Railway Company, but by incorporation of a new holding company with wide powers. This is the Mohawk Valley Company, through which control of the electric lines owned, mostly in the central part of New York State, is held. The year's acquisitions are the Rochester & Eastern Rapid Railway, operating an electric line between Rochester and Geneva 40 miles, and one-half the capital stock, the other half being held by the Delaware & Hudson, of the Schenectady Railway, operating electric lines in the city of Schenectady, with branches to Albany, Troy and Ballston. In addition to these purchases, it is hard to believe that the New York Central is not connected in some way with the buying of the United Traction Company, which operates the city lines in Albany and Troy by the Delaware & Hudson, which took over control of the Traction Company during the year.

Work on the improvement of the Grand Central Station terminal and the electrification of lines on the Hudson division to

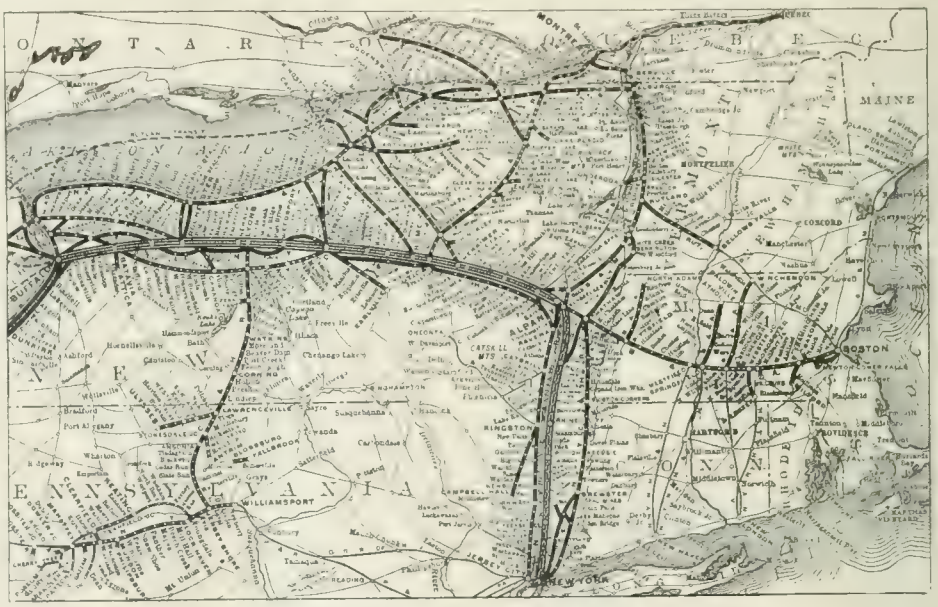
Croton and on the Harlem division to North White Plains, has steadily progressed. The main power stations at Yonkers and at Port Morris are nearing completion, and work is under way on various sub-stations and transmission lines, so that present prospects are that electric operation can be installed during the present year as far as between the New York terminal and temporary terminals at High Bridge and at Woodlawn. Preparation for this work has involved an immense amount of improvement on the New York end of these two divisions. On the Spuyten Duyvil & Port Morris, and on the Hudson division in particular, large improvements have been made. These include extensive rock cutting for four tracks just beyond Melrose Junction on the Spuyten Duyvil line, the construction of a new yard and engine terminal at High Bridge, abolition of grade crossings and a new cut-off between Melrose Junction and Spuyten Duyvil, the building out into the river on the Hudson division north of Spuyten Duyvil of from one to six new tracks and the beginning of a large yard, much of it on new land, at Croton. Expenditures on work connected with the electrification amounted to over $7,000,000 during the year. There has also been continuous betterment throughout the rest of the system, including the relief of main tracks between Albany and Buffalo by additional sidings, and more double tracking, revision of grades and new sidings on the Pennsylvania division, to meet the great growth in bituminous coal traffic.

These improvements have been taken care of in various ways. The extraordinary expenditures during the year amount to no less than $16,400,413, of which only $2,715,491 was charged direct to cost of road and equipment on the general balance sheet, though other sums appear on the balance sheet as increases in advances for leased lines. For construction and equipment on leased lines there was spent $8,744,865, in part charged against funds provided by the leased companies. Current income was called upon to the extent of $1,314,277 for maintenance of way improvements and $218,445 for additional equipment. At the same time, operating expenses included $2,853,718 for equipment renewals, and there was charged against the special improvement fund $553,618 for construction and additional equipment. Among the amounts expended for construction and equipment on leased lines is an expenditure of $332,039 on the Beech Creek Extension Railroad, for 20 Class "I" passenger locomotives. This Class "I" type is the most modern Atlantic type racing passenger locomotive in use on the system. It is, therefore, obvious, even without actual observation of the fact, that these locomotives are not suited to the traffic of a 128-mile line in the Pennsylvania coal fields. As a matter of fact, they have regularly been used in hauling fast express trains on the main line. It is not possible, of course, to tell how much of the cost of these locomotives was paid by the leased line and how much by the parent company, but as a general question it would be interesting to know to what extent the resources of leased lines have been called on to provide for needs of the parent company.

Taking up the expenses of operation, which it will be remembered increased by $5,398,663, maintenance of equipment shows the largest relative gain of $2,277,250, or over 20 per cent. Maintenance of way works out at $2,646 per mile on each of the 3,774 miles of main track operated, against $2,699 on each of the 3,515 miles in 1904. Thus, in proportion to average mileage operated, there was small change in this account. This is equally true per mile of main, second, third and fourth track owned and operated, on which maintenance of way cost $1,726 per mile in 1905 against $1,720 in 1904. Looking at this expense from these two points of view it is plain that expenditures on the line have been liberal. Repairs and renewals of equipment cost $2,561 per locomotive in 1905 against $2,609 in 1904; $643 per passenger car in 1905 against $542 in 1904; and $80 per freight car against $56 in the preceding year. The large increase in maintenance per freight car came in spite of an increase in the total number of cars of over 2,000, and is reflected in an increase of $1,633,219, or over 45 per cent. in the cost of repairs and renewals of freight cars, this being by far the largest increase in any single item under operating expenses. In addition to the large amounts spent under operating expenses, it must be remembered that there was in the income account also an expenditure of $1,532,722 for new construction and new equipment (addition betterments) which lessened net earnings to that extent.

The tonnage hauled was more than 49,000,000 tons and increased 5,600,000 over 1904. There was an increase in the total ton-mileage of 1,430,000,000, or 17 per cent. The freight density was 2,577,839 tons one mile per mile of road, an increase of 217,522 tons. Freight earnings were $13,916 per mile of road, and passenger earnings $9,028 per mile of road. The train load shows up well, with an increase of 27 tons over the previous year, bringing the figure for revenue freight to 399 tons, and for all freight to 459 tons. The average ton was carried 197 miles. The largest single item of freight traffic and the largest single increase during the year was in bituminous coal, a commodity in which the New York Central, through the ownership of its valuable soft coal properties and the efforts of an exceedingly efficient coal department, has succeeded in making a most important article of its traffic. There was also a strikingly large increase in tonnage of manufactures carried, thus adding another testimony to the general evidence of the immense increase in high grade traffic in trunk line territory last year.

Since the close of the fiscal year there has been authorized by the stockholders an increase of the capital stock of $100,000,000, bringing the authorized total to $250,000,000. Most of the $150,000,000 previously authorized is now outstanding. Especially since announcement of this increase it has been feared by many that the company was overreaching itself in its large expenditures for improvements. This feeling is largely because there is no actual proof that there will be a saving in expenses or a gain in earnings in any degree commensurate with the expenditures involved in the new improvements. It is, however, more than reasonably sure that the management is pursuing the course of wisdom in leading the way in these tremendous improvements and that the ultimate result will be thoroughly profitable. Certainly, returns in the year 1905 show an earning power large enough to seem to insure the stability of the company while the improvements are under way.



New York Central & Hudson River.

The principal statistics of operation are as follows:

	1905.	1904.
Mileage worked	3,774	3,515
Freight earnings	$52,312,931	$46,932,254
Passenger earnings	25,761,387	24,174,034
Express and mail earnings	5,580,286	5,134,466
Gross earnings	$86,095,602	$78,573,209
Maint. way and structures	9,984,101	9,487,347
Maint. of equipment	13,238,125	10,960,875
Conducting transportation	34,360,221	32,097,450
Operating expenses	59,968,029	54,569,366
Net earnings	26,127,573	24,003,843
Gross income	32,651,072	30,472,580
Net income	10,408,570	9,407,758

TRADE CATALOGUES.

Ballast Cars.—"An Ocular Demonstration" is the title of a little pamphlet of the Rodger Ballast Car Co., Chicago, showing half-tone engravings of the Hart convertible cars, built by this company, in action, both center and side dumping and being plowed off with a Lidgerwood unloader; also views of sections of track on which material has been deposited with these cars and distributed with the Rodger plow car. A view of a drop-bottom gondola, with a number of workmen shoveling out the material remaining after dumping, is presented to contrast the results obtained by the two types of cars.

Atchison, Topeka & Santa Fe.—The passenger department is distributing a folder showing a dozen exterior and interior views of tourist sleeping cars, which fill an important office in California traffic. These cars have the conveniences of first class Pullmans, but the upholstery and fittings are simpler. A trip over the Santa Fe is a delightful experience, and some of these pictures suggest the sources of delight, but in other views the photographer seems

to have failed to catch the psychological moment; the expressions on the travelers' faces may deter other persons from joining California excursions. The human face divine is a ticklish thing to monkey with.

CONTRIBUTIONS

Improving Discipline by Recognizing Good Service.

Tucson, Ariz., April 23, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with interest the editorial in the *Railroad Gazette* of April 13 on "The Unjust Seniority Rule," with reference to the improvement in railroad discipline as outlined by me, and while I do not presume to consider that my suggestions represent the only solution of the problem, it may be assumed that the present system of discipline is inadequate and that an improvement is both desirable and feasible. Therefore, as a possible elucidation of the several queries suggested by your article, I beg to say a word.

The question of "Conduct" appears to have been given undue importance. The highest standard desired in this respect is to impress upon the patrons of the company that all of its employees are gentlemanly and anxious to make them feel that it "costs nothing to be polite." An excessive degree of politeness is rather ludicrous, and on the other hand I have seen men enjoying but limited social advantages convey information so concisely and satisfactorily that it was a pleasure to transact business with them. So that, without discouraging "suavity," it may be said that if an employee has an interest in his work, he will take care of the "courtesy" end of it without any coaching. There should be no danger of the "suave" employee getting ahead appreciably, for this element of discipline weighs only 10 per cent. in the final result. At the same time this is sufficient to encourage politeness.

Therefore let us see what can be done to stimulate interest in the actual work. As you have said, it seems worth while trying to accomplish something in this direction. As I see it, the only way to get ahead is to make the employee feel that good work is going to be substantially rewarded; then you have him working for the company instead of spending half his time inventing excuses for work badly done. This accomplished, you relieve the executive officer from the necessity of continually investigating delinquencies, thus giving him time for doing his work. In train service we have a group of men who are held responsible for a certain result, under the leadership of one man. This group is known as the crew, and the head of it as the conductor. They are just as essentially a unit as a military organization, for they are working towards one end, and they should be dealt with as a unit. Failure to recognize this principle is bound to be detrimental to discipline and to the railroad company's interest. The crew must be made to feel that we are looking for results and are not desirous of comparing the moral or intellectual attainments of the several individual men. We must subordinate the individual to the group, and thereby make each one feel that his personal success is dependent upon the result of the joint labor of the entire crew. Co-operation is the keynote of success.

You say that the engineer and conductor may not get along together; but this is not logical, for men having a common interest will soon learn to eliminate personal likes and dislikes, particularly in business. Suppose you and your worst enemy were compelled to carry a basket of eggs to market, slung on a pole between you, and privileged to share in the profits of the sale—would you drop your end of the pole to spite the other fellow? I don't think you would, and furthermore, you would not worry about his dropping the other end either.

Then take the question of convenience in handling men as a group. There is a decided advantage in checking the record of five or six men at once. The conductor's report is made up by him for the trip and he is claiming all that he thinks they are entitled to. You check it against the train sheet and see what per cent. of schedule they made and make allowance accordingly. Say he was 30 minutes late getting out of the yard, and that each 15 minutes cancels five points of the 20 allowed. He has lost 50 per cent. of that item, and so on down the list. It is simply a question of percentage after the values of the respective items are once fixed. By that I mean the rating is established as standard permanently. There is no chance for favoritism. No "good judgment" is required. All you need is a good clerk—possibly two—to check up the records for a division and make the entries, and figure how many points should be cancelled from the report turned in for Bill Jones's crew on account of having lost three hours on the schedule and breaking in two the bodies of three flat cars by rough handling of the train. Don't you think Bill Jones would soon be able to figure this out himself and realize that there was "nothing in it" for his crew to do work that way?

I cannot see why any high priced official is necessary. The superintendent now hands out the "days" himself, and if any one is called "on the carpet" he passes judgment on the case before it goes on record. The present practice of putting employees on the defensive has resulted in making satisfactory discipline almost impossible, and it takes more than half the superintendent's time keeping "tab" on his men.

Regarding the possibility of errors and the necessity of making incidental revisions. This could not be seriously considered as an objection to this or any other system, for corrections are in order at any time before the record is closed for the year, and there is no more liability in this matter than any other involving simple computations. Six per cent. of 100 is 6, regardless of whether it affects a man's record or your bank account, and when you consider that the men are going to claim all that's coming to them, it will readily be seen that the better the work is done, the less trouble there will be keeping the record. You cannot compare a merit system with a demerit system because the principles involved are diametrically opposite. In the former, information is voluntary and voluminous; in the latter you have to extract information with a corkscrew if you get it at all.

It is true that to establish such a system and educate the men up to it would involve considerable time and patience, and it would undoubtedly meet with opposition among certain classes of employees. The railroads would also feel that this record, properly kept, might involve considerable expense; but did you ever stop to think what it must cost a railroad company to maintain the elaborate system of reports intended solely for the purpose of checking up the service rendered by the men? These are reports that should be unnecessary and would be superfluous if the men could be induced to take a proper interest in their work. Simply divert this expense from useless records to handling an adequate system of discipline, and watch the results.

It is not necessary that such a system be inaugurated in its entirety, at once. Begin, say, with a record of the movement of trains, and reward the crews for good service. Issue a bulletin to the men advising that a premium is to be paid for good service and that the record of each crew will be started off at the same point. Let monthly bulletins be issued showing the rating of respective crews and announce that all those averaging above 75 per cent. will be entitled to one day credit for each per cent., that is 80 per cent. would mean five days credits, 100 per cent. 25 days credits, 125 per cent. 50 days credits, etc., and have this offset discipline (demerits) charged against their records and also be a factor in promotion. Wouldn't it be worth while?

On one point, however, I desire to take issue with you—that is, regarding the "tyranny" of the superintendent. If the truth were known your verdict would most likely be reversed, in the majority of cases. If he is obliged to measure men by the "rule o' thumb" and enter discipline against a man's record on a summary of evidence abstracted from unwilling employees there are always those on the "off" side who complain, no matter how just the decision may be. Why not eliminate this style of discipline and let the man's record stand for itself?

W. D. BEUHRING.

Is the M. C. B. Air Brake Hose the Best for All Service Conditions?

TO THE EDITOR OF THE RAILROAD GAZETTE:

This question was brought forcibly to my attention on the road where I was employed during a severe winter when ballast trains were employed filling trestles. In December, January and February the delay to trains through hose freezing up, and damage to air pumps in the attempt to overcome leaks became very serious indeed, and was finally partially overcome by removing the hose frequently and drying them, while a fresh lot were put on in their places. This was well enough so far as it went, but we also had on the road a large number of flat cars engaged in log train service, and the trouble with these was even more serious and not so easily overcome. After they were loaded these cars were hauled some nine miles to a large division yard where they were made up into trains and stood pushed together until the road engine was ready to go on and start them on a 130-mile run to destination. It was found, as soon as the cars were moved, that 60 per cent. of the hose coupling joints leaked badly because the hose had been frozen solid in a short circle position, so that when cars were stretched out the coupling heads lifted and caused leaks, and the delay in getting these trains started on this account amounted in some cases to six hours. This was bad enough, but it was only the beginning of the trouble which continued for the greater part of the run, and the record of skidded wheels removed from these log cars for three months was enough to make the old man's hair turn gray. I became convinced that the remedy lay in securing an air hose that would not act as the standard hose was acting and we took the matter up with the air hose people with the object of securing a hose that would be as light and flexible as possible with thin walls, offering the least possible space for lodgment of moisture to freeze, and at the same time that would be strong enough to resist the bursting pressure of the air. It is not necessary to enumerate the difficulties we met with in securing what

we wanted, or anything near it, so hard it is to move people out of a rut.

Finally we accepted one out of the many samples submitted and applied it to the cars. Now this hose, although the best offered, was not what we wanted, nor was it anywhere nearly the best that could be made, yet the improvement was so great and so immediate that no sooner was one train equipped with the hose than the men whose duty it was to look after and handle the log train sent in urgent requests for a further supply, and by the time all of these cars were equipped the delays to trains had been cut down to practically nothing, while the number of skidded wheels was reduced to the proportion of one to eight. If anyone thinks it was not worth the small additional cost, just ask the Superintendent of Motive Power, the car men, and the engine drivers.

Finally the supreme test and recommendation came when it was found that the engine men on other trains stole the hose off the log cars to use in case of trouble. The next thing to be determined was whether the new hose had the life of the regular standard hose, and to determine this they were left on the cars, though the intention was to remove them in the spring, since, while they were 1¼ in. inside, they looked like a 1-in. hose from the outside, and car men used to remove them when going on foreign roads and report wrong hose.

They stood the time test well, but to my mind the most satisfactory test made was where one of these special hose was applied to the testing plant in the main yard and used every day under pressure of 110 lbs. for 18 months, and then returned to my office and it was still soft and pliable and full of life.

Therefore I maintain that the M. C. B. standard air hose of to-day is a long way from being the best procurable for the purpose for which it was intended, as the hose we developed will do all that the standard hose will do, and very much more besides. This may not be of much interest to railroads in the south, but I think I have proven that it is of very great importance to people who operate railroads where the thermometer goes down to 30 and 40 deg. below zero in a moist atmosphere. STOREKEEPER.

American Railway Association.

The semi-annual meeting of this association was held at Chicago, April 25. There were present 190 delegates, representing 80 roads. The membership of the association now comprises 314 members, operating 226,096 miles, and the associate membership 19 members, operating 628 miles.

The Committee on Train Rules presented a general revision of the Standard Code of Train Rules for Single and Double Track, which was adopted by the association. The changes which have been made by the committee are the subject of an article in another column. There are few or no radical changes, but many rules have been put into clearer language, and there are some changes in practice.

The Committee on Car Service reported the adoption of the amendments to the Code of Per Diem Rules, changing the per diem rate for the use of freight cars from 20 to 25 cents, to take effect July 1, 1906; and on recommendation of the committee the association

Resolved, That a penalty for diversion should be imposed only in cases where cars are delivered to specified foreign roads contrary to the expressed wish of the car owners.

The report of this committee contains arbitration cases Nos. 28 to 32, inclusive, and gives answers to some questions concerning the interpretation of rules. The committee says that the amendment to Rule 6, adopted last year, has had the effect of putting non-per diem roads on the same basis as private sidings and has had satisfactory results. The idea that the per diem rate can be increased sufficiently to warrant doing away with the penalty rate is not favored by the committee; a high rate would interfere with the free movement of freight cars when loaded, and would unduly stimulate the movement of empty foreign cars. The committee does not believe in an automatic rule for the prevention of diversion; it would either cause delays, or unnecessary transfers, or unnecessary empty mileage, or all three. The resolution above quoted having been adopted, the committee intends now to prepare a rule prescribing a penalty for diversion.

The Committee on Safety Appliances presented statistics showing that the number of freight cars fitted with air-brakes on Jan. 1, 1906, was 1,652,297, or 89.8 per cent. of the cars reported as in service by members of the association. The number of members is 304 and the total number of cars reported is 1,840,009. The number of engines equipped with power brakes is 50,413, or 99.6 per cent. of the total number in service. The number of new freight cars under contract or construction on January 1 was 191,863, and of new engines 2,568.

The Committee on Statistical Inquiry presented a form covering railway transportation statistics and directions for making it out, which were adopted.

The Committee on Standard Cipher Code reported that the Standard Cipher Code was practically completed and would be distributed in the course of a few weeks. It will cost $2.50. The Committee on Transportation of Explosives presented a plan for the formulation of a bureau for the safe transportation of explosives and other dangerous articles. The plan proposed by the committee was approved by the association, and the committee was directed to proceed with the organization of the bureau. The committee reports that 150 roads, operating 88,951 miles, had adopted the regulations for the transportation of explosives on March 19. Other roads are considering the matter. The proposition for the establishment of a bureau contemplates a formal organization, like that for the payment of car service on interchanged cars. Members agree to abide by the regulations, which implies refusing shipments of dangerous articles which do not comply with the requirements of the bureau. Provision is made for the appointment of a chief inspector and subordinate inspectors. Inspectors are to see that the regulations are complied with by manufacturers, shippers and railroad companies; to visit the works of each manufacturer every three months, or oftener, and to supervise the loading and transportation of explosives.

W. C. Brown, New York Central, was chosen President of the association, and W. A. Gardner, Chicago & North-Western, Second Vice-President. For members of the Committee on Train Rules the Chicago, Milwaukee & St. Paul, and the Lake Shore & Michigan Southern, were chosen in place of the Hocking Valley and the Louisville & Nashville.

It was decided to hold the autumn session of the association at Chicago, Oct. 24, 1906.

The Silvis Freight Yard of the Rock Island.

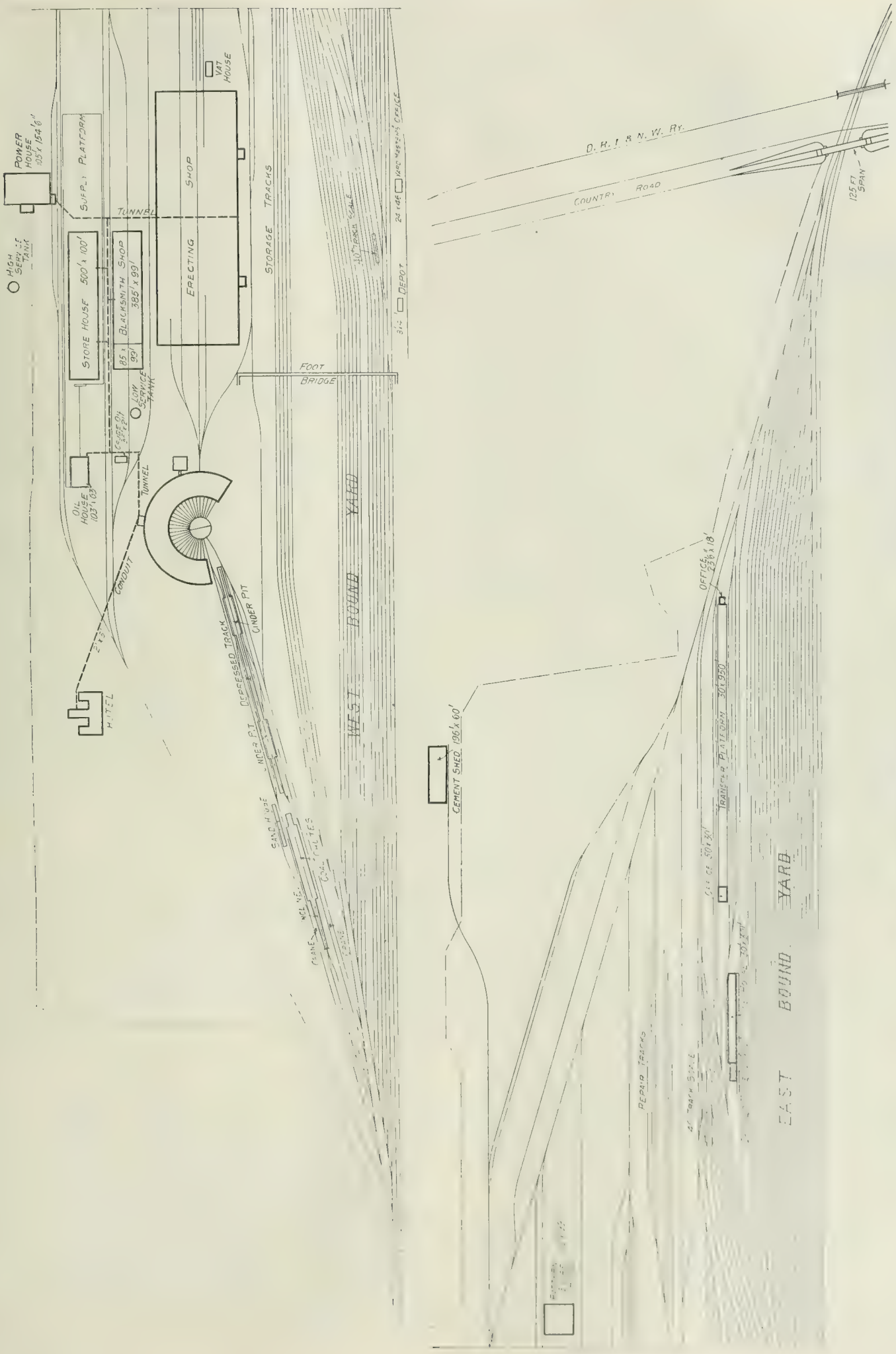
The original plan of the Chicago, Rock Island & Pacific for extensive new shops near East Moline, Ill., included a large freight yard between the main tracks and the shops. Construction of the yard was postponed, however, until after the shop plant was in operation. Work on it was not undertaken therefore until last summer and the yard was opened to service only in the present year. A plan of the yard is shown herewith.

Although in itself not a yard of exceptional size, in conjunction with yards already existing in the vicinity the aggregate capacity afforded is much the largest on the system. East Moline is 173 miles due west of Chicago and eight miles east of Rock Island, Ill. After crossing the Mississippi river at Rock Island to Davenport, Iowa, the Rock Island lines diverge in three directions—southwest to Kansas City, west to Omaha, and a connecting branch northwest. There is also a line from Rock Island southeast to Peoria. Five lines, therefore, center here. The capacity of the Natick yard at Moline is more than 800 cars, of the yard at Rock Island 600 cars, and at Davenport, on the west bank of the river, 500 cars, the combined capacity of the three being nearly 2,000 cars. The total capacity of the new yard is about 3,000 cars, so that there is now yard room in this territory for about 5,000 cars in all. Prior to completion of the new yard at Silvis, the name that has been given to the station formerly known as New Shops, the other yards mentioned were badly overcrowded. They will now be used mostly for local business and for storage. A plan of the Silvis yard showing its relation to the shops is given herewith.

The tract occupied by the new freight yard is about a mile and a half long by 500 ft. wide. The yard occupies part of the tract of 700 acres originally acquired for the new shops, which was all graded at the same time before the shop buildings were put up. Not a great deal of grading was necessary, as the ground was fairly level. For the freight yard alone about 32 miles of track were laid. The eastbound yard has 18 tracks, with capacity for 1,200 cars, and the westbound 12 tracks, with capacity for 1,030 cars. The storage track will hold about 500 cars. All main line and ladder track switches are interlocked. Other switches are moved by hand. There is a complete air-testing plant, the nearness of the shops making an abundant supply of air readily available.

The yard includes large engine terminal facilities at the west end. The entrance to the engine terminal is at the extreme west end of the westbound yard, although engines from or to the eastbound yard use the running track just north of the storage tracks. This arrangement permits free movement of engines to and from the round-house and the various facilities. The coal chutes have a track on each side, and engines may pass from these tracks to the ash-pits and thence to the turn-table, or around the ash-pits and directly to the turn-table. The coaling station is an 80-pocket Rock Island standard design, with inclined track approach. Cars are drawn up the incline by a 25-h.p. electric hoist. There are two double ash-pits, each 130 ft. long, enabling eight locomotives to be cared for at one time. The pits are the depressed-track, shovel-cleaned type.

Other yard facilities include an ice house 30 ft. x 301 ft., with loading platform and crusher house; a covered transfer platform 30 ft. x 950 ft., with office at the west end; and two 100-ton, 46-ft. automatic weighing track scales, one for each yard. The Silvis passenger station is on the south side of the main line. The plan



New Yard at Silvis (East Moline), Illinois—Chicago, Rock Island & Pacific.

also shows a steel foot bridge which has just been built, which crosses the tracks to the coal yard just west of the station. A special feature of the terminal is a hotel located northwest of the round house, for the accommodation of the many trainmen whose runs end here. It is a two-story building, which cost $25,000, and is run by the Rock Island eating-house department.

All of the work on the yard was done by company forces directly in charge of the Division Superintendent, under the supervision of W. L. White, Engineer of Maintenance, to whom we are indebted for the information and plan. The total cost, not including preparation of the site, was about $[illegible]

An Aggregate of Electric Railway Earnings.

A total of the gross and net earnings of so far as possible all the important street and electric railways in the United States has just been published by the *Commercial and Financial Chronicle*. The following is an abstract of the article:

It is no easy matter to obtain periodic returns of income, in a way at all comprehensive, for the electric railways of the country. It was formerly the policy of managers of street railways to pursue extreme and complete secrecy concerning the affairs of such roads. With the change, however, in the system of traction from animal power to electricity this policy has often had to be abandoned. In order to obtain means for making the conversion to electricity, new capital had to be enlisted. Furthermore, the numerous and extensive consolidations of street and electric railways have also been attended by the investment of much outside capital. Thus a new set of persons has become interested in these enterprises and these new owners have naturally insisted that they be kept informed as to the income and condition of the properties. Still, even now there are relatively few companies that give out monthly reports of earnings and less than half a dozen that furnish weekly statements. In New York State the Railroad Commissioners require the filing of income statements available to the general public every three months. Not as much can be said for other states. In fact, there are only a few states in which the street railways are required to furnish returns of any kind to the constituted authorities even once a year—from all of which the reader can judge of the difficulty of securing data regarding income for some definite and uniform period of time.

The effort has been to procure comparative figures of gross and net earnings from all the electric railways in the country except those inconsequential in extent and earning capacity. The figures sought were those covering the even calendar year. This has necessarily increased the difficulty of obtaining returns. For in the case of large numbers of companies the fiscal year and the calendar year do not correspond. In those states where annual statements are required by the state authorities—say New York, Pennsylvania and Connecticut—the fiscal year of the street railways quite generally ends with June. In Massachusetts the Railroad Commission asks returns from the street railways for the 12 months ending Sept. 30. In other parts of the country, where the state officials call for no returns, the fiscal years vary widely, some companies making up their statements to end with March, others with February, and still others with November or October—showing great diversity in the dates covered.

Notwithstanding these drawbacks we have succeeded in gathering a large number of returns for the periods desired—that is, for the calendar years 1905 and 1904. In some instances the figures are those of roads that furnish regular monthly statements, from which we have made up totals for the 12 months. But large numbers of others are those of roads which never supply figures for current periods and from which we have special reports covering the calendar year. The result is a comprehensive exhibit, covering no less than 163 roads. These 163 roads earned over $200,000,000 gross and over $85,000,000 net. In exact figures the total of the gross for 1905 is $204,123,606, which compares with $186,278,338 for 1904, thus showing an increase of $17,845,268, or 9.58 per cent. The total of the net is $85,553,639 for the calendar year 1905, against $76,451,540 for 1904; an increase of $9,102,099, or 11.91 per cent. In addition to the roads represented in these totals, 22 other roads have sent comparative figures of gross earnings but not net earnings. Adding these, the total of gross is brought up to $211,085,131 in 1905 as against $192,545,536 in 1904, the increase being $18,539,595, or 9.63 per cent.

The totals thus reached, while in themselves large, fall far short of indicating the full earnings of the street and electric railways of the country. The results relate to the calendar year, but large numbers of companies with fiscal years differing from calendar years will not furnish totals for any other period of 12 months. Roads whose fiscal years end with June 30 or Sept. 30 are particularly numerous. We have undertaken, therefore, to carry our investigation further and see what have been the earnings for the latest fiscal years of the roads for these two sets of periods. Obviously, this method is open to the objection that results do not cover a uniform period, but it may be recalled that even the United States Census Office, in its elaborate volume covering 1902, had to rest contented with a similar method.

In the following table to the total of gross and net for the calendar years 1905 and 1904 are added two other lines of figures, one the earnings of all the roads for which we have returns for the 12 months ending June 30, and the other the earnings of all the roads for which we have the figures for the 12 months ending Sept. 30. By combining the three we get a very comprehensive aggregate.

		Gross		Net	
	Roads	1905	1904	1905	1904
Calendar Years below	163	$204,123,606	$186,278,338	$85,553,639	$76,451,540
Years ending Sept. 30	88	21,914,088	21,332,298	8 17,079	7,192,806
Do June 30	261	80,025,451	73,908,500	37,158,205	34,272,395
Grand total	512	$306,067,145	$281,608,936	$130,884,923	$118,221,741
Increase		24,458,209		12,663,182	
Per cent		8.68		10.71	

The final total in the foregoing, it will be seen, shows aggregate gross earnings of $306,067,145 in 1905 against $281,608,936 in 1904, and net earnings of $130,884,923 against $118,221,741. The gain in gross amounts to $24,458,209, or 8.68 per cent., and in net to $12,663,182, or 10.71 per cent. Even these totals fall short of recording the entire earnings of the electric railways of the United States. The minor roads not represented in these figures would not swell the amounts to any very great extent, but, as it happens, there are a few large companies that are also missing because no data concerning their income can be obtained. Among these are the Chicago Union Traction and the Virginia Passenger & Power, both in receivers' hands; the Cincinnati Traction, the Denver City Tramway, the Omaha & Council Bluffs Street Ry., the St. Louis & Suburban, and also the Pacific Electric Ry. and other lines forming part of the extensive system of Huntington roads in California, besides a few other roads of smaller, but considerable, earning capacity.

It seems no exaggeration to say that if we could have returns covering all the electric railways in the country the total of the gross would run between $350,000,000 and $360,000,000. The census in its compilation for 1902 showed total gross earnings of $247,553,999. The increase from this figure to about $355,000,000 obviously reflects large expansion. Too, one gains a new idea of the importance of the electric railways from the fact that they should have reached a point now where their gross revenues exceed 350 million dollars. Earnings from the sale of electricity for lighting and power purposes are, to be sure, in some cases included in the totals, but in others, notably in the case of the Public Service Corporation of New Jersey, which, besides controlling practically the entire street railway business of northern New Jersey, also controls the gas and lighting interests of the greater part of the whole state of New Jersey, earnings only from railway operations are included. Hence, it can be truthfully declared that the electric railways of the country have been expanding their revenues in a noteworthy degree entirely apart from operations connected with the lighting and power portions of their business.

Washington Correspondence.

WASHINGTON, May 1.—An early vote on the final passage of the Hepburn railroad rate bill is now assured. By an unanimous agreement adopted yesterday the Senate has decided that on Friday of this week the bill shall be taken up to be read by sections for the purpose of amendment, the discussion on amendments to be under the rule limiting speeches to fifteen minutes each, and each amendment to be voted on as soon as its discussion has been concluded.

It is the general opinion that, under this limitation of debate, amendments will be disposed of rapidly, and that not more than three or four days will be required to complete the reading of the bill and the disposition of all amendments. It is the general expectation of Senators on both sides of the chamber that the final vote on the passage of the bill can be reached as early as Wednesday of next week. An agreement for a final vote on that day would have been made yesterday but for the objection of Senator Morgan, of Alabama, who gave notice that he would object to any proposition for fixing a definite time for voting. His reason for this objection was that if a definite time should be fixed there would be danger of a lot of amendments having to be voted on at the last moment without any debate. There seems to be no reason to doubt that the bill will certainly be passed before the end of next week, even if the vote cannot be reached as early as Wednesday. As it is certain that some amendments will be adopted, the bill, after its passage by the Senate, will have to be sent to a conference committee of members of the two houses, as it is not probable that the House will accept the Senate amendments without a conference, though there is little doubt that in the end it will be sent to the White House for the President's signature in substantially the form agreed upon by the Senate. The conference ought not to take a great deal of time, and the bill will probably be a law within ten days after its passage by the Senate.

There are in all about seventy amendments that have been of-

fered in the Senate to the Hepburn bill, and are technically pending; but only those will be acted on that are formally offered by some Senator during the reading of the bill or at some stage before the final vote. The rules of the Senate as to amendments are very liberal, unless they are modified by an unanimous agreement, and there is nothing to prevent any of the amendments heretofore presented or entirely new ones being offered during the reading of the bill, or after the conclusion of the reading.

Most of the amendments that are formally offered will be defeated; many of them will be presented by Senators simply for the purpose of making a personal record on the bill. The principal interest will be centered in the judicial review amendment, in the various propositions to amend the provision conferring the rate-making power, and in the Foraker amendment proposing to permit the Commission to apply to a circuit court for an injunction against an unreasonable rate instead of having a formal hearing before the Commission and an order from that body.

The adoption of a conservative review amendment seems to be assured. It is probable that its foundation will be the amendment agreed to in the White House conference on March 31, and presented to the Senate by Senator Long, of Kansas. This will be modified in line with the suggestion of Senator Knox for the incorporation of a provision for the protection of the rights of carriers secured to them by the laws of the United States as well as those secured by the Constitution. This Knox amendment will probably be narrowed so as to limit the protection to those rights secured by the Interstate Commerce Act of 1887 and the acts amendatory thereof. The Long amendment will probably be further amended so as to permit proceedings for review to be brought in the circuit court in any district in which the railroad company has its lines instead of in the circuit court for the district in which the company has its principal operating office. This amendment is necessary in order to prevent the shutting out of the Southern Railway Company, which has its principal operating office in the District of Columbia, which is not included in any judicial district of the United States.

Several amendments to the provision conferring the rate-making power on the Interstate Commerce Commission will be considered, but it is probable that the principal change made will be the elimination of the words "in its judgment," which, it is now generally conceded, would require the Commission to exercise legislative discretion in the fixing of a rate, and which, if retained in the bill, would probably insure the entire measure being held by the courts to be unconstitutional. The clause requiring the rates made by the Commission to be "just and reasonable and fairly remunerative" will probably be allowed to stand, although propositions will be presented for striking out the words "and fairly remunerative," and for substituting for them a provision such as is favored by Senator Bailey requiring the rates to be such as will afford just compensation for the services performed.

Senator Foraker will make a hard fight for the adoption of his amendment providing for the alternative method of procedure for the correction of an unreasonable or exorbitant rate. There seems to be no ground on which a sound argument against this amendment can be based. It does not propose to lessen in any way the power given to the Interstate Commerce Commission by the other provisions of the bill. It simply proposes to afford an alternative method by which the Commission may proceed if it or the complainant shall prefer. One of the strongest arguments that can be made in favor of the Foraker amendment is that, in the event of the rate-making feature of the Hepburn bill being found to be unconstitutional, as many lawyers believe it will be even if amended as proposed, the Foraker provision would still be left in force and would afford a most effective means for putting a stop to any unreasonable or exorbitant charges by the very summary process of injunction. The Foraker amendment, if adopted, will round out and complete the Elkins act. J. C. W.

Ruling Grades on the Transcontinental Lines.

In the *Railroad Gazette* of June 30, 1893, profiles and tables of the ruling grades of the five so-called transcontinental lines were shown. An earnest effort was made this spring to correct this information to date, but it was only partially successful. We are enabled, however, through the courtesy of Mr. Julius Kruttschnitt and of Mr. W. L. Darling, to show the revised profiles of the Harriman lines and of the Northern Pacific. Revised tables of ruling grades on the Atchison, Topeka & Santa Fe and the Canadian Pacific were also furnished us by Messrs. James Dun and W. F. Tye. The vital facts for each of the transcontinental lines now existing, except the Great Northern, are therefore printed below. The new lines to the coast, the Western Pacific Denver & Rio Grande-Missouri Pacific route and the Chicago, Milwaukee & St. Paul, replied that the information, in the form in which we requested it, was not yet available.

For purposes of comparison, the profiles of 1893 and some of the grade tables are reprinted.

Atchison, Topeka & Santa Fe; Ruling Grades in 1893.

From	Elevation, ft.	To	Elevation, ft.	Miles.	Maximum grade, West, ft.	Maximum grade, East, ft.	Total ascent (approx.), West, ft.	Total ascent (approx.), East, ft.
Chicago	593	Kansas City	750	458	58	79	4,111	3,954
Kansas City	750	La Junta	4,061	571	63	61	5,197	1,886
La Junta	4,061	Albuquerque	4,950	348	185	175	8,440	7,551
Albuquerque	4,950	Winslow	4,848	285	53	53	2,930	3,032
Winslow	4,848	The Needles	477	290	75	137	5,307	9,678
The Needles	477	San Bernardino	1,075	250	87	158	6,163	5,565
San Bernardino	1,075	National City	10	192	116	116	1,855	2,920
Chicago		National City		2,394	185	175	34,003	34,586
Kansas City		National City		1,936			29,892	30,632

Atchison, Topeka & Santa Fe; Ruling Grades in 1906.

Via Ottawa.

Chicago	593	Kansas City	750	458	58	53	4,088	3,931
Kansas City	750	La Junta	4,061	556	46	34	4,760	1,449
La Junta	4,061	Albuquerque	4,950	348	185	175	8,440	7,551
Albuquerque	4,950	Gallup	6,498	158	53	53	2,848	1,300
Gallup	6,498	Winslow	4,848	128	16	32	82	1,732
Winslow	4,848	Needles	477	292	75	137	5,307	9,678
Needles	477	San Bernardino	1,075	250	87	158	6,163	5,565
San Bernardino	1,075	National City	10	192	116	116	1,855	2,920
Albuquerque		National City		1,020	116	158	16,255	21,195
Chicago		National City		2,382	185	175	33,543	34,126

Northern Pacific; Ruling Grades of 1906.

St. Paul	732	Glendive	2,091	665	53	53	5,749	4,355
Glendive	2,091	Livingston	4,510	341	26	26	2,727	525
Livingston	4,510	Helena	3,955	123	116	100	1,786	2,304
Helena	3,955	Trout Creek	2,378	250	116	116	1,916	4,519
Trout Creek	2,378	Ellensburg	1,518	404	53	53	4,065	3,815
Ellensburg	1,518	Tacoma	12	125	116	116	1,400	2,819
St. Paul		Tacoma		1,908	116	116	17,643	18,337

Canadian Pacific; Ruling Grades of 1906.

St. John	17	Montreal	128	483	63	63	7,598	7,487
Montreal	128	Fort William*	616	991	53	53	10,926	10,438
Fort William	616	Winnipeg	746	426	53	21	3,349	3,219
Winnipeg	746	Broadview	1,939	267	21	21	2,150	957
Broadview	1,939	Moose Jaw	1,754	135	53	21	1,110	1,295
Moose Jaw	1,754	Medicine Hat	2,153	260	53	53	2,673	2,274
Medicine Hat	2,153	Laggan	5,037	297	40	40	4,185	1,301
Laggan	5,037	Revelstoke.†	1,498	146	116	116	2,678	6,217
Revelstoke	1,498	Vancouver	11	380	66	53	3,632	5,119
St. John		Vancouver		3,384	116	116	38,301	38,307
Montreal		Vancouver		2,901	116	116	30,703	30,820
Montreal		Winnipeg		1,417	53	53	14,275	13,657
Winnipeg		Vancouver		1,484	116	116	16,428	17,163

*Via Smiths Falls.

†A 4.58% grade (242 ft. to the mile) between Hector and Field; pusher used.

Southern Pacific; Ruling Grades in 1906.

From	Elevation, ft.	To	Elevation, ft.	Miles.	Maximum grade, West, ft.	Maximum grade, East, ft.	Total ascent (approx.), West, ft.	Total ascent (approx.), East, ft.
Algiers	8	Morgan City	14	81	20	16	45	31
Morgan City	14	Lafayette	39	64	19	19	91	79
Lafayette	39	Echo	16	107	19	16	84	113
Echo	16	Houston	58	110	52	45	233	201
Houston	58	Glidden	233	87	52	52	308	139
Glidden	233	San Antonio	661	122	52	52	2,046	1,562
San Antonio	661	Del Rio	976	169	52	52	1,887	1,623
Del Rio	976	Sanderson	2,772	137	52	52	2,994	1,200
Sanderson	2,772	Valentine	4,427	152	52	52	3,169	1,655
Valentine	4,427	El Paso	3,724	161	52	52	1,227	2,017
El Paso	3,724	Lordsburg	4,245	148	53	53	1,428	903
Lordsburg	4,245	Tucson	2,390	164	74	74	2,148	4,003
Tucson	2,390	Gila	736	128	48	53	990	3,243
Gila	736	Yuma	137	123	53	53		
Yuma	137	Palm Springs	676	142	53	53	1,292	753
Palm Springs	676	Colton	962	49	103	104	1,898	1,672
Colton	962	Los Angeles	291	57	66	64	395	1,066
Los Angeles	291	Santa Barbara	2	103	53	53	1,254	1,543
Santa Barbara	2	S. Luis Obispo	237	117	53	53	1,980	1,745
S. Luis Obispo	237	S. Margarita	995	17	117	117	1,103	345
S. Margarita	995	Salinas	43	118		37	477	1,129
Salinas	43	San Francisco	12	118	32	55	947	978
New Orleans		San Francisco		2,474	117	117	25,995	26,221

Omaha to Portland; Ruling Grades in 1893.

Omaha	1,031	Cheyenne	6,050	516	66	40	5,312	293
Cheyenne	6,050	Laramie	7,149	57	80	91	2,197	1,098
Laramie	7,149	Granger	6,279	303	66	63	2,302	3,172
Granger	6,279	Ticeska	3,087	358	66	79	1,306	4,498
Ticeska	3,087	Reverse	3,084	36	106	90	552	555
Reverse	3,084	Huntington	2,112	147	26	26	184	1,156
Huntington	2,112	Pendleton June.	1,101	173	116	105	3,736	1,745
Pendleton June	1,101	Portland	35	232	74	90	850	1,906
Omaha		Portland		1,822	116	105	16,439	17,435

Omaha to Portland; Ruling Grades in 1906

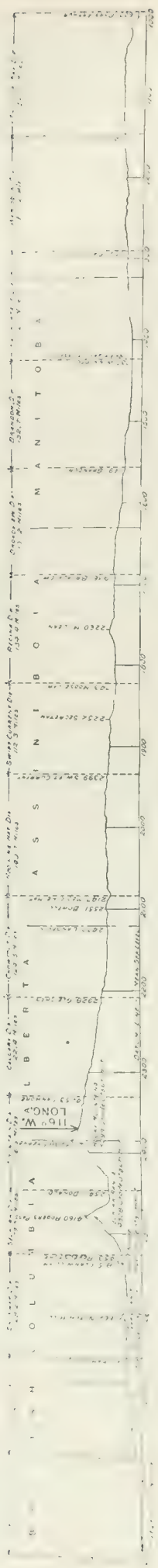
Via U. P. R. R.; O. S. L. R. R., and O. R. & N. Co.

Omaha	1,035	Cheyenne	6,058	516	66	40	5,299	376
Cheyenne	6,058	Laramie	7,145	57	80	43	2,021	934
Laramie	7,145	Granger	6,281	281	43	43	2,052	3,046
Granger	6,281	Ticeska	3,089	358	41	79	1,486	4,448
Ticeska	3,089	Reverse	3,089	36	106	90	634	634
Reverse	3,089	Huntington	2,112	147	26	26	206	1,233
Huntington	2,112	Pendleton Jne.	1,101	173	116	106	3,736	1,745
Pendleton June	1,101	Portland	35	232	26	66	850	1,916
Omaha		Portland		1,809	116	106	17,171	18,741

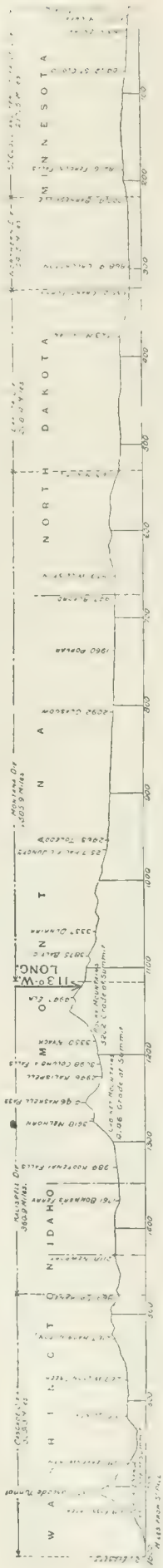
Omaha to San Francisco; Ruling Grades in 1906.

Via U. P. R. R. and S. P. Co.

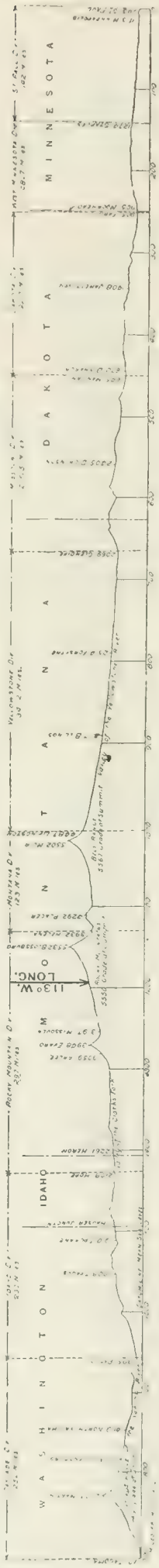
Omaha	1,035	Cheyenne	6,058	516	66	40	5,299	376
Cheyenne	6,058	Laramie	7,145	57	80	43	2,021	934
Laramie	7,145	Green River	6,077	281	43	43	2,186	3,046
Green River	6,077	Wahsatch	6,824	111	43	43	1,106	1,849
Wahsatch	6,824	Ogden	4,301	161		96		
Ogden	4,301	Lucin	4,517	102	71	71		
Lucin	4,517	Wells	5,631	73	43	43	1,886	
Wells	5,631	Sparks	4,413	304	71	71	141	1,354
Sparks	4,413	Truckee	5,870	35	58		141	6
Truckee	5,820	Rocklin	250	94	105	116	1,[illegible]	6,[illegible]
Rocklin	250	Sacramento	30	22		20	35	55
Sacramento	30	San Francisco	12	60	52	1	186	294
Omaha		San Francisco		1,787	105	116	17,[illegible]	18,[illegible]



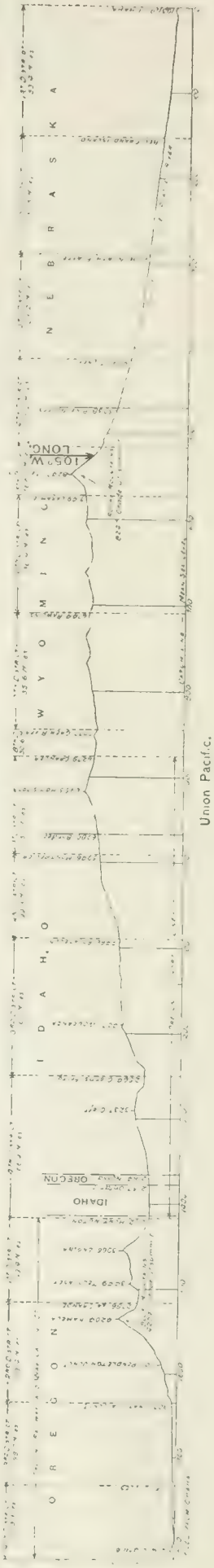
Canadian Pacific.



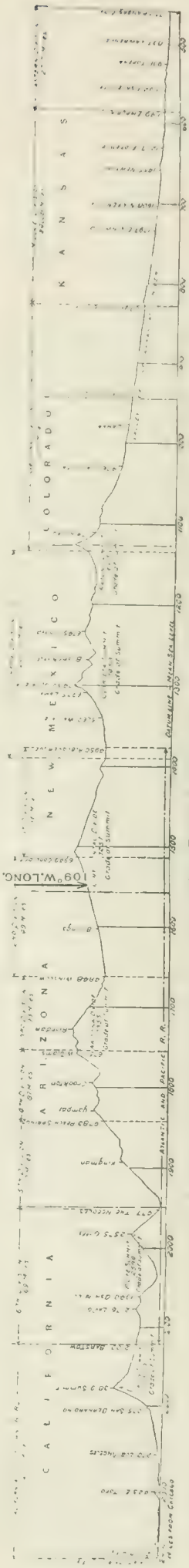
Great Northern.



Northern Pacific.

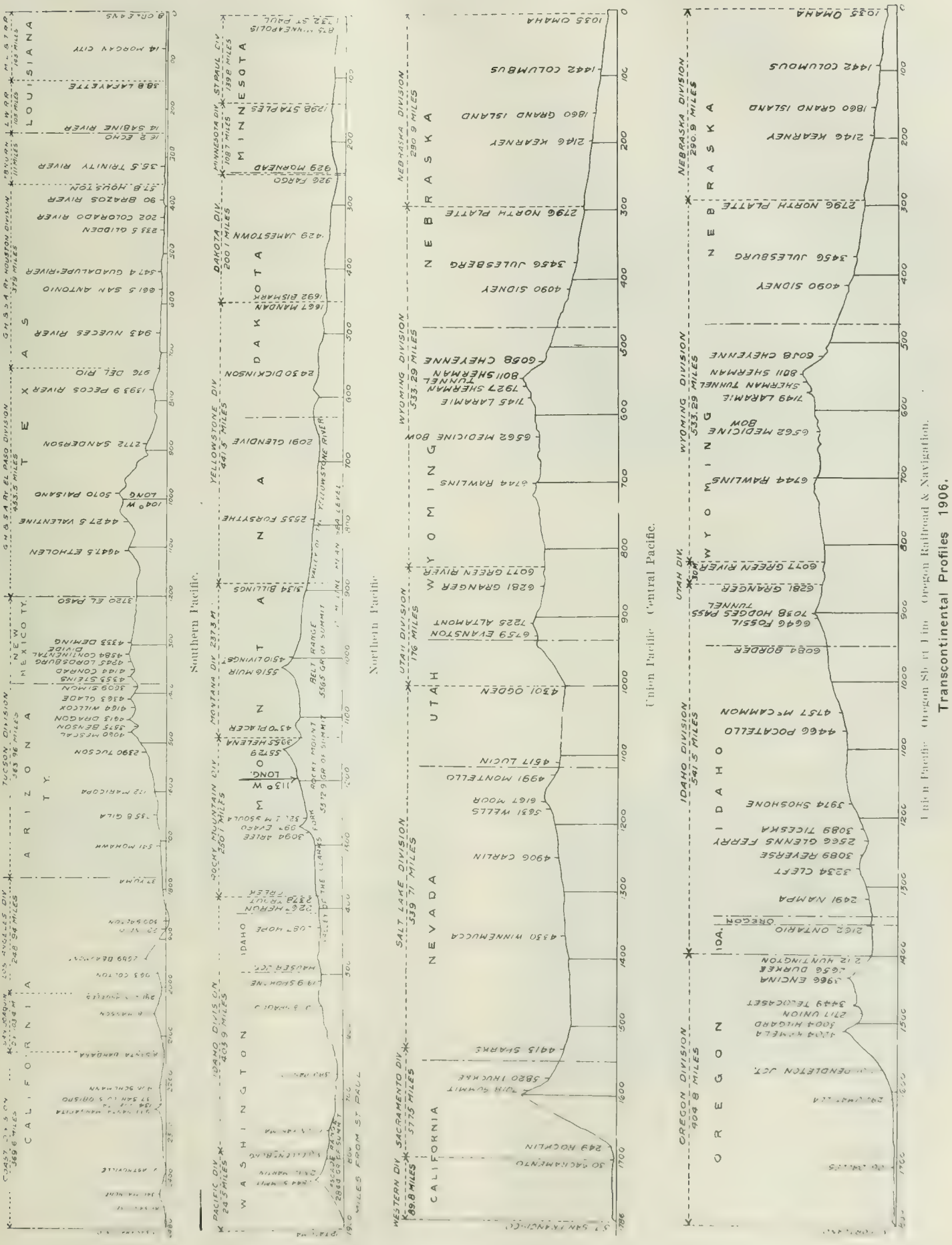


Union Pacific.



Atchison, Topeka & Santa Fe.

Transcontinental Profiles—1893.



Transcontinental Profiles 1906.

The Chicago Subway.

The *Boston News Bureau* publishes the following comments on the Chicago freight subway:

The Chicago Subway is not a railroad line. It is built to transport freight between railroads, and yet has no railroad connection, so far as its tracks are concerned. It is a lighterage or teaming proposition. Of the railroad mileage of the country, 40 per cent. terminates in Chicago. More than one-fourth of the valuable commercial business section of the city is given up to railroad terminals and freight yards. Under the Chicago Subway plan the whole business section of the city between the lake front and the rivers, and also underneath the rivers and beyond north and west, is treated as a freight yard, 12 tracks under the 12 parallel streets running north and south and 16 tracks running east and west. The terminals for this underground freight yard are furnished by the sub-basements of the buildings and blocks, so far as they make connection with the subway, and by the space as appropriated underneath the railroad terminals. Congestion in such a freight yard is practically impossible, for at every intersection of the tracks are four switches and cut-off loops, as well as telephone connection. In addition the spaces under the sidewalks are reserved for sidings. Therefore, the 44 miles of tunnel may gradually become three times this amount of track beneath the streets, and an indefinite amount of track within stores and buildings, for the small cars that have been adopted may not only be rapidly whisked in and out of sub-basements, but elevated to higher basements or to wholesale departments or storage rooms upon any floor of a building. Thus every merchandise building in this part of Chicago may become a limitless railroad terminal. The small units of cars and the 2-ft. railroad gage were adopted in order that the central lines of the streets might be followed and every street corner turned, and also that the space under the sidewalks might be reserved for sidings from which elevators might lift the cars to the basement floor. But the rapidity with which Chicago is building down to the subway, 40 feet below the street, has shown the greater utility of placing the elevator system within the building.

When, many months ago, Marshall Field learned that somebody was tunneling below his block in Chicago he declared his intention of getting a court injunction against such work. The answer was: "You are too late, Mr. Field. The work about your building was finished long ago." Then Mr. Field was invited down to visit the streets of a city he had but recently learned about. As he read the brass signs on the street corners below he exclaimed: "So this is my first view of my own corner underground. Can I see the other three corners?" In a few minutes he had been upon a tour of inspection about the other three corners and around his own block. Mr. Field stood and looked down the long alley, through whitewashed and electrically lighted walls relieved in color only by the lead pipes filling the arched roofs and carrying hundreds of miles of telephone cables connecting the 8,000 or 10,000 subscribers to the Chicago Automatic Telephone system. He reflected for a few minutes and then exclaimed: "Well, it was fortunate I did not know what you were doing down here, for I certainly would have fought you in the courts. Real estate may be as valuable under ground as above ground. You need not bother to build elevators under our sidewalk. I will meet you more than half way. I will come down to your level with the entire building."

Already 27 buildings are building down at the expense of more than $3,000,000 to a level with the subway. To build up from the subway and instal the elevator system and connection beneath the sidewalk takes only about two weeks. Nearly 30 such connections are already in, and 40 more have been ordered. Applications for these connections are coming in daily. The making of additional basement floors beneath the buildings is a matter of larger moment, but in this case the subway has the hauling of the material from the excavation and this point serves to illustrate the possibility of subway earnings and the point that its competition is with horses and not with steam locomotives.

At the present time, when new buildings are built in this district in Chicago, connection is made with the subway and the old building is taken down from within. Its debris and the soil below disappear through the subway. In taking the dirt from beneath the building of Marshall Field & Co., 1,500 cu. yds. of dirt per day was the work of one little electric locomotive and six cars, as contrasted with the possibility of 300 cu. yds. per day that could have been removed by horses. While the horses would have occupied space and stood idle, the electric locomotive pulled three cars, or 15 cu. yds. of dirt out to the lake front dumping ground, while the three other cars were loading, and that was all it had to do—simply throw three empties upon one track and take out three full cars on the other. The price was the teaming price of 60 cents a yard, which meant $900 per day for the earnings of that locomotive and its engineer, at a cost of wages, oil, waste and power, as near as could be figured, of $5.50 per day. Of course, the balance of the cost is the interest on the cost of the subway. The figures look ridiculous, but they are vouchsafed for by one of the engineers in charge. They are no more ridiculous than those for transportation between the Chicago & Alton terminals and the First National Bank building. The Chicago & Alton hauls soft coal 162 miles and dumps it through a subway funnel into the subway cars for 50 cents per ton. The subway, by actual timing, recently received this coal in the delivery time of one minute and 20 seconds, and in 18 minutes thereafter it delivered it into the coal hole of the First National Bank building. The subway received the same price for 20 minutes' work and less than a mile haul that the Alton road received for its 162-mile haul, and the bank got in its coal without dust or dirt, horses or teamsters or labor, within or without its building.

The subway is dry and sweet, with an even temperature of about 58 deg. and perfectly ventilated. When the problem of ventilation appeared the management did not send for sanitary engineers or experts on ventilation, but sent a man through the district to inquire what basement boilers had poor drafts. Then to the owners of such boilers was offered a draft of air from below. The result was magical. Poor furnaces and bad chimneys quickly became economical, and the demand for subway air was such that it has since had to be systematically regulated. The ventilation problem was solved without expense to the subway.

The Chicago Subway has as many tunnels under the Chicago river as there are bridges. There are five bridges over the river and five subway tunnels underneath. Over the south branch of the Chicago river there are 10 bridges and underneath, the Chicago subway has seven tunnels. Over the north branch of the Chicago river there are four bridges and underneath, the subway has two tunnels. This is a total of 14 tunnels to 19 bridges. There were no dedicatory services, opening ceremonials, brass bands or headlines in the newspapers announcing the completion of these tunnels, and they are purposely without date, for they were building without public knowledge or inspection, every hour of the day, whether Chicago was asleep or awake, and they were built as every other part of the tunnels were built—with telephone connection from the breast of the work, not only to working desks, but to the bed-sides of the engineers in charge. The directions were emphatic that if anything was struck besides clay formation, unusual or not understood, not another movement forward was to be made until it had been referred back up the line of supervision for authoritative consideration. If the foreman did not understand it, the matter went to the local engineer; and if not understood there, it went further up the staff and to a Chief Engineer with a salary larger than that of the President of the United States. Thus the Chicago Subway was built, without crash, accident or flood. Nevertheless, there are automatic pumps, at regular intervals, which remove drainage or water as automatically as the flues to the boilers above cleanse the atmosphere. The first seven miles of the Chicago Subway were finished before the newspapers of Chicago knew of the existence of such an enterprise, and yet the record of every day's work was properly and legally placed on file at the City Hall. At times the subway construction has been in progress days and nights with the maximum number of men that could be worked under every street, and at other times, awaiting some necessary franchise or legal action, the subway work has been shut down for many months, and at both times during the past six years, the management has been as unresponsive to the demand for public information as it has been to demand from its stockholders for information. The policy has been that one man could pilot a work so dangerous and difficult but that more could not.

Terminal connections have purposely been kept in the background for the reason that up to within a few months it has not been deemed best to permit the extent of the work to be known. No terminal connections were desired until the 44 miles of tunnel were completed and ready for full operation. One of the most roomy tunnel installations with Chicago Subway is beneath the post office. It has double tracks, high arches, automatic delivery system, by endless belt line—all installed in working order and awaiting only government red tape on minor details of contract relations. In a few weeks not only the newspapers of Chicago, but all the mail from the railroads, will pass to the post office through the Chicago Subway, saving the great delays of the teaming transportation system. It is expected that by June 1st connections with the railroads will be completed and opened for business. At that time 54 connections with mercantile houses will have been installed.

It is figured that by August 1 there will be moving through the subway 30,000 tons of merchandise every 24 hours. None of this will pay less than 50 cents per ton, and if the average rate is 60 cents per ton and the estimates are based upon 365 days, the gross income from this source alone should be $6,500,000 and the net income from this should be not less than $5,000,000.

The subway can be operated very cheaply, day and night, and in all weather; the rates are teaming rates and not railroad freight rates, and the percentage of cost as applied to gross earn-

ings in railroad operations in no way applies to this enterprise. It is electric power on a clear right of way and on a level as against oats, horses and men in the most congested teaming district in the world, where teaming has practically reached its daytime limit with a gross annual expense of $65,000,000. So dense has the traffic in this section of Chicago become that for the most part teams can no longer be hired on a trip or tonnage basis. They must be engaged by the day, for no man can tell what progress teams can make through the city. Of the estimated $5,000,000 for annual net earnings of the subway at least $1,000,000 must be deducted for interest on the $20,000,000 indebtedness and what remains is the earnings upon $40,000,000 of stock, provided the capitalization remains as at present. That an estimate of 30,000 tons per day is not excessive is indicated by the fact that 11,000 tons in less than carload lots goes at 60 cents per ton between the railroads every day, and this business only awaits the completion of the subway terminals under the railroads. Two thousand tons of express matter goes between stations daily by wagons. It is further figured that one-third of the goods now teamed through this section of the city at an expense to the merchants of more than $60,000,000 a year, will in 1907 pass through the subway. This means gross earnings of $20,000,000. On this basis, the estimates are $12,000,000 for net earnings, but it will be very difficult to find a basis for $8,000,000 of expense, as the subway does not do the loading or unloading of the cars. The goods are received in the cars and the cars are delivered for unloading in the stores or for automatic unloading as in the case of coal.

Three New Railroad Shop Tools.

The accompanying illustrations show three new railroad shop tools which are just being put on the market by the Niles-Bement-Pond Company, New York. Figure 1 shows a new hydraulic wheel press which embodies a number of new and valuable features. To facilitate the handling of heavy work with an overhead crane

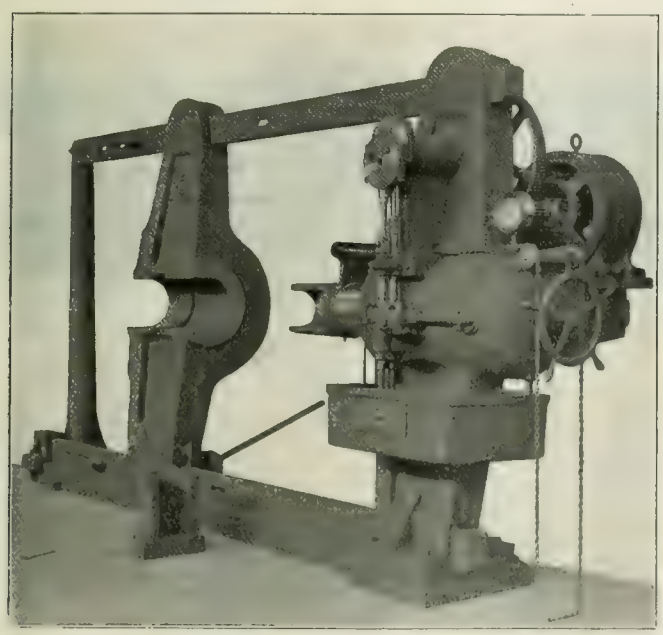


Fig. 1—Niles-Bement-Pond 300-Ton Hydraulic Wheel Press.

the cylinder and resistance head of the press are set over in order that the top tie bar may not interfere with the hook of the crane. This press has a capacity of 300 tons, and it is driven by a 7½-h.p. motor. The maximum distance between the ram and the sliding-head is 8 ft. 1 in. It will handle wheels up to 72 in. in diameter on the tread, and the distance between the tie-bars is 78 in. The machine is mounted on a base-plate, but no strains are transmitted to it as all pressure is taken by the tie-bars. The cylinder is lined with copper expanded into place and burnished. The piston is packed with best cup-leather; is tight, durable, and causes little friction. The pump is double-acting. It has two sizes of plungers and three speeds of delivery, any one or all of which are under instant control. The delivery may be instantly stopped by trip-valves without shifting the belt. The ram is counterweighted for quick return when the release-valve is opened. The safety-valve can be set to open at a desired pressure and is protected from tampering by a lock-box. The pressure gage is graduated for tons of pressure and for lbs. per sq. in. on the ram. A water-tank is bolted under the cylinder and takes the discharge and supplies the pump. The sliding-head is held in position by large steel keys and is supported by rollers running on planed ways on the base and also by rollers on the lower tie-bar.

Figure 2 shows a new design of locomotive rod-boring machine, built at the Niles Works. It will bore rods from 36 in. to 10 ft. between centers, and holes from 3 in. to 7 in. in diameter. The spindles are driven by tangent gearing, giving a smooth motion under heavy cuts. Each spindle is driven by a 7-h.p. motor, so that the spindles are entirely independent and may be run at different speeds. They are counterweighted, have power feeds, controlled by pull pins, hand feeds and quick hand return. The heads are movable on the rail by rack and pinion, and have clamps for fixing position. The work table is 20 in. x 11 ft. 10 in., and

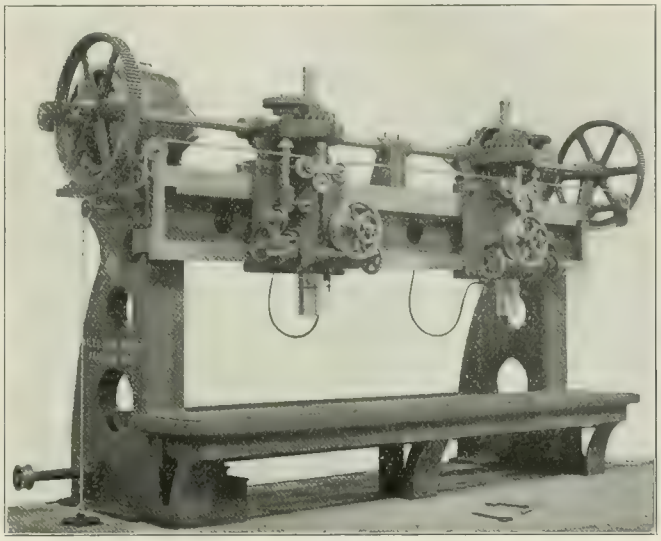


Fig. 2—Niles-Bement-Pond Locomotive Rod Boring Machine.

the maximum distance from the table to the spindles is 15 in. The overhang in front of the housings is 10 in., and the down feed is 14 in. This is a most efficient machine for the purpose intended and will do a variety of other boring also. An ingenious arrangement for lubricating is provided consisting of a circulating pump which forces the lubricant into a pipe placed back of the rail from which it is fed to the boring spindles by means of flexible pipe connections.

Figure 3 shows a 79-in. standard wheel lathe designed by the Niles-Bement-Pond Company for railroads not requiring a machine of the capacity of its heavy driving wheel chucking lathes. This machine is fitted with "sure-grip" drivers, which engage the tires directly and hold them absolutely rigid under the heaviest cuts, allowing the full power of the machine to be used at the tools. The face plates, as in the larger machines, have holes for the

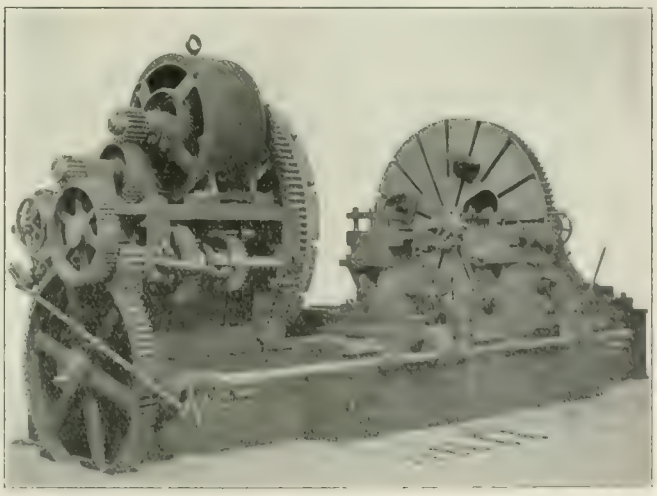


Fig. 3—Niles-Bement-Pond 79-in. Standard Driving Wheel Lathe.

reception of the crank pins, enabling the tires to be chucked close to the face plates. The tool-rests are of massive design and the feed mechanism is operated by a rocker shaft at the front.

The dimensions of this lathe are: Swing over bed, 80 in.; diameter of face-plates, 79 in.; distance between face-plates: minimum, 6 ft. 6 in.; maximum, 9 ft. If motor driven, a 20-h.p. motor is used.

The Belgian State Railroads have let contracts for 177 locomotives to various works in the country at prices as follows: Twelve-wheeled engines with superheater, 50 at $15,180 each; 76 similar

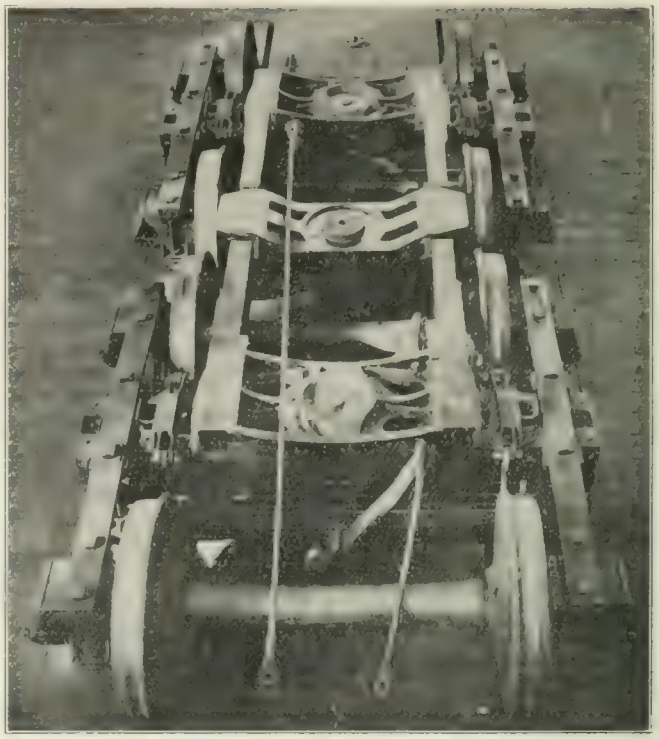
engines, but without superheater, $14,395. 30 16-wheeled tank engines, $16,723. 21 eight-wheeled tank engines, $16,257 each.

100-Ton Flat Cars for Allis-Chalmers Company.

Two 200,000 lbs. capacity flat cars, intended for the special purpose of carrying heavy engine shipments, have been built at the West Milwaukee shops of the Chicago, Milwaukee & St. Paul for the Allis-Chalmers Company. Drawings and photographs of the design are shown herewith.

The car is 39 ft. 6 in. long back to back of end sill channels, 8 ft. wide center to center of side sill webs, and 9 ft. 8¾ in. wide over all. The center and side sills are 15-in., 100-lb. I-beams, and the transverse members are 8-in., 21¼-lb. channels spaced 3 ft. 7 in., riveted to center and side sill webs. Between center sills, similarly spaced, are 1-in. x 8-in. plates bent to rivet to the sill webs. The end sills are 15-in., 55-lb. channels. Each corner of the frame is reinforced by a ½-in. plate 1 ft. 6 in. wide riveted to the top flanges of the end and side sills. Oak nailing pieces 4 in. x 4 in. are bolted to the transverse channels, three on each side of the center sills. As shown in one of the sections and in the plan, the double body bolster is formed from heavy plates, with the principal members passing respectively above and below the center sill flanges, and their ends riveted together and to the side sill webs. Suitable stiffening members and side bearings are provided, as shown in the cross-section. All of the plates are 1 in. x 10 in. except the lower one, which is 1½ in. thick. The draft gear is equipped with the Harvey friction spring, Class D, 6¼ in. x 8 in.

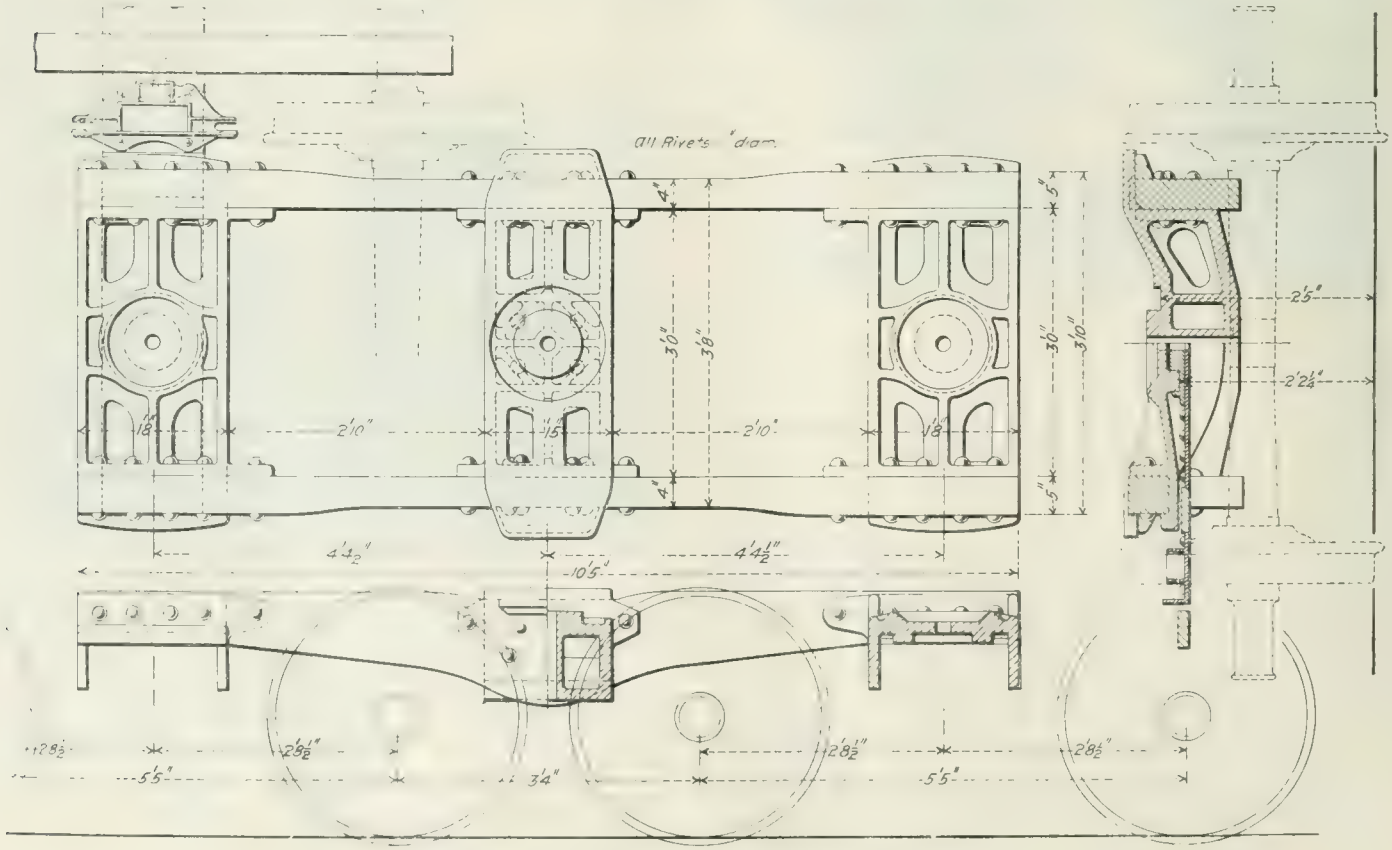
Interest in the design centers in the truck arrangement. The body is carried by a cradle swung between two 100,000-lb. capacity Barber trucks. The two longitudinal members or equalizer bars of this cradle are hammered iron. The cradle center bearing and two truck bearings are cast steel and are riveted to the equalizer bars



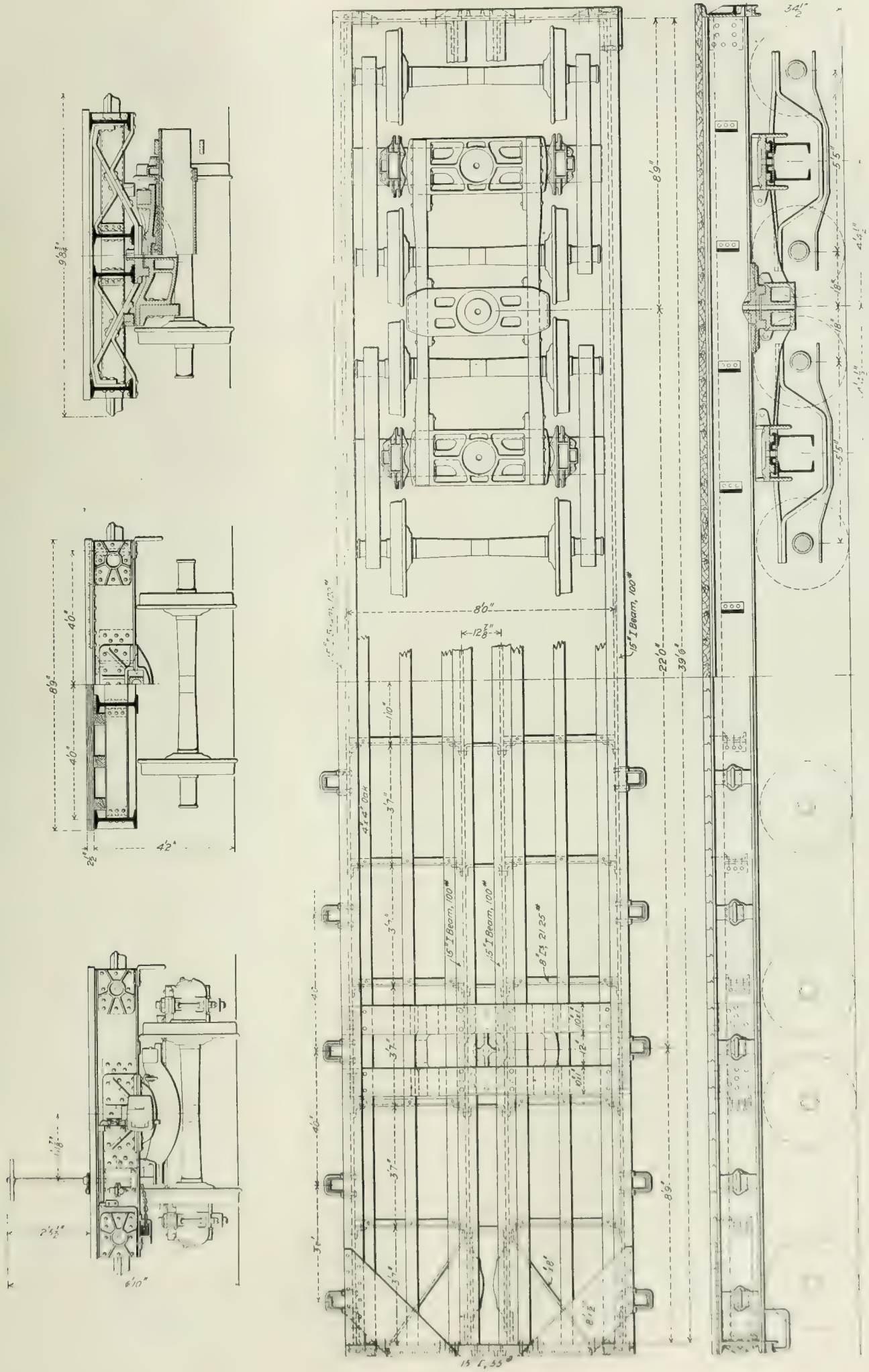
Cradle for 100-Ton Flat Car—Allis-Chalmers Company.



100-Ton Capacity Car for the Allis-Chalmers Company.



Cradle for 100-Ton Car—Allis-Chalmers Company.



General Plan, Half, Side Elevation and Cross Sections—100-Ton Flat Car for the Allis-Chalmers Company.

with 1 in. rivets. One of the cars was tried on a 16 deg. curve and took it without difficulty. It is expected they will go where any ordinary car will. The trucks are M. C. B. standard, so that axles, bearings, wheels, etc. can be replaced readily anywhere in interchange territory.

The car was designed by J. F. DeVoy, Mechanical Engineer of the Chicago, Milwaukee & St. Paul, under the supervision of A. E. Manchester, Superintendent of Motive Power, and J. J. Hennessey, Master Car Builder.

Canadian Railroad Notes.

OTTAWA, April 30. The Ontario Government's railway tax bill was introduced in the Legislature last week. The principle of the bill is taxation according to mileage. In organized territory, railways will pay $60 per mile of single track, and $20 a mile for each additional track. In unorganized territory the rates will be $40 and $10 respectively. The rates for roads less than 150 miles long will be $15 for single track and $5 for each additional track. In view of the early replacing of steam by electricity in Ontario, the government proposes to tax electric roads of over 150 miles, running on their own right-of-way, the same as steam lines. Thus if the Grand Trunk installs electric locomotives it will continue to pay the same tax. Rural electric lines are to be taxed $10 a mile on each track. There will be no tax on city street railways. The increase in revenue from this source will amount to about $200,000.

The transportation interests were on hand last week in full force to point out the injustice that would be done them by the passage of the government's Sunday observance law in its present form. General Manager McNicholl, of the Canadian Pacific, was the first witness before the committee. He strongly objected to the canceling of Sunday trains and showed why public necessity opposed it. His statements were corroborated by Mr. F. H. McGuigan, Vice-President of the Grand Trunk. Representatives of the trainmen also opposed the measure as involving extra work on Monday and in no way lessening the labor of freight handlers, etc. The steamship companies' representatives also were hostile to the bill.

The first bill taken up by the railway committee Friday was that authorizing the Grand Trunk Pacific to issue debenture stock to the amount of $25,000,000. The Minister of Justice explained that the issue would not interfere with the security of the government. The money would be used by the company to purchase rolling stock upon which the government would hold a lien. The clause authorizing the company to guarantee the bonds of the Grand Trunk Pacific Branch Lines Co. caused considerable discussion. Mr. Emmerson, Minister of Railways, suggested that any such guarantee should be subject to approval by the Governor-in-Council. The bill was finally reported with the amendment suggested by the Minister of Railways.

The bill to incorporate the Grand Trunk Pacific Branch Lines Company was next taken up. The capital stock is placed at $50,000,000. Twenty-two branch lines from different points of the G. T. P. are mentioned as feeders to the main line. J. A. M.

The Revised Standard Code.

The Train Rules Committee of the American Railway Association has, during the past year, made a comprehensive revision of the Standard Code of Train Rules, having held sessions which covered in all 15 days; and the revision, as reported by the committee, was adopted by the association at its meeting in Chicago last week. The principal changes made by the committee are noted below. In this work the committee has been aided by the following train despatchers: F. G. Sherman (C. of N. J.), W. H. Graves (C. & N.-W.), J. F. Mackie (C., R. I. & P.), and H. M. Tompkins (L. S. & M. S.).

General rule G, second sentence, refers to the use [at any time], not the habitual use, of intoxicants. Rule K refers to "patrons" instead of passengers.

The definition of a regular train is "a train authorized by a time-table schedule." A main track is "a track extending through yards and between stations, upon which trains are operated by time-table, or train order, or the use of which is controlled by block signals."

Rule 2 provides for the inspection of the watches of other classes than conductors and enginemen. Rule 4 A is omitted and the single form for Rule 4 reads:

Each time table, from the moment it takes effect, supersedes the preceding time table, and its schedules take effect on each division or subdivision at the leaving time at their initial stations on such division or subdivision. But when a schedule of the preceding time table corresponds in number, class, days of leaving direction and initial and terminal stations with a schedule of the new time table, a train authorized by the preceding time table will retain its train orders and assume the schedule of the corresponding number of the new time table.

Schedules on each division or subdivision date from their initial stations on such division or subdivision.

Not more than one schedule of the same number and day shall be in effect on any division or subdivision.

The new code prescribes the use in time-tables of a capital L for leave and a capital A for arrive. Rule 12c prescribes a circle "at half arm's length", in 12e the signal is to be given above the head. Under rule 14h, three short blasts of the whistle will be used, when a train is running, to answer 16d. The title for rule 16 is "Communicating signals," which does not seem to be much of an improvement. In rule 20 the words "of a train" are omitted, and rule 22 omits "to a train."

Following rule 23, the next title is "Superiority of trains," and the first rule, No. 71, contains the paragraphs about right and superiority which formerly were contained in the definition of "superior train." Rule 81 is made No. 72 and there are other slight changes under this head. Rule 82 reads:

Time table schedules, unless published are in effect for twelve hours after their time at each station.

Regular trains twelve hours behind either their schedule arriving or leaving their initial station lose both right and schedule and can thereafter proceed only as authorized by train order.

Rule 87 is changed to 86, and reads:

An inferior train must clear the time of a superior train in the same direction not less than five minutes, or must be clear at the time a first class train, in the same direction, is due to leave the next station in the rear where one is shown.

The last clause, it will be observed, lengthens the time interval where the next station in the rear is far away, but never shortens it to less than five minutes. Rule 88 provides specifically for extra trains and continues to require trains to pull into sidings instead of being pulled in by the locomotive.

Rule 93 has been included in Rule 85, in improved language, and a new rule numbered 93 reads: "Within yard limits the main track may be used, protecting against ——— — class trains ———— class and extra trains must move within yard limits prepared to stop unless the main track is seen or known to be clear."

Rule 94 has a new paragraph added permitting a train which loses its right of track to go to the next telegraph station ahead of and on the right of another train which overtakes it.

Rule 96 requires the arrangement with the operator to be made in writing. In rule 101 the directions as to keeping the engine in motion and telling how to go back are omitted.

Rule 207 requires the despatcher to say what direction he refers to; as, for example, "31 West, copy 5." Rule 208 is made 208A, and a new rule, 208B, provides for sending the order to the operator at the meeting or waiting point. Rule 209 has a note requiring that when additional copies of an order are made on a typewriter, the new copies must be telegraphed to the train despatcher. Rule 211 permits an operator to send orders to enginemen rather than go far away from his office. When a "19" order restricts the superiority of a train at the station where delivered, the train must be stopped before the order is delivered. Rule 218 reads: "When a train is named in a train order by its schedule number alone, all sections of that schedule are included, and each must have copies delivered to it." Rule 219 requires the operator to get the signatures of the conductor and engineman. Rule 220, second paragraph, applies not only to orders but to parts of orders.

Rule 221B provides for east and west, corresponding with the provision in Rule 207.

In the forms of train orders a large number of changes have been made. In all of the forms the supposed stations are represented by letters of the alphabet and not by names of towns on the other side of the globe; for example, old form A 5 read: "No. 5 will meet Extra 95 at Hong Kong." The new form reads, "No. 5 meet Extra 95 east at B." Form D is omitted. Under form F, nine examples are given. Under forms L and M the rule following the example is omitted.

All of the foregoing refers to the rules for single track. Following this code is the code of rules for double track. This in nearly all of its features is the same as the code for single track, those rules which are necessary only on single track being omitted. The blank forms, 31 and 19, are not changed, but the clearance card is changed a trifle.

Increase in Size of Ocean Steamships.

The following diagram was prepared by Mr. Elmer L. Corthell to show the increases in size of the vessels of the Cunard fleet from the foundation of the line, in 1840, until the present day. It was published as part of a report to the Permanent International Association of Navigation Congresses. In the same report, Mr. Corthell shows the average length and gross tonnage of the 20 largest steamships, as follows:

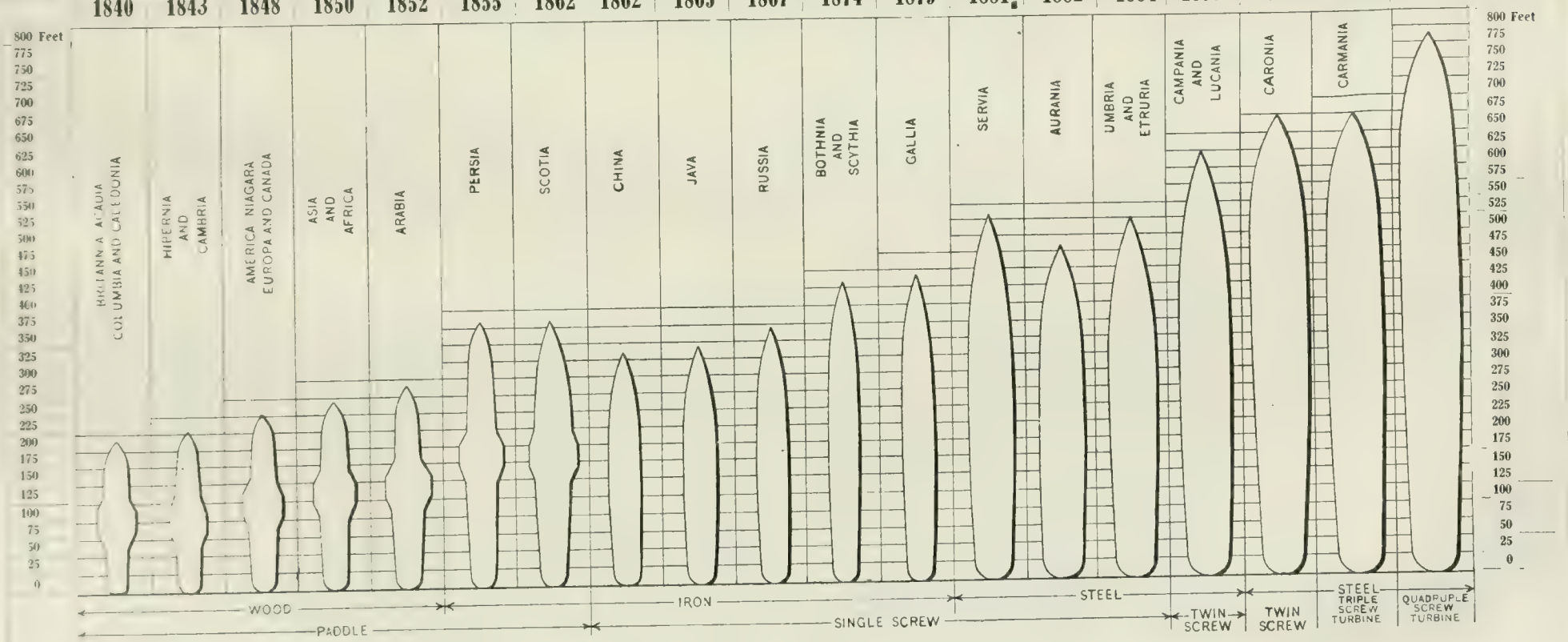
Average Length, 20 Largest Steamships.

1848	230 ft.	1891	..	507 ft.	
1873 .	390	1898 .	.	541	
1881 . .	460	1903 .		640	

Average Gross Tonnage, 20 Largest Steamships.

1848 . .	1,430	1881 .	4,900	1898	10,717
1873	4,413	1891	6,977	1903	17,151

Length between perpendiculars	207' 0"	210' 0"	251' 0"	266' 0"	285' 0"	376' 0"	379' 0"	326' 0"	337' 0"	358' 0"	420' 0"	430' 0"	515' 0"	470' 0"	500' 0"	600' 0"	650' 0"	650' 0"	Length
Breadth of Beam	34' 2"	35' 9"	35' 0"	40' 0"	40' 8"	45' 3"	47' 8"	40' 5½"	42' 6"	42' 6"	42' 3"	44' 3"	52' 3"	57' 3"	57' 3"	65' 3"	72' 4"	72' 4"	Breadth
Depth of Hold	24' 4"	24' 2"	25' 3"	27' 2"	27' 7"	29' 9"	30' 5"	27' 7"	27' 7"	28' 0"	35' 0"	35' 0"	39' 9"	37' 6"	39' 0"	40' 6"	43' 9"	43' 9"	Depth
Gross Tonnage	1139	1422	1825	2226	2402	3300	3871	2539	2697	2959	4556	4808	7391	7268	8127	12500	21000	21000	Gross Ton'ge
Indicated H.-P.	740	1040	2000	2400	3250	4000	4900	2250	2650	3100	3250	5300	9900	9900	14500		21000	21000	I. H. P.
Speed in Knots pr. hr.	10.4	11.3	11.8	12.5	13	13.8	14.4	13.9	14	14.4	13.8	15.5	16.7	17	19.5	22			25 Speed
DATE	1840	1843	1848	1850	1852	1855	1862	1862	1865	1867	1874	1879	1881½	1882	1884	1893	1905	1905	DATE



The breadths of the steamers shown on this diagram are taken from taffrail to fore edge of stem

Comparative Size of Cunard Mail Steamers from 1840 to 1905.

Actual Efficiency of a Modern Locomotive.

At the February meeting of the Pacific Coast Railway Club, Mr. Wm. P. Evans, of the Baldwin Locomotive Works, read a paper on locomotive efficiency, in which he made careful and detailed comparisons of the efficiency of the modern large locomotive with the lighter ones of 20 years ago. These comparisons were based

1. On the theoretical efficiencies.
2. The first cost.
3. The interest on the investment.
4. Depreciation in value.
5. Cost of fuel consumed.
6. Cost of supplies consumed.
7. Hauling capacity.
8. Cost per ton-mile.
9. Reliability of service.
10. Time lost in shop repairs.

I. THEORETICAL EFFICIENCY.

The comparison will be based on coal and water per horse-power per hour. Any marked saving in this direction is to be found only by comparing single expansion engines with compound engines, or with those using superheated steam. The water rate of single expansion engines has not been improved to any appreciable extent since 1885.

At that time consolidation engines with cylinders 20 x 24 in. were in use. They had Stephenson valve gears, which were as well designed as to-day. The boilers with their narrow fireboxes did not evaporate quite as much water per pound of coal as is done now with wide fireboxes and longer boiler tubes. The theoretical advantages of compounding are familiar to all, but the results of a recent comparative test on the Chicago & Eastern Illinois between two 10-wheel freight engines, one a four-cylinder balanced compound weighing 191,060 lbs., and the other a single expansion engine weighing 185,800 lbs., will be of interest.

The average of seven tests on each shows:

	Compound	Single expansion
Water per horse power per hour	29.20	34.12
Saving by compound in per cent. of water, 17 per cent.		

There also should be incidental economies resulting from the use of the balanced compound engines, as they should be free from frame breakages and much easier on the machinery as well as the rail due to the fact that the forces in these engines are perfectly balanced.

Superheated steam is comparatively new and still in the experimental state, but its advantages in reducing the water rate per horse-power are proven without question. The following results of tests made by the Canadian Pacific show what has been done in this line. The Schmidt fire tube superheater was used:

	Coal, per 1,000 ton miles.	Saving by superheat.
January to May, with superheater	129 lbs.	26.70 per cent
Freight, without superheater	176 "	
June to September, with superheater	382 "	22.83 "
Passenger, without superheater	495 "	

In this connection there must be added a demand on the locomotive boiler for about 10 lbs. of coal per hour for each car in the train for heating; and, if electric lights are run by a dynamo driven by steam from the engine, this, as in the case of the Chicago & North-Western equipment, may call for 150 lbs. of coal more per car per hour.

Improvements in the valve-gear are continually being made the subject of experiment, but only two types, in this country, need be given serious thought—the Stephenson link-motion and the Walschaerts valve-motion. The Stephenson link was in general use 20 years ago and is the most common to-day, but in the last year the Walschaerts gear has been applied to a great many new engines. No economy is claimed for this year over the Stephenson, and its application is due to mechanical simplicity and reduced weight. No comparative tests have been made to my knowledge, so it may be assumed that no gain in the water rate is obtained.

II. RELATIVE WEIGHTS AND PRICES OF LOCOMOTIVES.

	1885			1905		
	Weights	Price.	Price per lb.	Weight.	Price.	Price per lb
American	80,857	$6,695	$0.0828	102,200	$9,410	$0.092
Atlantic				187,200	15,750	.083
Mogul	72,800	6,662	.0912			
Pacific				227,000	15,830	.07
Ten wheeler	85,000	7,583	.0892	156,000	15,690	.088
Consolidation	92,400	7,888	.0854	192,460	14,500	.075

The price per pound is figured from the total weight of the engine with three gages of water in the boiler, but excluding the tender.

III. INTEREST ON INVESTMENT.

This figure is governed by the economic conditions of the country. At present the usual rate of interest is 4 per cent. In 1885 it was 5 to 6 per cent. Interest is therefore 1 to 2 per cent. lower than in 1885. The fluctuation between the two dates has been great, especially during the panic of 1893 to 1897.

IV. DEPRECIATION IN VALUE.

As soon as the engine goes into service, its value takes a sudden drop due to the fact that it then becomes a second-hand machine. After this its depreciation is gradual until the cost of repairs and maintenance equals the service which can be obtained for it. Under average conditions prevailing in this country this occurs after a service of about 20 years when the curve of depreciation runs parallel to the base line.

It may be discussed systematically by dividing it into several principal headings.

1. The original cost of the locomotive and its present value. To the cost charged by the builder should be added the freight charge for delivery and the cost of breaking in the locomotive. The value of locomotives which have been in service a number of years, but which are in good working order, may be obtained approximately by obtaining the net weight of the locomotive proper, without tender, and without water in the boiler, and multiplying this weight by seven for the value of cents.

2. Depreciation must have some relation to the estimated life, but it is not necessarily a constant, as is often assumed. The common rule is to divide the original cost by the estimated life in years to find the yearly depreciation. A more rational method is based on the fact that after certain periods of service locomotives depreciate more rapidly. When this is taken account of, it is suggested that for the first five years the full second-hand value of the locomotive may be taken; for the second five years 85 per cent. of this second-hand value; for the third five years 70 per cent., and after 15 years 50 per cent. of the second-hand value; after 20 years 25 per cent. of the first cost.

V. DEPRECIATION.

Again the money invested in a locomotive may be treated as an amount of capital which is to be redeemed by an annuity in a certain period of years. For example, if the life of a locomotive is taken as 15 years and the interest at 6 per cent., we find in the annuity tables that the annual payment required to redeem $1,000 in 15 years is approximately $43, and for a locomotive costing $10,000 the annual charge would be $430, which is considerably less than the straight charge obtained by dividing $10,000 by 15, which equals $666.

This argument applied to engines in 1885 as well as 1905, except concerning the length of life of the engine. The actual life of a locomotive is a very uncertain thing to compute. An engine 38 years old was recently withdrawn from active service, having the original rods, frames, etc., and in England engines are said to be running in the neighborhood of 50 years old, and a Baldwin engine 60 years old is still in operation in Cuba.

Generally in this country when a locomotive is 20 years old it is supposed to have reached the limit beyond which it is not considered policy to spend much money for repairs, and if the same size and price of engine were purchased with which to replace it, an annual charge of 5 per cent. would create sufficient funds to effect a renewal at the end of the 20 year period.

In connection with the depreciation of locomotives, it is very properly maintained that it is best to keep engines in active service to as great an extent as possible so that they may be worn out and the benefits of new and improved forms be obtained. In short, it is very much better, if it be possible to so operate the road, to have, say, 50 engines which must be replaced in 10 years, than to have 100 stay in service for 20 years.

From what has been said it is plain that depreciation depends more on the service and use of the locomotive than the locomotive itself. Since engines 20 years ago were used more carefully and made fewer miles in a month than they do now, the rate of depreciation was much lower than to-day. In this respect the charges against an engine of 1885 would be less than for an engine of 1905.

As it has been impossible to get reliable data covering the past 20 years, that which it has been possible to gather for the years from 1897 to 1905 is given herewith:

1897 coal cost	$3.37	1900 coal cost	$3.12	1903 coal cost	$3.17
1898 "	3.20	1901 "	3.29	1904 "	3.26
1899 "	3.12	1902 "	3.14	1905 "	3.38

The introduction of oil has reduced the cost of this item on roads within reach of the oil supply.

An average figure for evaporation of water per pound of coal is 6¼. From the results of a number of tests made with fuel oil in California we may safely allow 10½ lbs. water per pound of oil.

Coal, $3.38 per ton.
Oil, ¾-cent gal., 8 lbs.
168 gal. oil = 1 ton coal

Coal at $3.38 a ton, or 169c. per lb., $\frac{.169}{6\frac{1}{4}} = .02704$.

Oil at ¾-cent gal. or .09375 per lb., $\frac{.09375}{10\frac{1}{2}} = .00892$

This makes a saving of 60 per cent. by the use of oil.

When the boilers are equipped with some form of superheater the evaporative rate for both oil and coal is lower, but they continue to bear about the same ratio.

This is due to the fact that some of the heat of the boiler is diverted from evaporating water to superheating the steam, and also because of the reduction of the heating surface effective for evaporating water. This is not true of the Vauclain superheater, which is entirely in the smoke-box and utilizes the waste gases for

the purpose of superheating the steam without in any way reducing the heating surface of the boiler.

VI. SUPPLIES.

As fuel has been discussed separately, the item of "Supplies" will include water, oil, waste and tools. Where water has been treated chemically to precipitate the scale forming salts it has a real value after treatment, aside from the cost of putting it in the locomotive tenders, which varies greatly with the character of the water and the method of treatment.

Twenty years ago water was not treated at all. To-day very few railroads use a water which they know is bad without treating it first. The money paid for water treatment is then an expense which is found charged to engines to-day which was not charged 20 years ago.

The cost of oil is a subject of great discussion among motive power men, and although the cost of lubricating locomotives is usually not over 1 per cent. of the locomotive expenses, it generally receives as much attention as the cost of fuel. When we consider that the fuel ordinarily runs into expense 30 or 40 times as fast as oil, there seems to be little reason for this anomalous fact unless it is the peculiar conditions under which lubricants are purchased. Very often there is an agreement with the oil company that lubrication will be effected for a specified figure, and whatever is used over that amount (per engine mile) is supplied free of cost; that is the extra cost as represented by the excess of oil used is refunded to the railroad when the annual settlement is made. At first sight this would seem to minimize the anxiety to make a good oil record, but the incentive lies in the fact that when the contract is renewed in one or two or five years time, if the refunded amounts have been large the unit price is increased.

As an illustration: A certain railroad was working under a guaranteed amount of oil for locomotives at $1.20 per 1,000 engine miles. The year before the contracts expired, owing largely to an increase in the size of locomotives caused by the liberal purchases of heavy power, the cost (as charged out at the agreed prices) ran in the neighborhood of $2. While the amount necessary to reduce the cost during the life of the contract was promptly forthcoming the price was raised in the new contract to $1.82 per 1,000 engine miles. These statements and documents passing constantly through the hands of the officials are no doubt responsible for the alertness with which oil consumption is watched, as no such arrangement obtains with fuel.

The next table gives what may be considered a fair average of the number of engine miles for an engine to make on a pint of valve oil.

Engine Miles per Pint of Valve Oil.

Engine.	Service.	Cylinder.	Miles per pint.
Simple	Passenger.	17	150
Simple	Freight.	17	100
Simple	Passenger.	19	120
Simple	Freight.	19	80
Simple	Passenger.	22	90
Simple	Freight.	22	60
Compound	Passenger.	17 and 28	90
Compound	Freight.	17 and 28	60

This shows that the modern engines can go only about one-half as far on a pint of valve oil as the smaller engines of 20 years ago.

The introduction of grease for heavy bearings of late years has made a saving which can be illustrated as follows:

Estimated Cost of Cylinder and Engine Oil or Grease.

Engine.	Service.	Cylinder.	Grease — Without.	Grease — With.
Simple	Passenger.	17	1.31	0.85
Simple	Freight.	17	1.65	1.12
Simple	Passenger.	19	1.67	1.08
Simple	Freight.	19	2.07	1.41
Simple	Passenger.	22	2.23	1.45
Simple	Freight.	22	2.68	1.84
Compound	Passenger.	17 and 28	2.23	1.45
Compound	Freight.	17 and 28	2.68	1.84
			16.52	11.04
			11.04	
			5.48	

This shows a saving of 33.2 per cent. by the use of grease.

The cost of waste per thousand miles has been found to be proportional to the cost of the oil. From a report of the Chicago & North-Western Railway, the cost varied on different divisions from one-tenth to one-quarter that of oil, the average for the whole road being one-seventh, that is, where the oil costs $2.10 per 1,000 engine miles, the waste amounted only to 30 cents for the same distance. The oil and waste should ordinarily vary proportionately for engines of different size so that if we take the waste at one-seventh the cost of oil, we cannot be very far from the truth. If an engine is equipped for grease on all the main bearings the expense is much less, as then only the waste for the tender truck boxes and for wiping the engine is necessary.

We now come to the most important division of our subject, viz.

VII. HAULING CAPACITY AND COST PER TON-MILE.

The hauling capacity may be considered as a definite quantity, depending entirely upon the design of the engine. Assuming that the boilers of engines 20 years ago were as well proportioned for the work the cylinder would do as they are to-day, the hauling capacity is fixed by the size of the cylinder and wheels, or in other words, by the tractive power.

In the following table are given the weights on drivers and tractive power of representative passenger and freight engines built in 1893, comparing them with engines built in 1904.

Comparison of Tractive Power, 1893 and 1904.

Type.	Weight on drivers.	Tractive power.
Passenger, 1893.		
American type simple	75,210	17,270
American type compound	83,860	12,900
American type simple	64,560	15,550
American type compound	78,480	14,050
Ten-wheel type compound	93,850	16,480
5		76,250
		15,250
Freight, 1893.		
Consolidation compound	120,600	22,950
Ten-wheel simple	101,000	23,310
Mogul simple	91,340	21,030
Decapod compound	172,000	35,580
4		102,870
		25,720

The tractive effort of passenger engines has increased from 15,250 to 23,740, or 55.6 per cent.; of freight engines from 25,720 to 46,600, or 81.2 per cent. These figures show an enormous increase in size of locomotives in use to-day over those employed 20 years ago. During this time, however, but few railroads have seen any material improvement in the roundhouse facilities or shop equipment, and it is a grand tribute to the mechanical officers of railroads that repairs have been kept as low as they have.

Comparison of Tractive Power, 1893 and 1904.

Type.	Weight on drivers.	Tractive power.	
Passenger, 1904.			
Atlantic type compound	101,420	22,180	4.57
Atlantic type simple	103,600	16,420	6.28
Pacific type simple	141,290	29,910	4.71
Pacific type simple	114,890	25,610	4.46
Atlantic type simple	80,930	25,590	3.10
5		118,710	
		23,740	
Freight, 1904.			
Santa Fe compound	234,580	62,740	3.73
Consolidation 2-cyl. compound	166,000	40,300	4.13
Consolidation simple	151,490	40,720	3.71
Consolidation simple	171,460	44,080	3.89
Consolidation simple	165,770	45,170	3.61
5		233,010	
		46,600	
Increase passenger		55.6 per cent.	
Increase freight		81.2 per cent.	

During this period compound engines have also been introduced, and statement of their increased cost of maintenance has very frequently been due to an increase in size of the size of the power rather than to the compound features.

There have been compilations made of the average weight of trains in tons (of 2,000 lbs.) hauled by certain American roads during a period from 1895 to 1905. These figures include branches as well as main lines, and also exclude the tare weight of the cars, so that the tonnage actually hauled by the locomotives in through freight trains will be very much greater.

The following table shows the increase of train loads possible on account of heavier power.

Average Weight of Train in American Tons.

Eastern.	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904
Lehigh Valley	...	...	...	412	424	448	467	464	486	486
New York Central	...	...	290	320	361	398	392	387	421	419
Pennsylvania	...	...	...	...	470	478	489	518	527	..
Southern.										
Louisville & Nashville	...	...	179	194	216	239	222	231	231	234
Norfolk & Western	...	...	325	355	384	435	452	476	486	488
Chesapeake & Ohio	...	325	352	379	450	500	533	538	...	536
Southern	...	162	173	176	188	203	222	226	218	225
Central.										
Illinois Central	...	...	194	191	209	222	275	325	335	332
Chicago & N.-W.	...	141	152	194	208	236	232	250	232	
C., M. & St. Paul	152	167	167	175	187	205	263	285	281	280
L. S. & M. S.	318	322	321	352	427	455	531	577	615	.
Western.										
Southern Pacific	...	...	...	220	226	240	254	261	267	...
Northern Pacific	...	...	230	313	336	391	381	401	381	403
Great Northern	...	256	281	316	336	357	381	418	417	447
6						1,373				
Average			229							385.2

The actual train loads show what has been done with the power available on the roads, part of it being light power built some time ago, and part the modern heavy power. The train loads have actually increased from 229 to 385 tons, or 68 per cent.

With an increase of tractive effort of 55.6 and 81.2 per cent for passenger and freight engines in 10 years, the train loads actually hauled have increased 68 per cent. These figures agree surprisingly well, which is coincidence, because there are a great many considerations other than engine power which go to make up the average tonnage of trains hauled for a year.

VIII. THE COST PER TON-MILE.

This cost is an important one as it is the means used by all railroad officials in making comparisons of one month or year with another or one division with another or, in fact, any transportation charges.

The cost of hauling trains per ton mile has been tabulated for

the same period for which the tonnage hauled was given, and show the effect partially due to enlargement of trains. We say partial, as there are many other items besides the train loads which offset this cost, as the variation in price of materials, labor, etc. Such increases have occurred principally within the last five years, and it will be seen that generally the cost has risen in this period while it fell before. But we also see that the greatest increase in tonnage per train was made in the previous five years.

Average Cost of Transportation per Ton Mile in Cents.

	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904
Eastern										
Lehigh Valley		.43	.42	.35	.40	.42	.41	.41	.43	.40
New York Central				.39	.35	.35	.38	.42	.44	.48
Pennsylvania					.34	.36	.38	.40	.43	...
Southern										
Louisville & Nashville			.58	.54	.52	.54	.50	.51	.54	.55
Norfolk & Western			.33	.28	.27	.26	.28	.27	.29	.31
Chesapeake & Ohio	...	.28	.27	.24	.23	.22	.24	.25	...	.31
Southern		.68	.65	.64	.63	.64	.66	.66	.76	.69
Central										
Illinois Central			.44	.44	.45	.43	.41	.40	.39	.43
Chicago & N. W.	.63	.60	.56	.54	.50	.51	.50	.55		
C., M. & St. Paul	.67	.60	.61	.61	.59	.63	.57	.56	.58	.59
L. S. & M. S.	.39	.37	.37	.34	.32	.33	.34	.38	.41	...
Western										
Southern Pacific				.62	.62	.64	.64	.66	.68	
Northern Pacific	...	...	.70	.50	.50	.47	.48	.46	.47	.46
Great Northern	...	.51	.53	.44	.45	.46	.48	.42	.42	.46

Examine, for instance, the record for the Northern Pacific, the cost dropped from .70 to .47 between 1897 and 1900, and the tonnage per train increased from 230 to 391 in the same time; whereas, from 1900 to 1904, the load has only increased from 391 to 403 (12 tons) and the cost has been reduced only one point, that is, from .47 to .46.

Also for the Chicago, Milwaukee & St. Paul from 1895 to 1902, the train load increased from 152 to 285 tons, nearly double, and the cost dropped from .67 to .56, but since then the train load has decreased slightly and the cost has risen to .59. In this case again the lowest cost is accompanied by the heaviest train. Other roads, however, show an increased cost (generally slight), although the train load has become slightly heavier, this being due, no doubt, to the greater charges for labor and material. If we now return to the table of train weights, we will see what enormous strides some of the lines have made in introducing heavier trains. The Lake Shore & Michigan Southern has increased from 318 to 615 tons in 10 years, or nearly double, and the Chicago, Milwaukee & St. Paul has accomplished nearly as much in proportion, but its average train load now is not as great as the Lake Shore's was 10 years ago. This is accounted for by the fact that the Lake Shore is nearly straight, with maximum grades of 18 ft. per mile, while the Milwaukee has grades possibly three times as steep, and numerous branch lines of light traffic.

We must not confuse these train loads, however, with what is really hauled by the locomotives, as the Lake Shore has engines which can pull 3,000 tons or more back of the tender. As stated above, the figures are the average train loads for main lines and branches, and, moreover, do not include the weights of the cars themselves, which may be from one-half to one and one-half times the load, depending on whether it is heavy (like coal and ore) or bulky (like some classes of merchandise, such as furniture). One of the transcontinental lines recently so grouped its power that it could move trains from 1,350 to 2,600 tons westbound; that is, the train load back of the tender lay between these limits for different portions of the line, the locomotives being located according to the grades encountered, the idea being to maintain a constant train load as far as possible.

Of course, introduction of heavy locomotives into the power equipment of a railroad will have an immediate effect upon the average train load, but even if 100 such machines were introduced into a lot of 1,000 engines, the general average would be but slightly raised.

Statements from different roads show that locomotive growth is not responsible for all the increase in train load, and that we might look elsewhere for the reason. The portion which cannot be attributed to the size of the locomotive must be credited to the system of tonnage rating, and its accompanying results. When an engine was given 30 or 40 cars without regard to their loading, it might be stalled on controlling grades, or be under loaded. When there was a little congestion, and rates were high, these things received little attention, but with increasing competition and the advance in costs, it became necessary to figure closely upon the hauling power of the locomotive and the resistance of the train. By this means cars were given more nearly their true value in making up a train, and straw hats and pig iron were no longer considered equal loads.

By repeated trials and changes of method, the rating of engines is now so perfected on a few roads that the engines are run at the most economical tonnage and speed, all things considered. Where this adjustment has been made, any further saving must come from heavier power, as has been to some extent the case in the past.

IX. RELIABILITY OF SERVICE.

This division of the subject is taken to mean the number of engine failures as related to the trains run both twenty years ago and to-day.

First it will be well to discuss what is meant by an engine failure. Some roads report as an engine failure anything whatever that delays a train over two minutes on the road, which is chargeable in any way to the locomotive, whether or not such time was subsequently made up. Other roads count only breakdowns. The Chicago & North-Western Railway has made the definitions of an "engine failure" the subject of an official circular, which has been in effect several years.

1. All delays waiting for an engine at an initial terminal, except in cases where an engine must be turned and does not arrive in time to be despatched and cared for before leaving time.

2. All delays on account of engines breaking down, running hot, not steaming well, or having to reduce tonnage on account of defective engine, making a delay at a terminal, a meeting point, a junction, or delaying other traffic.

The first case could not have been any different with engines twenty years ago than to-day. The second, which embraces breakdowns, hot boxes, and failures for steam, are chargeable more to the engine than are delays at initial terminals, but even these are not always the fault of the engine or crew. All know of cases where engineers have reported loose eccentrics time and time again, but because the cams would have to be taken off and reduced, nothing was done but tighten a set-screw, perhaps. Then the eccentric shears off a key and slips around. The engine may limp into the next division point, but there is a breakdown charged against the engine and crew when the roundhouse foreman or some higher authority was more responsible than the crew. In general, the reason engines of to-day would be more or less reliable than those of twenty years ago is on account of the service they have to perform and the care taken of them and the use of material better adapted to the special service in which it is used. The higher speeds of to-day are hard on the engine. The excessive loading which some trainmasters expect a freight engine to handle often accounts for a failure which would not have occurred had the engine been more properly rated.

The use of cast-steel driving tires and centers in place of cast-iron, of steel boiler-plates in place of laminated iron, of high carbon forging for axles, pins, and rods in place of case-hardened iron, have all tended to materially increase the reliability of the engine of to-day as well as to decrease the cost of maintenance. The care used in the selection and inspection of material, and the corps of trained chemists and metallurgists maintained by the large manufacturing plants of to-day have all assisted to this end.

The art of building locomotives may progress unevenly, that is, a fault may creep into all engines built for a certain period of years, which is due to the use of the same design or method of manufacture when it no longer produces a satisfactory product. When the fault is recognized, the method, material or design is changed and a finer article is produced than ever before, only to make some other part seem unsatisfactory in comparison.

To show where the new power is more satisfactory than the old, the following experience may be cited. For a long time the service between certain points was erratic. The trains were hauled by eight-wheeled engines which were too small to make time with the trains put behind them. Being old, they were subject to frequent breakdowns on the road. In their youth these engines had done the work expected of them. The trains were less and less regular, until a sufficient number of powerful ten-wheel engines were purchased and the trains are now run so that the officials are proud of the railroad's record of scarcity of train delays from engine failures.

X. HOURS LOST BY BEING HELD FOR SHOP REPAIRS.

This may be said to have nothing to do with the size of the engine. Of course, in any modern shop the small engines of fifteen years ago which are still running can be repaired with much less labor than the modern power, but the biggest engines are given a complete overhauling to-day in less time than was necessary for any engines twenty years ago.

In one of the shops of the northwest, where a proper system of shop management has been in conscientious operation for four or five years, the time of general repairs has been reduced from one month to thirteen days.

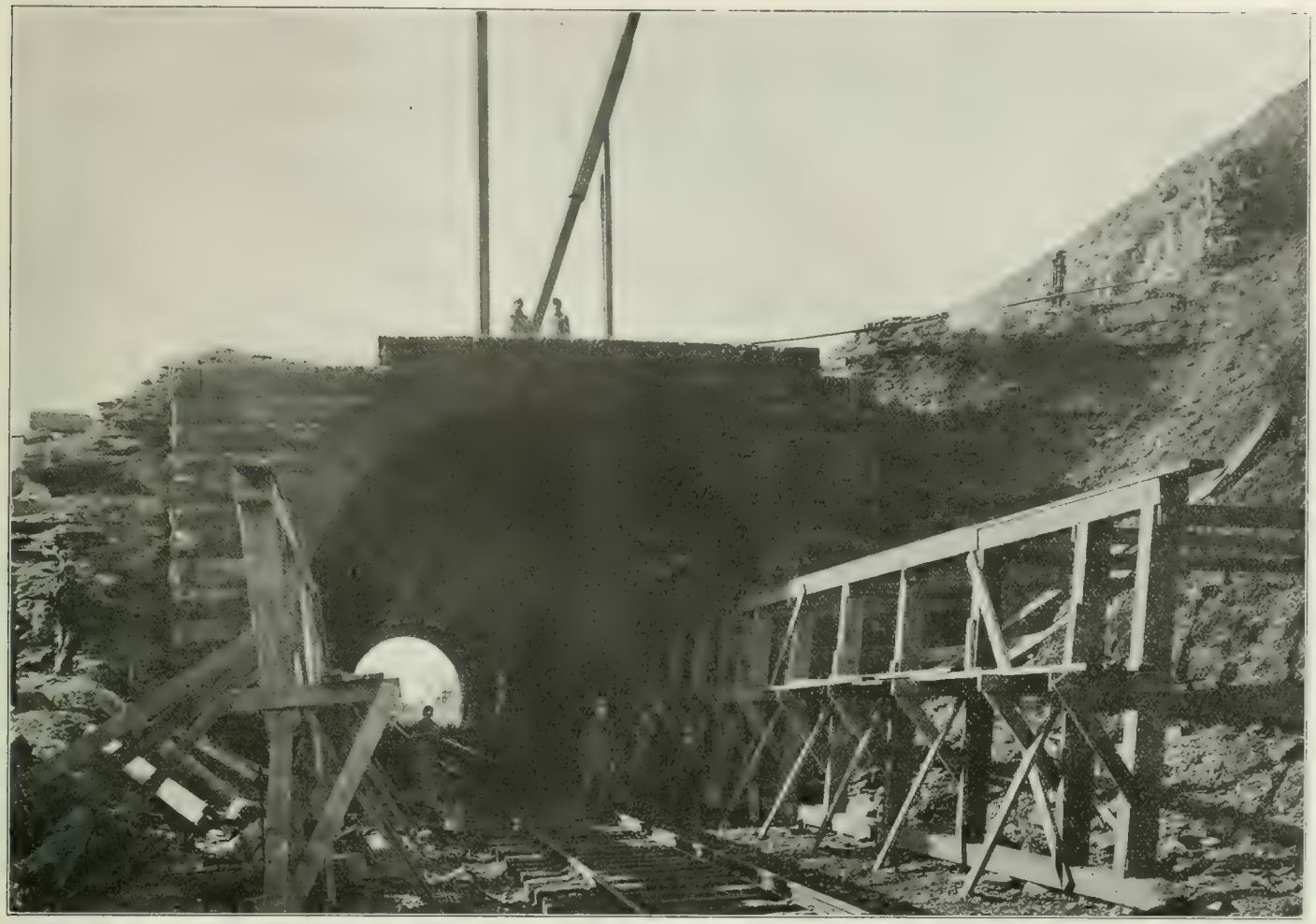
The cost of maintenance has been reduced when based on the cost per ton mile as is shown by the following table for one of the southeastern lines:

Cost of Maintenance per Ton mile.
(For one of the southeastern lines.)

	Cost of repairs per 1,000 freight ton miles.		Cost of repairs per 1,000 freight ton miles.
1897	25.4	1901	18.2
1898	23.9	1902	21.6
1899	21.7	1903	21.6
1900	20.3		

Removal of Bulger Tunnel.

Bulger tunnel, on the line of the Pittsburg, Cincinnati, Chicago & St. Louis is about 24 miles west of Pittsburg. In 1887 this tunnel, which is 320 ft. long, was widened for double track and lined with brick and stone. When the necessity for a third track in this territory arose it was decided to remove the tunnel entirely and make instead an open cut through the ridge that it pierced. This work is now in progress and the accompanying views, taken



Erecting Centers Before Removing Masonry of Bulger Tunnel—P. C. C. & St. L.



Cutting Out Bulger Tunnel on the P., C., C. & St. L.

February 23, give a good idea of its features. The opening is being made wide enough for four tracks and is about 90 ft. deep. It contained about 235,000 cu. yds. of material, principally rock. The alinement in connection with this work is also being materially improved, 2 deg. curves replacing a number of curves of 4 and 6 deg. We are indebted to Mr. W. C. Cushing, Chief Engineer of Maintenance of Way of the Southwest System of the Pennsylvania Lines West of Pittsburg for the photographs.

Railroad Decisions in April.

Public Lands. The act of Congress authorizing the confirmation of titles to *bona fide* purchasers of land erroneously patented to western railroads will not be a bar to a suit by the government against the railroad company conveying the land to recover the value of these lands. Southern Pacific R. R. v. United States, 26 Sup. Ct. Rep. 296.

Drainage through Rights of Way.—The Illinois Farm Drainage act which charges railroad companies with the expense of removing soil when necessary to widen and deepen channels through rights of way to carry increased volume of water, and also with the cost of new bridges and culverts made necessary by these changes, violates the constitutional inhibition against taking property without due process of law in placing the expense of moving the soil to widen the channel on the railroad company. The provision placing the expense of erection of bridges and culverts to conform to the new conditions is sustained against the objection that it is likewise a violation of the due process provision, and in addition the constitutional provision guaranteeing the equal protection of the laws to all citizens. Chicago, Burlington & Quincy R. R. v. Grimwood, 26 Sup. Ct. 341.

Removal of Condemnation Proceedings to Federal Courts.—The mere fact that a non-resident defendant in condemnation proceedings is the owner of part of the lands sought to be taken as a whole for railroad purposes does not create a separable controversy between the particular land owner and the railroad company under the Wisconsin eminent domain statute, so as to entitle him to remove the proceedings to the Federal Court on the ground of diversity of citizenship. Perkins v. Lake Superior & Southeastern Railway, 140 Fed. Rep. 906.

Receivership Proceedings.—A federal court in possession of the property of an insolvent railroad through a receiver will not be ousted of exclusive jurisdiction over the property by the fact that a mortgagee residing in the same state with the railroad company, and thus entitled to bring foreclosure in the state courts, has intervened in the proceedings to enforce his particular rights under the mortgage. Cole v. Philadelphia & Easton Railway, 140 Fed. Rep. 940.

Liability as between Lessor and Lessee of Railroad.—In the absence of a statute fixing liability, a railroad company leasing its railroad to another company is not liable for injuries resulting from negligence of the lessee company in its exclusive operation of the road. It follows that the joinder of the non-resident lessor and the local lessee as defendants in a suit by an injured employee will not authorize the removal of the action to a federal court, as the action is really against the local company alone. Curtis v. Cleveland, Cincinnati, Chicago & St. Louis Railway, 140 Fed. Rep. 777.

Routing by Initial Carrier.—The provision of the Interstate Commerce Act which requires filing of joint traffic rates, when agreed upon with the commission, does not forbid the adoption by carriers as part of an agreement for a through rate from California to the east of a rule allowing the initial carrier the right to route the shipment beyond its own terminal as a condition to guaranteeing the through rate. This particularly where the purpose of the rule is to prevent rebating by connecting lines. In the practical operation of the rule the shipper has generally directed the actual routing, and his request to divert the shipment *en route* has usually been respected. Neither is the rule open to the objection that it works a discrimination or is in effect a pooling device. Also a federal circuit court may enforce an order of the Interstate Commerce Commission to a railroad company to desist from enforcing a rule, though for a different reason than the one relied upon by the Commission. Southern Pacific Co. v. Interstate Commerce Commission, 26 Sup. Ct. Rep. 330.

Minnesota Fence Law.—The Minnesota railroad fence law, when applied to a case of parallel railroads, does not allow a recovery against one of the companies for an animal injured or killed on the adjoining right of way, although the animal reached the right of way where it was killed through a defective fence of the former company. The action lies solely against the railroad which ran over the animal. Bear v. Chicago Great Western Railway, 141 Fed. Rep. 25.

Eminent Domain of Foreign Companies in Kentucky.—A railroad company incorporated under the laws of a sister state cannot exercise the right of domain under the laws of Kentucky unless it is incorporated under the laws of that state. This right is not conferred by mere compliance with a law of Kentucky authorizing foreign railroad corporations to possess control and maintain railroads in that state on filing their foreign articles of incorporation with the state. Evansville & Henderson Traction Co. v. Henderson Bridge Co., 141 Fed. Rep. 51.

Time of Filing Claims. A federal court will permit the filing of a personal injury claim against a receiver of a railroad after the time fixed by a notice for the filing of claims, in a case where the claimant is a minor and the negligence is that of his representative. Park v. New York, Lake Erie & Western R. R., 140 Fed. 799.

Colorado Frog Blocking Act. The law of Colorado which requires railroads to securely block all frogs and switches does not deprive a railroad company of the right to defend an action for an injury caused by a failure to observe this law by showing that the employee continued his employment with the knowledge of this violation of the law and hence assumed risk of injury from the defect. Denver & Rio Grande R. R. v. Norgate, 141 Fed. Rep. 247.

Venue of Suits. A railroad company may waive its right under the statute to be sued in the federal court of the district of its corporate residence by making a general appearance in a suit without objection to the jurisdiction of the court. Mahr v. Union Pacific R. R., 140 Fed. 921.

Pacific Coast Railway Club.

The March meeting of this club, held at the Palace Hotel, San Francisco, on the 17th, was given up to an address on Railroad Young Men's Christian Associations, by Mr. George D. McDill, of the International Committee. Mr. McDill's talk was illustrated with stereopticon views showing the railroad Y. M. C. A. buildings at Springfield, Mass.; Port Richmond (Philadelphia), Pa.; Collinwood, Ohio; Oakdale, Tenn.; St. Paul, Minn.; McKee's Rocks, Pa.; Binghamton, N. Y.; Bellevue, Ohio; Douglas, Ariz.; Helper, Utah, and Childress, Tex. Seven of these buildings cost over $25,000 each. Most of them are new, and the collection of pictures was unusually interesting. The views are reproduced in the Proceedings of the Club, Volume 7, No. 11. Mr. McDill gave interesting facts concerning the rapid growth of the association on the principal railroads. On the Gould Lines in the Southwest, in the five years following 1899, the number of associations increased from eight to 25; membership from 1,000 to 10,000; percentage of running expenses paid by members from 48 to 75. At Pocatello, Idaho, the total membership of the railroad association is 620, of whom 378 are members of no church, 125 members of the Mormon church, 99 of the Roman Catholic Church, and 18 of all Protestant churches.

The speaker devoted himself more particularly to the Y. M. C. A. work west of the Missouri river, and told of the large sums paid by the roads in that region for Y. M. C. A. buildings. In conclusion, Mr. McDill said that the most westerly buildings of the Railroad Y. M. C. A. were those at Helper, Utah, and Douglas, Ariz. These two associations, with Pocatello, where money is being raised for a building, form the frontier of the railroad work. . . . "I want to see the time when California, and Oregon, and Washington shall have adequate provision for their railroad men in club houses such as you have seen before you to-night, and under the auspices of the Young Men's Christian Association. No other club plan has ever been successful for any length of time. The Association has to-day practically the only experts in welfare work in the country. Over 2,000 men are now employed by the North American Associations, and the majority of these men could command larger salaries in other vocations. But they are giving their lives to help men, and I want to commend to you their work, and ask you who are present to-night to help the Association to secure a foothold on this coast."

Foreign Railroad Notes.

The returning soldiers seem to have taken possession of the Siberian Railroad, and to be working it very badly, even for their own interest, which is to get home as soon as possible. A correspondent of a Russian newspaper who tried to return from Manchuria says that the soldiers would not permit passenger trains to overtake and pass soldiers' trains (long trains of freight cars, which can only move slowly); that they flatly refused to obey either their own officers or the railroad authorities, and often destroyed buildings, etc., on the line. They were determined, they said, no longer to starve and freeze in Manchuria.

The Berlin Elevated Railroad, a massive masonry construction for the most part, was built quite as much for the entrance of trains from other railroads and for the passage of such trains through the city from east to west as for strictly urban travel. Now it is found that these long distance trains limit the city travel unduly: not trains enough can be put on to accommodate the travel. To remedy this there is now talk of designing two-story cars for the city trains, the upper story to be entered from special station platforms. The German Society of Mechanical Engineers offers a prize of 6,000 marks for an effective working out of this plan.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

The Garfield Report 465
Flagging Rule Ignored in England 465
Government Quarterly Accident Bulletin 466
On the Eve of a Rate Bill 466
The Great Railroad Systems 467
Pennsylvania Company 468
Cleveland, Cincinnati, Chicago & St. Louis 469
New York, Chicago & St. Louis 470
New Publications 471
Trade Catalogues 471

ILLUSTRATED:

Alternating Current Track Circuits in the New York Subway 472
New Missouri Pacific Yard at Kansas City 474
The First T-Rail? 477
Whitewashing Car of the Central London 481
Union All-Electric Interlocking at Elsmere Junction, Baltimore & Ohio 481
Duluth Extension: Wisconsin Central .. 484
Track Circuit in Place of Detector Bars .. 487

CONTRIBUTIONS:

Reforms and Advance Information 471

MISCELLANEOUS:

Oakland to New York in 71½ Hours ... 472
Cross-Tie Record of the Santa Fe 474
Relation of the Railroads to the Public .. 476
Accident Bulletin No. 18 478
Standard Oil Co.'s Low Railroad Rates .. 480
Disastrous Collision near Altoona 481
Foreign Railroad Notes 484
Railway Signal Association 485
Canadian Railroad Notes 487
Upward Indication of the Semaphore Arm 488
Philippine Railroads 488
New Railroads in Arabia 488

GENERAL NEWS SECTION:

Notes 139
Elections and Appointments 140
Locomotive Building 141
Car Building 141
Bridge Building 142
Railroad Construction 142
Railroad Corporation News 144

VOL. XL., No. 19. FRIDAY, MAY 11, 1906.

Commissioner Garfield's report to the President on railroad rate discrimination in favor of the Standard Oil Company should be taken seriously. Although it contains errors of fact, although it has been used hysterically to influence legislation not strictly germane, nevertheless it officially calls attention to evil practices long known and not at all confined to the Standard Company or to the railroads named. Upon receipt of this report, the President transmitted it to Congress with a message favoring an enlargement of the powers of the Interstate Commerce Commission. It would seem to be the proper course for the President on receiving this somewhat detailed report of specific violations of the Interstate Commerce Law to at once urge with all his accustomed vigor upon the Department of Justice the enforcement of that law. For nineteen years it has been the duty of the executive officers of the United States to prosecute and punish every railroad for discrimination; for charging one more or less than another for a like service. For more than three years it has been unlawful for any shipper to solicit or receive any concession. It is a statutory crime, a misdemeanor, punishable by a fine of from $1,000 to $20,000 for each offence. The law has already been enforced and fines imposed, which proves that it is workable. It would be much more easy of enforcement if the proper government officers were authorized to go without notice at any time and examine a railroad company's records for the purpose of finding evidence of violations of this anti-rebate law. For another purpose the form of examination of National banks has worked well for many years. The anti-rebate law is designed for the protection of the railroads and the smaller shippers. The railroads have found that they cannot, without the enforcement of this law, avoid discrimination and at the same time do justice to their stockholders, and the bill which became the law was initiated by one of the trunk lines and prepared by its own law department. When pooling was made unlawful, a law of this nature was the only one to which the railroads could turn for their own protection and the protection of their independent customers. The President undoubtedly refers to the anti-pooling clause when he says: "In the effort to prevent the railroads from uniting for improper purposes we have very unwisely prohibited them from uniting for proper purposes; that is, for purposes of protection to themselves and to the general public as against the power of the great corporations. They should certainly be given power thus to unite on conditions laid down by Congress, such conditions to include the specific approval of the Interstate Commerce Commission of any agreement to which the railroads may come." But there is no reasonable present hope of this anti-pooling clause being repealed. We need, and railroad officials will welcome for their own protection, a strict enforcement of the law against discrimination. Secret rates and rebates in any of their many forms are immoral and of immeasurably greater harm than high rates.

The attitude of the British Board of Trade toward the flagging rule is once more illustrated significantly in the report of Major Pringle on a mild collision which occurred after dark, on the night of February 8, at St. Mary's Junction, Derby, on the Midland Railway. A local passenger train ran into the rear of a preceding passenger train of the same character, which was standing at a starting signal. The rear guard of the train had two or three minutes in which he might have gone back, but he did not do so, and the inspector has not a word of censure for his inaction, or even a word mentioning it. And yet the rule requiring the man in charge of the rear end of a train, when detained, to go back with a flag or lantern and torpedoes, stands to-day in the English rule books, as it stands in those of America, in all the solemn dignity that attached to it before the space interval was ever thought of. Indeed, its dignity is even more profound than it was in the old days when it was a vital matter, for then there was not so much force in the language of the rule, though there was more in the men who executed it. Aside from this point, the principal feature of Major Pringle's report on the St. Mary's collision is his declaration that if a signalman, by reason of multitude of duties, has not time to be deliberate and to watch the trains that pass his cabin, "some additional security in the shape of track circuit or treadles is necessary." In this case a train bound for Bakewell stopped at the St. Mary's Junction starting signal because the signalman (37 years in the service as signalman and 18 years at this cabin) forgot to pull off this signal. He pulled off two others all right, but left this one in the stop position. (This omission is attributed partly to the fact that the levers of the three signals are not fixed close together. The two signals which were pulled were Nos. 48 and 47, but the one which was forgotten was No. 9.) Immediately after dealing with the Bakewell train the signalman was called upon to admit a second train, one going to Ripley. This he allowed to come on and to pass the home and "directing" signals (after it had approached near enough to show that it was not running fast), though he did not attempt to pull off the starting signal

from the stop position; this because the clearance of the Bakewell train had not (of course) been received from the station in advance. The Ripley train was running at from 6 to 12 miles an hour when it struck the rear of the other one. The standing train had been there about three minutes, and the guard had just got out, with the intention, not of flagging following trains, but of going back to the signal cabin to learn what was up. When, however, he saw the Ripley train coming, he showed a red signal with his hand lamp. (Both red and green signals are shown with a single lamp.) He got back about 100 ft., but the engineman appears to have had his eyes fixed so intently on the semaphore signal that he did not see the guard's light. Indeed, he might have seen the tail signals of the train, as there was a view for some distance. Major Pringle holds that the engineman might have prevented the collision. The inspector criticises the custom of announcing successive trains from one block station to another at such short intervals that a signalman has two or more overlapping indications, so to speak, on his mind at the same time. Concerning electrical control, from the signal instruments of one station to those of another ("lock and block") he has not a word to say.

The Government quarterly accident bulletin, published in this issue, shows remarkable increases in casualties in the last three months of 1905. The number of employees killed in train accidents during the quarter was 42 per cent. greater than a year ago, and the number killed in coupling accidents 20 per cent. greater; and the total of employees killed in accidents of all kinds was 1,008, or 20 per cent. above the same quarter of 1904. Each item was also decidedly larger than in the quarter immediately preceding (July-September). The enormous increases in freight traffic which have taken place, together with the opening of new railroads, are in themselves sufficient, no doubt, to explain much of this increase in the totals; but the Commission is undoubtedly right in mentioning as an important element the employment of inexperienced men, and the overworking of both experienced and inexperienced. When the Commission has to report, as it does in this bulletin, that a conductor, sleeping in his caboose, failed to put out a red light when stopped, and that an engine came on and ran into the caboose (killing two persons) because of this neglect, *and* of the fact that the man running this engine also was asleep, one may well inquire what good is to be expected by the public from the veiled publicity of these bulletins. They have now been published four years and a half, but the accounts of accidents give no names of persons, roads or places. Unless the Commission is also empowered to investigate the facts of such flagrant cases and report them, as is done in England, with sufficient fulness and detail to concentrate upon them a proper degree of attention, the bulletins fall far short of their true function. One boiler explosion in this bulletin is attributed to the fault of a man who had worked a period of 21 hours and another period of 11 hours with only 2¾ hours between the two for rest. Facts like these, unless explained, are sure to lead the public to look upon railroad safety regulations as a farce. The report of the Baker Bridge collision, in November, gives little that was not known before; and the details of the Wyoming collision, that killed 10 men, only serves to pile up additional evidence of the weakness of the best single-track meeting-point arrangements that have been devised, unless they are fortified by the block system.

ON THE EVE OF A RATE BILL.

Until May 8 there seemed to be no doubt that the Republican Senators, possibly with the exception of Senator Dolliver, of Iowa, and Senator Clapp, of Minnesota, would stand as a unit in support of the agreement reached last week for the amendment of the Hepburn railroad rate bill so as to eliminate the requirement that the Interstate Commerce Commission should exercise legislative discretion in prescribing what will "in its judgment" be the just and reasonable rate to be observed as the maximum to be charged, and so as to provide for an unrestricted judicial review by simply giving the United States circuit courts jurisdiction of suits brought to set aside orders of the Commission. On Tuesday, of this week, however, it became known that Senator Allison, of Iowa, who had agreed to offer the amendments that had been decided upon, had been won over by his colleague, and that he would not support any amendment that was not acceptable to Senator Dolliver. This necessitated an entire readjustment of plans, and as a result of conferences among the Republican Senators a new agreement was drawn up and put in writing so that there could be no doubt about it. It consists of six propositions, as follows:

First—The words "fairly remunerative" in Section 4 of the bill are to be stricken out.

Second—The words "in its judgment" in the same section are to be retained.

Third—Jurisdiction is to be vested in the United States circuit courts to hear and determine suits against the Commission.

Fourth—No preliminary injunction or interlocutory order is to be granted without a hearing and notices.

Fifth—The application for a preliminary injunction or interlocutory decree is to be heard by three judges.

Sixth—A direct appeal from an interlocutory order or decree is to be provided for, such appeal to lie only to the Supreme Court of the United States.

While all of the Republican Senators have tentatively consented to support this agreement efforts are being made to have it modified. We have expressed the opinion that the retention of the words "in its judgment" will render the bill fundamentally unconstitutional and worth no more than waste paper. Many of the best lawyers on the Republican side are endeavoring to induce Senator Dolliver to consent to the elimination of these words, but they have not yet been able to make him waver from his determination to insist on their retention, and Senator Allison is supporting him. The action of Senator Allison has been surprising, as it had been generally believed that after President Roosevelt had given his approval to the agreement reached last week there would be no difficulty in carrying it through the Senate. Had Senators Dolliver and Clapp been the only ones standing out against that agreement it would doubtless have been carried through without their votes, but when they were joined by Senator Allison, who carried with him Senator Cullom and a few others, there was nothing to do but to seek a new basis of agreement. Hope of inducing Senator Dolliver to agree to the elimination of the words "in its judgment" has not yet been abandoned, and he has been besieged by his Republican associates. It has been pointed out to him that if he persists in his course he will be responsible for putting into the bill words that will almost certainly make it unconstitutional, and that if it results in the whole act being declared void, the country will hold him responsible.

Whatever may be the final result of the efforts now being made to induce Senator Dolliver to agree to striking out the words "in its judgment" there is little doubt that all the other clauses contained in the agreement will be supported by the entire Republican side. The proposition to strike out the words "fairly remunerative" is advocated on the ground that they are not necessary, and that a rate that was not fairly remunerative would be one that would be unjust and unreasonable from the standpoint of the carrier. The clause providing that a temporary injunction can be granted only after notice and after hearing before three judges, does not narrow the scope of the judicial review in any way, and it is not probable that it will prevent the granting of such injunctions in many cases, for the fine of $5,000 per day provided for by the bill seems sure to influence judges to grant such injunctions in nearly all cases in which they are asked. But the effect of these amendments will be to harass the applicants for injunctions and to cause delays, as it will be very difficult in many cases to get three judges together.

An amendment, not included in the agreement, that will be very strongly supported is one proposed by Senator Gallinger, of New Hampshire, to provide explicitly that the Interstate Commerce Commission shall not fix differentials, and that it shall not hear complaints based on the relation of rates or fix rates with relations to other rates. The leading advocates of the bill have contended that there is nothing in it that would give the Commission power to fix differentials or to fix the relation of rates, and the Gallinger amendment simply proposes to make it clear that it is not the intention of Congress to confer any such power. Up to the present time the consideration of amendments has proceeded much more slowly than had been expected. Senator Foraker's amendment prohibiting the giving of free transportation and requiring equality of services and accommodations for equal fares opened up a general discussion of the "jim crow" car subject. The substitute offered by Senator Culberson, which was finally adopted, avoids this difficulty and simply limits the giving of free transportation to officers, agents, employees and attorneys exclusively in the service of the roads giving the transportation, and to ministers of religion and inmates of hospitals, eleemosynary or charitable institutions, and provides a penalty of not less than $100 nor more than $2,000 for each offense. An effort is to be made to have this modified so as to allow passes to be exchanged, so as to permit the giving of passes to the families of employees, and so as to strike out the words

"exclusively in the service." It is pointed out that few, if any, railroad attorney are exclusively in the service of any single railroad, and that the language used would make it necessary for a road to pay the transportation of its own attorneys, traveling over its own lines, on its own business.

THE GREAT RAILROAD SYSTEMS.

To take as a basis the fundamental units of railroad ownership in this country and then enlarge these units by the addition of the properties directly affiliated has often been attempted. The process is not an easy one; from direct control through lease or stock ownership the interest of one railroad or group of railroads in another railroad proceeds through successively lessening stages until the border line is reached, beyond which no tangible affiliation exists. Close to this border line there is an area of considerable uncertainty with regard to the camp in which a road belongs. The clue furnished by the annual reports in such cases is apt to be a slight one. It is well known, for example, that the Vanderbilts, in connection with Mr. Hughitt, hold enough proxies at a Chicago & North-Western meeting to control the directorate; also, that the Central of Georgia is controlled, through stock ownership, by Southern Railway interests, and hence is directly affiliated with the Southern; yet the control in each of these cases is personal and not corporate. This distinction between personal and corporate control is the stumbling block in the path of the student of railroad economics who desires to construct a correct grouping of the systems.

For the purposes of the present grouping, the border line has been arbitrarily fixed at the point where it seems most tangible and permanent. The financial interest of great banking houses, and of certain heavy individual interests in systems not otherwise connected, has been excluded from consideration for the reason that it is apt to be shadowy and loom greater than it really is. Mr. Morgan and his associates took the Louisville & Nashville from John W. Gates, and placed it with the Atlantic Coast Line. They also finance the Southern Railway and the Erie, and Mr. Morgan is himself a member of the directorate of the New York Central, the New York, New Haven & Hartford, and the United States Steel Corporation; but it is obviously stretching the imagination too far to say that any actual affiliation exists between the Atlantic Coast Line, the Southern, the Erie, the New York Central, the New Haven and the Steel Corporation.

It will be understood that the lists here given do not include all the lines directly held in the great systems. For example, a group of four roads closely held in the Vanderbilt System—the Peoria & Eastern, the Cincinnati Northern, the Dunkirk, Allegheny Valley & Pittsburg, and the Lake Erie, Alliance & Wheeling has been excluded from the group, in spite of the fact that each of these properties presents a separate report, for the reason that they are so closely held in the corporate bond that it seems unnecessary to single them out. The same thing is true of the West Shore; but the Boston & Albany, as a more recent acquisition, has been listed separately. The selection in this way, while it may be considered an arbitrary one, is nevertheless probably quite clear, and it seems advantageous to avoid making a list long enough to include each separate, small, controlled company. Similarly, construction companies, such as the Vancouver, Victoria & Eastern, which is building in Canada for the Hill system, are excluded from the list, as it is certain that it is closely woven into the Great Northern control. Roads of over 500 miles which are to be ranked as independent, are grouped together under a separate head. Certain of these roads have considerable mutuality of interest in the way their securities are held, but it is nevertheless true that the roads as given cannot be said to belong in any of the other groups. The central idea has been to present a concise view of the actual railroad grouping of to-day, as it stands a matter of public record, or of definite public understanding.

In reckoning the mileage of each of the systems in the following tables, no account has been taken of mileage of roads in which there is a part interest which does not amount to control. For instance, the mileage of the Chesapeake & Ohio, the Reading, and the Hocking Valley, is not included in the statements of either the Vanderbilt or Pennsylvania systems, although all three roads are closely held in control by these two groups. Similarly, the mileage of the Colorado Midland controlled jointly by the Denver & Rio Grande and Colorado & Southern is not included in either the Gould or the Hawley systems. In the case of the Cincinnati, New Orleans & Texas Pacific, controlled jointly by the Southern Railway and the Cincinnati, Hamilton & Dayton, the fact that the President of the Southern Railway is President is responsible for the inclusion of its line in the mileage of the Southern Railway system. The figures used are in most cases those of average mileage operated as shown in the latest annual report.

The nine important systems and the independent group are made up as follows:

Vanderbilt System; 21,353 *Miles.*

New York Central & Hudson River.
Boston & Albany.
Lake Shore & Michigan Southern.
Michigan Central.
Cleveland, Cincinnati, Chicago & St. Louis.
Pittsburg & Lake Erie.
Lake Erie & Western.
New York, Chicago & St. Louis.
Chicago, Indiana & Southern.
Indiana Harbor.
Toronto, Hamilton & Buffalo.
Rutland.
Chicago & North-Western.
Chicago, St. Paul, Minneapolis & Omaha.
One-half of Reading control.(1)
One-sixth Hocking Valley.
One-half Chesapeake & Ohio control.
Large interest in Lehigh Valley.(2)

(1) ½ of 43 per cent., with the rest safely disposed. Reading controls Central Railroad of New Jersey.

(2) Principal interest divided between the Reading, Erie, Lackawanna and Lake Shore.

Hill System; 20,242 *Miles.*

Great Northern.
Northern Pacific.
Chicago, Burlington & Quincy.

Pennsylvania System; 16,836 *Miles.*

Pennsylvania Railroad.
Baltimore & Ohio.
Long Island.
Cumberland Valley.
Norfolk & Western.
Pittsburg, Fort Wayne & Chicago.
Pittsburg, Cincinnati, Chicago & St. Louis.
Vandalia.
Grand Rapids & Indiana.
Toledo, Peoria & Western.
One-half Reading control.
One-half Hocking Valley control.
One-half Chesapeake & Ohio control.
One-third Richmond-Washington line.

Gould System; 16,520 *Miles.*

Missouri Pacific.
St. Louis, Iron Mountain & Southern.
Denver & Rio Grande.
Western Pacific.
St. Louis Southwestern.
Texas & Pacific.
International & Great Northern.
Wabash.
Wheeling & Lake Erie.
Wabash-Pittsburg Terminal.
West Side Belt.
Western Maryland.
One-half Colorado Midland.

Harriman System; 14,725 *Miles.*

Union Pacific.
Oregon Short Line.
Oregon Railroad & Navigation.
Southern Pacific Company.
Arizona & Colorado.
Cananea, Yaqui River & Pacific.
Maricopa & Phoenix & Salt River Valley.
Gila Valley, Globe & Northern.
Sonora.
One-half San Pedro, Los Angeles & Salt Lake.

Rock Island System; 14,355 *Miles.*

Chicago, Rock Island & Pacific.
St. Louis & San Francisco.
Chicago & Eastern Illinois.
Evansville & Terre Haute.
Evansville & Indianapolis.
Chicago & Alton.
Colorado Southern, New Orleans & Pacific.
One-half Trinity & Brazos Valley.

Atlantic Coast Line System; 11,247 *Miles.*

Atlantic Coast Line.
Louisville & Nashville.
Nashville, Chattanooga & St. Louis.
Louisville, Henderson & St. Louis.
Atlanta & West Point.
Western Railway of Alabama.
Georgia Railroad.
One-half Chicago, Indianapolis & Louisville (Monon).
One-sixth Richmond-Washington line.

Southern Railway System; 11,146 *Miles.*

Southern Railway.
Mobile & Ohio.
Central of Georgia.
Georgia Southern & Florida.
Northern Alabama.
Cincinnati, New Orleans & Texas Pacific.*
Alabama Great Southern.
One-half Chicago, Indianapolis & Louisville (Monon).
One-sixth Richmond Washington line.

*Part control.

Hawley System; 3,556 *Miles.*

Minneapolis & St. Louis.
Iowa Central.
Toledo, St. Louis & Western.
Colorado & Southern.
Colorado Springs & Cripple Creek District.
Fort Worth & Denver City.
Wichita Valley.
One-half Colorado Midland.
One-half Trinity & Brazos Valley.

Independent Systems.

Atchison, Topeka & Santa Fe.
Chicago, Milwaukee & St. Paul.
Illinois Central and Yazoo & Mississippi Valley.
Missouri, Kansas & Texas.
Kansas City Southern.
Wisconsin Central.
Chicago Great Western.

Minneapolis, St. Paul & Sault Ste. Marie and Duluth, South Shore & Atlantic.*
Grand Trunk and Central Vermont.
Erie
Delaware, Lackawanna & Western.
Lehigh Valley
Delaware & Hudson
New York, New Haven & Hartford and New York, Ontario & Western.
Boston & Maine and Maine Central.
Seaboard Air Line and the so-called Richmond Washington line.
Buffalo, Rochester & Pittsburg.
Cincinnati, Hamilton & Dayton and Pere Marquette.
Detroit, Toledo & Ironton and Ann Arbor.
El Paso & Southwestern System.
San Antonio & Aransas Pass.

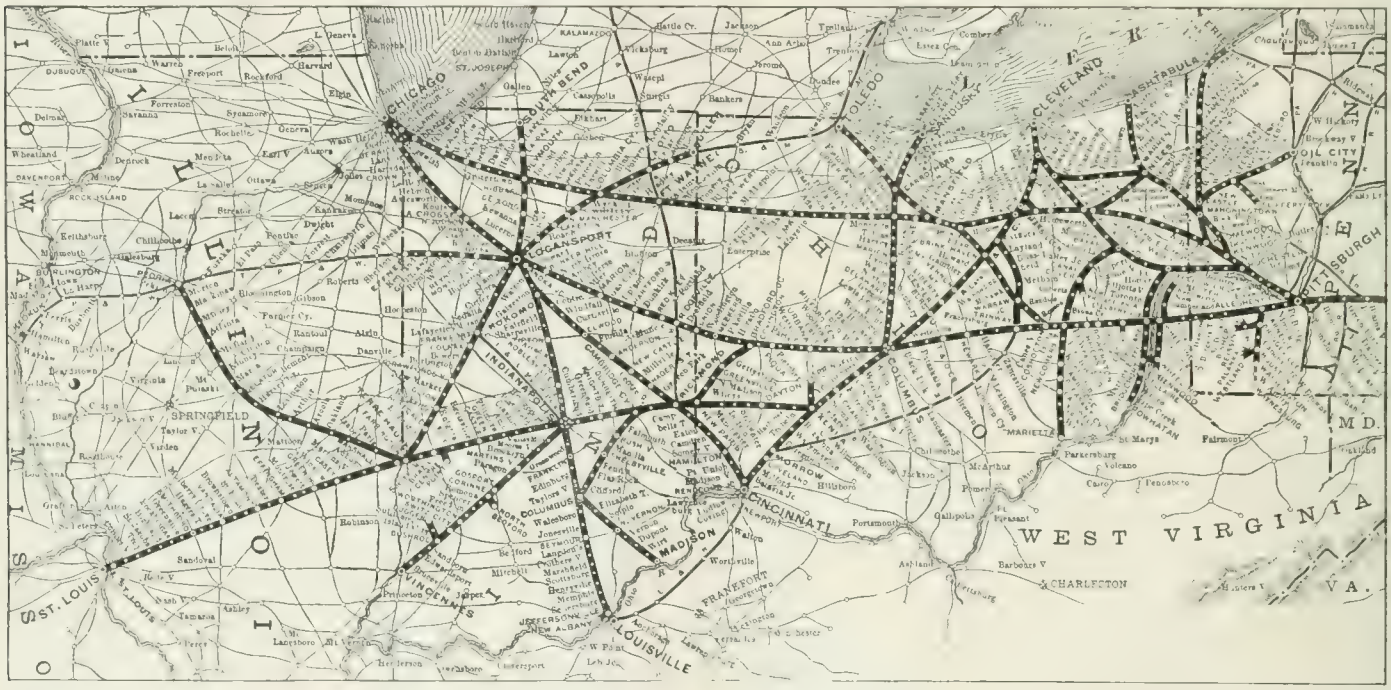
*Controlled by Canadian Pacific.

Of the independent roads, included in the last group, the Chicago, Milwaukee & St. Paul is undoubtedly controlled by the Rockefeller interests, but these interests have not yet so organized their share holdings in the properties in which they are concerned that these properties can be called a system of railroads. Whether they ever will be must be a matter of conjecture. Judging from the past history of the Standard Oil group of capitalists, it is probable that they will prefer to operate their properties singly rather than in groups. The Harriman roads are understood to be represented on the Santa Fe by at least two directors. The President of the Chicago, Milwaukee & St. Paul has lately been elected a director of the Union Pacific. The Harriman interest is also active in the Illinois Central, but so far as can be seen at the present time, Mr. Fish is still on top. The Erie, Lackawanna, and Lehigh Valley are all closely allied in the trunk line community of interest, dominated by the two strongest interests in that territory, the Pennsylvania and the New York Central. The Chicago Great Western and the Grand Trunk are in a position of true independence, being controlled in Great Britain. The New Haven road is also essentially independent, principally for the reason that its stock is held in small shares, widely spread, and shy of the market. The Pennsylvania, however, owns $1,000,000 par value of the road's stock. The Boston & Maine is also independent, although New York Central interests through the American Express Company have a considerable share in the control.

Pennsylvania Company.

The form of control under which the Pennsylvania Railroad holds its Western lines is complicated enough so that it is not out of place to again briefly review the inter-relation of the different parts of the system. The Pennsylvania Company is the corporation which holds control of all the Pennsylvania Lines West. It also owns large blocks of securities of allied roads, like the Baltimore & Ohio, Chesapeake & Ohio and Norfolk & Western. The Pennsylvania Company operates directly 1,342 miles, made up of 13 different companies, of which the principal one is the Pittsburg, Fort Wayne & Chicago, the Pennsylvania's fast line route between Pittsburg and Chicago. These 1,300 odd miles constitute the Northwest System of the Pennsylvania Lines West. The Pittsburg, Cincinnati, Chicago & St. Louis, itself controlled by the Pennsylvania Company, including several smaller companies operates 1,427 miles of line, constituting the Southwest System. In addition to these two groups, there are some 15 other companies operated independently, of which the principal are the Vandalia Railroad, with, including the Terre Haute & Peoria, a working mileage of 778 miles, and the Grand Rapids & Indiana, operating 575 miles. Of the other independent roads, the Toledo, Peoria & Western is the largest, and the Cleveland, Akron & Columbus the next, in point of mileage. All these roads are controlled by the Pennsylvania Company. With the exception of the northern end of the Grand Rapids & Indiana, which runs north to the straits of Mackinac in Michigan, the Lines West are shown on the accompanying map; certain of the smaller independent railroads, however, appearing in lighter lines than those which represent the principal systems. The whole mileage of lines west of Pittsburg and Erie owned, operated, controlled by or associated in interest with the Pennsylvania Railroad amounts to 5,041 miles, on which gross earnings for the past year were $89,781,390. The purpose of the present review, however, is to deal with results on the 1,342 miles directly operated by the Pennsylvania Company, the 1905 reports of the Pittsburg, Cincinnati, Chicago & St. Louis and the Vandalia Railroad having already been reviewed in the *Railroad Gazette*.

Gross earnings of the Pennsylvania Company were over $40,500,000, an increase of $4,200,000 over 1904. Of this increase, more than $3,700,000 came from freight traffic. Operating expenses increased nearly $3,000,000, leaving net earnings of $11,500,000, an increase of $1,200,000 over the year before. Returns from investments amounted to more than half as much as net earnings, making the gross income, after deduction of $1,970,195 for rentals paid railroads operated on the basis of net earnings, $16,343,460. Net income, after fixed charges, was more than $6,000,000, from which $2,000,000 was appropriated for extraordinary expenditures, and the balance, $398,268, after payments of dividends and contributions to sinking funds, was transferred as the year's credit to profit and loss. A similar appropriation of $2,000,000 for extraordinary expenditures was made in 1904.



Pennsylvania Lines West of Pittsburg and Erie.

Results of operation on the various Lines West, as presented in the different reports, are not always easy to assign to the proper company, owing to the rather complicated system of presenting returns, which, moreover, do not always, owing to different viewpoints, exactly correspond in different places. For instance, the miles of road operated by the Pittsburg, Cincinnati, Chicago & St. Louis are given in that company's report as 1,427, and the total mileage operated by the P., C., C. & St. L. is given in one tabulation in the Pennsylvania Company's report as 1,370. There is also a figure of 1,170 miles reported as the mileage of the Pittsburg, Cincinnati, Chicago & St. Louis Railway in a separate income account in the P., C., C. & St. L. report. Again, by consulting the Record of Transportation Lines published by the Pennsylvania Railroad, showing detailed figures of mileage, the length of the P., C., C. & St. L. and directly operated companies appears to be 1,376 miles. These apparently conflicting figures are worth mentioning as an instance of the complexity of the statistics presented. It is, of course, in most cases possible with care to assign figures to their proper place, but the form of presentation certainly tends to confusion

rather than clearness so far as quickly getting a definite idea of the detailed operations of the two largest companies is concerned.

The increase of nearly $3,000,000 in operating expenses already mentioned, which raised cost of operation to $29,038,788, was made up of an increase of over $1,500,000, or nearly 40 per cent., in maintenance of way, $586,000 in maintenance of equipment, and $829,000 in the operating branch of conducting transportation. The increase in maintenance of way can be shown even more strikingly in another way, in that, per mile operated, it increased from $2,867 in 1904 to $3,990 in 1905, a notable increase of over $1,000 per mile on a road already exceedingly well maintained. This compares with $2,735 per mile on the Pan Handle lines. Repairs and renewals per unit of equipment cost $2,404 per locomotive against $2,783 in 1904, $902 per passenger car against $831 in the previous year, and $71 per freight car against $59 in 1904. As a matter of comparison, the P., C., C. & St. L. spent $3,455 per locomotive, $1,462 per passenger car, and $124 per freight car last year. The Pennsylvania Company, therefore, is spending much more on the up-keep of its roadbed, the Pan Handle much more on its equipment. As the freight density on the Pennsylvania Company's lines is equal to 3,725,000 tons one mile per mile of road, against 2,440,000 tons on the Pan Handle, it seems as though in some way the Pan Handle must, with so much heavier maintenance of equipment expenditures, be taking care of some of its controlling company's equipment needs.

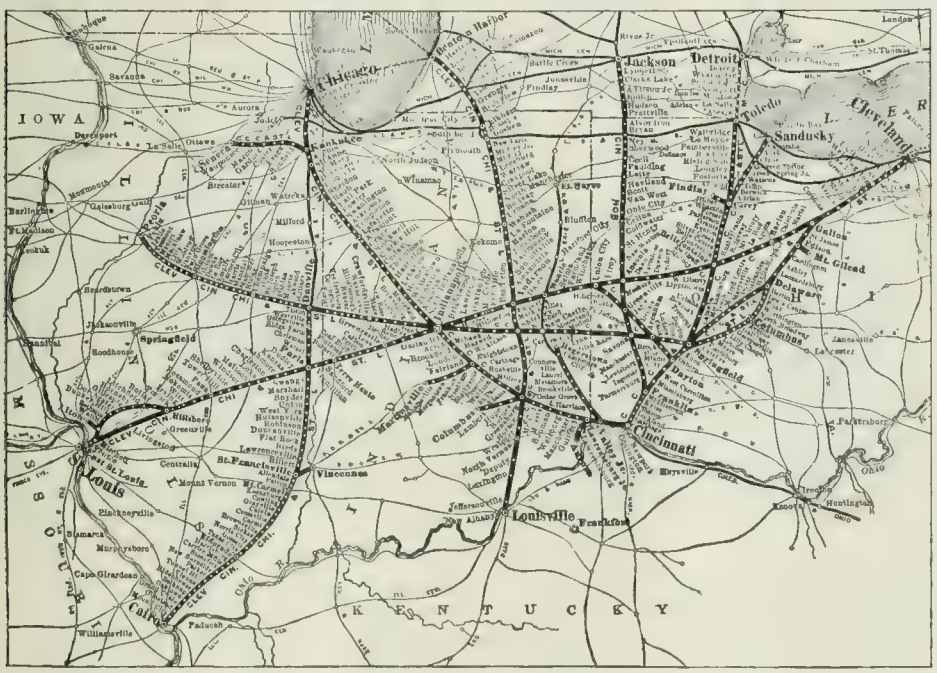
There were 77,880,690 tons carried, which made up over 5,172,000,000 ton miles. Freight earnings per mile of road were $22,497, and passenger earnings $4,446. The train load shows the large increase of 46 tons to 439 tons in 1905. On passenger traffic the average receipts per passenger mile were 2 cents, and the average cost per passenger mile 2.30 cents, which results in a net loss from passenger traffic per mile of road of $504; a showing similar to, and even more unfavorable than, that on the P., C., C. & St. L., where the loss was $310 per mile. In connection with this large passenger deficit on the Pennsylvania Company's lines, which include the route of the Pennsylvania Specials between Pittsburg and Chicago, it would be exceedingly interesting to know how much influence the heavy expenses of these two 18-hour trains have on making passenger traffic unprofitable. It is a fairly well-settled fact that there is a large loss on the operation of such trains, made up to the company only by the great advertising value of the high speed service.

Connecting, as its lines do, lake ports like Toledo, Sandusky, Cleveland, Ashtabula, Erie and Chicago with the Columbus and Pittsburg territory, it is to be expected that coal and ore should furnish a large share of the Pennsylvania Company's traffic. As a matter of fact, out of a total of 77,880,690 tons carried, over 53,000,000 tons were products of mines, of which bituminous coal furnished 24,400,000 tons, coke 8,200,000 tons, and ores 15,100,000 tons. The increase in ore tonnage is especially notable, the figure for 1904 having been 9,550,000, which means an increase of more than 5,000,000 tons last year. Coke tonnage also increased from 5,900,000 to 8,200,000 tons. Iron products, castings, machinery and bar and sheet metal furnished 10,500,000 of the 17,300,000 tons of manufactures carried.

As long as the steel trade continues active the Pennsylvania Company cannot fail to share largely in its prosperity. The present report shows clearly enough that much of the past year's good results has been turned back to bring up the already exceptionally high standard of its lines.

The principal results of the year's working follow:

	1905.	1904.
Mileage worked	1,342	1,340
Freight earnings	$31,242,539	$27,485,171
Passenger earnings	6,174,760	5,868,722
Gross earnings	40,596,440	36,390,582
Maint. way and structures	5,354,734	3,842,144
Maint. of equipment	6,416,431	5,829,573
Conducting transportation:		
Traffic	641,175	622,804
Operation	14,646,803	13,817,014
Operating expenses	29,038,788	26,043,362
Net earnings	11,557,652	10,347,220
Income from investments	6,756,003	7,120,349
Net income	6,054,431	5,187,930



Cleveland, Cincinnati, Chicago & St. Louis.

Cleveland, Cincinnati, Chicago & St. Louis.

The Big Four corresponds more or less closely for the New York Central, to both the Vandalia and the Pan Handle for the Pennsylvania. Like the Vandalia it furnishes a connection to St. Louis, but its line, instead of ending at Indianapolis, extends as far east as Cleveland. It also, like the Pan Handle, gives connection with Columbus, Dayton, Springfield, Columbus, and, by trackage rights, Louisville, Ky. The past year has seen the closer uniting of the road to the rest of the Vanderbilt system. In January Mr. M. E. Ingalls, long President, became Chairman of the Board, and the authority of the president and vice-presidents of the New York Central Lines was extended over the road. Since then a number of other general officers of the New York Central have been put in authority over the Cleveland, Cincinnati, Chicago & St. Louis.

The principal financial event of the year was the issuing of $7,597,463 additional common stock, bringing the total (common stock) outstanding to within less than $5,000,000 of the $40,000,000 authorized. The new stock was offered to stockholders at par to the extent of 20 per cent. of their holdings, but was not eagerly taken up. As a result, additional Big Four stock to practically the amount of the new issue found its way into the possession of the Lake Shore, which now holds $18,752,700 of the $35,595,163 outstanding common. From a physical standpoint the year has been marked by completion of the St. Louis Line, 44 miles long, from Hillsboro southeast to Lenox, Ill., a new double track line saving 12 miles of distance over the old route. This is being used jointly by the Big Four and the Chicago & Eastern Illinois as entrance into St. Louis. A further betterment during the year has been a large and general improvement of the Cairo division, the southernmost line of the road, so as to put it in condition for carrying heavy traffic. Expenditures on this division during the year reached nearly $1,900,000. In connection with the new Vanderbilt line south from Indiana Harbor, Ind., on the Lake Shore near Chicago, to Danville, Ill., the Cairo division furnishes a through line from Chicago to the junction of the Mississippi and Ohio rivers at Cairo. A new fast freight line, which it is expected will carry a large traffic, has been formed to handle through shipments over this route between Chicago and New Orleans, using the Mobile and Ohio line south of Cairo. This is to serve as a Gulf connection for all the New York Central Lines, competing for Cuban and South American, as well as Gulf, export traffic. The Dansville-Indiana Harbor line is also soon to serve the Big Four in another important way by bringing it into Chicago over Vanderbilt rails instead of, as at present, using 56 miles of the Illinois Central track between Kankakee and Chicago.

The income account for the past year shows a small gain in gross earnings- $376,653. Earnings from freight traffic increased $1,275,600, but passenger earnings fell off nearly as much, due to loss of the large St. Louis traffic which naturally came to the Vanderbilt connection to St. Louis during the World's Fair year. Eliminating this Exposition passenger business from the 1904 earnings, passenger returns for 1905 would have shown, instead of a decrease of $1,073,502, an increase of over $300,000.

Operating expenses increased $983,743, leaving a decrease in net earnings of $371,579. This in spite of the fact that no addition betterments were deducted from gross earnings, as against $235,000 deducted on this account in 1904. Net income was $1,870,425, a decrease of $508,411, dividends $1,828,875 an increase of $209,338, due to the new stock, and the year's surplus only $41,550 as against $759,300 in 1904, a decrease of $717,750. The amount

credited to profit and loss, after certain other deductions, was, therefore, only $8,950.

To offset, on the balance sheet, the new stock issue occur two new items: Sundry collectible accounts, $1,571,403, and loans and bills receivable, $3,040,000, which might well be further explained. It is, of course, not unlikely that these items represent cash received from sale of the new stock temporarily on loan. An item of $117,000 for advances to the Kankakee & Seneca Railway, a small subsidiary company, seems hardly justified as an asset, when another part of the report shows that this road showed an operating deficit for the year.

There was spent for new construction and additions to property $3,182,225, and for new equipment $2,181,383. The first sum was charged to construction and equipment on the balance sheet. Of the second sum, $1,227,383 was covered by the whole of the reserve fund for equipment, and the balance of $954,000 was charged to cost of road and equipment. In addition to $1,429,890 included in the improvement account for the Cairo division, there was advanced during the year for real estate and easements on that division, $442,928.

Maintenance of way and structures cost $2,999,105, an increase of $268,162 over 1904. Per mile of road this account took $1,512 against $1,444 in 1904. Maintenance of equipment was $3,390,675, an increase of $308,438. This works out in repairs and renewals per unit of equipment at $2,490 per locomotive against $2,691 in 1904; $708 per passenger car against $665 in 1904, and $60 per freight car against $62 in 1904. In spite of this last decrease the largest single item of increase under maintenance of equipment was in freight car repairs and renewals, due to an increase of 3,489 in the number of freight cars owned. The maintenance figures are liberal, though not especially so in view of the fact that two subsidiary companies on which maintenance expenditures would naturally be lower than on the main lines, the Peoria & Eastern and the Cincinnati Northern, are not included in these totals.

The conducting transportation figure for the year is high, amounting to 44.36 per cent. of gross against 43.47 per cent. in 1904, both high percentages. The principal increases were in engine and roundhouse men; train service, supplies and expenses; switchmen, flagmen and watchmen, and station, yard and telegraph service. The total increase in conducting transportation was $364,154, and the whole account $9,989,670. One item of increased expense which can be directly traced is that of $64,374 for rents of tracks, yards and terminals, due chiefly to operation under new trackage rights of a Toledo connection over 46 miles of the Hocking Valley. As a result of the various operating expense increases, the operating ratio increased from 72 per cent. in 1904 to 75 per cent. last year.

The principal articles of tonnage were grain, 1,530,746 tons, an increase of 244,800 tons; bituminous coal, 3,808,462, an increase of 336,050 tons; lumber, 1,268,387, an increase of 51,000 tons, and manufactures, 3,922,507 tons, an increase of 773,675 tons. The total tonnage carried was 14,510,234, an increase of 1,661,681 tons, and the ton mileage, $2,464,700,000. The freight density was 1,243,160 tons mile per mile of road, an increase of 113,756, and the passenger density 165,586 passengers one mile per mile of road, a decrease of 51,818. The train load increased from 348 tons in 1904 to 376 tons in 1905.

The Peoria & Eastern, with 350 miles operated, shows gross earnings of $2,960,727, and net earnings of $904,004; the Cincinnati Northern, with 248 miles operated, gross earnings of $847,230, and net earnings of $100,086.

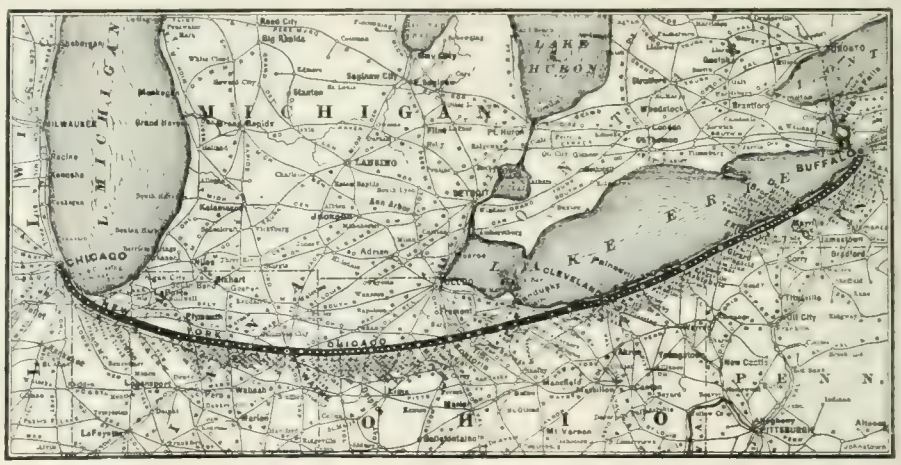
The principal statistics of operation of the Cleveland, Cincinnati, Chicago and St. Louis follow:

	1905.	1904.
Mileage worked	1,983	1,891
Freight earnings	$14,291,108	$13,015,507
Passenger earnings	5,379,056	7,452,558
Gross earnings	22,517,763	22,141,110
Maint. way and structures	2,999,105	2,730,943
Maint. of equipment	3,390,675	3,082,236
Conducting transportation.	9,989,670	9,625,515
Operating expenses	16,879,345	15,895,603
Net earnings	5,638,418	6,245,507

New York, Chicago & St. Louis.

The present year apparently marks the beginning of a new period for the Nickel Plate road. The history of the New York, Chicago & St. Louis from the time it was built in 1881 was reviewed in the *Railroad Gazette* of June 16, 1905. For the past 19 years, since reorganization in 1887, there has been no increase either in the miles of road operated or in the amount of capital stock or of funded debt. The balance sheet figure for cost of road and equipment, too, is smaller than it was in 1888. During this period the improvements which have been made have come out of current earnings. One result has been that the road has always been handicapped by defective roadway and lack of equipment. The betterment funds were in particular needed for the strengthening and replacing of the many bridges on the line. Here the road has been very weak, and although for the past few years there has been an average annual appropriation out of earnings of between $200,000 and $300,000 for renewals and strengthening of bridges, efficiency is even yet limited by the weakness of the long Cleveland viaduct, necessitating the turning over of at Cleveland a good deal of heavy traffic to other roads. Work on this viaduct is now under way and part of the renewal has already been made. On completion of this improvement the weakest spot in the road will be removed and operation should be made more profitable and economical. Expenditures during 1905 for bridge improvements amounted in total to $252,036. On the other hand the total additions to the equipment roster during the past ten years have been only 27 locomotives, 13 passenger cars and 898 freight cars, increments of equipment entirely too small to handle the increases in traffic on even so modest a railroad as the Nickel Plate. As a result there have been large annual payments for hire of equipment. This fairly well sums up the general improvement policy of the company for the past ten years.

The new step which has been taken was the sale in March of an issue of $10,000,000 4 per cent. debenture bonds maturing in 1931, the proceeds to be used for general improvements. Part of the funds received from this sale are to be used in buying several thousand cars and another part in finishing the strengthening of bridges. The new equipment should enable the company to make a considerable reduction in per diem payments, which for 1905 were $412,621, most of which is really a charge for hire of equipment. Although the new bonds impose a considerable charge against income ($400,000), the money which they furnish should strengthen the net earnings of the road by more than the amount required for this annual payment. Continuation of the present dividends on the first and second preferred stocks after the new payment seems especially safe from the fact that, if desirable, the Lake Shore could at any time easily turn over enough traffic to the Nickel Plate to give the necessary boost to earnings. The history of the New York, Chicago & St. Louis is interesting as an example of a road coming out of reorganization with weak credit and a limited mortgage, with the possibility of raising funds by issues of new capital stock precluded by the low price of the stock, which has been compelled through a long series of years to spend money for improvements (if at all) out of earnings. As a result of this policy and the gradual improvement of the road, its credit has been brought to a point where debenture bonds can be sold at a reasonable price. The time has now come when the management feels safe placing an additional (though not obligatory) charge of $400,000 a year ahead of dividends. It is a reasonable expectation that economies resulting from the use of the new capital will overbalance the extra charges.



New York, Chicago & St. Louis.

A further use to which part of the new funds is likely to be put is in making a serious beginning of ultimately double tracking the whole road. The chief operating official of the Nickel Plate has been quoted to the effect that $500,000 is to be spent this year on double track from Cleveland west to Lorain, 26 miles, and on a 12-mile section just east of Chicago. At present the total second track of the road amounts to 6.24 miles.

Gross earnings, which were $6,300,000 in 1895, were $9,100,000 in 1905, an increase of $463,356, or 5.36 per cent. over 1904, and of $2,790,000 or 44 per cent. in the 10-year period. Compared with 1904, freight earnings increased $382,225, or 5.31 per cent., and pas-

senger earnings $100,781, or 7.83 per cent. Operating expenses were $6,483,010, and there was charged to expenses for addition betterments $537,341, leaving net earnings, after betterments, of $2,083,379, an increase of over $281,000. From the year's surplus of $290,363 there was deducted $250,000 as a special improvement fund for new improvements and betterments, making a total deduction from earnings for betterments and additions to property of $787,341. Here, evidently, is a source which could, if necessary, be called upon for the new debenture payment. The year's improvements include a new branch line 3½ miles long, the first branch line owned by the road, to the National Tube Company's plant at South Lorain, Ohio, and 15 new freight locomotives, 12 of which were renewals and three, new numbers in the equipment.

The report gives a brief summary of the conditions of the special improvement funds at the close of the year. According to this, funds amounting to $868,000 were set aside during the year to the credit of these funds. As the amount appropriated from the year's surplus to the special improvement fund amounted to only $250,000, and there is no other source indicated from which other funds were received, the source of the extra $618,000 added to the funds during the year is not clear. There is another respect in which the report is lacking, namely, that although figures are given among the first charges for the amount paid on principal and interest of equipment trusts there is no statement of the amount of equipment trusts outstanding or of the number of units of equipment covered by such arrangements.

Operating expenses as a whole increased $182,204. Per mile maintenance of way cost $1,572 against $1,723 in 1904. Repairs and renewals of locomotives amounted to $2,580 per locomotive against $1,968 in 1904, an increase of $612 per locomotive, due particularly to a considerable expenditure for renewals. Repairs (no renewals) of passenger cars remained practically stationary, at $807 per car against $802 in 1904, while there was a considerable increase in repairs (no renewals) of freight cars—from $58 in 1904 to $73 in 1905.

The balance sheet contains two small items of current assets which are not usually included by most railroads. They are, contributions to co-operative fast freight funds, and contributions to traffic association funds, together amounting to some $30,000. Without accurate knowledge of the reason, it seems strange to consider these current assets. Such payments would naturally appear to fall under the head of operating (traffic) expenses, rather than to be current assets, like cash in the hands of the treasurer.

In freight traffic the Nickel Plate gets a long haul, 236 miles. This, however, is a decrease from the year previous, when 251 miles was the average haul. The train load decreased eight tons, from 337 tons in 1904 to 329 tons in 1905. Freight density is 2,837,600 tons one miles per mile of road, an increase of over 200,000, and passenger density 174,155 passangers one mile per mile of road. The average number of passengers per train is high and shows an increase, being 74 in 1905 and 70 in 1904. The large number is probably due to the comparatively small number of passenger trains run. The number of commutation passengers, which increased over 200 per cent. in 1904, shows an added increase of 16 per cent. in 1905.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	523	523
Freight earnings	$7,534,856	$7,152,631
Passenger earnings	1,437,616	1,336,834
Gross earnings	9,108,730	8,645,374
Maint. way and structures	822,272	901,180
Maint. of equipment	1,197,263	952,266
Conducting transportation	4,328,013	4,151,286
Operating expenses	6,483,010	6,163,680
Net earnings	2,625,720	2,481,695
Addition betterments	537,341	674,467

NEW PUBLICATIONS.

Morton Memorial: A History of the Stevens Institute of Technology, with biographies of the trustees, faculty, and alumni and a record of the achievements of the Stevens family of engineers. Bound in half leather, size 8x11¼ in., 650 pp. Edited by Prof. F. de R. Furman. Hoboken, N. J., from whom copies can be had. Price, $10.00.

This luxurious volume in memory of Henry Morton, first President of Stevens Institute in 1870, and so continuing until the time of his death in 1902, was partially made by Dr. Morton and completed by Professor Furman. It consists of three sections, the History of Stevens Institute, the Story of the Engineering Works of the wonderful Stevens family, while the third section consists of biographies of those connected with the institution. Every one who knew or knows of Dr. Morton's work will want the volume. To others the interest lies in a second section, the developments in steam railroading and steam navigation, made by the members of the Stevens family. Colonel John Stevens was a lawyer about 40 years old, when he saw John Fitch's steamboat struggling with the tide on the Delaware. That settled his career ever afterward as an engineer. In 1798, ten years before Fulton ran his "Clermont," Colonel Stevens had a steamboat on the Hudson as builder, owner and captain. Several years before Fulton's steamboat appeared, Colonel Stevens had a double-screw steamer running. He patented the multitudinal boiler in 1801. In 1813 he designed an iron clad ship; in 1817 he obtained the first charter from New Jersey, "to build a railroad from the river Delaware, near Trenton, to the river Raritan near New Brunswick." In 1826 he built a steam locomotive, which he operated on a circular track on his own property in Hoboken. His sons, Robert Livingston Stevens and Edwin A. Stevens, were both assistants and successors to their father's engineering work. Robert designed and built, in 1884, the yacht "Maria," which beat the "America" in a fair race just before the "America" went across the Atlantic to win its famous victory in international competition. Robert Stevens designed and had made in England the first T rails approximating the present standard sections, but the story of the work of this family is too long for this notice. This is intended to be merely suggestive of what the reader may find in it.

TRADE CATALOGUES.

The Canadian Northern Railway has issued a handsome descriptive pamphlet telling the salient facts concerning the road and its plans for the future. The road is now in running order to Edmonton, Alberta, 825 miles west by north from Winnipeg. It passes through "A thousand miles of wheatfields," and this phrase is the title of the pamphlet. The Canadian northwest is all so new and has grown so rapidly that every page gives the reader a surprise. The Canadian Northern Railway was unknown in 1895; and it is only since 1901 that it has been running trains through from Port Arthur on Lake Superior to Winnipeg and beyond; but to-day its lines aggregate 2,400 miles, and it has an imposing railroad map all its own. Besides a wheat country which will support an empire, Saskatchewan and Alberta promise great things in coal mines, oil wells and other necessaries of life; and the railroad promoters and builders of the region now have in mind definite and sober plans for building to Hudson's Bay. The present, astonishing as it is, only foreshadows a far greater future. The present pamphlet was issued on the occasion of the visit of H. R. H. Prince Arthur, last month, and it is made up principally of an annotated time-table of the prince's train. This makes an attractive narrative, and it has been prepared by a skilful pen.

Trussed Concrete Bulletin.—The Trussed Concrete Steel Co., Detroit, Mich., has begun the publication of a monthly bulletin under the above title, the first number of which has just appeared. It is a four-page form, 8½ x 11, printed in two colors. The first two pages are devoted to "A Test by Fire" of a large reinforced concrete warehouse in Minneapolis recently, in which after burning inside for two hours the damage to the building was given as only $500. The remaining space is devoted to statements regarding the number of important orders for large buildings recently booked, tests of reinforced concrete beams, etc.

Corrugated Bars for Reinforced Concrete.—A useful catalogue containing upwards of 235 4½ in. x 6½ in. pages has just been published by the Expanded Metal & Corrugated Bar Co., St. Louis, Mo. It is profusely illustrated throughout with both line and half-tone engravings of reinforced concrete bridges, buildings, etc. It also contains a number of engineering tables as well as much other useful data for use in connection with the designing of reinforced concrete structures.

Foundry Information.—The Obermayer Bulletin for March-April has articles on "Electricity in Foundry Practice," "Warping of Castings," "The Strongest Copper Alloy," "The Cupola Tender" and "Wanted—A Foundry Foreman." There is also considerable other matter of interest to the trade.

Paroid Roofing.—A clever advertising poster is issued by F. W. Bird & Son, makers of Paroid roofing, East Walpole, Mass. It is a life size reproduction of a thoroughbred bull dog. The firm is sending it to all railroad officers who ask for it.

CONTRIBUTIONS

Reforms and Advance Information.

[illegible], Pa., May 5, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In these times of investigation of hunting for discriminations and graft, why has no one publicly alluded to the giving out of advance information by the President? The foreknowledge of the contents of an important or radical Presidential message is worth millions of dollars, in the aggregate, to the receivers. This advance information is given, and the sum of stock values advance or de

cline from $1,000,000 to $50,000,000. Who, in general, gets the benefit we know. But what do they pay for it?

If any other individual or clique gave, to a selected few, government information worth millions of dollars, what would we think? Is it not the most important act of discrimination yet unearthed? Is it not an excellent opportunity for graft? Without any exceptional sources for receiving information I got the important points of the "Muck Rake" speech 18 hours before it was published. In remote Pittsburg, quite out of touch with Wall Street, I got a reliable synopsis of the message accompanying the Garfield report four hours before its publication. Partly from facts and partly from market indications, one may assume that no important Wall Street interest had less than 24 hours advance information of the last Presidential utterance.

Probably no one believes that Mr. Roosevelt was directly paid for this information. A few people may think that he might as well sell as give an unfair advantage. Has not the time come to point out to our arch reformer that reformation, like charity, should begin at home?

Is it not a piteous comparison—the incisive logic and diction of the Standard Oil reply and the vague, illogical, redundant Garfield report? It seems that the Lawson style has affected the government more than the people attacked. D. B.

Oakland to New York in 71 Hours 27 Minutes.

Mr. E. H. Harriman, President of the Southern Pacific, arrived in New York City over the New York Central, by a regular train (the Empire State Express), on the evening of May 8, in 33 minutes less than three days from Oakland, Cal. To Buffalo Mr. Harriman traveled by special trains. The memorandum of times given to the reporters on arrival in New York was as follows:

Left Oakland Mole, Cal., 7:33 p. m. Saturday.
Sparks, Nev., 305 miles, 6:47 a. m. Sunday.
Green River, Wyo., 709 miles, midnight Sunday.
Omaha, Neb., 827 miles, 2:45 p. m. Monday.
Chicago, Ill., 448 miles, 12:45 a. m. Tuesday.
Buffalo, N. Y., 540 miles, 12:59 p. m. Tuesday.
New York, 440 miles, 10 p. m. Tuesday.

The best time ever before made over this route was in October last, by special trains all the way, but over the Erie instead of the New York Central east of Buffalo. That trip also was made by Mr. Harriman, and was reported in the *Railroad Gazette* of December 15, page 565. The distance shown in that record was 3,329 miles, and the time was 73 hrs. 12 min. The New York Central is 15 miles longer than the Erie.

Alternating Current Track Circuits in the New York Subway.*

Up to a few years ago, track circuits for automatic signals had apparently settled down to an almost uniform arrangement of standard apparatus in which one installation was different from another only in details of construction and style and character of batteries. As a number of years had then elapsed since the first successful system of block signals had been installed, this uniformity of design seemed to indicate that in the near future it would only be necessary for a railroad company to purchase standard plans, place on them the number of signals required, decide whether they would use storage, gravity or potash batteries for their track circuits and proceed with the installation.

Every signalman knew that such batteries had their limitations for track circuit work, as they often had signals act mysteriously on account of stray currents from electric railroads becoming mixed up with the track circuits. While these conditions caused many detentions to traffic, yet as there was nothing better on the market the railroad companies took the many detentions as necessary evils which had to be tolerated.

With the advent of the high-speed electric roads, it was realized that they would have to be signaled, but as the rails were used for returns for the power current, it was manifestly impossible to use batteries for track circuits. To operate track relays it was necessary to have relays responding to the return current from the motors. Alternating current fulfills these requirements, not alone when direct current is used for motive purposes, but as well when alternating current is used. The instruments must respond quickly to the action of alternating current; but when the train shunts the track circuit, the return power circuit, whether direct or alternating, must not cause the track relay to remain in the clear position.

In the New York Subway, single-phase 60-cycle current is used for the track circuits and for lighting the signals. This is supplied by turbo-generators in the main power house, and delivered to the sub-stations at a potential of 11,000 volts. The generators carry a constant load, and are entirely independent of the motive power circuit, and thus the electro motive force is constant. In the sub-station the alternating current is stepped down by oil-cooled transformers with a ratio of 20 to 1 to 550 volts, and delivered at this potential to the signal cables which extend through the Subway from sub-station to sub-station. In normal operation of the system the transformers in all sub-stations are on the signal mains in multiple, and each station is provided with switch-boards on which are mounted the necessary switches, circuit breakers, ammeters and

*A paper by J. M. Waldron, Signal Engineer, of the Interborough Rapid Transit Company; read before the Railway Signal Association at New York May 8.

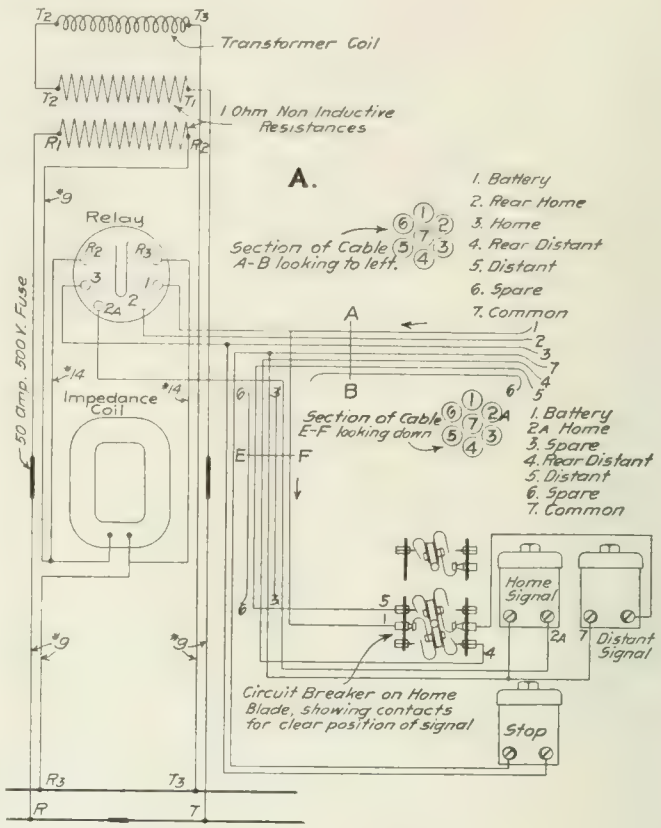


Fig. 1—Automatic Signal Connections, New York Subway.

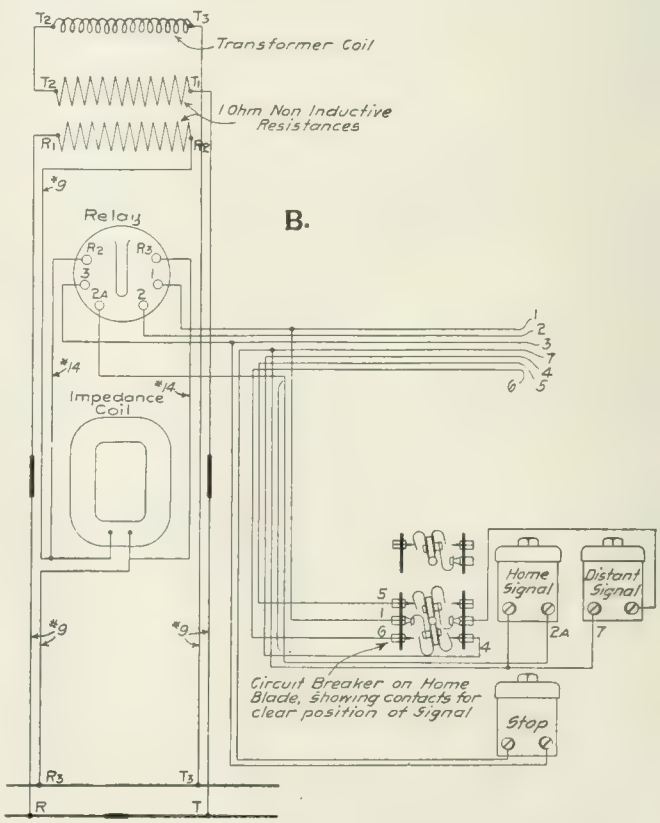


Fig. 2.

synchroscopes, all of which are so connected that any sub-station can be cut off the line at any time without interfering with the connection between adjacent sub-stations.

In case the 11,000-volt 60-cycle cables leading from the main powerhouse to the several sub-stations should break down, there is provided for reserve power in each sub-station a 25-K.W. transformer, which is connected by an oil switch to the 25-cycle 11,000-volt power circuit. This, at a potential of 550 volts, can be thrown on to the signal mains by reversing a double throw switch. The reversing of this switch cuts the 60-cycle transformer off, and the 25-cycle on the signal mains. The 25-cycle current is not intended for constant operation, as there are considerable voltage fluctuations in the power current. The frequency being lower, the energy consumed when operating the signal system by it is increased about 66 per cent. In the course of a year this would be no small item in dollars and cents.

A transformer with two secondary coils is placed at the exit end of each block. The primary coil is connected across the alternating current mains. Cut-outs and fuses are placed in each of the primary connections. One of the secondary coils supplies current to the rails for track circuits at a potential of about 10 volts. The other is for lighting the signals at 50 volts potential. In the circuit between the transformer and the block rail is a grid resistance of one ohm and a 50-ampere 500-volt fuse. The purpose of the resistance is to prevent a dead short circuit in the secondary coil of the transformer when a train is in the block. At the signal end of the block the alternating current passes from the rail through a 50-ampere fuse to a grid of one ohm resistance, then through a relay and impedance coil, which are in multiple, to the return rail; then through this rail back to the transformer or point of starting. The impedance coil has a winding of very low ohmic resistance around a laminated iron core, and is placed in the circuit in multiple with the alternating current relay to prevent a harmful amount of direct current from passing through the relay.

The alternating current relay consists of two pole pieces, which are made up by winding coils of wire around laminated iron cores between which an aluminum vane moves through a quadrant of a circle. This vane is supported on jeweled bearings, and has mounted on its shaft, but insulated from it by lavite insulations, the necessary springs for controlling signals and stops. Attached to the end of these springs are small pieces of graphite which make contact with platinum on the tops of the stationary pedestals when the relay is energized; the relay is adjusted so that it will pick up at three volts; that is, it will cause the springs to make contact when there is a potential difference of three volts between the two rails of the track at the end of the block adjacent to the signal.

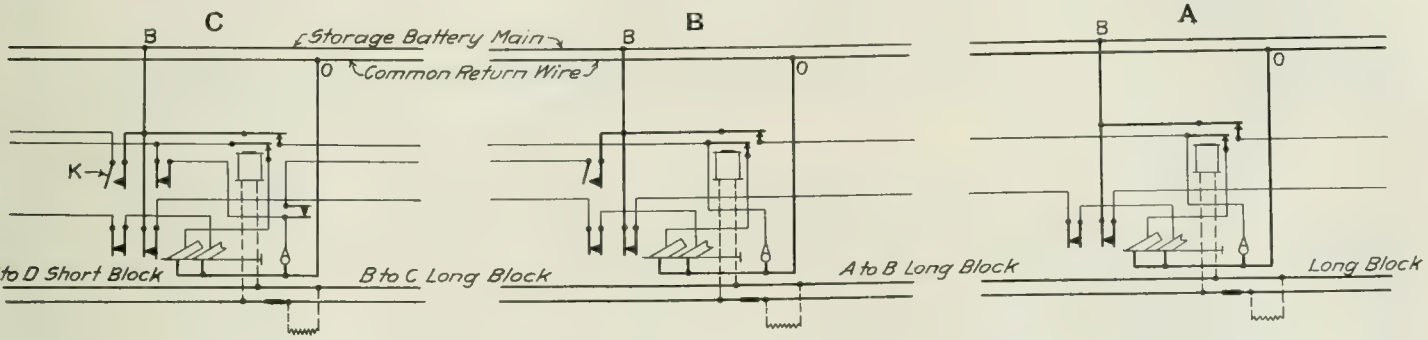


Fig. 4—Automatic Signal Circuits of the Express Tracks in the New York Subway of the Interborough Rapid Transit Company.

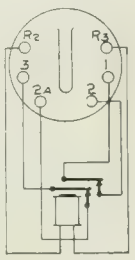


Fig 5.

In the normal operation of the system there is a difference of about six volts maintained between rails at the relay end of the block, thus giving a working margin of 100 per cent. The block lengths average about 820 ft. Their lengths are equal to braking distance plus 50 per cent. when a train is making the greatest speed possible for it to make at that point. Grades are taken into consideration in making these calculations. The illustrations show the circuits used for traffic in one direction, and where there are no complications entering into the block signal system.

Fig. 4 shows connections from signal to signal, and Figs. 1, 2 and 3 the wiring in the signal case at each of the signals, A, B, and C, which are shown in Fig. 4. Fig. 1 shows the ordinary wiring in an instrument case. Fig. 2 shows the arrangement where the first block in advance is normal length—about 850 ft.—and the second is short, say, 450 ft., and Fig. 3 shows the wiring where the next two are short. These special wirings are designed to guard against the interference of the automatic stop with the cars of a long train which is not to be stopped. Ordinary trains are of uniform or nearly uniform length, but two ordinary trains coupled together make a train so long that the foremost car may work the automatic stop before the last car has reached it. The illustrations are traced from the operating drawings, made by the Railroad Company. In the originals the index to the cable section shown in Fig. 1 is shown in the same way in Figs. 2 and 3. Fig. 5 shows how the binding screws on a relay are connected to the relay itself, and is designed to aid repair men and inspectors in studying diagrams.

As all automatic signals must depend upon the track circuit for their operation, the efficiency of this determines the degree of success of the signaling system; therefore, it is of prime importance that the track circuit should be the best obtainable. A large portion of the Subway signaling has now been in operation for 18 months, which is equivalent to nine years' operation on a road having 304 trains per day. The number of failures has been small, averaging about 17 a month. The a.c. relay failures have been one to about 75,000,000 movements. About 40 per cent. of the total number of failures have been due to slivers from brake shoes bridging rail insulation joints in the vicinity of stations.

It is hard to realize what this record means until one goes to a station in the Subway during the busy time of day and counts the passing trains; at the end of 60 minutes it will be found that 122 trains or 786 cars, probably carrying 80,000 people, have passed by. If you make a journey over the road, you will find hundreds of signals and automatic stops. All depend for their operation upon the track circuit, and all respond promptly to the action of the passing trains; all perform their duty towards humanity by protecting the train in advance from being run into by your train. On this record, the signals are to be considered the guardian angels of the Subway. You will probably be interested in this precision and almost infallible operation, for the many hundred signals and hundreds of automatic stops you have passed make 200,000 complete operations each 24 hours. These have for a whole month performed their duty with but 13 failures, all on the side of safety; or one detention to nearly one half million movements.

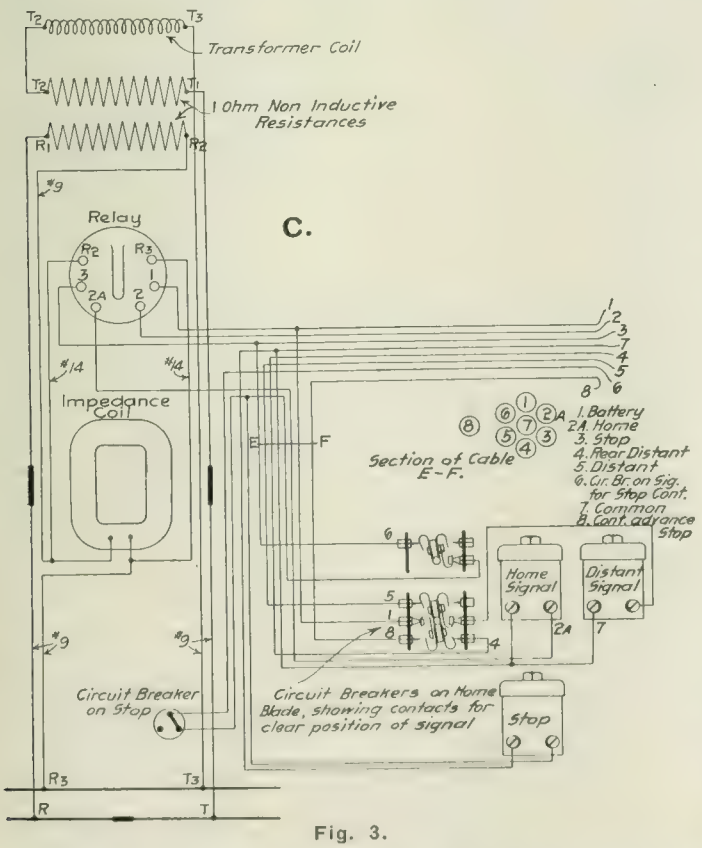


Fig. 3.

Cross-Tie Record of the Santa Fe.

The annual statement of ties laid and removed on the Atchison, Topeka & Santa Fe, issued by Mr. E. O. Faulkner, Manager Tie and Timber Department, gives the records for 1905. The records for the first half of that year were printed in these columns October 6, 1905. As in that case, the present statement gives the number of treated and untreated ties removed on the Eastern and Western grand divisions by divisions and by years, the latter referring to the year of treatment and insertion of the ties. The records on the Eastern grand division go back only to ties treated in 1896, while those on the Western date from 1885. The statement also includes figures for the total number of treated pine ties laid from 1885 to 1905 inclusive, and the total number of removals since 1897, no record of removals having been kept prior to that time. The figures for insertions are for 1905 only, of course. Omitting the figures for removals by years, the totals by divisions for both removals and insertions are as follows:

TIES REMOVED.

	Treated—Rotten.	Treated—Other causes.	Treated—Total.	Untreated.—Rotten.	Untreated.—Other causes.	Untreated.—Total.	Av. life of treated ties, yrs.
Eastern Grand Division.							
Illinois Div.	1,530	152	1,682	108,548	494	109,042	4.8
Missouri Div.	4,388	625	5,013	103,677	846	104,523	4.5
Kan. City Div.	737	96	833	13,815	422	14,237	5.3
Eastern Div.	3,282	821	4,103	135,838	2,692	116,530	5.3
Middle Div.	25,304	395	25,699	182,645	2,115	184,760	6.3
So. Kan. Div.	10,556	2,943	13,449	189,510	12,046	201,556	5.7
Oklahoma Div.*	26,920	1,361	28,281	78,156	162	78,318	6.5
Western Grand Division.							
Western Div.	74,096	1,372	75,468	177,700	4,799	182,499	9.5
Pan Handle Div.	8,553	489	9,042	165,532	2,664	168,196	6.2
Colorado Div.	27,138	1,305	28,443	39,416	2,252	41,668	10.5
New Mex. Div.	73,337	5,122	78,459	24,944	1,096	26,040	10.5
Rio Grande Div.	93,675	1,699	95,374	20,791	1,081	21,872	14.4

*Including Eastern Oklahoma Ry.

TIES INSERTED.

	Treated.	Untreated.	Total.
Eastern Grand Division.			
Illinois Division	253,154	873	254,027
Missouri Division	194,222	4,430	198,652
Kansas City Division	38,223	.....	38,223
Eastern Division	239,354	1,747	241,101
Middle Division	300,561	317	300,878
Southern Kansas Division	241,191	.....	241,191
Oklahoma Division	119,962	489	120,451
Total	1,386,667	7,856	1,394,523
Western Grand Division.			
Western Division	297,906	1,406	299,312
Pan Handle Division	184,847	.....	184,847
Colorado Division	82,108	.....	82,108
New Mexico Division	104,801	84,232	189,033
Rio Grande Division	135,698	394	136,092
Total	805,360	86,032	891,392

The total number of treated ties that have been laid in these divisions is 13,708,467, of which 2,192,027 were laid last year. Most of these (11,179,721) have been laid since 1897. The total removed was 1,576,006, of which 1,493,483 were for decay, and the remainder for other causes. The average life of those removed for decay was 10.62 years. There were still in track the first of the present year 10,928,362. Of those laid in 1897 there remained 84.95 per cent.; 1898, 87.28 per cent.; 1899, 93.59 per cent.; 1900, 98.12 per cent.; 1901, 97.74 per cent.; 1902, 99.38 per cent.; 1903, 99.62 per cent.; 1904, 99.85 per cent.; 1905, 99.97 per cent.

New East Bottoms Yard of the Missouri Pacific at Kansas City.

The old freight yard of the Missouri Pacific in the East Bottoms, Kansas City, Mo., was used for only a part of the trains entering and leaving the city. When it was decided to handle all of the trains at this yard, enlargement and a complete rearrangement was made necessary. Additional property was acquired and plans made for a terminal that would for some time to come meet the needs of Kansas City business. The plan as laid out to meet these requirements is shown herewith, with the portion immediately necessary for handling present business shown in solid lines and additions to be made in the future when traffic requires represented by broken lines. It should be explained, however, that the eastbound and westbound receiving yards are not shown to correct scale corresponding to the remainder of the layout, or with the right number of tracks, being merely sketched in to indicate their relation to the general plan.

In order that the peculiarities of the design may be understood, the general location of the yard with reference to traffic should be explained. This is shown on the accompanying sketch map of the local freight district of Kansas City which gives the location of the various Missouri Pacific lines into the city. Trains from the Pueblo (Colorado) line, the Joplin and Coffeyville lines, and the two St. Louis lines enter the yard from the east and leave for these lines at the same end of the yard. Trains from the Omaha line and other Nebraska and Kansas lines enter the yard from the west and leave at the same end. The local freight district of Kansas City is west of the yard, therefore the trains destined for entrance at the west end of the yard pass through this district, requiring that cars for city delivery retrace this part of the route. Also, cars in trains from the east for the south and west, from the west for the south and east, and from the south for the east and west, must leave the yard at the same end by which they enter. For an ordinary through yard it is usually sufficient to provide ready means of transit from the receiving to the departure yard in the same direction. But owing to the variety of car movements necessary in the East Bottoms yard, convenience of access from the eastbound receiving to the westbound classification and departure yard, and from the westbound receiving to the eastbound classification and departure yard had to be provided. This was done by means of two cross-over yards connecting the respective switching leads.

The physical conditions limiting the size of the yard are: The junction of the Pueblo and Joplin lines with the St. Louis lines at the east end of the westbound receiving yard; the tracks of the St. Louis & San Francisco, and of the Chicago, Milwaukee & St. Paul at the east end of the classification yards; the narrowing of the available ground between the engine house and the Dixey elevator at the west end of the classification yards, and several city streets beyond the west end of the eastbound receiving yard.

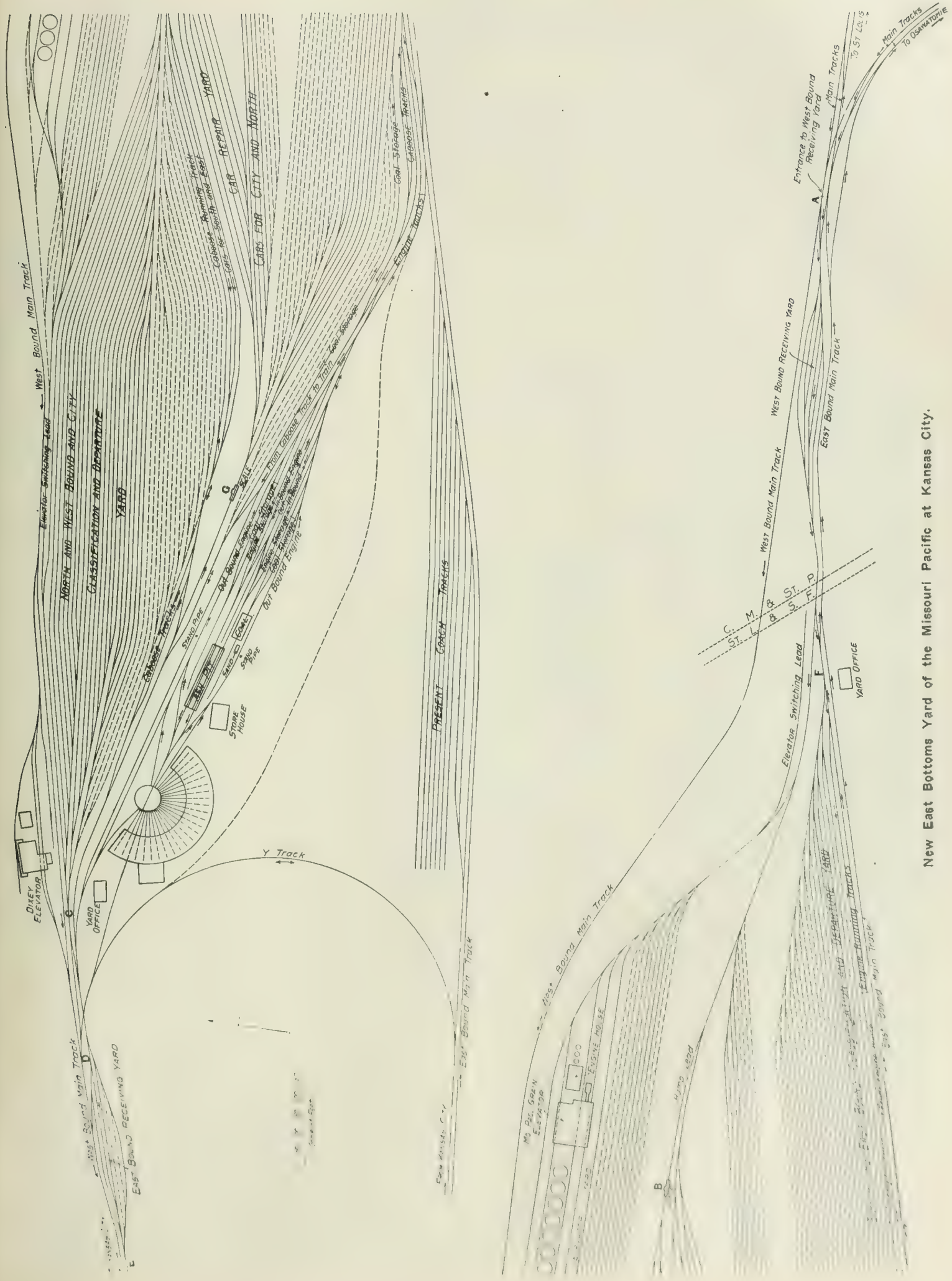
The sizes and capacities of the individual yards are as follows, the figures having reference to the ultimate plan to be completed as conditions require: Westbound receiving yard, 11 tracks averaging 61 cars standing room; westbound classification and departure yard, 36 tracks with from 18 to 55 car lengths of standing room; hump lead connecting these yards, 63 car lengths clear between hump and railroad crossing; elevator yard, 10 tracks averaging 51 cars standing room, with "drilling" lead at each end; eastbound receiving yard, six tracks averaging 75 cars standing room; eastbound departure yard, 21 tracks averaging 62 cars standing room; eastbound hump lead connecting receiving and departure yards, 45 cars clear length; cross-over yard from eastbound receiving to westbound departure yard, 105 cars, clear room; cross-over yard from westbound receiving yard to eastbound departure yard, eight tracks averaging 35 cars standing room. There are also five coal storage tracks with capacity for 125 cars; seven car repair tracks, average length 16 cars; three eastbound caboose tracks and two westbound caboose tracks. The engine house layout includes a 22-stall roundhouse with 75-ft. turntable; a 200-ft. double ash pit; a 500-ton Link-Belt coaling station; an engine crane with 1½ yd. clam-shell bucket for coaling and for cleaning the ash pit; two 12-in. water cranes which receive their supply from a treating plant; a sandhouse, and miscellaneous structures.



Location of East Bottoms Yard; Kansas City.

To make clearer the train, engine and car movements, important points in the yards have been designated by letters. Freight trains from the east and south enter the westbound receiving yard at "A." The engine, upon being cut off, picks up its caboose and proceeds over the engine running track to the eastbound caboose track, leaving the caboose on the proper track and proceeding to the ash pit and engine house. Meantime a yard engine is attached to the east end of the string of cars and pushes them over the railroad crossing into the hump lead and over the hump at "B," classifying the cars into the westbound departure yard, eastbound cross-over yard or the repair yard, occasional cars for the elevator being thrown into the north track of the westbound departure yard. Cuts of cars for the city and trains for the north leave the westbound departure yard at "C," the caboose being taken by the yard engine from its proper track and placed on the rear of the train in the westbound departure yard, the engine meantime proceeding from the engine house to the west end of the yard at "D."

Cuts of cars from the city and trains from the north and west



New East Bottoms Yard of the Missouri Pacific at Kansas City.

enter the eastbound receiving yard at "E." The road engine is cut off, takes its caboose, places it on the caboose tracks and moves over the caboose running tracks to the entrance of the engine tracks at "F." The yard engine pushes the cars from the receiving yard into the hump lead and classifies them over the hump at "G" into the eastbound departure yard, the westbound cross over yard or the repair yard. It also takes cuts from the eastbound cross-over yard (which have been switched over the westbound hump at "B") and places them in eastbound trains, and takes the caboose from the eastbound caboose track for placing on the rear of the train. The road engine passes from the house over the engine running track to the front end of the train at the exit of the eastbound yard at "F."

Company coal which is brought into the yard from the east is classified first into the eastbound cross-over yard over the hump "B" and is then run into the coal storage yard from which it is taken to the coaling station as needed.

We are indebted for the plans and information to Mr. M. L. Byers, Engineer Maintenance of Way of the Missouri Pacific.

The Relations of the Railroads to the Public.*

BY R. C. RICHARDS,
General Claim Agent, Chicago & North-Western Railway.

The subject which has been assigned to me to-night is certainly a broad one, and one that is entitled to a much abler mind and speaker than myself. From the last report of the Interstate Commerce Commission, which was for the year ending June 30, 1904, we learn that the capital invested in the railroads was $13,213,124,679; the mileage, 214,477; the earnings, $2,073,177,325; that we were paid for wages $817,598,810; that we had 46,743 locomotives, 1,798,000 cars; carried 715,419,628 passengers, and 1,309,899,165 tons of freight.

I give you these figures simply to show the immensity of the business and to emphasize, if possible, the great importance it is to the prosperity and success of that business that our relations with our patrons, the public, should be open and above board, reasonable and courteous; that the public, which is our customer (and nearly every person in the country at one time or another uses our facilities), should be reasonably satisfied with our service. We carried the whole population of the country ten times in the year covered by the report referred to, and we hope to carry more of them and more of their property this year than we did that.

Now, whether the relations between the public and the companies who employ us shall be pleasant, friendly and neighborly, or whether we shall be at swords' points, the public demanding more than it is entitled to and we granting less, depends partly on the general policy of the owners of the companies, partly on you and me and the others who are doing the actual work of the roads and who come in personal contact with the public, and partly on the knowledge the public has of the good things we and our companies do. If we are decent and courteous, kindly and fair in our dealings with our patrons, they will believe that the owners and real managers of the corporations are the same and will in time learn to treat us in the same way. If our stations are reasonably commodious and well kept, our trains comfortable, run at reasonably frequent intervals, with safety and at convenient times; if we handle the freight with promptness and despatch; if the man who sells the ticket, the man who solicits the freight, who collects the charges, assists the passenger, investigates the claims and complaints, is honest, fair, prompt, considerate and courteous, the public will believe that the company is the same, and if a question arises between the public and the companies we will be much more likely to get a fair hearing and a just decision, and less attention will be paid to the specious and unfair arguments of demagogues and agitators, and the company so represented will get its share or more of the patronage.

Who is it that is always called on for aid in the way of reduced rates, special service and other accommodations when any special event is to happen in our towns and cities, when it is desired to locate a fair, a convention, get up an excursion, or when a calamity such as has recently happened in San Francisco occurs? It is always "What will the railroads do?"—and we always do our share and generally more. Who is it that is called on when some special information is wanted that can be gotten quickest through distant representatives of the railroads, or when there is some special order to be promptly filled? Any railroad agent or solicitor can answer the question without the aid of an encyclopædia. Who is it that pensions their old employees, if not the railroads? The North-Western paid over $70,000 for that purpose last year. Who is it that takes care of its injured men, furnishes them with hospital and surgical care, if not the railroads? Who is it that buries many of the dead who are killed trespassing on the tracks, if not the railroads? I remember such a case in my own town, and after the funeral the family published a card of thanks, but forgot to mention the fact that the North Western paid the expenses. Why would it not be well to advertise some of the good and generous things we do? We rarely get thanked for them. Would not the public have a better feeling towards us if it knew about these things, which are an every day occurrence on a railroad? Some one always tells them about the bad and mean things it is claimed we do.

But, if, on the other hand, our stations are inadequate and poorly maintained, the trains slow and run at infrequent and inconvenient hours, the freight handled carelessly and without reasonable expedition, the ticket sellers, the freight solicitors, the collectors, conductors and brakemen, or other employees or officers are generally arbitrary, disagreeable, discourteous, impertinent and unfair, or inaccessible and unaccommodating, woe betide us when any such question comes up. And, gentlemen, the way this question will be decided does not depend any more upon the Presidents, Vice-Presidents, General Managers, Freight and Passenger Traffic Managers, than it does on you and me and the other subordinates, and if we do our duty as we should the decision will occasionally be in our favor.

One thing that I desire to call special attention to, and that is the importance of promptly and honestly investigating complaints and claims, and reporting the facts as they are, not as we would like to have them. On account of my having been for many years connected with the North-Western Claim Department, which is organized, as all Claim Departments are, for the correction of other people's errors and mistakes, I may over-estimate the importance of this matter, but I believe it is the man who has a complaint, whether it is reasonable or not, who stirs up trouble and who never ceases talking and telling his friends about it if his complaint has not been given proper consideration, who whips his goods over some other line and tries to get his neighbors to do the same. I remember hearing about a farmer who had an unsettled claim against a railroad of 30 years standing who swung a jury against them for a large verdict; of an attorney who had a claim for loss of a coat in a Pullman car and because the road hauling the car had not paid him, had not traveled a foot on that road for ten years, and so it goes.

And in this matter try and look at the complaint or claim not from our standpoint alone, but from the point of view of the customer—that is what the successful business man does; and if our patrons will give us a little indulgence in these matters in the way of time and not complain if we take as long a time in the investigation of their complaint or claim as they would gladly allow the customer in which to pay for the goods, we will get along better, be better friends, and at the same time save a lot of wear and tear to our nerves, and some profanity.

Unfortunately we are obliged to confess that we receive too many complaints and claims, and yet when you think of the many million of consignments that we handled on the North-Western alone last year, each averaging four or five or more packages (right here in Milwaukee we handled one day this week 2,352 waybills and 18,156 packages of less than carload freight, and 507 cars with the same number of waybills for carload shipments), and that railroad men are only human and make mistakes occasionally as well as other men, can you wonder that sometimes a shipment goes astray or is damaged, especially when you consider the way in which many of them are marked and packed; yet out of the 57,229 claims presented to us last year for loss and damage to freight only 11 resulted in litigation, so you will see that we are at least trying to adjust them with reasonable promptness and fairness, and you will perhaps understand why it sometimes takes longer than it should to straighten out these matters, and why some claims are unnecessarily and I regret to admit unreasonably delayed, but such cases are becoming more rare every year, as we are all trying to improve our methods.

I remember a complaint my wife had a short time ago with the largest mercantile house in Chicago, if not in the world, that seemed as plain as the nose on your face, and yet it took two months to straighten it out, simply because the right man did not get hold of it, and so it is with us.

We also learn from the same report of the Interstate Commerce Commission that we numbered 1,300,000 men, and it occurs to me, as I think it has many times to my hearers who have given any thought to the subject, that we ourselves constitute a considerable portion of the public. Our number computed on the usual basis of figuring the number of residents to a town from the number of names in the directory, and allowing for a reasonable increase in the number of employees in a year, would make the number of people directly dependent for a living upon the railroads, without including those engaged in the construction of new lines, nearly 6,000,000, or about one-twelfth of the total population of the country, so that out of every dozen people in Milwaukee at least one of them gets his living directly from the railroads, and if we will all give our business the support we ought to and explain to our friends the reasons why many things are done which they do not understand, and occasionally tell them of some of the many good and charitable things the companies do, instead of criticising

*An address delivered before the Transportation Association of Milwaukee.

every move our superiors make and every policy they adopt, which unfortunately many men do, we can be a mighty and almost incalculable force and influence in making and controlling public opinion.

And let me say to you, gentlemen, that we are engaged in as important, as honorable, and as great a business—if it is not now recognized as a profession it soon will be—as there is in the world. There are some improvements to be made in it, as there are in every business or profession. Two of them occur to me, probably many do to you. Those I wish to mention and which I have for years urged and hope to live to see adopted are:

First.—A new method in the selection of employees; and

Second.—Their education after selection; so that the same care will be taken in choosing a man in whose care innumerable lives and property of incalculable value are to be entrusted as is always done in selecting a type of locomotive, car, bridge or other structure; as much care taken in choosing ten $600 men as is taken in selecting one $6,000 man, and when selected a school established in which to educate them as to their duties and how to perform them.

If we all do our best the day will come in the near future when the recognition we are entitled to will be fully accorded us. And remember, gentlemen, that while Wisconsin has its great merchants, lawyers, bankers and politicians, we have our great railroad men who are at least their peers, who have done as much if not more to advance the welfare of the state as any of its other citizens, and when we can, with justice to our patrons and honor to ourselves, write on our trade marks and advertisements the words "simplicity, selection, supervision, safety and speed," we will have taken a long step towards advancing to the front rank the business of which we all are, as we ought to be, so proud, and I believe that at the same time we will have done that which will assist in bringing about a better understanding between the public and ourselves and result in friendly co-operation and cordial relations between us.

The First T Rail?

The engraving and account which follows are reproduced from the Morton Memorial Volume, edited by Professor F. deR. Furman, of Stevens Institute of Technology, Hoboken, N. J.

Early in October, 1830, and shortly after the surveys of the Camden & Amboy Railroad were completed, Robert L. Stevens sailed for England with instructions to order a locomotive and rails for that road. At that time no rolling-mill in America was able to take a contract for rolling T-rails.

Robert Stevens advocated the use of an all-iron rail in preference to the wooden rail or stone rigger plated with strap iron, then in use on one or two short American railroads. At his suggestion, at the last meeting held before he sailed, after due discussion, the board of directors of the Camden & Amboy Railroad passed a special resolution authorizing him to obtain the rails he advocated.

During the voyage to Liverpool he whiled away the hours on shipboard by whittling thin wood into shapes of imaginary cross-sections until he finally decided which one was best suited to the needs of the new road. He was familiar with the Berkenshaw rail, with which the best English roads were then being laid; but he saw that, as it required an expensive chair to hold it in place, it was not adapted to our country, where metal workers were scarce and iron was dear. He added the base to the T-rail, dispensing with the chair. He also designed the "hook-headed" spike (which is substantially the railroad spike of to-day) and the "iron tongue" (which has developed into the fish-bar), and the rivets (which have been replaced by the bolt and nut) to complete the joint.

The base of the rail which he first proposed was to be wider where it was to be attached to the supports than in its intervening spaces. This was afterward modified, so that the base was made the same width (three inches) throughout.

Mr. Stevens received no favorable answers to his proposals, but, being acquainted with Mr. Guest (afterwards Sir John Guest), a member of Parliament, proprietor of large ironworks in Dowlais, Wales, he prevailed upon him to have rails rolled at his works. Mr. Guest became interested in the matter and accompanied Mr. Stevens to Wales, where the latter gave his personal supervision to the construction of the rolls. After the rolls were completed the Messrs. Guest hesitated to have them used, through fear of damage to the mill machinery, upon hearing of which Mr. Stevens deposited a handsome sum guaranteeing the expense of repairing the mill in case it was damaged. The receipt of this deposit was preserved for many years among the archives of the Camden & Amboy company. As a matter of fact, the rolling apparatus did break down several times. A fac simile of a bill for altering the rolls for the Stevens rail is shown on the following page. At first, as Mr. Stevens, in a letter to his father, which I have seen, described it, "the rails came from the rolls twisted and as crooked as snakes," and he was greatly discouraged. At last, however, the millmen acquired the art of straightening the rail while it cooled.

The first shipment, consisting of 550 bars 18 ft. long, 36 lbs. to the yard, arrived in Philadelphia on the ship "Charlemagne," May 16, 1831.

The rail was first designed to weigh 36 lbs. per yard, but it was almost immediately increased in weight to between 40 and 42 lbs., and rolled in lengths of 16 ft. It was then 3½ in. high, 2⅛ in. wide at the head, and 3½ in. wide at the base, the price paid in England being £8 per ton. The import duty was $1.85 per ton.

Transcription of Letter Shown in Manuscript Below.

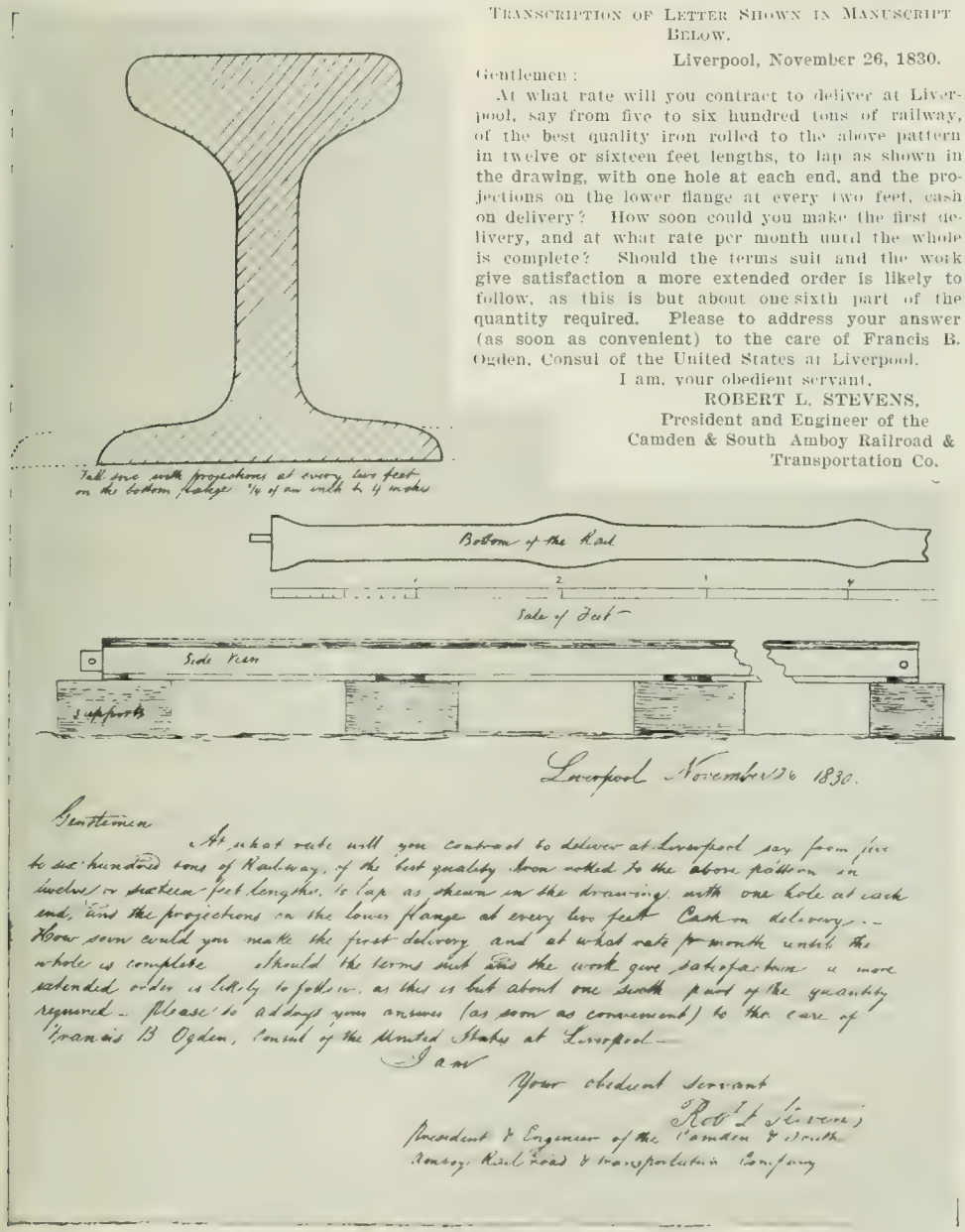
Liverpool, November 26, 1830.

Gentlemen:

At what rate will you contract to deliver at Liverpool, say from five to six hundred tons of railway, of the best quality iron rolled to the above pattern in twelve or sixteen feet lengths, to lap as shown in the drawing, with one hole at each end, and the projections on the lower flange at every two feet, cash on delivery? How soon could you make the first delivery, and at what rate per month until the whole is complete? Should the terms suit and the work give satisfaction a more extended order is likely to follow, as this is but about one-sixth part of the quantity required. Please to address your answer (as soon as convenient) to the care of Francis B. Ogden, Consul of the United States at Liverpool.

I am, your obedient servant,

ROBERT L. STEVENS,
President and Engineer of the
Camden & South Amboy Railroad &
Transportation Co.



The First T Rail?

Accident Bulletin No. 18.

The Interstate Commerce Commission has issued accident bulletin No. 18, giving the record of railroad accidents in the United States during the three months ending Dec. 31, 1905. The number of persons killed in train accidents was 320 and of injured 3,797. The total number of casualties from train accidents and other causes was 18,227 (1,109 killed and 17,118 injured). These reports deal only with (*a*) passengers and (*b*) employees on duty.*

Table No. 1. Casualties to Persons

	Passengers — Classes a and b — Kld.	Injrd.	Class bb — Kld.	Injrd.	Employees — Kld.	Injrd.	Total persons reported. — Killed.	Injrd
Collisions	23	970	8	100	155	1,107	186	2,177
Derailments	15	529	3	70	81	579	99	1,178
Miscellaneous train accidents	..	36	1	16	34	390	35	442
Total train accidents	38	1,535	12	186	270	2,076	320	3,797
Coupling or uncoupling	..	...	..	...	85	886	85	886
While doing other work about trains or attending switches	..	...	..	...	63	4,124	63	4,124
Coming in contact with overhead bridges, structures at side of track, etc.	2	2	..	4	38	383	40	389
Falling from cars or engines, or while getting on or off	24	538	1	18	190	3,041	215	3,597
Other causes	18	524	6	61	362	3,740	386	4,325
Total (other accidents)	44	1,064	7	83	738	12,174	789	13 321
Total, all classes	82	2,599	19	269	1,008	14,250	1,109	17,118

The total number of casualties to employees this quarter is very large; larger in nearly every item than during the last preceding quarter, and much larger than in the October-December quarter of the year before. As there was an enormous amount of traffic moving on all of the principal railroads of the country throughout the time covered by this report, it is fair to conclude that the number of men employed had been materially increased, and that therefore the proportion of employees killed or injured to the number in the service was not so much greater as would appear from a comparison of the casualties alone. On the other hand, there is evidence that many of the new men which it was necessary to employ to handle the additional business were entrusted with dangerous duties after but very little training, and that both new and old men were, in the stress of work necessitated by an enormous freight business, frequently kept on duty continuously for many hours beyond a reasonable day. Some notes are given below of accidents caused by men who had been on duty without adequate periods of rest. In view of the high standard of safety which the railroads set for themselves, and which the people and the courts justly require of the railroads, this list of instances of overwork constitutes a grave criticism of the management of the roads on which the accidents occurred.

The most disastrous accident in the present record, measuring by the number of fatal injuries, was collision No. 16,* killing 17 persons, for which an engineman of limited experience was at fault. Another collision, No. 26,† killing 10 persons, was due to gross carelessness of three men, one of whom was killed. One derailment,‡ reported as due to cause unknown, killed 13.

Table No. 2.—Collisions and Derailments.

	No.	Loss.	Persons — Killed.	Injured.
Collisions, rear	538	$513,282	60	736
" butting	231	447,086	74	685
" trains separating	294	128,973	3	98
" miscellaneous	1,014	463,744	49	658
Total	2,077	1,553,085	186	2,177
Derailments due to:				
Defects of roadway, etc.	356	$255,170	10	414
Defects of equipment	767	530,543	11	181
Negligence train and signal men, etc.	93	60,363	10	91
Unforeseen obstruction of track, etc.	68	92,887	17	99
Malicious obstruction of track, etc.	16	23,745	6	22
Miscellaneous causes	345	301,501	45	371
Total	1,645	$1,264,209	99	1,178
Total collisions and derailments	3,722	$2,817,294	285	3,355

Table No. 2*a* is a list of train accidents in which the damage is reported at $10,000 or over, including also notable cases in which passengers are killed, and those doing damage less than $10,000 and down to $2,000, wherever the circumstances or the cause may be of particular interest:

Table No. 2a. Causes of Prominent Accidents.

[Note.—R. stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

COLLISIONS.

Item.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars and roadway	Record No.	Cause
1	R.	F. & P.	0	0	$300	56	2 engines coupled together "bucking" snow ran into the cars of their own train; occurred 5 a. m.; engineman, 15 years' experience, on duty 15 hrs., intoxicated; conductor suspended 10 days for continuing operations, knowing engineman's unfitness.
2	R.	F. & F.	2	2	985	74	Occurred 1 a. m.; conductor in caboose fell asleep and failed to flag; engineman of approaching train also asleep. (See note in text.)
3	R	P. & F.	0	2	2,000	1	Engineman and fireman both asleep. They had been on duty 27 hours, detained by landslide, but had had 4 hours' sleep in this time.
4	R.	P. & F.	0	0	3,000	26	Signal operator, 2 weeks in service, gave passenger train clear block signal when block section was occupied.
5	B.	P. & F.	2	17	3,200	34	Misplaced switch; engineman of passenger train not keeping good lookout.
6	B.	F. & P.	1	1	3,500	10	Misplaced switch. (See note in text.)
7	R.	F. & F.	0	0	4,100	58	Inexperienced engineman failed to control speed of 50 car freight train (48 cars air braked). Brakemen censured by superintendent for not applying hand brakes.
8	R.	F. & F.	0	0	4,311	57	Disregard of automatic stop signal, and also of stop signal given by flag. Engineman, 15 days' experience, on duty 14 hours, with 5 hours' intermission.
9	B.	F. & F.	2	3	4,517	8	Failure to deliver despatcher's order. (See note in text.)
10	B.	F. & F.	2	1	4,981	39	Occurred 4 a. m. Operator asleep; awoke when called by conductor; delivered 3 orders, forgetting a fourth.
11	B.	F. & F.	1	4	5,120	40	Despatcher gave conflicting orders to 2 passenger trains. Men in charge of one of the trains disregarded rule to get clearance card at a preceding station.
12	B.	P. & F.	0	23	5,500	37	Work train encroached on time of regular passenger train.
13	R.	F. & F.	0	2	6,000	33	False clear block signal given; also engineman approached station carelessly; saw tail lights of standing train, but assumed that they were on the parallel track of another railroad. Signalman in service here 5 days; elsewhere 2 years; had long experience as telegraph operator.
14	B.	F. & F.	0	3	8,300	42	Southbound train ran past meeting point. Northbound had run past automatic block signal set against it.
15	M.	F. & F.	3	2	10,600	44	Approached station not under control; engineman in service 7 months.
16	R.	P. & P.	17	36	10,700	27	Engineman of 5 months' experience ran past five warning signals. (See note in text.)
17	B.	P. & F.	0	3	11,102	4	Freight encroached on time of passenger train.
18	R.	F. & F.	0	1	11,350	59	Engineman asleep: ran past automatic block signal set against him also past a red flag. Brakeman on engine failed to keep good lookout. Crew on duty 16 hours 45 minutes, with 2 hours intermission.
19	B.	P. & P.	6	15	11907	35	Freight ran beyond meeting point; engineman and fireman killed. Conductor tried, too late, to apply air brakes.
20	B.	F. & F.	5	2	13,800	6	Westbound freight train met only one section of eastbound; schedule of second section was "overlooked"; engineman and fireman killed.
21	B.	P. & P.	3	10	14,000	62	Southbound encroached on schedule time of superior northbound train. Should have cleared 5 minutes.
22	B.	P. & F.	4	4	20,000	36	Southbound freight encroached on time of northbound passenger train. Engineman killed; conductor asleep in caboose. (See note in text.)
23	B.	F. & F.	0	3	23,015	9	Mistake by despatcher. (See note in text.)
24	M.	F. & P.	1	23	23,550	11	Freight train became uncontrollable on descending grade. Air brakes had been tested, but were found ineffective when applied a short distance from fouling point.
25	B.	P. & P.	2	67	29,700	2	Despatcher claims to have sent a meeting order which operator denies having received. No evidence to prove either statement.
26	B.	P. & F.	10	17	32,500	66	Men in charge of freight failed to identify opposing passenger trains. (See note in text.)
27	R	F. & F.	0	2	34,553	29	Freight train, 65 cars (85 per cent. air-braked), became uncontrollable on steep grade. Brakes had worked for 5 miles on grade; engineman appears to have failed to maintain adequate supply of air.
Total....			61	243	$302,591		

DERAILMENTS.

1	D.	F.	0	0	$2,500	82	Occurred 1 a.m.; excessive speed; conductor and engineman in duty 18 hours.
2	D.	P.	2	2	5,310	49	Double-head train ran past signal and off derailing switch; both enginemen killed.
3	D.	P.	2	24	8,000	51	Excessive speed on curve of 13 deg. 30 min.; outer rail elevated 8 in.; speed limit, 25 miles an hour; speed of this train estimated 70 miles an hour; engineman experienced.
4	D.	F.	0	2	10,700	50	Stone arch bridge undermined by heavy rain. Train had a helping engine at the rear; 14 cars fell down bank.

* In Table No. 1 the passengers have been divided into three classes—Class a includes all ordinary passengers; Class b includes passengers traveling on freight trains; Class bb includes postal clerks, express messengers, employees on Pullman cars, newsboys, men in charge of freight, etc.

*Baker Bridge, Mass., November.
†Rock Springs, Wyo., December.
‡Sheffield, Mo., October.

Item.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars and roadway.	Record No.	Cause.
5	D.	F.	0	0	12,000	83	Lading of open car shifted and struck bridge, knocking down one span.
6	D.	P.	2	6	12,500	80	Spikes maliciously removed. Express car, with messenger inside, took fire and was burned up.
7	D.	F.	1	1	13,500	78	Accidental obstruction; car derailed by casting which had fallen from a car of preceding train.
8	D.	P.	13	46	14,600	..	Unexplained. (See note in text.)
9	D.	P.	0	21	18,000	47	Broken rail; rail found defective inside.
10	D.	P.	3	31	18,000	53	Probably due to excessive speed (35 miles per hour) over a line on which there was a temporary speed limit of 18 miles an hour. Yard engine, running tender first.
		Total....	23	133	$115,110		
		Grand total*	84	376	$417,701		

*Includes 27 collisions and 10 derailments.

Collision No. 16 was due to the gross negligence of an engineman of five months' experience. The accident occurred about 8 p.m. The engineman had been on duty only about an hour, and had been off duty all that day. A heavy express train, consisting of two engines and nine cars, was following, at a speed of about 40 miles an hour, an accommodation train which made station stops about every mile; and it was a few seconds after the slower train had started from a station that the collision occurred. The express had been following within less than the regular time interval for several miles; and at two points within 2½ miles of the point of collision lantern signals were shown to caution the engineman of the express; but these the engineman of the leading engine disregarded, as well as one or more fusee signals which had been thrown off by the rear brakeman of the preceding train; and the express struck the rear car of the local train with great force. The wreck took fire from the locomotive firebox and some of the passengers were burned to death. The line of road approaching the point of collision was straight for a long distance up to the station, where it curved through a cut, and it was just around this curve that the collision occurred. The explanation made by the negligent engineman is not clear, and the officers of the road appear to have been unable to get at the truth as to all of the circumstances and conditions. The engineman asserts that he was giving his attention mainly to watching for the tail lights of the preceding train; but this, of course, affords no explanation of how he became entirely oblivious to the lantern and fusee signals. His statements about shutting off steam and applying brakes appear to be wholly unreliable. The fireman of the leading engine was killed, so that there is no evidence either to corroborate or to contradict what the engineman says.

The engineman of the second engine of this train shut off steam a mile or more before reaching the point of collision, having seen the warning signals; yet he took no measures to check what was obviously reckless conduct on the part of the leading engineman. The engineman of the leading engine had been a fireman on this division for six years and in that capacity had worked on fast trains, but he had been engineman only a few months and had been passenger engineman only one trip, and that on a local train. The fireman of the leading engine had been in the service only three months. The engineman asserts that he had had no conversation with the fireman for some minutes before the collision. A rule of the road requires firemen to so arrange their work as to be able to assist the engineman in the lookout at stations and crossings and in observing the indications of fixed signals, but it appears that both the engineman and fireman in this case paid no attention to this rule. Both the engineman and the fireman are reported as men of good character, and their records had been clear.

Collision No. 26 occurred about 3 a.m. and caused 10 deaths and 17 injuries. None of the killed were passengers. The freight train, bound westward, waiting on a side track for four eastbound passenger trains, was started out after the passage of the third train and collided with the fourth. These trains were first and second No. 20, No. 18 and No. 4. Conductor X, of the freight, says that when he left A (westbound) he knew that he could go no farther than B for the four eastbound first class trains, and so notified not only the engineman, when he delivered him personally the orders, but the head brakeman and rear brakeman, Z, as well. Engineman Y entered the side track at the east switch at B, and as the train cleared this switch the conductor remarked to Z, "We are here for all four of them." The conductor claims that after going onto the side track he began to make out his wheel report—he having filled out his train at A—and that the rear brakeman was eating his luncheon. The conductor says that he looked out when No. 20 passed and saw the signals. He also noted second 20 when it went by, and when No. 18 went by he walked to the rear of his caboose and remarked to the rear brakeman, "That is not No. 4; No. 4 must have run around No. 18." While he was discussing the matter with the brakeman, Engineman Y gave the whistle starting signal, the head brakeman threw the west switch, and the train started to move. Both X and Z claim that they were morally certain that all four passenger trains had gone by. The orders were perfectly clear to them and thoroughly understood, and neither of them has been able to figure out, since the accident, how the oversight occurred. Fireman H claims that when Y started to move his engine he told him that but three trains had gone. Y corrected him by saying that all four trains had gone and that there were no other trains to come. Engineman Y was killed.

Derailment No. 8 is reported as due to some cause unknown. The report says that the tender of the engine first left the track and that six cars following it were derailed. The baggage car, next to the engine, ran against the bluff on the inside of the curve, and the cars were telescoped and wrecked. The inside rail of the track was found turned over for about 90 ft. The track was in good surface and alinement and had been inspected daily. The ballast was stone. The weight of the engine was 201,500 lbs.; weight on drivers, 99,500 lbs. The tender was in good condition. The speed of the train was about 35 miles an hour.

In collision No. 6 a switch had been left in wrong position by a brakeman of two weeks' experience. Extra freight train, engine 131, westbound, collided with extra freight train, engine 8, eastbound, which was standing on the passing track. When extra 8 went into the passing track, a local freight, No. 19, westbound, backed out of the east end onto the main track to proceed west. The rear brakeman of this train set the switch for the main track, and after his train had cleared it (going west on main track) he threw the switch for the passing track again and locked it. Extra 131 was about one mile east when No. 19 departed. In some way the lamp on the switch, which was burning when No. 19 passed over it, became extinguished, and the engineman of 131 failed to notice the absence of the light, being deceived, he says, by other lights in the vicinity. The engineman and fireman on 131 jumped off and the fireman was instantly killed. The rear brakeman of No. 19, who wrongfully threw the switch for the passing track, had been in the service two weeks, under instructions; and, moreover, had been told by both the engineman and the fireman of his train just after it had backed out of the passing track to set and lock the switch for the main track and get onto his train.

Collision No. 9, which occurred at 3 a.m., was due to the failure of an operator to deliver a meeting order. First No. 8 had orders to meet No. 7 at X, and No. 7 was to receive the order at X. The operator at that point, 19 years of age and of 10 months' experience, failed to take the precaution of placing torpedoes on the rail, as required by the rules (when an order fixes a meeting at the point where the order is delivered), and he also failed to fasten the rope of the train-order signal in the "tell-tale" device. When No. 7 arrived at his station, he forgot that he held an order for that train, and changed the semaphore signal from "stop" to "all right," and did not discover his error until after No. 7 had passed.

Collision No. 22 was between a freight train and a passenger train, both running on schedules of six months' standing. The freight, after having done considerable work at a station, was started for the next station on the time of the passenger train. The engineman and fireman were killed. The conductor had given the starting signal and then had gone to the caboose and had fallen asleep, and he was asleep at the time of the collision, though he had not worked excessive hours. It does not appear that the conductor or any of his men had had any conference with the engineman as to where the freight should meet the passenger train.

Collision No. 23 was due to an error in the despatcher's office. The despatcher who was on duty at 11 p.m. issued an order scheduling No. 3 west from A to F somewhat later than its regular schedule, leaving A at 1 and arriving at B at 1.25 a.m. Extra 85 eastbound signed this order at F at 11.15 p.m. and left there. No. 3 was ready to leave A at 12.15 a.m., about 30 minutes earlier than the despatcher had expected. The despatcher who came on duty at 12 o'clock midnight revoked the special schedule and so notified No. 3 at A, overlooking the fact that extra 85 had received a copy of it at F. Extra 85 was going to B to meet No. 3, which was due there on the special schedule at 1.25. This order having been annulled to No. 3 at A, No. 3 ran earlier, and the collision occurred a half mile west of B at about 1.05 a.m. The record of the transfer of outstanding orders from one despatcher to the other at 12 o'clock indicated very clearly that extra 85 had been given the order at F. The second despatcher had had 18 years' experience as despatcher, but had been in this place only eight months. He had had a good record up to the time of accident.

Two collisions shown in Table 2*a*, Nos. 4 and 13, were due to "failures in block working" errors of attendants at block signal stations. It will be noted that both of these attendants were men of brief experience. Three other collisions, Nos. 8, 14 and 18, were due to disregard of automatic block signals indicating "stop." In one of these cases the men at fault had been on duty an excessive number of hours.

In nearly or quite every accident bulletin that has been issued

it has been necessary to record one or more collisions due to the mistakes or negligence of men who had been on duty so many hours as to raise the supposition, if not the presumption, that they had become drowsy, if they had not actually fallen asleep; and cases in which enginemen are definitely reported as being asleep on duty are common. In the quarter covered by the present report traffic was very heavy and in some localities, according to common report, there was difficulty in finding additional men for the freight-train service as fast as they were needed, and the reports make a very unfavorable record in this respect, culminating in a collision—No. 2 in the foregoing table of causes—in which a conductor who should have protected the rear of his train was asleep in his caboose, while the engineman of the following train was asleep in his cab, so that he would not have seen the conductor's red lantern if it had been shown. In collision No. 1 the engineman at fault had been on duty 15 hours. In collision No. 8 an engineman, who had been in service as such only 15 days, had been on duty 14 hours, but with an intermission. In collision No. 18, before referred to, all of the men on the train had been on duty 16 hours 45 minutes, with an intermission. Collision No. 10 was due to the fault of an operator who had been asleep, though whether or not his mistake was due to this is not clear. Derailment No. 1, due to misconduct or neglect of a conductor and an engineman who had been on duty 18 hours, may or may not have been due to overwork. Collision No. 22, referred to above, is also to be noted under this head.

In the list of boiler explosions, which do not appear in Table 2 *a*, there are also cases in which men were apparently overworked. In one such explosion the engineman, who was held at fault for allowing the water in the boiler to become too low, had been on duty very irregularly for the preceding two days. After a rest of 7 hours 40 minutes he was on duty 21 hours; then rested 2 hours 45 minutes; then was on duty 11 hours 5 minutes, up to the time the accident occurred. The way such a "schedule" of hours works out in practice may be seen by assuming the case of a man who finishes his work at 7 o'clock on Saturday night. If, then, he rests 7 hours 40 minutes, he will be called at 2.40 a.m. on Sunday; working then 21 hours, he will be off at 11.40 p.m. on Sunday. A rest of 2 hours 45 minutes then would end at 2.25 a.m. on Monday, and working then for 11 hours 5 minutes would bring him to 1.30 p.m. Monday.

In another case an engineman, who was dismissed from the service on account of his responsibility for the explosion, had been on duty 16 hours 40 minutes, following a rest of 21 hours 40 minutes. This man had been in the service of the company about 10 years, but had been an engineman only two months. In another boiler explosion, which caused the injury of nine employees, and was reported as being due to the water becoming low in the boiler, the engineman held accountable had been on duty 18 hours.

The Standard Oil Co.'s Low Railroad Rates.

On May 4 the President of the United States transmitted to Congress a report made to him, of date May 2, by James Rudolph Garfield, Commissioner of Corporations, concerning the Standard Oil Company's methods of getting low railroad rates. Mr. Garfield classifies the discriminations made in favor of the Standard Oil Company as follows:

First, secret and semi-secret rates; second, discriminations in the open arrangement of rates; third, discriminations in classification and rules of shipment; fourth, discriminations in treatment of private tank cars. He treats these subjects in inverse order, as follows: On the Pacific Coast most independent refiners receive for the use of their cars six-tenths of a cent a mile, except where the haul exceeds 800 miles, in which case three-fourths of a cent a mile is allowed on the excess mileage. This allowance, or rental for private owners' cars, applies to loaded movements only, whereas he charges that the Standard Oil Company's tank cars are paid for at the rate of three-fourths of a cent a mile on both loaded and empty cars.

The New York, New Haven & Hartford and the Boston & Maine have charged local rates on oil and have refused to pro-rate on oil shipped from west of the Hudson river. Inasmuch as the Standard Oil Company has, at tidewater, refineries supplied with crude oil by its pipe lines, this gives the Standard Oil Company an overwhelming competitive advantage in New England, inasmuch as its rail haul is short while the rail haul of the independent refiners is long.

The Pennsylvania Railroad has given to the Standard a rate of nine cents a barrel from Olean, N. Y., to Rochester, while independent refineries near Olean were given a rate of 38 cents a barrel. "By means of this nine-cent rate, in combination with a rate from Rochester to Norwood, N. Y., a virtually secret and very low rate from Norwood, N. Y., to Burlington, Vt., and secret local rates therefrom, the Standard has been able to supply central and northern Vermont with oil at a rate of from 15 to 21 cents a hundred pounds, whereas no independent refiner could reach that territory from Western Pennsylvania save by a rate varying from .53 to 50 cents a hundred pounds."

The published tariff from Whiting, Ind., the great western refinery of the Standard Company, to Birmingham, Ala., has been 44 cents a hundred pounds, but the Standard Company, by means of a secret combination of rates by way of Grand Junction, Tenn., over the lines of the Chicago & Eastern Illinois, the Illinois Central and the Southern Railway, has shipped oil to Birmingham for 29½ cents. An independent competitor at Toledo has had to pay for a similar distance, but over another route, 47½ cents. The Whiting refinery has shipped to local points in the same state at less than the open rate. The Standard has shipped oil from Whiting to East St. Louis at a rate of 6 to 6¼ cents on three of the five railroads connecting those points, while the only published rate on all roads has been 18 cents, and the rates from the independent refinery points of Ohio to East St. Louis have been about 12 cents higher than the rate from Whiting, whereas on other commodities of similar grade these points pay only about five cents more than Whiting. Open published rates from Whiting to a large part of the United States have given the Standard Company an unfair advantage of from one to 12 cents a hundred pounds.

In Kansas, crude oil is charged on the basis of 7.4 pounds a gallon, whereas its actual weight is 7.2 pounds. Fuel oil, produced by the refineries, is charged at 6.4 cents a pound, whereas it weighs 7.6 pounds.

In California, direct rebates, as well as discriminations by the use of secret rates, have been given on oil.

The Commissioner says that during and subsequent to his investigation most of the secret rates and some of the open discriminations discovered by his bureau have been abolished by the railroads. Among them he notes the secret rate of nine cents a barrel from Olean to Rochester and 10 cents a barrel from Olean to Buffalo. The low tank car rates made by the Rutland Railroad from Norwood to Burlington have been made applicable to oil in barrels. The secret rates from Whiting to Grand Junction, to Evansville, and to East St. Louis have been cancelled. The railroads have advanced their published rates from Whiting so as to put them on an equality with the rates from independent refinery points. The New York, New Haven & Hartford now pro-rates. A large number of the secret rates of California railroads have been published as open rates.

The Commissioner concludes as follows: "This investigation has shown very clearly one glaring defect in the Interstate Commerce law, viz., the method of filing and publishing tariffs. Although a tariff or a rate has been filed with the commission in compliance with the terms of the law, none but the favored shipper may know of its existence. Tariffs may be made and rates may be combined in such manner as to make it practically impossible for the ordinary shipper to find them. As long as the state rates are not required to be made public, and shippers use such rates in combination with interstate rates, all manner of devices to evade the purpose of the law are possible. All state rates used in connection with interstate shipments should be filed with the Interstate Commerce Commission, and a radical change should be made in the direction of simplifying tariffs and in methods of posting and filing them."

John B. Thayer, Fourth Vice-President of the Pennsylvania Railroad, replies as follows:

"The report of Commissioner Garfield, so far as it refers to our company in its relations with the traffic of the Standard Oil Co., is an inexcusable and outrageous perversion of the facts.

"It is true there has been in effect a special rate of nine cents per barrel on oil from Olean to Rochester, and it has not been withdrawn. This rate was originally made in 1888 by the Western New York & Pennsylvania Railway, 12 years before the acquisition of that company by the Pennsylvania Railroad, in order to retain to the railroad traffic which would otherwise have gone by pipe line.

"The traffic to be transported was crude oil and unfinished products moving from one refinery to another, belonging to the same owners. Attention having been recently called to the wording of the tariff, which might be construed to include refined oil, and perhaps was so erroneously construed and applied in a few instances, insignificant compared with the total traffic, the wording of the tariff was corrected so as to clearly confine the rate to crude oil and unfinished products thereof, as intended. It is not a secret rate and never has been secret.

"The tariff was not filed with the Interstate Commerce Commission because it applies to traffic solely within the State of New York, and tariffs upon such traffic are never filed with the commission, whose jurisdiction covers only interstate traffic. It was issued in the same manner as tariffs are issued on all other state traffic. It was not made as a favor to the Standard Oil Co., but for good business reasons, similar to those which actuated the railroad in making special rates under other special conditions for the so-called independent refiners.

"There are a number of such rates in effect and for numbers of shippers of other commodities as well. It was not made, as

stated by the reports for the purpose of combination with other rates to produce secret, low through rates to New England, and was never to our knowledge, used for such purpose."

W. H. Newman, President of the New York Central & Hudson River, makes the following comment: "We refuse to furnish our state rate to the Bureau of Corporations of the Department of Commerce and Labor because the department has jurisdiction only over interstate commerce. We cheerfully gave the department access to our interstate commerce books, just as we would give the proper state authorities information as to our state rate if it was called for.

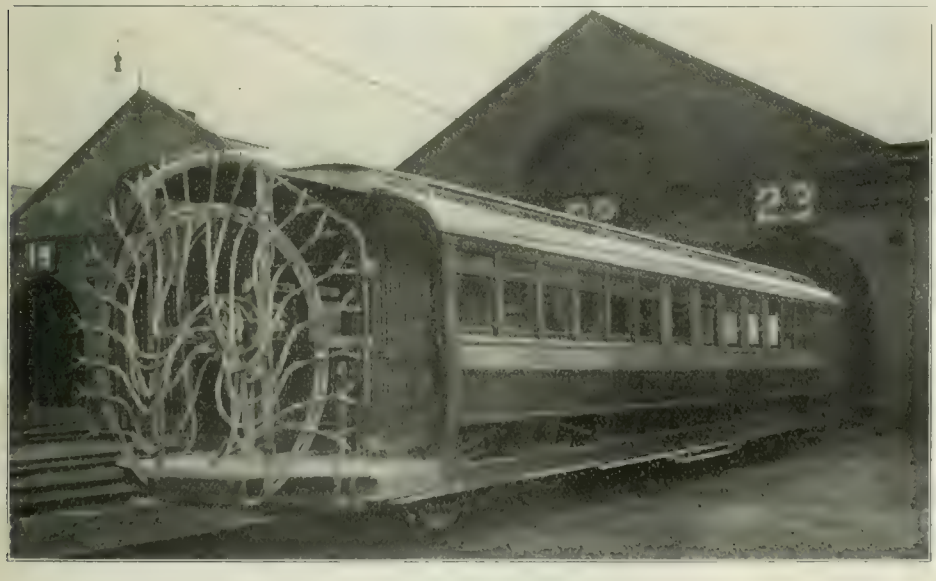
"As to the New York Central being the only company which refused to supply Commissioner Garfield with the state rate, attention should be called to the fact that the New York Central is the only large state railroad in the country.

"I do not think that the Standard Oil Company received rebates from any railroad. Naturally, it is always on the lookout for the most favorable rates, and, by reason of its compact organization, is instantly ready to take advantage of any changes in the tariff.

"Any other shipper could do the same thing, only the Standard Oil Company, by being alert, has been enabled to get the best possible rates by unceasing scrutiny of the tariffs. If it had failed to take advantage of any rate changes favorable to itself the Standard Oil Company would have been foolish."

Whitewashing Car Used on the Central London Railway.

The car shown in the accompanying photograph is used for whitewashing the tunnels of the Central London Railway. It is a motor car which has been converted for the purpose. At one end is the motor for driving the car, while, at the other end, on a circular frame, are arranged a large number of pipes, each terminating in a double branch. The nozzles of these branches are so placed as to distribute the liquid ejected from them. The seats inside the body of the car have been removed and their place taken by a tank for the whitewash liquid of about 800 gals. capacity. From this tank a pipe connects with an electric driving pump, and this pump again, by a main pipe, connects with all the branches fixed on the rear end of the car. The whitewashing process is extremely simple. The car travels along the tunnel at the rate of about four miles an hour and the electric pump forces the liquid out of the pipes and sprays it on the roof and sides of the tunnel. About three applications of whitewash are sufficient to properly coat the walls. Thus the work is both quickly and economically performed.



Whitewashing Car—Central London Railway.

Disastrous Collision near Altoona.

In a butting collision of passenger trains on the Pennsylvania Railroad Friday, May 4, about 10.45 p.m., near Clover Creek Junction, Pa., four postal clerks, four passengers, and two trainmen were killed, and four trainmen, four postal clerks, and about a dozen passengers were injured. In consequence of the wreck of a freight train at Union Furnace, on the main line, blocking all four tracks, through passenger trains were being run between Altoona and Petersburg over the Hollidaysburg and Petersburg branches, single track lines, and the trains in collision were the westbound St. Louis express train No. 21 and the eastbound Chicago mail train No. 18. No. 18, in leaving Altoona for the branch, was pulled backwards, and its single passenger car, at the rear, became the leading car in the train; and it was in this car that the four passengers were killed. Most of the injured were also in this car. The mail clerks were in the car next to the passenger car. The only serious casualty on the westbound train was the fatal injury of the baggage master. Five cars in the eastbound train were wrecked. The collision was due to a misunderstanding of orders on the part of the men in charge of the westbound train, No. 21. In the derailment at Union Furnace, 27 loaded cars were piled up in a wreck which blocked all four main tracks. This derailment was due to the bursting of an air hose. Petersburg is 27 miles east of Altoona, on the main line; and the branches named connect Altoona and Petersburg by a line about 40 miles long.

Union All-Electric Interlocking at Elsmere Junction.

The Union Switch & Signal Company's electric interlocking apparatus is now in use at five places on the Baltimore & Ohio, and one of the plants, that at Elsmere Junction, Del., near Wilmington, is described in the accompanying illustrations. In the Union scheme the switch machine is quite different in design from other electric motor apparatuses used for this purpose, and the dwarf signals are worked by motors instead of solenoids. Elsmere is a junction with the Philadelphia & Reading and the arrangement of tracks is shown in Fig. 1. In the machine there are 36 working levers as follows: Nineteen levers for 16 switches and 20 derails; 17 levers for the operation or control of 48 signals; and 11 spare spaces, making a 47 lever-frame, which occupies a floor space 10 ft. 9 in. long and 4 ft. 4 in. wide.

This machine, Fig. 3, is fixed in a tower previously occupied by a manual-power machine, and although the number of functions operated is double that formerly worked, the machine takes up only about half the space required by the machine in the old system. The electric machine is, essentially, of the Union Switch & Signal Co.'s well known electro-pneumatic type, redesigned to suit the conditions arising from the use of 110-volt operating current and fitted for the attachment of indication-motors in place of magnets.

The switch levers have two operating positions, "left" or normal and "right" or reverse. The signal levers are normally on the center and each can operate two signals, one "right" and one "left."

All the wires are carried to a slate terminal board attached to and extending the full length of the machine, and on this are mounted suitable fuse blocks and binding posts. The operating wires from the machine are carried through the tower to the trunking lines in asbestos lined wooden boxes. These boxes are fitted with doors which are readily opened and give access to all wires.

The electric switchboard in the tower has on it a switch, which when opened cuts out all current to the machine; an ammeter which shows the amount of current consumed in operating the different functions, and two pilot-lamps which normally glow but in case of grounds show by their brightness whether the trouble is in the "common" or the operating wires.

A power house, situated 150 ft. from the tower, contains the generating set and the storage batteries, with a switchboard by which all possible charging and discharging conditions are controlled. The generating set consists of one 2 k.w. generator, belt-driven by a 4 h.p. Fairbanks-Morse gas engine. For storage battery they are two sets of 55 cells each of Chloride Accumulator, type 7-E, of 120 ampere hours capacity. This battery is kept on a rack three shelves high, with sliding doors in front.

A few feet away from the power house the gasoline tank is set in a concrete well, ventilated and with trap-doors on top.

The high signals are worked by the well-known Union "style B" electric motor, with the indication device added. The mechanism is enclosed in a case at the base of the post. The motors are wound for a 110-volt current.

Dwarf signals are motor-driven, an electric clutch being used (in place of slots) to operate and hold the signal clear. As in the high signal, all of the mechanism is enclosed.

The construction of the motor-driven dwarf semaphore is shown in Fig. 5. The motor drives a horizontal shaft by means of a worm gear, the shaft having fixed to it the armature of an electro-magnetic clutch. The other part of the clutch, enclosing the exciting coil, is fitted loosely on the shaft. This loose part of the clutch has a crank pin affixed, to which the operating rod of the signal is attached. When the signal is in the normal or stop position the crank pin



Fig. 3—Union All-Electric Interlocking Machine.

Fig. 1—Plan of Tracks, Showing Switches and Signals at Elsmere Junction, Delaware—Baltimore & Ohio and Philadelphia & Reading Railroads. Signalman's Working Plan; Not Drawn to Scale.

Approximate distances: From cabin north to switch No. 15, 750 ft.; from switch No. 11, by track S, to switch No. 15, 1,100 ft.

EXPLANATION OF SIGNALS.

Fig. 6—Baltimore & Ohio Signal Indications.

The blades are painted with black band. R indicates Red; G, Green; W, White.

is vertically under the shaft; when clear the crank pin is about 45 deg above the horizontal.

The exciting coil of the clutch is connected in series with the motor, and when the operating current is switched on, both the motor and clutch are excited the first causing the clutch armature to rotate, and the second causing the loose part of the clutch to adhere to the armature and move with it. When the signal reaches the clear position a circuit switch cuts in sufficient resistance to reduce the holding-clear current to a very small amount and stops the motor.

The signal is locked in the normal position by means of a hook-shaped formation on the eye of the operating rod, which engages with the shaft carrying the clutch whenever the rod is moved upward a very short distance. Sufficient lost motion is allowed in the crank-pin hole to permit a slight upward movement of the rod without turning the clutch. Having a motor, the dwarf signal gives its indication in the same way as a high signal.

The switch movement and the control apparatus, Fig. 4, are mounted on a steel plate 6 ft. 2 in. long, 14 in. wide and only 12 in. high with the sheet-iron cover on. The base plate is bolted to the ties and the top of cover is but 2 in. above the top of the rail.

At each switch movement there is a safety controller, described below. This is in an iron box with a hinged top, taking up a space of 12 in. x 8 in. x 4 in.

The switch machine is best shown in Fig. 2, in which A is the electric motor, B a magnetic clutch, C reducing gear, reducing the speed at a ratio of 30 to 1, D loose joint, E operating drum. The main purpose in making the machine of the shape shown is to adapt it to use in narrow spaces between tracks, where a motor with its main rod at right angles to the tracks cannot be used. The operating rods are moved by the worm grooves in the cylinder, through the instrumentality of lugs on the rods; these lugs engage with the grooves. One groove works the lock-bar and detector-bar, and completes their stroke; then the next groove moves the switch, the lock-

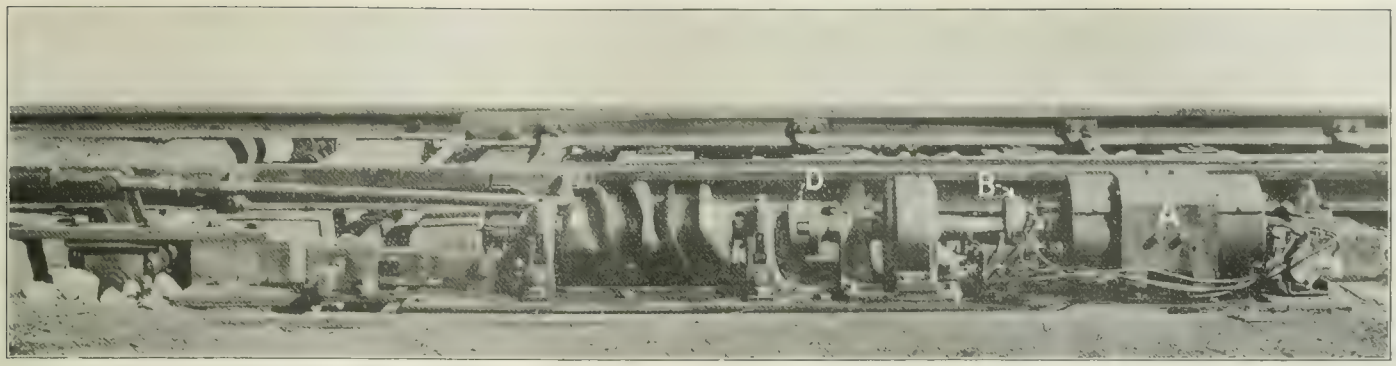


Fig. 2—Electric Motor and Switch and Lock Movement, Cover Removed.

Made by Union Switch & Signal Co.

bar being motionless meantime by reason of the change in the shape and direction of the groove; and after the switch movement is completed the lock-bar is again locked. The cylinder or drum carrying the worm grooves is reversible, so that, without changing the position of the motor and clutch, the switch movement may be changed from right to lift, or vice versa.

The motor is 1½ h.p. and works at 110 volts. It is made to revolve the drum in the direction opposite to that in which it was last revolved simply by changing the connection of the operating circuit to the other field winding, there being two field windings arranged for this purpose. The magnetic clutch makes a perfect working connection, while yet, as it is not a mechanical fastening, it permits the motor to run on without damage in case the motion of the switch rails becomes obstructed. In such a case the added load on the motor soon cuts off the power (by blowing a fuse) unless the operator reverses and puts the switch rail back to its original position.

The "indication" from a switch back to the machine (insuring proper sequence and preventing the clearing of a signal before the closing of the corresponding switch) is effected by fitting the commutator of the motor, in addition to the parts usually found on a direct-current motor, with a collector ring and a brush bearing thereon. The collector ring is connected electrically with one segment of the commutator. At the end of the movement the automatic controller switches the operating wire from the operating brush, bearing on the commutator, to the indication brush, bearing on the collector ring, at the same time cutting out the magnetic clutch. The motor then continues to run light, driven by current from the battery, which current is caused to undulate by the varying position of the segment to which the collector ring is attached. This undulating current induces an alternating current in the secondary of a small transformer in the tower, and this alternating current drives a small alternating-current motor which releases the indication latch and permits the completion of the stroke of the lever on the machine. The stroke being completed, the signal or next desired function is unlocked.

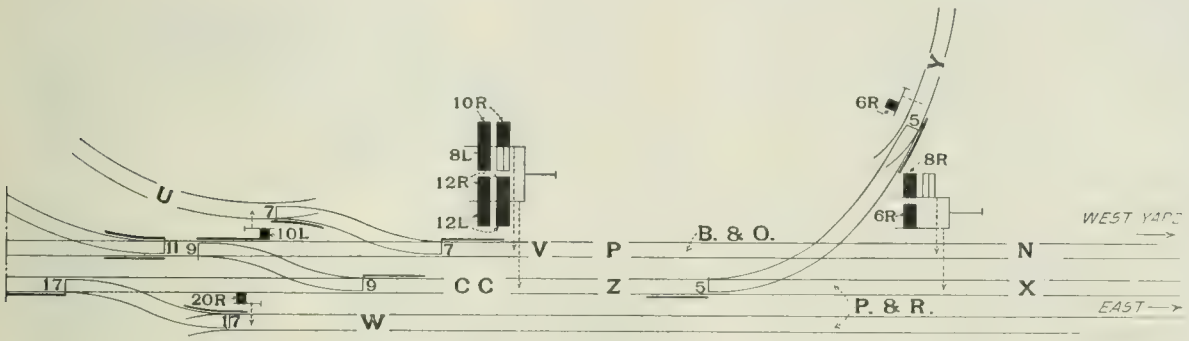


Fig. 1 Continued.

The indication motor is an alternating-current motor of a well-known type, with its armature shaft in a vertical position, having a piece of centrifugal apparatus attached thereto, similar to the governor on a steam engine. The rapid rotation of the armature causes the weights to diverge and lift the indication latch and release the lever. A very rapid rotation of the indication motor armature is necessary to produce the desired effect, and this can be secured only by a rapid succession of alternating impulses in the coils of the motor. A direct current through these coils has no effect other than to lock the armature against rotation. Single impulses which may be caused by making or breaking a circuit will cause the armature to move through not more than 10 deg., and a succession of such impulses following each other as rapidly as it is possible to make and break a circuit by hand will cause only a step by step movement of the armature, each step being about 10 deg., the armature coming to a full stop at the end of each step, so that impulses produced in this manner will not cause the weights to move from their position of rest against the arma-

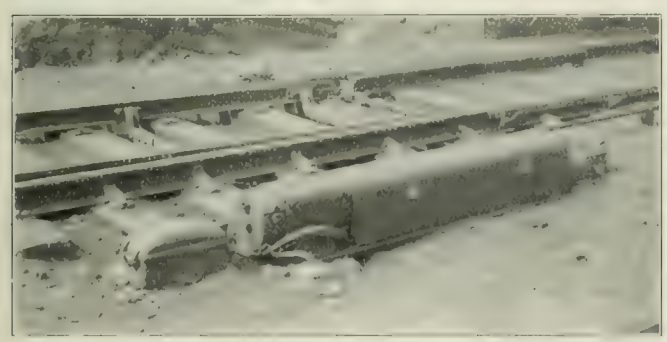


Fig. 4—Union Switch & Signal Company's Electric Switch Movement.

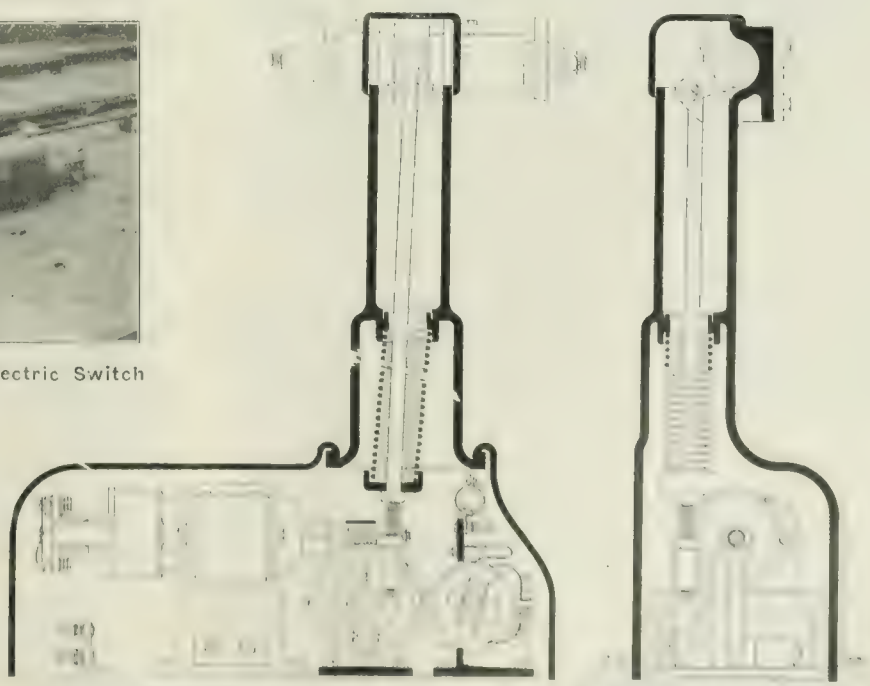


Fig 5—Motor-Driven Dwarf Semaphore.

ture shaft. From this it will be seen that no condition of crossed wires, either constant or swinging, will give rise to a false indication.

There are two methods of operating the switches of a crossover, one called the multiple, and the other the series method. In the first, two switch motors receive current simultaneously, and the movements are effected at the same time. In the second method one of the motors receives no current until the other switch has completed its movement. In either case the indication circuit is not closed until both switches are home and locked.

To avoid making a wrong movement by means of crossed wires, the switch movement has an automatic cut-out which combines in one the functions of two electro-magnetic circuit controllers. The function of one is to open the motor circuit when the lever movement is completed, and of the other to open the next operating circuit when it is energized improperly by crossed wires. The instrument comprises two suspended magnets, connections to the coils of which are made by means of brushes bearing on contact pieces connected to the terminals of the coils. When the circuits are in proper condition and the lever completes its movement, current is sent through the magnet in the next operating circuit, one magnet being in each operating circuit; this moves a circuit controller to open the motor circuit and stop the flow of current from the battery. At the same time it moves a latch to lock the magnet in the last operating circuit so that it will be held in position. If now a live wire becomes crossed with the next operating circuit, current will flow through the magnet in that circuit. When the automatic controller is replaced, which occurs before the lock bolt is withdrawn, current will also flow through the magnet in the last operating circuit, which will cause the magnet in the next operating circuit to be withdrawn from its contact brushes and thus open the next operating circuit and prevent a movement of the switch rail.

Signals as well as switches are protected against improper movements due to crossed wires. A fuse is placed in the signal operating circuit between the slot coil and the motor. When the signal lever is in the normal position the indication wire is connected to the common wire, and as the indication wire is also connected to the control wire at the signal motor, both being connected to the same brush on the armature, a current which might reach the control wire would be short circuited back to battery through the indication wire, which would cause a very heavy current to flow and blow the fuse in the operating circuit, thus cutting off current from the signal motors and preventing a false movement.

If the cross should occur beyond the fuse it would also be beyond the slot, so that the slot magnet would not be energized and the signal would not clear. The same arrangement is followed in reference to the safety controller in connection with the switch motor. The coils of the magnets spoken of are both placed between the field coils of the motor and the armature, so that if a cross should occur beyond these protecting magnets it would also be beyond the field magnet coils, and consequently in this case the field magnets would not be energized so that the armature would not rotate.

This method of protecting switches and signals against crossed wires affords entire protection, and the operation of these safety devices does not interfere with any other part of the plant except the particular switch or signal affected by the crossed wire.

As the automatic block system on the B. & O. is carried through this interlocking, all high-speed signals are controlled both by track conditions and by the position of the lever in the machine, making them semi-automatic in character. On this division of the B. & O. semaphores having but a single arm are always automatic signals, and interlocked signals always have two arms; for example, signals 16R and 22R, though having no diverging route, have a second arm, which is fixed and immovable. With this arrangement the explanation given in the rule-book for trainmen is as shown in Fig. 6, three-position signals being used, as indicated.

The other four plants equipped with the Union all-electric apparatus on the B. & O. are at Broadford Junction, Pa.; Laughlin Junction, Pa.; Newton Falls, Ohio, and Fairpoint, Ohio. Mr. Patenall, the Signal Engineer, informs us that the plants which are completed have given very satisfactory service.

Foreign Railroad Notes.

The Southwestern Railroad of Russia, one of the great systems of the country, carrying grain chiefly to Odessa, had become so short of fuel that it sent every available car to the coal mines, and is reported to have suspended all freight business at no less than 77 of its stations, in spite of which 36,500 carloads of freight were awaiting shipment.

The German railroads are having a prosperous season, much like our own. In January last the gross earnings of all railroads in the Empire were nearly 17 per cent. greater than in the corresponding month of last year. An increase of 5 per cent. is considered great there. Also in Austria and Hungary there was a very unusual increase in earnings.

The Prussian State Railroads have adopted the Nagel system of investigating sensitiveness to colors, instead of the Holmgren yarns, heretofore used. The railroad physicians are required to receive instruction in the methods of this system, and, moreover, they must themselves be tested for color blindness, which seems a reasonable requirement, for if the color blind lead the color blind the trains will surely go into the ditch.

The Duluth Extension of the Wisconsin Central.

The Owen & Northern and the Lake Superior & Southeastern which are the names of the two companies under whose charters the Duluth extension of the Wisconsin Central is being built, will together be 157 miles long. The new extension starts at Owen on the St. Paul line of the Wisconsin Central and runs northwesterly in almost an air line to Superior. The traffic possibilities of the line seem to be most promising. It traverses a rich agricultural territory and timber region. Also, it is understood that it will compete strongly for ore traffic from the head of the lakes to

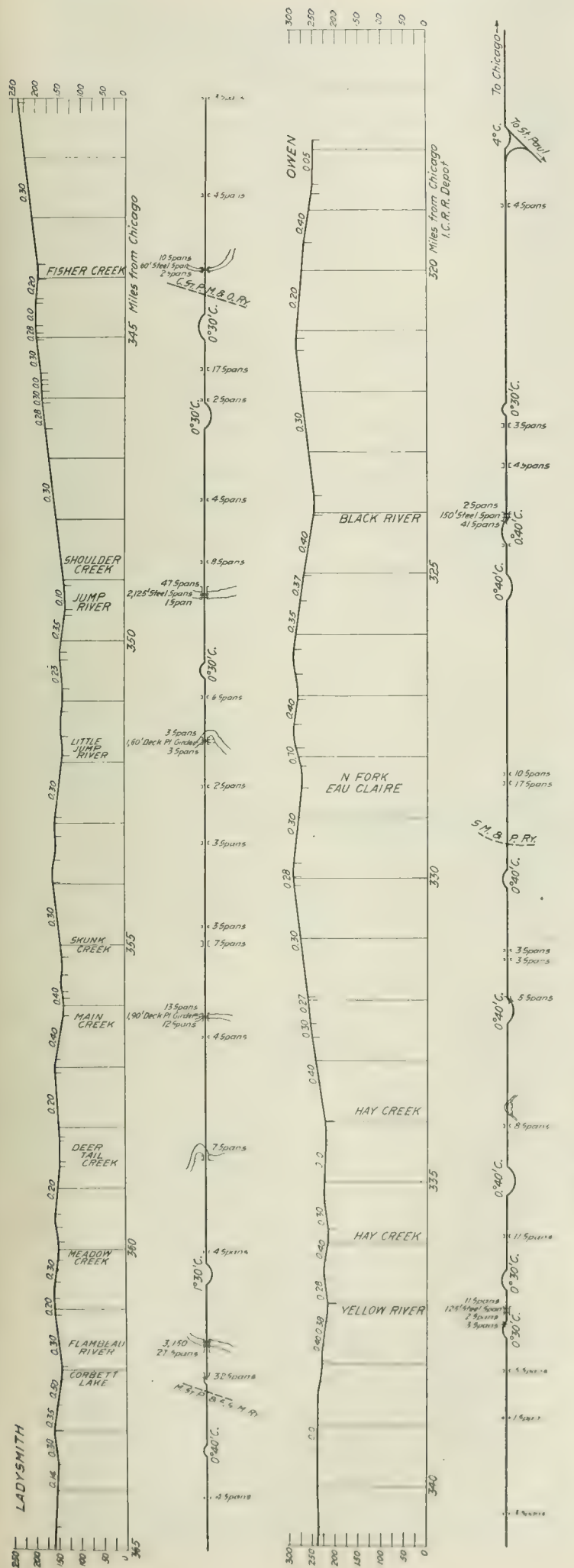


Wisconsin Central Showing Route of Duluth Extension.

Chicago, since it is being built with low grades and light curvature suitable for heavy tonnage movement. It will also offer a direct route for passenger traffic between Chicago and Duluth.

The accompanying maps show the northwestern portion of the state of Wisconsin with the new line and the relation of the Duluth line to the rest of the Wisconsin Central system. The Owen & Northern from Owen to Ladysmith, 45½ miles, has been completed, with the exception of the bridge across the Flambeau river at Ladysmith. The remainder of the line, the Lake Superior & Southeastern, from Ladysmith to Superior, 112 miles, is under construction. This has been sketched on the map in accordance with the information as to the general route of the line at present available. The Owen-Ladysmith section has in addition to its 45½ miles of main line about 9½ miles of siding and yard tracks. The alinement is good, with but seven 30 min. curves; four 40 min. curves; two 1 deg. 30 min. curves, and one 2 deg. curve—a total of 14 curves on the entire line, with a total curvature of 186 deg. 44 min., or 4 deg. 5 min. per mile. Ninety per cent. of the line is tangent.

The notable feature of this 45-mile line is its light grades, the maximum grade southbound being 0.3 of one per cent. and northbound 0.4 of one per cent. The condensed profile and plan reproduced herewith shows the characteristics of the line in respect to grade and alinement. The right-of-way is the usual 100 ft., with additional width where required for deep cuts and high fills. Depot



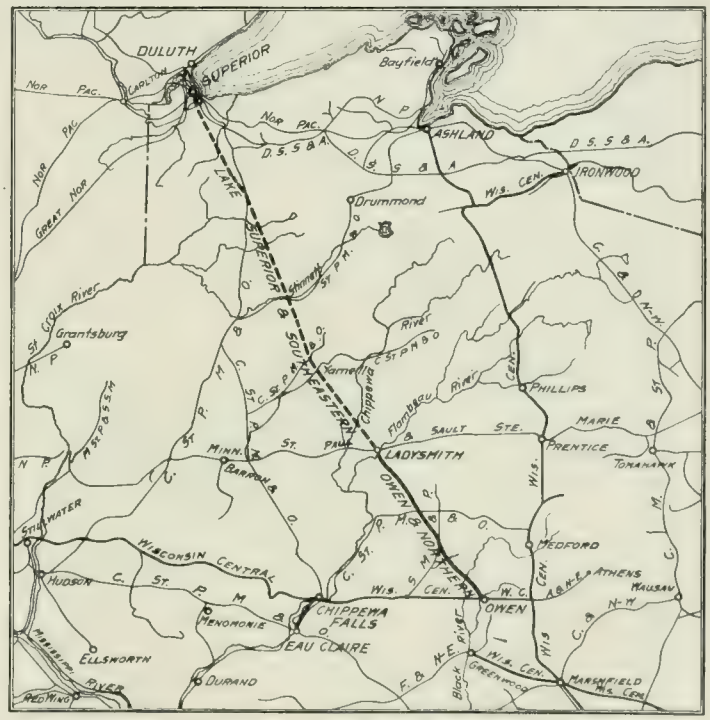
Profile and Alinement of the Owen & Northern, Part of the Wisconsin Central Extension to Duluth.

grounds are 250 ft. wide and about 2,000 ft. long. The roadway is Wisconsin Central standard: 18 ft. base for embankments, 24 ft. base for cuts, with 1½-to-1 slopes.

The bridges across principal streams are steel spans designed for live loads of Cooper's E-50 specifications. The piers and abutments for these spans are wood, to be replaced with concrete as soon as the piling is worn out. The other bridges are types of the road's standard pile bridge, and culverts are wooden boxes. No permanent work has been put in originally, as it was estimated that it would be much cheaper to put in the permanent work after the track was laid, enabling the material to be carried to site by rail. The principal river crossings are the Black river, with one 150-ft. riveted truss; Yellow river with one 125-ft. riveted truss; Fisher creek with a 60-ft plate girder; Jump river with two 125-ft. riveted trusses; Little Jump river with a 60-ft. plate girder; Main creek with a 90-ft. plate girder, and Flambeau river at Ladysmith with three 150-ft. riveted trusses. These steel spans contain about 2,000,000 lbs. of metal.

The main track is laid with 85-lb. rails and Bonzano rail joints. Sidings are laid with 60-lb. rails with ordinary angle bars. The grading was almost entirely earthwork. About 1,000,000 cu. yds. of material was handled to make the roadbed, averaging about 23,000 yds. per mile.

Three other railroads are crossed by this line: The Stanley, Merrill & Phillips at Gilman; the Chicago, St. Paul, Minneapolis & Omaha at Donald, and the Minneapolis, St. Paul & Sault Ste.



Duluth Extension of the Wisconsin Central.

Marie at Ladysmith. At the latter crossings, interlocking plants are being installed.

We are indebted to Mr. C. N. Kalk, Chief Engineer of the Wisconsin Central, for the profile and information.

Railway Signal Association.

The May meeting of this association was held in New York City on Tuesday last, President C. H. Morrison in the chair. About 60 members were present, and 34 candidates were admitted to membership. The new constitution, discussed and approved at the last meeting, was adopted. Its main features were described in the *Railroad Gazette* of March 23, page 302, the principal change made since that time being one in Article 2, Section 3, classing as Seniors all railroad *officers* who are active members. Article 8, dealing with standards, is as follows:

Section 1. Any proposition looking to the approval or recommendation by the association, of definitions, nomenclature, specifications, standard construction or standard practice, or aimed at defining formally the position of the association on any matter of importance, shall be presented in writing and shall be accompanied by drawings if the latter are necessary for a clear understanding of the subject. No such proposition shall be acted upon by the association unless it has been published in the advance notice provided for in the constitution, of the annual meeting at which action is to be taken. Action on such a proposition, whether direct,

by vote on a resolution, or indirect, by vote on the adoption of a committee's report, shall be taken at an annual meeting only, shall be on the proposition as published, without amendment, and shall be determined by the votes of the senior members, which shall be taken by call of the roll or by ballot. A proposition receiving the votes of two-thirds of the senior members voting, provided that not less than twenty senior members are present, shall be adopted by the association.

Sec. 2. Absent members may send to the Secretary-Treasurer their votes on any questions, including amendments to the constitution, which have been published in the advance notice of an annual meeting; all votes received before the taking of the vote at the meeting shall be counted.

Sec. 3. Any report, resolution or recommendation involving the use, or proposed use, by railway companies, of any device or process that forms the subject matter of an existing patent, shall first be submitted to the Executive Committee and may be submitted to the association by the Executive Committee only.

The first paper read was that of Mr. H. W. Lewis, of the Lehigh Valley, on the use of track circuits in place of detector bars. A report of this paper is given in another column. In the discussion on it Mr. C. C. Anthony (P. R. R.) advocated the use of track circuits at switches not simply to open the control wire, as is the case in the example cited by Mr. Lewis, but to lock the lever, so that the signalman will be prevented not only from moving the switch but from moving the lever. In practice, if the signalman can throw the lever he will, when the switch does not respond, continue his attempts to throw it until the train which is holding him up has passed off from the track circuit; and if, while doing this, there is an accidental closing of the circuit, even for an instant, the switch will be thrown under the train.

Mr. Sperry (Gen. Ry. Signal Co.) spoke on the general unreliability of the detector bar under present conditions. With 100-lb. rails, which are now common, and which are three inches wide on the head, the treads of the wheels of a car will in many cases be too narrow to hold down a detector bar on the outside of the rail; and even with narrower rails there is the danger in a power plant that the powerful force applied will move the bar in spite of the pressure of wheels. The only safeguard against this is the safety fuse, which will cut off the power when there is great resistance to the movement of the bar; but this is not available except with electric switch motors.

Mr. Balliet (Grand Central Station) proposes to use both track circuits and mechanical detector bars in the new installations in Grand Central yard, New York City, and will plane off ¾ in. of the outside of the head of wide rails. This weakening of the rail would not be admissible, of course, in a track traversed by trains at high speed. The reason for using both track circuit and detector bar is that with a very short track circuit the wheels of a car or an engine sometimes will not shunt the circuit soon enough to open the control circuit with the necessary promptness. Where trains run at high speed it is usually practicable to place the stop signal far enough back from the switch to permit the use of a longer track circuit—one long enough to insure the proper dropping of the armature of the relay. This makes the track circuit effective and renders the detector bar unnecessary.

Mr. A. G. Shaver (Hall Signal Co.) said that in some experiments made by him on the Union Pacific a few years ago, with a train of ten freight cars, detector bars failed not only in tracks laid with 100-lb. rails, but also with 80-lb. rails.

Mr. Hull (N. Y. C.), replying to a question, said that with track circuits 60 ft. long he had used 4-ohm relays, but had found that in the case of an engine alone, running fast, it was necessary to use one of eight or nine ohms. With a 9-ohm relay the armature will drop at 18 milliamperes.

Mr. Rudd (P. R. R.) advocates locking all switches in a route as soon as an approaching train passes the distant signal.

The next paper was that of Mr. Clausen on the upward inclination of the semaphore arm, reported in another column. The discussion on this paper covered the whole subject of semaphore indications, from the beginning of the nineteenth century to the present time, and some of Mr. Clausen's historical allusions were criticized as inexact or misleading. One of the first speakers referred to the recent letter ballot in the Maintenance of Way Association, which was not favorable to the upward inclination; but it was pointed out that many of the members voting in that ballot had given little definite thought to the subject. Mr. Rudd had found, at the last meeting of the M. W. Association, that there was a strong sentiment in favor of endorsing the acts of the Railway Signal Association whenever possible; therefore it becomes the duty of this association to discuss subjects with intelligence and thoroughness, and to record decisions on them clearly, so as to secure the approval of the more influential association. The M. W. Association has adopted entire the specifications for mechanical interlocking prescribed by the Railway Signal Association.

Mr. Hull said that the signal supervisors of the New York Central, at a recent meeting, had voted that for a three-position signal the upward position is desirable; but for a two-position signal he thought that they still preferred the downward inclination. Mr. Denny (L. S. & M. S.) said that on the tracks used jointly by the Lake Shore & Michigan Southern and the Chicago, Rock Island & Pacific at Chicago, three-position signals, with the upward inclination, are to be used. Mr. Ames (L. S. & M. S.) later explained that the use of the upward inclination was found to be the most practicable compromise between the different systems desired by the two roads. The Lake Shore for "all clear" puts the arm 60 deg. downward, while the Rock Island, desiring to use the three-position signal, would, if the downward inclination were used, show 45 deg. downward for caution. Thus, a Lake Shore engineman would in one place read 60 deg. downward for all clear, and in another place find a signal in nearly the same position (45 deg. downward) which would not mean all clear. The upward inclination removes this difficulty.

Mr. Yocum (P. & R.) spoke in favor of the upward inclination, and then added that we should also go farther, and effect a complete reform by putting the arm on the left side of the post. This would be more natural, and there would be far less difficulty in fixing signal posts so that the views of the arms would not be obscured or confused by telegraph cross arms and trees. Mr. Denny said that in locating a large number of new signals on the Lake Shore & Michigan Southern the putting of the arm on the side of the post next to the track obviated many difficulties in location. On the Lake Shore the trains run on the left-hand track, so that the ordinary American semaphore, with the arm extending to the right has the advantage of the condition mentioned by Mr. Yocum, for the signal posts are set on the left side of the track.

Mr. Sperry called attention to the importance of this element in designing signals for electric railroads having overhead structures. Such roads frequently have a scanty right of way, and, in any event, a continuous row of poles on both sides of the line interferes seriously with the signals. On the New York, New Haven & Hartford, which is now putting up overhead electric structures for 20 miles of its four-track line between Woodlawn and Stamford, it will be necessary to relocate all of the signals (now on bracket posts) to get them into good view.

Mr. Clausen in his paper presents a sketch of a three-position signal, in which the spectacle casting is in the same position as that now common; that is to say, on the opposite side of the axis from the blade. This was criticized as neutralizing the benefit to be obtained from the upward inclination in guarding against the danger from accumulated ice. Mr. Shaver told of his difficulties with ice in Wyoming, where he had had eight inches on blades on one occasion.

Following this discussion Mr. Waldron (Int. R. T.) read his paper on the signals in the New York City subway. This paper is given in another column. Mr. Waldron said that the difficulties which he had had with track circuits by reason of slivers of iron falling between the ends of rails and connecting one rail to another were being done away with by the use of a modified design of end insulation which is so made that the slivers drop through to the ground and do not lodge where they are in contact with the rails. Replying to a question, Mr. Waldron said that in switching his signal circuit from the 60-cycle power line to the 25-cycle power line the only precaution necessary was to reverse the switch as quickly as possible; doing this, there will be no overcharging the line by having both supply wires connected at the same time, while at the same time the interval of time between the two contacts will be so short that the automatic stop will not have time to exhaust. Mr. Waldron is using track circuits in place of detector bars. These work satisfactorily, though they are only 30 ft. long. Asked if, with alternating current, he could use a higher voltage in the rails than with direct current, he replied that he could; though perhaps this was because the supply of current is greater, and therefore a greater loss by grounding can be endured. He has operated track circuits successfully under water. The rail of his track which is used for the signal circuit is bonded with No. 6 copper wire.

The next paper was one by Mr. W. H. Arkenburg, of the Union Pacific, who presented an argument on electric locking in connection with electric power switch and signal plants, similar to that which was contained in his letter printed in the *Railroad Gazette* of April 6, page 347. His general argument appeared to meet with unanimous approval, but there was sharp criticism of his proposal to leave indication magnets uncovered so as to make it easy for the signalman to cut out the safeguards provided by electric locking. Even in his provision to make it slightly difficult for the signalman by making him crawl under the machine, Mr. Arkenburg was declared to be behind the times. The only correct rule is to put all the apparatus beyond the signalman's control, and have the releasing done solely by the repair men; and the repair men should be trained to take all needed precautions. Mr. Anthony called attention to the fact that the whole question of what to do when apparatus is out of order is a serious one. We take great risks and ought to have very systematic and precise regulations. Mr. Anthony criticized the principle that approach locking should not take effect until the distant signal is intentionally cleared. On a

straight line an engineman often sees the home signal at clear before he passes the distant, so that he is justified in keeping up full speed, whether the distant is cleared or not. Therefore, the locking should take effect when the train passes the distant signal, without regard to whether that signal is in one position or the other.

Mr. Denny said that on his road route locking is made effective when the home signal is cleared. This tends to prevent the signalman from clearing his signal too long in advance of the approach of the train.

Mr. Shaver: Mr. Arkenburg's position may not be justifiable on the busy roads of the East, but on the thin lines of the West the signalman must have more discretion. The storms there are severe and repair men are few and far between.

Canadian Railroad Notes.

OTTAWA, May 7.—Mr. Blaiklock, Superintendent of the Eastern division of the Grand Trunk, gave evidence before the committee on Mr. Lancaster's bill which would deprive the railroad commission of authority to permit railroads to run faster than ten miles an hour over unprotected crossings in cities, towns and villages. To show that the reduction of the speed to ten miles at such crossings would mean serious loss of time and money in the operation of the road, he said that on the 334 miles of the Grand Trunk, between Montreal and Toronto, there are 92 crossings in communities, and to slow down to ten miles at each of these crossings would result in increasing the time of the fast express from 7½ hours to 12 hours. He also said that to slow a passenger train of five cars down to ten miles an hour would cost 50 cents, and a freight train $1. It would take five miles to get up speed again. The Grand Trunk has 781 unprotected crossings that would be affected by this bill. The cost of installing a gate is $650, and its maintenance would cost $1,000 a year. Each crossing bell would cost $250. "The greatest number of accidents occurred in the country and not at town and village crossings. Mr. Blaiklock admitted that the overhead or underground crossing was ideal, but these would be still more expensive.

Application has been made by the James Bay Railway Company for approval of the route of its proposed line from a point on the authorized line near Toronto to Ottawa. The plans filed with the department do not show the entrance to the city, but only alternative routes to either side. A date will shortly be set for the hearing of the various parties interested before the minister.

The Grand Trunk Pacific Branch Lines bill was passed over all the committees. Bills were reported to incorporate the Vancouver, Fraser Valley and Southern, the Keith River Valley and the Pueblo Tramway, Light & Power Company.

There was another contest before the Senate Railroad Committee over the Vancouver, Westminster & Yukon bill giving power to build through the Yellow Head Pass to Edmonton which was fully reported without amendment. Senator McMullen opposed the building of the line on the ground that such a line would divert the business of Canada to the United States, and the Hon. Mr. Sempleman, of British Columbia, Minister of Inland Revenue, announced that the government did not favor any attempt to block legitimate railroad building. The government favored the construction of this road and of all others that were going to aid in building up the country. He also asserted that the company was a Canadian company. It had been said that Mr. Hill was behind the project. Mr. Sempleman hoped that Mr. Hill was, he being the only man that built railroads in British Columbia, without subsidies.

The railroad committee referred the application of the Canadian Pacific to enter the City of Ottawa in its proposed route, which meant level crossings over two of the principal streets of the Capital—Lauren and Nicholas streets. This was strongly opposed, the level crossings being a menace and great source of danger as well as obstruction to the city and citizens.

During the present session of the Dominion Parliament, the number of companies seeking incorporation to build railroads using electricity as a motive power is unusually large. In Ontario there is, including the great cataract at Niagara, so much water power by which electricity may be cheaply generated, and so little coal for the generation of steam, that electric motive power for railroads will soon become general.

Track Circuit in Place of Detector Bars.*

It appears to be common knowledge that the detector bar is not giving us the protection required, and that it cannot be depended upon even though it is maintained in the pink of perfection, for it is continually exposed to all kinds of danger and damage which would destroy its function with no evidence to the operator or tower man. While it is true the operator of a mechanical plant might suspect something wrong by the easy pull of the lever should the bar be missing, it is very doubtful if he would notice any difference in the pull of a lever operating two or more bars, should one of them become disconnected; and on power plants he is entirely at sea, with nothing to indicate a break or disconnection.

I believe I am warranted in saying that the majority of accidents due to detector bar failures occur in the heat of congested traffic, thereby intensifying the evil. The operator, having his mind concentrated on speedy operations, does not notice or detect failures, but relies solely on the machine.

It would be preferable to discard the cumbersome bar altogether and substitute the simple track circuit protection. Fig. 1 shows part of one of our all-electric interlocking plants. This track circuit

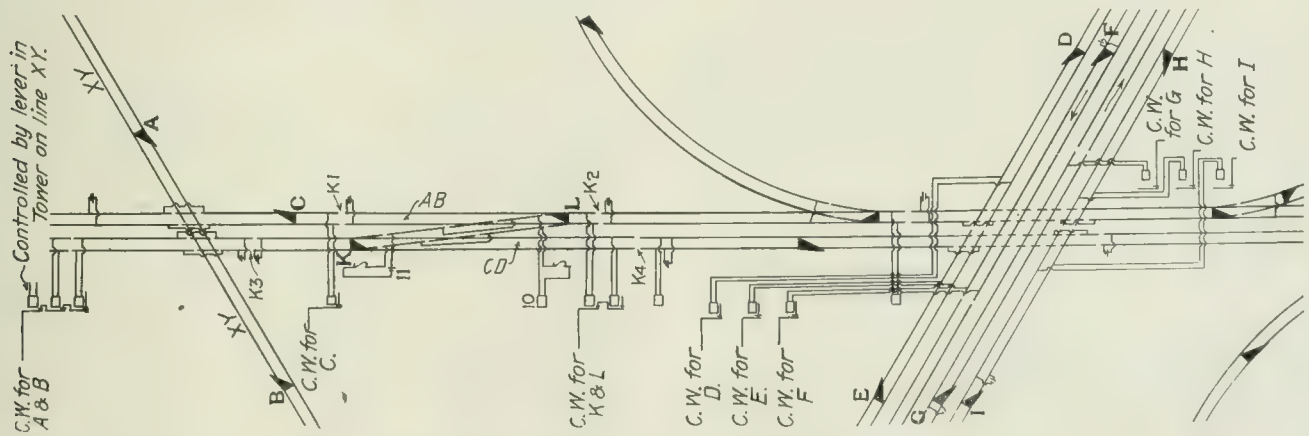


Fig. 1—Interlocking Without Detector Bars on Lehigh Valley Railroad.

arrangement has been in continual service for the past two years, using the ordinary track relay and the regular Weber insulated track joints. We control the switches by opening the common wire leading to their motors on the various track relays.

Mr. Lewis here explained the arrangement of the track circuits. For example, crossover switches K and L cannot be moved until track A B is clear from K¹ to K², and track C D is clear from K³ to K⁴, these points being the limits of the track circuits covering these switches.

The arrangement of the track relays and the control wires for the derails in the four track crossing is shown in the same way. The crossover track circuit (Relay No. 10) controls the signals but does not control the switches.

From the time this method of protection was put in service over two years ago, we have only noted six failures, two when plant was placed in service, being due to operator pulling lever at same time as train entered the section, and four since, due to foreign current opposing and neutralizing the track circuit, causing the relay to open momentarily while the switch was being operated causing the breaking contacts to arc and burn them off.

Such protection can be installed, maintained and operated to a greater degree of satisfaction and safety than detector bars, and with less cost, particularly where automatic signals extend through interlockings; for the same track circuits and relays used for these signals can be utilized by simply adding another contact to the relay.

It has been said that it requires better labor to maintain these circuits than would be needed for taking care of bars, but, on the other hand, it is not necessary to send extra help around frequently

*From a paper by H. W. Lewis, Supervisor of Signals, Lehigh Valley, read before the Railway Signal Association at New York, May 8, 1906.

to fix up run-down bars. And, as remarked at our last meeting in Chicago, the Track Supervisor and Section Foreman will soon become our friends.

The Upward Indication of the Semaphore Arm.*

As it is a cardinal principle of railway signaling that any derangement of a signal or breakage of parts shall result in the arm gravitating to the stop position, it is hard at the present day to understand why a board entrusted with the selection of a proper signal should have agreed on the downward indication for proceed, and its action in the matter is now very generally considered a serious mistake. . . . There is one country where the bad features of the downward proceed indication and the good features of the upward proceed indication were realized some years ago, and in this country (Germany) the upward has been very generally in use for a number of years. I understand that the German design is also used to a limited extent in Austria and Belgium. . . . There are two good arguments in favor of a continuance of the present practice: (1) a change would involve considerable expense, and (2) such a change would, from the standpoint of the trainmen, be a radical departure.

The following arguments may be mentioned as unfavorable to present practice:

1. The arm must be counterweighted to cause it to gravitate to the stop position.

2. The counterweight for summer weather will not be safe for winter, on account of the amount of ice and sleet or snow which may accumulate on the signal arm. As this amount is indeterminate, and may vary from a few pounds to 25 or 30, or even more, depending upon local conditions, the excess of counterweight must be rather large.

3. The counterweighting makes heavy construction necessary throughout, and the blows delivered to the stops at the end of the upward and downward stroke, due to the increased weight of the arm and casting, become excessive.

4. The increased violence of the blow is an element of danger and expense, as the colored glass roundels, which are also carried on the arm casting, may become broken.

5. To reduce the amount of counterweight required, and to avoid trouble from icicles, the blades must be made as short as possible. This will readily be recognized as a bad feature, as it shortens one side of the angle and neutralizes the true semaphore indication.

6. To still further reduce the amount of counterweight required, it is customary to design the arm casting to carry the colored glass roundels on the opposite side of the shaft or axis of revolution from the arm or blade. This practice has a tendency to still further neutralize or obscure the true semaphore indication, as is familiarly shown in the universal arm casting.

7. The excessive counterweight must be lifted day after day, and month after month, in the operation of the signal, merely to provide safety during the one hour or two hours perhaps in a year when the conditions are unfavorable. This is not a serious defect where signals are manually operated, or where a power plant is used, but it becomes a very important argument against the present practice where primary and storage batteries are used for the operation of the semaphore, and the watt consumption per signal movement has to be considered. As the greater percentage of automatic signals is operated by primary or storage cells, and as automatic signals are now being, and will continue to be, installed very rapidly, the latter question is of over-increasing importance.

I will now attempt to enumerate the more important arguments in favor of the upward indication:

1. In the early days of railroading it was considered necessary to have fixed signals show only danger or caution, and no indication was shown when it was safe for a train to proceed. This principle may be seen exemplified in the older forms of train order signal and switch targets, which consist of sheet iron blades of various shapes which stand parallel to the track, and therefore cannot be seen by the enginemen when the conditions are right for the train to proceed. But at the present time it is deemed just as important to give the engineman a proceed indication as it is to give him a stop signal; under any condition he must obtain decisive information. And the upward proceed indication of the fixed semaphore complies most closely with the standard of hand signaling. When giving the proceed or go-ahead signal (in railroad parlance "the highball") it is customary to hold the hand nearly vertical over the head; and this is just the position taken by the arm of the proposed new semaphore.

2. It has become a recognized principle of signal practice that every semaphore should assume the stop position immediately after the engine of a train has passed it; and none will dispute that an arm which falls downward to the stop position is more to be depended on, all things considered, than one which moves upward by the aid of a counterweight.

3. It is obvious that snow and sleet collecting on the arm will but increase the tendency to assume the stop position.

4. The arms or blades may be as long as desired.

5. The glass may be applied to the arm casting without nullifying the true semaphore indication to any considerable degree.

6. The power required for operation may be reduced to a minimum.

The possibility of using the 90-deg. and 45-deg. indications in the upper quadrant is, I believe, unquestioned.

The new indication can be introduced on any division of a railroad with the simplest of rules for the guidance of employees. Trainmen will almost immediately grasp and interpret the indications of a fixed semaphore which correspond so closely to the present hand signals.

Signaling in the United States is in its infancy, and is experiencing a remarkable development. Apparatus placed on the market two years ago is now out of date. One road has contracted for installation of apparatus worth one and one-half million dollars. It is reported that another road has submitted specifications and has contracted for an installation costing over three millions of dollars. Let us not permit a mistake of choice made years ago to influence our correct action at this day.

*From a paper by L. R. Clausen, Signal Engineer of the Chicago, Milwaukee & St. Paul, read at the May meeting of the Railway Signal Association, New York City.

Philippine Railroads.

The new system of railroads in the Philippines will cost thirty million dollars, and is to be built by private American capital, under concessions granted by the Insular Government. It has already been arranged that the system covering the islands of Panay, Negros and Cebu shall be financed and built by a New York syndicate, composed of Cornelius Vanderbilt, J. G. White & Co., William Salomon & Co. and associates. There will be in the system about 400 miles of road, almost equally divided between the three islands. The plans of the Government provide also for a system of equal size on the Island of Luzon, but the concession has not yet been awarded.

The harbor improvements nearing completion at Iloilo and Cebu form a part of the system of transportation of which the railroad lines now to be built constitute the principal feature.

The first division of 50 engineers sailed for Manila from Seattle on April 29. The more prominent members have nearly all been chosen for special experience in the projection of railroad and engineering enterprises abroad on the frontier of civilization, but the majority selected from the railroad field of the West are principally young engineers.

Some of the engineers selected on the basis of experience abroad are the following: P. H. Ashmead, H. F. Howe, C. H. Farnham, J. M. Robinson and L. E. Bennett. Mr. Ashmead, Mr. Howe and Mr. Farnham have all been connected with the Canton-Hankow Railroad in China. Mr. Ashmead was formerly Chief Engineer; Mr. Howe was recently Acting Chief Engineer, and Mr. Farnham was Division Engineer and Superintendent of Construction, of the San Shui Division. Mr. Robinson has been Locating Engineer of the Quayaquil & Quito. Mr. Bennett was assistant to Governor Taft in outlining the transportation plans of the Government in the Philippines, which are now being put into execution. Previously Mr. Bennett was Engineer to the Emperor of Siam for railroads and irrigation.

Several hundred native Filipinos will be used as rodmen, axemen, chainmen, etc. With the confidence gained through previous undertakings, entire dependence will be placed upon native Philippine labor for the work of construction. It is expected that some 10,000 to 15,000 native Visayans will be employed during the four years required to complete construction. For location work, the present party will be divided into five sections—three for Panay, and one each for Negros and Cebu. Work will be commenced simultaneously on the three islands, but that on Panay will be pushed to completion first. Plans for the construction equipment are already well advanced, and such equipment as must come from home will follow as required.

New Railroads in Arabia.

Plans are being made for building two new lines of railroad to reach the interior of Arabia. The difficulties which the Turkish Government has been experiencing with Arabian insurgents has resulted in official plans being made to build a railroad from Hodeidah, on the Red Sea, to Sannaa 200 miles. At Sannaa 75,000 Turkish troops are quartered. A French engineering corps, under an armed escort, is making surveys for the government. The road is necessary for military operations, but will be available for commercial purposes. Sannaa is the largest city in Southern Arabia, and is 5,000 ft. above the sea level. The English Government has authorized the building of a railroad from Adan to the British military post at D'thala. It is expected that bids for the work will be asked during the present month.—*Consular Report.*

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Manhattan Bridge Delays 489
- Clover Creek Junction Collision..... 489
- Motor Cars and Lower Passenger Fares 490
- Manhattan Bridge Superstructure Bids. 490
- Mr. Hill in Canada 491
- Pink Journalism 492
- Baggage Smashing 492
- Delaware, Lackawanna & Western 492
- Trade Catalogues 494

ILLUSTRATED:
- Station Platform Canopies on the N. Y. C. 495
- Reinforced Concrete Highway Bridges on the Big Four. 496
- Dining Car for Argentine Railroad 498
- Controlled Manual Block Signals of the Chicago & Eastern Illinois 499
- A Check for Baggage on Storage..... 500
- Proposed Card Way-Bill; Diversion of Cars 501
- A Graphical Solution of the Knee-brace Problem. 502
- The Denver, Northwestern & Pacific..... 503
- The Lincoln Variable Speed Motor..... 509
- Picked Up on the Road 511

CONTRIBUTIONS:
- Color Blindness and Scripture. 494

MISCELLANEOUS:
- Canada as Seen by J. J. Hill..... 494
- Southern Pacific's Earthquake Relief Work and Mr. Harriman's Transcontinental Run. 499
- Car Service Questions 500
- Leaves from Railroad Officer's Note Book 501
- British View of Large Locomotive Boilers 508
- How Canada Regulates Its Railroads.... 510
- Washington Correspondence 512
- Speed Recorders on French R. R.'s (Note) 512

GENERAL NEWS SECTION:
- Notes 145
- Meetings and Announcements 146
- Elections and Appointments..... 147
- Locomotive Building 147
- Car Building 148
- Bridge Building 148
- Railroad Construction 149
- Railroad Corporation News..... 150

VOL. XL., No. 20. FRIDAY, MAY 18, 1906.

An expert Muck Raker—all honor to the noble woman and a few of the imitative men who have acquired this imperfect title—would find congenial work in writing the inside history of the Manhattan bridge delays which have already cost the citizens of New York and Brooklyn, before its superstructure has been begun, as much as the highest estimated cost of building it. Its Brooklyn pier is at Adams street, four or five hundred yards north of the old Brooklyn bridge, where for more than six years there has been every morning an objectionable herding of men and women. The New York pier is at Pike street, about half a mile north of the New York terminal of the Brooklyn bridge, where foreign visitors go to see the evening climax of indecency, the blackest spot on the transportation systems of America, and appearing daily in its greatest city. It is obvious that the Manhattan bridge would relieve this congestion, and yet since early in 1900, when the bridge was authorized, differences of opinion as to the form and material of the superstructure have caused a daily moral degradation and a money loss distributed among the citizens, land owners and the street car lines in Brooklyn. These differing opinions have been partly professional, and capable, as in any other engineering question, of quick settlement under normal conditions. But politics, contractor's interests and organized bodies of busybodies have resulted in suits by dummy taxpayers and the law's delay. The original plans for a 1,465 ft. wire cable suspension river span were set aside by the incoming administration of 1902. New plans for an eye-bar suspension bridge were prepared but failed to secure the approval of the board of aldermen. Another administration rejected the eye-bar plans in 1904 and again prepared wire cable plans for which bids were opened in August, 1905. At that letting the Pennsylvania Steel Company seemed to be entitled to the contract, but, as the result of a taxpayer's suit, the court declared invalid one clause which had commonly been in other city contracts, and also held that the specifications were not sufficiently definite. This year the specifications and contract forms for a wire cable bridge have been again submitted for bidding, but before the bids were opened two taxpayers' suits were begun, one apparently to prevent anything but an eye-bar bridge being built, and the other inspired by reasons not so easily understandable. We have faith in the wisdom of the Court in dealing with these dilatory undertakings to prolong the present seriously bad situation. In another column some peculiarities of the biddings are discussed, and it appears, in round figures, that the cost of the unmanufactured material for the Manhattan bridge will not exceed $2,000,000, and the balance of about $5,000,000 will be for manufacture, erection, general expenses and profit. When the time for the relief of the community is so precious, the experience, capital, plant and skill of the contractor—essential elements in reliability—should be sharply considered. It requires much more than one million dollars to compensate for the possibility of further delay. This is a case where the city has no right to take any chances whatever.

The butting collision of passenger trains at Clover Creek Junction, Pa., on May 4, killing 10 persons and injuring 37, reported in the *Railroad Gazette* May 11, page 481, was due to forgetfulness on the part of the pilot of the westbound train, a passenger engineman of experience and perfectly acquainted with the road. He had an order to wait at the end of double track for the eastbound train, but did not do so. One account says that the name of the meeting point was indicated by letters ("S T"), and that the mistake was in running for another station beyond, the name of which was composed of similar letters. An officer of the road, however, is quoted as saying that the mistake was simple forgetfulness. However this may be, two points stand out clearly. Questions of forgetfulness and of mistakes or negligence of enginemen in conferring with conductors or with firemen will probably demand consideration for the next hundred years, if we continue for that length of time our present dependence on the despatching system, for there seems to be little prospect of agreement as to how to manage these things; but the two points which we refer to are so plain that there can be no difference of opinion concerning them. First, we make it a fundamental rule that the grave duty of protecting a train from butting collision shall be put upon the minds of two men, a conductor and an engineman, and then deliberately suspend that rule whenever it becomes necessary to run a train over a line with which its conductor and engineman are not familiar. The suspension is not always complete, but even a single loophole sometimes causes a collision. We must expect disasters under such practice. If dual responsibility is necessary we must enforce it, if not necessary let us abolish the rule, so that in depending on a single pilot we shall be consistent. Secondly, we make it a rule to block-signal our important lines (depending on the time-table and the despatcher on the less important), and then deliberately permit the suspension of this rule also by allowing unimportant lines to be converted at a moment's notice into important ones. The only rational rule is to establish the block system on all lines. There was some newspaper criticism of the use of telephones for sending train orders

on the Petersburg branch; but no fault was found. Moreover, this particular order was sent by telegraph.

MOTOR CARS AND LOWER PASSENGER FARES.

One result of the present tendency toward lower passenger rates, either voluntarily or under legislative compulsion, may be looked for in a heightened interest in and an added impetus to the endeavors to obtain a satisfactory motor car design with which to replace, where practicable, present unprofitable passenger train service. Just now it is gratifying to note that more attention than ever before is being given to steam car designs. A very hopeful report reaches us that a design for a flash boiler of capacity suitable for rail motor car service is nearing perfection. Oil is to be used for fuel and the one present practical difficulty is to develop a burner that will yield the requisite degree of heat. President Hill, of the Great Northern, sent an expert to Europe several months ago to make a thorough study of the motor car question over there and recommend as a result of this study a type of car for similar service in this country. This emissary recently returned and though no official report has been given out, it is understood that his conclusions have been altogether in favor of a steam car; in fact, the Burlington now has under consideration the matter of building at its Aurora shops a motor car of a design based on his recommendations. The Florida East Coast is experimenting with a Ganz car and the Erie has ordered one. A steam car is also being built for the Missouri Pacific and will soon be ready for experimental service. Following these experiments, we may expect in the near future some definite results from several different designs of steam cars to compare with the other two types—gasolene and gasolene-electric.

In considering motor car types, the point should not be overlooked that in assigning such cars to branch-line service they may be remote from the shops or repair points. Unfamiliar types or complicated designs will require special talent in case anything goes very seriously wrong. The simpler the design, the less this will hold true. In this fact, the advocates of the steam car may perceive an advantage. It would not be the mystery to the man running it or the crew aboard it that other types would undoubtedly be, because of its analogy to a locomotive. In case of a breakdown, therefore, the steam car's crew would in all likelihood be able to fix it, or at least get it into the terminal.

Reference to this phase of the matter brings up again a point which recurs in discussions of this question, the use of a light locomotive and single car. The equipment assigned to this service would in most cases be such as had outlived its usefulness in regular service and therefore, compared to an expensive motor car, would be regarded as having only a nominal first cost. Likewise, less would be expended for maintenance, so that a very material saving will have to be figured in operating costs to make the average operating officer see the wisdom of taking up the motor car proposition, especially where it involves high first costs.

MANHATTAN BRIDGE SUPERSTRUCTURE BIDS

It is interesting to compare in detail the bids made for the Manhattan wire cable suspension bridge on August 1, 1905, and on May 7, 1906. Five bids were received at each of the two lettings. Three of the bidders at the first letting were represented at the second letting, when two new bidders appeared to take the place of the two who had dropped out. The bids, arranged in order from lowest to highest at the second letting, were as follows:

	Aug. 1, 1905.	May 7, 1906.
Ryan-Parker Const'n Co...	.....	$6,493,223.00
John Peirce Co.	$7,486,491.14	6,596,638.30
General Erecting Co.	7,284,739.00	6,769,983.00
Penna. Steel Co.		
Milliken Brothers	7,983,970.00	7,566,191.65
R. H. Hood Company .	7,956,712.00	7,566,191.65
King Bridge Company ...	9,312,940.00	
American Bridge Company .	.....	8,312,146.00

The General Erecting Company and the Pennsylvania Steel Company are bracketed together because it is commonly thought that the Pennsylvania, to whom the contract had been awarded at the first letting, is represented in the General Erecting Company at the second letting, leaving itself free to prosecute its suit for damages against the city because the contract awarded in August, 1905, had not been executed.

There are about 42,000 tons of steel to be made and erected as against about 45,000 tons contracted for six or eight years ago for the Williamsburg bridge and approaches, and the work is of such a character in manufacture and erection as to require the close attention of the most expert bridge contractors. It seems, therefore, singular that the two lower bids, within 2 per cent. of each other, should be made by firms well known as granite and masonry contractors, but never before appearing as contractors for steel bridge construction. It is plain that both Peirce and Ryan-Parker, having no steel works or plant or organization for erecting, are middle-

Manhattan Bridge Bids for Anchorage Steel, Towers, Cables and Suspended Superstructure, Received May 7, 1906.

Items.	Engineer's est. of quantities, lbs.	Ryan-Parker Const'n Co.			John Peirce Company.			General Erecting Company.			Milliken Brothers.			The American Bridge Co.		
		Quantity.	Unit price.	Total.	Quantity.	Unit price.	Total.	Quantity.	Unit price.	Total.	Quantity.	Unit price.	Total.	Quantity.	Unit price.	Total.
Anchorage material, f. o. b. bridge site.		1,386,600	$0.08	$106,880	1,300,000	$0.05	$65,000	1,335,600	$0.0383	$51,153	1,335,800	$0.04	$54,232	1,212,000	$0.0475	$62,220
Riveted work including architects' metal work	21,452,900	21,670,000	.05	1,733,600	21,300,000	.0744	1,584,720	21,333,800	.0661	1,410,164	23,858,700	.0735	1,755,893	22,376,000	.0825	1,846,020
Steel castings	3,385,200	3,385,200	.09	304,740	3,385,000	.09	304,650	3,317,703	.0903	314,763	3,400,000	.0746	254,155	3,429,000	.1025	351,473
Iron castings	189,100	189,000	.08	15,120	189,100	.09	17,019	189,100	.1238	23,410	185,000	.0605	11,232	616,000	.14	86,240
Concrete, mortar, etc., per cu. yd.	930	930	10.00	9,300	930	12.00	11,160	930	11.25	10,463	930	10.80	10,044	950	15.00	14,250
Cables, suspenders, etc., structural steel	30,200	30,200	.10	3,020	30,200	.06	1,812	30,000	.1052	3,156	30,200	.0564	1,703	18,000	.0825	1,485
Cables	12,538,200	12,538,200	.125	1,567,275	12,538,200	.12	1,504,584	12,538,000	.1429	1,791,334	13,015,576	.142	1,848,212	12,842,000	.140	1,797,880
Suspenders, hand rope, etc., cable bands, strand, shoes, anchorage saddles, rollers, etc.	1,153,600	1,154,000	.10	115,400	1,153,600	.14	161,504	1,200,000	.1699	203,880	1,500,104	.164	246,017	1,147,000	.150	172,050
Steel castings, including pins	1,744,600	1,744,600	.09	156,960	1,744,600	.09	157,014	2,050,000	.1283	263,015	2,120,192	.126	267,144	1,863,000	.155	288,765
Iron castings	54,500	54,500	.10	5,450	54,500	.089	4,850	55,000	.1068	5,874	88,100	.094	8,281	63,000	.1275	8,033
Pins, bolts, nuts, etc.	383,000	383,000	.10	38,300	383,000	.09	34,470	191,000	.1080	20,628	95,000	.173	16,608	77,000	.10	7,700
Bronze	12,000	12,000	.30	3,600	12,000	.30	3,600	12,000	1.17	14,040	15,680	.60	9,408	12,000	.40	4,800
Zinc for suspender sockets	25,200	25,200	.10	2,520	25,200	.13	3,276	25,000	.1347	3,368	24,722	.164	4,054	26,000	.30	7,800
Lead fillers	7,400	7,400	.10	740	7,400	.08	592	7,000	.1547	1,083	6,500	1.00	6,500	7,500	.10	750
Suspended superstructure:																
Nickel-steel riveted work	16,247,400	16,247,400	.06	974,844	16,400,000	.05	1,312,000	16,247,000	.0759	1,233,147	19,658,800	.079	1,553,124	16,341,000	.10	1,634,100
Medium carbon steel riveted work	21,050,000	21,050,000	.05	1,052,500	21,100,000	.055	1,160,500	21,050,000	.0650	1,354,250	18,820,500	.067	1,260,973	21,012,000	.078.5	1,650,342
Steel castings	41,900	41,900	.06	2,514	130,000	.07	9,100	30,000	.0858	3,574	42,000	.08	3,360	138,000	.10	13,800
Iron castings	82,200	82,200	.05	4,110	30,000	.07	2,100	32,000	.0698	2,234	33,000	.056	1,848	105,000	.09	9,450
Pins	32,600	32,600	.05	1,630	35,000	.07	2,450	33,000	.0708	2,336	32,000	.10	3,200	54,000	.0975	5,265
Bronze	6,300	6,300	.30	1,890	6,300	.30	1,890	6,300	.328	2,066	6,400	.35	2,240	12,000	1.00	12,000
Inspection (unit price $1.20 per net ton)	41,684	50,400	1.20	50,400	41,804	1.20	50,237	42,000	1.20	50,400	44,333	1.20	53,200	48,186	1.20	57,823
Total				$6,493,223			$6,596,638			$6,769,983			$7,566,192			$8,312,146

men, bidding for a commission on the money to be paid to the actual constructors of the bridge.

The lowest bid, by Ryan-Parker, is unbalanced, the price quoted for over 5,000,000 lbs. of simple steel work for the anchorages, merely delivered at the site, is nearly twice as great as that of the other bidders for the same work, and 60 per cent. greater than their own price for more costly material to be erected in the main span over the river. This may be partly accounted for by the desire of this bidder to get ahead in cash at the start. This material must be delivered first, within six months, and even if purchased from and delivered by one of the higher bidders would put the contractor in possession of nearly $200,000 profit before the serious part of the work was begun.

The other low bidder, Peirce, adds one-half a cent a pound to his price of material delivered at the bridge site to cover the cost of erection of materials more expensive to make and more costly to erect in the suspended structure over the river. The three higher bidders add from 1.67 cents to 3.1 cents as cost for this work. This bidder quotes a price for the wire cable work 23 per cent. below the next higher bidder and 25 per cent. below the average of the three higher bidders for the contract. This difference is too great to be reasonably accounted for, unless by the use of inferior material.

It would be interesting to know just how much the bids were reduced by substituting the less costly basic steel for acid steel, but this cannot be precisely developed. The Pennsylvania Steel Company makes both basic and acid steel and probably has more accurate knowledge than others of the relative cost of the two materials. Judging from its bids, closely confirmed by the bids of Milliken Brothers, it would appear that the reduction due to the substitution of basic steel is about ten dollars a ton, but the John Peirce Company bids 23 per cent. less for ten thousand five hundred tons of basic steel in the suspended structure at the second letting than it did for the same amount of acid steel at the first letting and reduced its first bid for the cables, which must be made of acid steel and are not therefore affected by the change, nearly one hundred and thirty thousand dollars.

Acid steel was used exclusively in the Williamsburg bridge and cost about one hundred and fifty dollars a ton erected in place. The price for rolled material is now about ten dollars a ton more than then, so that, other things being equal, the basic steel for the Manhattan bridge should not cost more than the acid steel for the Williamsburg bridge. Other things are not, however, equal. All of the expensive cable erection must now be done by bridge men at about five dollars a day, whereas much of this work was done by common laborers on the Williamsburg bridge at about half the wages paid the bridge men. The labor cost of erection of all structural material has increased greatly in New York City since 1900, and its control is far more uncertain. This may be taken to account in great measure for the relative high prices quoted by the American Bridge Co. and Milliken Brothers, who have had recent bitter experience with the labor union. Still, we find that the bid of the General Erecting Company averages about one hundred and sixty-one dollars a ton for the whole work, or about eleven dollars a ton more than the corresponding cost of all the steel work on the Williamsburg bridge, which may fairly be taken as a just measure of the increased cost due to the terrorism of the Bridgemen's Union.

MR. HILL IN CANADA.

For a long time there have been various rumors that Mr. James J. Hill was to largely extend his sphere of railroad influence northward into Canada. Not long ago, according to report, he had bought control of the Canadian Pacific, his great northern competitor, and through the large resources of that company was to build new lines in Canada and weld the whole, both north and south of the border, into a united group. On several other occasions, according to the financial reporters, Mr. Hill had bought control of the Canadian Northern, the new and expanding line in the Canadian northwest, and through it was to build up a great Canadian system. It now turns out that, as is not infrequently true of such conjectures, the underlying fact in the case, expansion of the Hill influence in Canada, is true, but the suggested means of accomplishing this result are mostly drawn from the imagination of those railroad strategists who at one time or another involve every important railroad in a far-reaching consolidation on paper.

Already, as is well-known, the Great Northern influence reaches across the Canadian border. In the southeastern corner of British Columbia, Great Northern allied lines cross the boundary at at least seven points, the westernmost point reached being Keremeos and the easternmost, Fernie, both in British Columbia. Under the charter of the Vancouver, Victoria & Eastern, an extension from Keremeos westward to Princeton, 40 miles, is already nearing completion, and a further extension has been located through the Hope mountains and the valley of the Frazer river, the remaining 150 miles to Vancouver on the Pacific Coast. This much is made clear in the last annual report of the Great Northern.

The first public announcement in regard to more extensive plans in Canada came in a letter from Mr. Hill, written some weeks ago, to the Winnipeg (Manitoba) Board of Trade, in which he said:

> "We are now undertaking to build up a new system—a transcontinental line through the Canadian northwest which I hope will serve to further develop your city and the country from which its prosperity is drawn."

At this announcement the railroad strategists got to work again, and soon had a Hill system in Canada stretching from Vancouver to Montreal, with branch and connecting lines bringing up the total mileage of the new system to at least 3,000 miles. More recently, in an interview in New York City, Mr. Hill denied that he had any intention of building the eastern half of this line, and brought down the length of his new Canadian mileage to 1,300 miles. This week, in an interview in St. Paul, he gave fuller facts in regard to the new line. His intention is to connect Winnipeg and Vancouver with each other, and the new line at several points with the Great Northern in the United States. The Vancouver, Victoria & Eastern extension will furnish the western end of the line. The Great Northern feeders, which at present extend north into British Columbia, are mostly, more or less at right angles to the Great Northern main line, and there is no direct connection between Keremeos and Fernie, which are some 200 miles apart. This will probably shortly be built, bringing the Vancouver line as far east as Fernie. Fernie is just west of Crow's Nest Pass, where the Great Northern interests are developing great coal deposits. After crossing the Rocky Mountains at this point on what are reported to be exceptionally favorable grades—and good grades are Mr. Hill's hobby—the line turns northeast, crossing the Canadian Pacific main line probably at Medicine Hat, where large purchases of land are reported for division headquarters. The line is to run considerably north of the Canadian Pacific main line, crossing the great wheat prairies to Winnipeg. At the same time, a connecting link from the United States boundary, already reached at Emerson by a Great Northern branch, is to be built to Winnipeg, where terminals have already been acquired. More than this, at least two other connecting lines are already well under way north from the present termini of Great Northern branches in North Dakota; one from Gretna, on the international boundary, northwest to Portage la Prairie, and the other from Bottineau, a few miles south of the boundary, north via the Canadian towns of Boissevain and Souris, to Brandon, Manitoba. This, as nearly as can be told from Mr. Hill's statements, is the extent of his immediate plans for new lines in Canada.

The exact location of the Fernie-Winnipeg line has not yet been made public, but Mr. Hill made the significant statement that instead of seeking the most direct transcontinental route he was most concerned in tapping a territory prolific in agricultural resources, where the local traffic was sure to be heavy. Apparently, therefore, it will swing northeast through the northern part of Assiniboia, and finally south again through the highly competitive territory in Manitoba west and northwest of Winnipeg, already well occupied by Canadian Pacific and Canadian Northern main lines and feeders, and with the main line of the Grand Trunk Pacific projected through it. Questioned about the means of sending further east, products received at Winnipeg over the new line, Mr. Hill remarked that for the present the Great Northern was willing to turn over traffic there to the existing Canadian roads east of Winnipeg; although, in case of necessity, Great Northern engineers had already planned an almost direct line from the Canadian boundary to Duluth, over a country where a 4 10 of one per cent. grade would be the maximum on a 280-mile line. Adding to this the 65 miles from the boundary to Winnipeg, the total distance by this route from Winnipeg to Duluth would be 345 miles, with low grades, over which to bring Canadian grain to the head of the Lakes for shipment.

From a through traffic standpoint the new Hill lines in Canada, even if roundabout, would have a certain degree of effectiveness. The Canadian Pacific has just completed an allied line into Spokane, which will give it a good, though longer, route than the Great Northern's between St. Paul and Spokane. Just as this line will be able, to a certain extent, to compete for St. Paul-Spokane traffic, so Mr. Hill's new line, though more roundabout than the Canadian Pacific's, will be able, in case of necessity, to give the Canadian

Pacific a rub for its Winnipeg Pacific Coast traffic. More than this, when the time comes for carrying grain from Canada into the United States, it will have an added advantage over all the Canadian systems, as the Great Northern controls, with the exception of the Canadian Pacific's Minneapolis, St. Paul & Sault Ste. Marie, all of the important railroad connections in the United States reaching to the border. With this control of the territory immediately south of the line, the Great Northern will be able to bring it about that grain from its own lines in Canada rather than from the territory of the Canadian roads, shall be most easily shipped into the United States.

The main reason for the determination of the Great Northern's master to seriously invade Canadian territory is evidently the desire to share in the great and increasingly tremendous prosperity of the Canadian Northwest, and particularly in its rich local traffic, most of which is long distance at the same time that it is local. The American invasion of the wheat lands of Manitoba, Assiniboia, Saskatchewan and Alberta goes on at a rapid pace. In the past few years more and more farmers in the United States have sold their farms at high prices and moved across the border to the cheaper and (now) more fertile territory of the northwestern Canada provinces, where soil and climate have been thoroughly proved to be admirably fitted for successful wheat raising. Production of wheat in the Canadian Northwest increases by leaps and bounds each year, and according to Mr. Hill's view, the time is not as much as ten years distant when the United States will be Canada's best wheat customer. Back of the present and very rapidly growing prosperity of the region, in Mr. Hill's mind, this further economic development evidently had a very strong influence on his decision to build up a Canadian system. Should conditions, as he suggests, come to the point where it may tax the capacity of Canada to supply the needs of the United States in grain, the Great Northern, with its monopoly of the northern half of the northern tier of states west of Lake Superior, and its fifteen or more laterals reaching north from its main lines in the United States toward or across the boundary would, as already explained, be in an especially favorable position to handle this international interchange of traffic.

Once established in Canada, if the precedents of the Canadian Pacific and Canadian Northern count for anything, and particularly if Mr. Hill's own policy in the United States is an example, there will be constant expansion of his influence. If the Canadian Pacific finds it profitable to build several hundred miles of branches and connections in the Canadian Northwest every year, the Great Northern can hardly fail to find it equally profitable. The region is so vast that not nearly all of the desirable situations are already occupied. A map of western Canada, showing the northern limit of cereal growing territory is especially suggestive of the immense possibilities of expansion. The productive area takes in a wide sweep of territory, including all of the province of Manitoba, the districts of Assiniboia, Saskatchewan and Alberta, more than two-thirds of the great district of Athabasca, part of the province of Mackenzie, a scrap of Yukon territory, and the northeastern corner of British Columbia—a vast region. With the greater demand for cereals and further development of agricultural methods by which grain raising may be more successfully carried on in these higher latitudes, it is not at all improbable that Great Northern lines will eventually penetrate to some of these now far north regions. Putting aside all the rumors of Hill lines to be built at once as far north as Edmonton and Prince Albert, a suggestive fact in this connection is the recent granting of permission to the Vancouver, Westminster & Yukon, a small road near Vancouver, more or less affiliated with the Hill system, to build lines from Vancouver northward to the Alaska boundary, with a branch northeast to Edmonton.

It is somewhat puzzling at first to see why Mr. Hill waited so long to build his Canadian line. The principal reason probably is that even his marvelous foresight never expected such growth as has taken place in the past ten years in northwestern Canada. A second reason no doubt is that up to this time he has been kept busy in strengthening and assuring his territorial control in the United States. With the northwestern strip now held fast, he naturally looks for new fields to conquer. A third reason is that the Great Northern, a United States road, could never hope to obtain the great subsidies which helped the Canadian roads to break into and open to civilization these great areas of productive territory. By having waited for the pioneer roads to develop the region, so that traffic will at once be offered to a new line, Mr. Hill is able to build his Canadian railroad without subsidy, an argument which will be practically unanswerable as against the objection which is already being shown in eastern Canada to what is called "Hill's Canadian Invasion." The first railroads have opened up the country, demonstrated its richness, advertised its resources, and brought in many thousands of colonists, and now the problem for a new railroad of getting traffic is comparatively simple. Resources, and what is more important, settlers, are there and production waits only on the railroad. It may easily be that instead of being a procrastinator, Mr. Hill has seized upon the most fortunate time for his entrance into the vast Canadian wheat field.

A contemporary announces that in its June number it is going to commence a series of articles on "railroad abuses." Its decision to do this "springs from the highest sense of duty, prompted by exhaustive investigation." We are informed that "no frenzied or hysterical crusade is to be made." No, indeed! The eminently judicial attitude of the publishers is shown by the following expressions from the advance circular, which is printed on pink paper with the caption "Break the Railroads' Throttling Grip!"

"Merciless railroad octopus."
"Spirit of piracy savagely avaricious."
"Trampled the laws under foot."
"Hurled defiance into the teeth of the masses."
"Infamous conspiracy."
"Organized treason."
"Callousness of a Nero."
"Inflicting monstrous losses upon bound victims."
"Indifference of revolutionary madness."
"Unspeakable repulsion."
"They have their own despicable creatures upon the bench."
"Shamelessly vicious masters."
"Without a parallel in the annals of commercial atrocity."

"The railroads are the most powerful, dangerous and treacherous of the blood suckers sapping the strength of the body politic and menacing the life of the nation itself."

Upon arriving at the fourth page of the pink pamphlet, the reader is inclined to be glad that no frenzied and hysterical crusade is to be undertaken, for where could the author find words for such a crusade? And who is the calm, dignified economist who is going to link up these honeyed phrases into a series of articles, keeping his hand of steel well masked in the glove of velvet? The Honorable (!) Chas. E. Townsend, member of Congress, author of the Esch-Townsend bill.

With all the improvements in railroading, the handling of trunks remains as a relic of early crudity. It is the universal usage on American railroads, to handle personal baggage with consistent violence. There has been much talk about the regulation of baggage smashing, but the evil continues, upon the easy assumption that it is impossible of remedy. It remains for the transportation companies adequately to meet the situation which the tremendous growth in railroad travel has created, as they have met and solved other problems.

What is this "problem" that the *Syracuse Post* and the *Springfield Republican* are trying to inflate? There are more trunks, since the tremendous growth in travel, but does any individual trunk get treated worse than it would have been treated 40 or 60 years ago? Or do a larger percentage of the trunks get smashed? Why not consider for a moment the other side of the question—whether it is not better either to make stronger trunks or to pay the losses on trunks of the style now used, rather than try a remedy that would be more costly than the disease. Either the baggage handlers must take more time, delaying the trains, or facilities must be provided at all stations to lift and lower trunks by gentle movements. Delays annoy the passenger, and increased facilities must in the end be paid for by him. Practically all of the smashing that passengers or editors complain of is that due to dropping inflexible-frame trunks on their corners on hard floors. Sole leather trunks, having no rigid frames, are immune to this danger. Would it not be cheaper to buy sole leather trunks? Some of the "problems" evolved by space writers are wholly imaginary. Why not bring up the problem of the breakage of tea cups and tumblers in the kitchen? As dish-washing is now a department of railroading (in dining cars) the subject is "affected with a public interest" and would be suitable not only for dull-season editorials, but for agitating the sleepy atmosphere of the halls of legislation. Flexible crockery and unbreakable drinking glasses are a crying need.

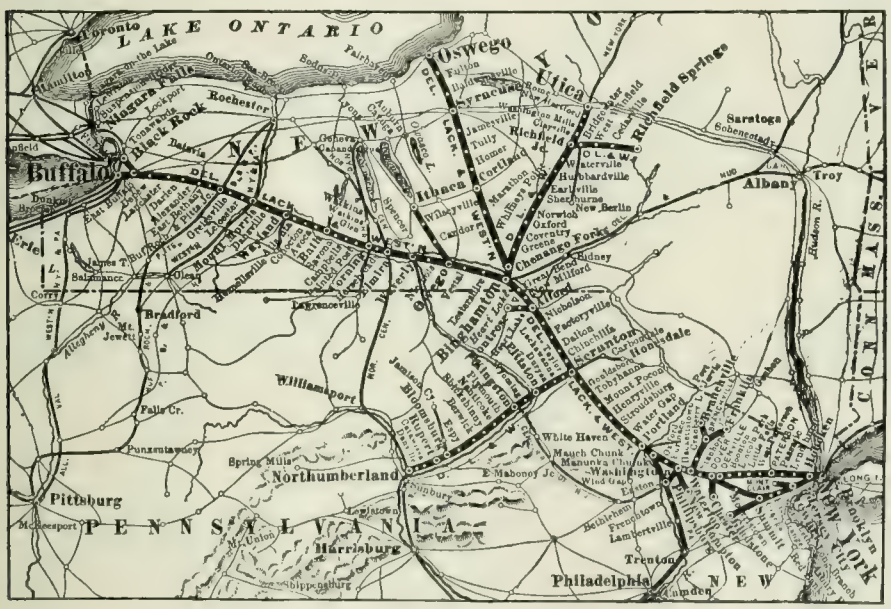
Delaware, Lackawanna & Western.

The Delaware, Lackawanna & Western is one of the richest anthracite coal roads, and is also a New York-Buffalo trunk line. Its charter antedates the provision of the Pennsylvania state constitution prohibiting railroad companies from engaging directly in the coal-mining business, and therefore its report is a combination of results of operation of a trunk-line railroad and a coal-mining company, the tonnage of anthracite coal being, however, greater than the total tonnage of all other commodities transported by the railroad. In this double capacity, as in the case of most of the

anthracite coal roads, it is pretty clear that the company receives more for coal transportation than it would were not the business held so closely in control by the anthracite community of interest. At any rate, the average ton-mile rate last year was 0.871 cents per ton on coal, against 0.688 cents per ton on merchandise traffic; whereas, on most roads the rate received on coal is much lower than the average rate on merchandise. More than this, even with over $2,000,000 charged to operating expenses for extraordinary improvements, the operating ratio was only 53 per cent.

The Lackawanna has in recent years been exceptionally prosperous. In 1904 a regular dividend of 7 per cent. and an extra dividend of 10 per cent. were paid, and last year the regular rate was raised to 10 per cent. and another 10 per cent. "Christmas present" made at the end of the year to stockholders. As a consequence of this prosperity, the stock sold in October last within two points of 500. The road earned last year over charges, as shown in its income account, 30.29 per cent. on its capital stock. The real earnings on the stock have been estimated as high as 50 per cent.

Earnings from transportation of coal in 1905 touched the highest figure in the company's history—$13,993,585—surpassing the previous high record of $13,826,844 reached in the rush of business immediately succeeding the 1902 strike. Besides this account, transportation earnings are divided into earnings from miscellaneous freight (other than coal), passengers, mail, express, milk, by ferries, and from miscellaneous sources. Every source of earnings shows an increase for the year, the gains ranging from 5.76 per cent. on coal to 14.48 per cent. from miscellaneous sources. Miscellaneous freight earnings were $9,230,787, an increase of $892,965, or 10.71 per cent. Passenger earnings were over $5,500,000, an increase of



Delaware, Lackawanna & Western.

6 per cent. These two sources of earnings are, in the case of a great coal road like the Lackawanna, always interesting as showing what would be left to the road if it were deprived of its coal traffic. It has been the particular effort of the present management, which took control on March 1, 1899, to increase these general earnings. In 1899 miscellaneous freight earnings were $6,300,000. As already mentioned, they have now risen to over $9,200,000. Passenger earnings in 1899 were $3,950,000. They were $5,530,000 in 1905. These two figures reflect in a fair way the increased general prosperity of the road.

Along with and even more important than this effort of the present officers has been the practical reconstruction of the whole line. This has been accomplished steadily, effectively and to a strikingly large extent. As an instance, automatic block signals of the most modern type have, during recent years, been installed; the work progressing west year by year, until now it is expected that by the end of the present year the entire line between Hoboken and Buffalo will be fully protected. This is only a small instance of the thoroughness of the improvement policy. An idea of its extent can perhaps best be gained from the fact that with only 957 miles of operated line, of which only 410 miles is main track, the company last year, following the great improvement expenditures of the years immediately preceding, charged to the year's income renewals and betterments costing over $3,500,000. This was in addition to $2,280,000 included in operating expenses, representing extraordinary expenditures, mostly for maintenance of way. In addition, the regular expenses on the line brought up maintenance of way cost to $4,849 per mile. Of this sum, ordinary expenditures cost $2,479, and extraordinary expenditures, $2,370 per mile. Adding in maintenance of way expenditures included in the betterment account, the total figure for maintaining way and structures would be still further increased. These amounts are clearly very large. What was done with these large funds is told in considerable detail, which pleasantly contrasts with the practice of some roads in giving only brief general statements of such expenditures.

The Lackawanna's balance sheet shows a wonderfully strong financial position. There is $26,200,000 capital stock outstanding, and there are also $3,067,000 bonds (maturing next year). These constitute the entire capitalization, and are almost covered by the profit and loss surplus of $23,800,000. The Delaware, Lackawanna & Western proper owns 139 miles of line. The other 818 miles are mostly leased by paying dividends and interest on the securities of the leased companies. Counting in the $90,000,000 stocks and bonds of these leased companies, the total capitalization would, of course, be greatly increased. The annual charges on these securities amount to $5,155,800, but receipts from operation of these lines must easily cover the charges, so that the financial condition of the parent company, as shown by its assets and liabilities is a remarkable one.

Maintenance of equipment is the only operating expense which decreased in 1905. This decrease was wholly in the item of repairs and renewals of freight cars, and was due to the large expenditures in previous years for repairs of the freight equipment. Most of the older cars have now either been torn down and scrapped or put in thoroughly serviceable condition, so that this particular expenditure was last year lessened by $129,703, or about 10 per cent. Repairs of locomotives cost $1,533 per locomotive, against $1,554 in 1904; of passenger cars, $539 per car, against $544 in 1904, and of freight cars, $48 per car, against $53 in 1904. These rather low figures are over-balanced by very large expenditures out of income on renewal and betterment account for new rolling equipment, which amounted for the year to more than $1,750,000. Maintenance of way, as already mentioned, cost $4,849 per mile. This is against $4,092 per mile in 1904. Conducting transportation shows an apparent increase of $1,368,000, $978,000 of which was due to charging for the first time expense of ferries to that account. Offsetting this new charge, gross earnings from ferry operations were $1,094,000. Both of these figures must be considered in making comparisons of total net earnings and expenses for the year, the company having last year for the first time itself operated its North river ferries, formerly owned by the Hoboken Ferry Company.

The reconstruction of the road has made large returns in increased efficiency of operation. In the last six years there has been an increase of over 1,000,000,000, or about 55 per cent., in the revenue ton mileage, against an increase of only 679,000, or about 11 per cent. in the freight train mileage. The revenue train load at the same time has increased from 325 tons in 1900 to 461 tons in 1905. Evidently the good effect of the money spent on improvements can here be very directly traced.

The gross tonnage of anthracite coal was 9,168,974, an increase of 553,176 tons over 1904. All other tonnage (net tons) was 8,166,768, an increase of 870,086 tons. Of the general tonnage figures, grain furnished 522,935 tons, a decrease of 342,900 tons; bituminous coal, 940,100 tons, an increase of 66,541 tons; lumber, 317,591 tons, a decrease of 127,890 tons; and merchandise (distinct from manufactures), 1,226,275 tons, an increase of 491,634 tons. The latter figure is an especially satisfactory item of increase in high-class traffic.

The coal department makes a separate report of its operation, which shows that it earned $41,226,647 in 1905, as compared with $38,593,598 in 1904. Both figures include coal on hand December 31, which amounted to 655,924 tons last year as against 955,490 tons in 1904. The profit from the coal department's operations transferred to the general account are $3,295,426, less by $150,000 than in 1904. Since there was a largely increased output, and a better average price received for coal, this shows how liberally betterments to the coal properties have been charged against earnings of the coal department.

During the year the Lackawanna bought the Harlem Transportation Company, which controls a freight terminal on the Harlem river in New York City. Since the close of the year it has made a large purchase of land in Brooklyn for a Brooklyn freight terminal. These purchases are an evidence of the increasingly important position of the road among the Eastern trunk lines. Its success in securing fast freight traffic is another proof of the same fact.

The extensive grade crossing work at Newark has been completed, having been accomplished along with the running of a large suburban passenger service over tracks located on the grounds where

the work was being done. Similar work at Summit has also been finished. No progress appears to have been made during the year in coming to a satisfactory agreement with several other municipalities in the suburban district of New Jersey, and further work of this kind is put off until such agreements can be made. The past year saw the completion of and putting in service of the new ferry terminal at the foot of Twenty-second street, New York City, and its almost total destruction by fire on December 20, after having been in operation less than three months. Earlier in the year, on August 8, the Lackawanna's passenger and ferry terminals at Hoboken were destroyed by fire. This was not altogether a misfortune, as the property was well insured and the burnt buildings would have had to be torn down within a year or two to make way for new terminal buildings. Consequently, the delay and inconvenience caused were the most serious features of the loss. As observed by those who use the road's suburban service, order was brought out of the confusion with great energy and skill. The new terminal is, in large part, to be completed during the present year.

With the settlement of difficulties in the anthracite mining industry for the next three years, the present high prosperity of the Delaware, Lackawanna & Western is likely to continue for at least that length of time. Its ownership of some 400,000,000 tons of unmined anthracite is tremendously valuable, and year by year, as a result of the large expenditures on improvements, its property becomes more and more efficient and its traffic consequently more and more profitable.

The principal statistics of operation follow:

	1905.	1904
Mileage worked	957	957
Coal transportatn earnings	$13,993,585	$13,230,871
Freight earnings	9,230,788	8,337,823
Passenger earnings	5,529,002	5,215,919
Gross earnings	31,951,064	28,701,991
Maint. way and structures	4,640,208	3,916,117
Maint. of equipment	2,871,911	2,937,675
Conducting transportation	9,816,196	8,448,362
Operating expenses	17,827,975	15,758,893
Net earnings	14,123,089	12,943,098
Coal department earnings	3,295,426	3,445,477
Gross income	17,061,967	16,191,419
Net income	7,938,429	6,773,871
Surplus	2,698,429	2,319,871

TRADE CATALOGUES.

Pacific Type Passenger Locomotives.—A pamphlet just issued by the American Locomotive Company describes Pacific type passenger locomotives built for various railroads. The pamphlet opens with a description of the Pacific type and an outline of the special advantages for very heavy and fast passenger service. These are very briefly stated and are followed by a description of two forms of trailing trucks which have been used with great success on this type of locomotive. The description is followed by two pages of tables containing, in condensed form, the leading dimensions of all the locomotives illustrated in the pamphlet, the tables being arranged in the order of the total weight of the locomotives. By use of the side elevation and sectional drawings a typical Pacific type locomotive is illustrated and engravings of outside and inside bearing trailing trucks are included. The remainder of the pamphlet is devoted to photographic reproductions of locomotives, the opposite pages containing tabular information concerning each design. This is the first of a series of catalogue pamphlets to be issued by the company, which will eventually include all the standard types of locomotives, and will constitute a record of locomotive production.

Wisconsin Central Summer Book.—The 1906 "Summer Book" of the Wisconsin Central tells of the summer resorts in Illinois and Wisconsin reached by this road. The book is 5 x 7¼ in order to have it a convenient size for handling, and, as explained in the introductory note, its purpose is only to give hints of the characteristic features of the various localities. It is filled with attractive half-tone engravings, enumerates briefly the interesting points of each resort, and gives hotel lists and rates. It contains 80 pages.

CONTRIBUTIONS

Color Blindness and Scripture.

To the Editor of the Railroad Gazette:

I have read with interest the note in your issue of May 11, page 484, stating that the Prussian state railroads have adopted a new method of testing employees for color blindness, the implication being that the Holmgren method has not proved itself to be entirely satisfactory; and stating also that the examiners must have their own eyes tested and shown to be perfect. Whether or not the worsted method, so long used both in Europe and this country, has actually failed to detect defective eyes in every case would be an interesting question, as well as the question what has been done to improve on the Holmgren method. Possibly our German friends have simply adopted Drs. Williams' and Scripture's scheme of using a light to test for that defect of the eye, caused by the use of tobacco, which becomes manifest only when the subject is required to observe a small signal, as a red light, which is at a long distance away and makes an image only on the center of the retina. However, I do not write you to present this point particularly, but rather to congratulate you on the poetic vein in which your editor writes. His reference to the blind leading the blind into the ditch gives a literary touch which one encounters all too rarely in our technical journals. Would that more of our writers had minds steeped in the classical thought and terminology of the King James Bible. But this literary charm is only a charm, after all. The allusion satisfies one's taste for pleasant reading, but it is not worth a cent in the actual business in hand. An examiner of eyes is not dependent on good eyes. His defect need not harm either the color blind examiner or the railroad. With the use of the numbered test colors a person having no sense of color whatever can test a man's eyes successfully, as has been shown over and over again. Indeed, if the numbers on the sticks, or glasses, or skeins of yarn were raised so that they could be read by touch, a person who is stone blind could satisfactorily manage the test of another man's eyes. The subject tests himself; the examiner merely testifies to the result.

It is perhaps to be expected that blind railroad commissioners will lead blind legislators into the ditch of useless and silly laws, because that is the way to please the wilfully blind locomotive engineers—who object to having their eyes tested for color blindness as persistently as conductors object to having their fingers tested for honesty; but spare us, please, the spectacle of an editor whose acuteness of vision for scripture makes him blind to the facts of science. Anyone who wants scripture in this connection should rather turn his attention to Yale university—to the late chief of the psychological laboratory there, Dr. E. W. Scripture, who has in years past instructed the readers of the *Railroad Gazette* on the subject of color blindness.

J. B. B.

Canada as Seen by J. J. Hill.

James J. Hill has given out an interview concerning his plans for a new transcontinental Canadian road to parallel the Canadian Pacific and Canadian Northern, in the course of which he says:

"The Canadian subsidy policy is entirely unnecessary. With the country developed as it is, railroads should be built without costing the people a cent. That is the policy we have followed in our country, and that it has paid handsomely I can easily prove. We propose to build our Canadian system at the lowest possible cost consistent with excellent work and thorough equipment, for, as you must have gleaned from the tenor of my policy, I am a believer in the best roadbed, the lowest grades, the biggest engines and the largest capacity in rolling stock. Only a cheap and faulty road could be produced for $9,000 a mile. Such a road as we intend to build will cost between $18,000 and $20,000 a mile.

"In Canada we do not propose to bond our roads for a dollar. We shall issue stock representing the actual cash outlay, and as we have never figured on receiving more than an average of 7 per cent. on our outlay, you will see that the burden upon the people will be light. Our policy will enable us to set a new pace in the matter of rates, and I think you can mark it down that as a result of our advent into this splendid territory an effective period will be put to the bonusing or subsidy system. I should scarcely think that public men would care to propose subsidies and that companies would have the hardihood to ask them in face of the facts.

"Something is going to happen in a very few years that will change the entire trend of Canadian trade and give such a market for Canadian surplus product of foodstuffs as is little dreamed of. Just look at the United States. She has a gross product of wheat of 650,000,000 bushels, and I am sorry to say that it takes on an average two acres and a half now to produce as much wheat as one acre used to produce in the early days. Our farmers are not as wise nor as good a class as the Canadians. Canadian farmers husband their soil; ours take every ounce they can get out of it, with the result just stated. By 1910 I have no doubt that the population of the United States will have risen to 100,000,000. The natural increase is three or four millions a year, and our immigration runs nearly two millions, so you can reckon it up for yourself. Our average consumption of breadstuffs per capita is six and a half bushels, and with a production of 650,000,000 bushels of wheat, which may decrease instead of increase, you will see where we will be at in a very few more years. Then will come the chance of the Canadian West. We shall be obliged to become Canada's best customer, and the order to fill our wants will increase every year at

an astonishing rate. At first we may only want a share of the surplus, but later on it may tax Canada's capacity to supply the needs of this republic. The tariff should have been adjusted long before this, and the adjustment ought certainly not to be much longer delayed. The responsibility for it all rests with the statesmen this side of the line. Canada's greatest and best customer for her surplus products will soon be the United States."

Speaking of the Georgian Bay route—that is, the plan to use Georgian Bay, the Ottawa river and the St. Lawrence for a great waterway from the Gulf of St. Lawrence clear up to Fort William, Port Arthur, Duluth and other points on the upper lakes—Mr. Hill said:

"Nature did about all she could for Canada when she pierced the continent with the St. Lawrence, the Ottawa and the lakes, and to utilize the great boon the country must do her share. If she did, there would soon be a continuous waterway of, say, 24 ft. from Quebec or Montreal clear up to the head of Lake Superior. Just think what it would mean to Canada if that great enterprise were consummated. She could send all her wheat from the head of Superior to Quebec for 3 cents a bushel. With a 6 or 7 cent rate from the prairies to the lakes, the cost of transporting Canadian grain to Liverpool and other British ports could be reduced to the minimum. I can think of no enterprise that would so advance the interests of the Dominion. The cost, roughly speaking, would not exceed $50,000,000, and the work might be completed in five years. But the cost is trifling compared with the advantages of such a cheap waterway. I would undertake to use the Gulf of Mexico as a more desirable outlet for Canadian products than the present one. The Gulf route is all down hill, and with the right kind of grades Canadian products could be sent to British and other markets at a very low cost; but, as I said before, the best highway is via the Georgian Bay route. There are certain disadvantages connected with the Hudson Bay route that must appeal to any man of prudence or forethought who considers the subject for himself. I have some of the reports of the Hudson Bay Company extending away back 150 years. They are not very promising, and I understand none of the Hudson Bay navigation records are."

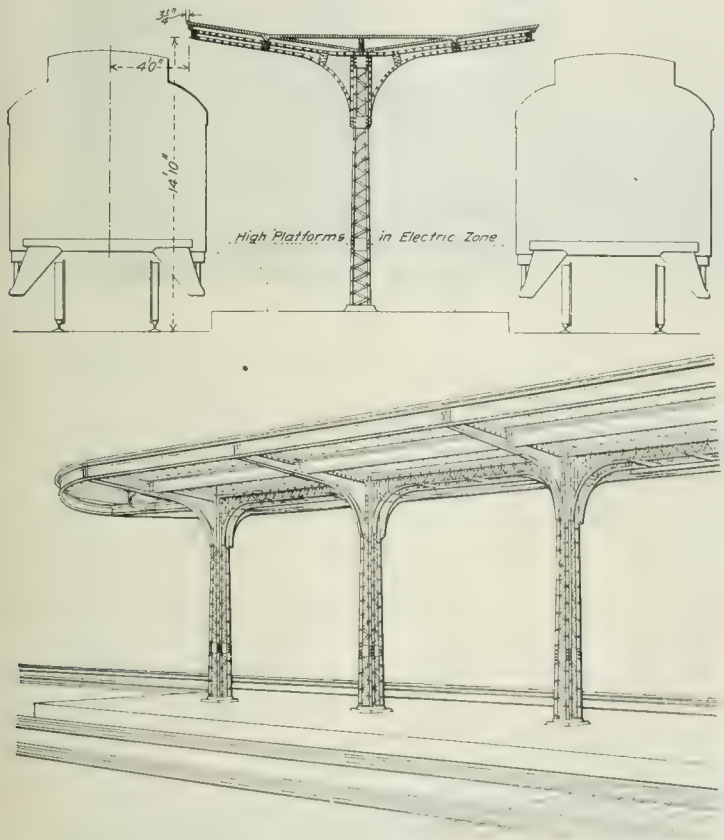
Mr. Hill also said that if all the lands still remaining in the United States that could be utilized by irrigation were so utilized, there were only 50,000,000 acres that could be reclaimed.

"I have often wondered," said Mr. Hill, "about the resources of that territory that the Grand Trunk is going to tap between Winnipeg and the East. I am told that there are unlimited deposits of peat. Now, if, as I understand, there are unlimited deposits of peat up in that country, it can be converted into charcoal at a cost of $2.50 per ton. With charcoal you can smelt iron, which is there, and you know what that means."

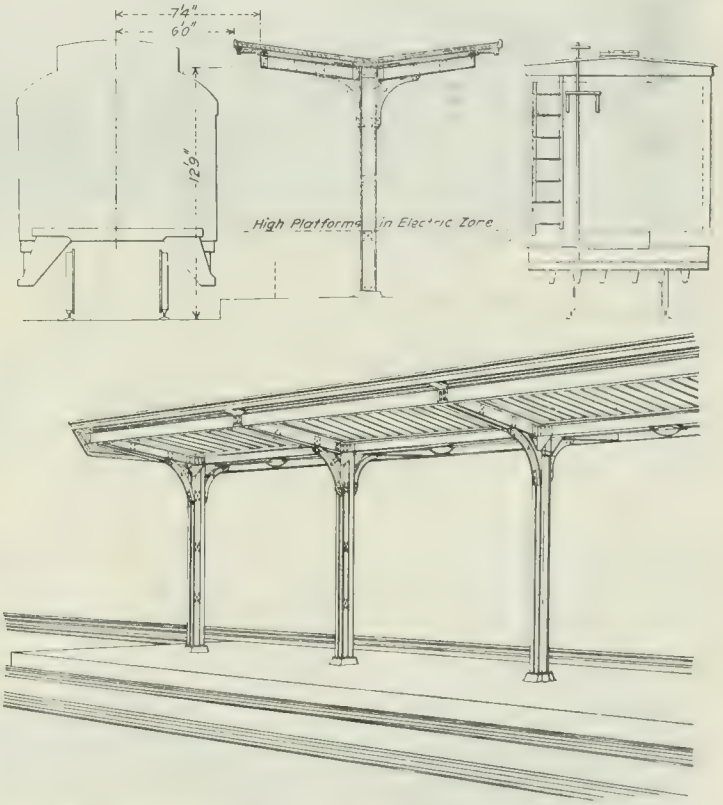
Station Platform Canopies on the New York Central.

The accompanying drawings show two designs of station platform canopies which will be used on all outlying stations in the New York Central electric zone. They are both of the inverted type, supported by a single row of posts down the center of the platform and drainage is toward a single gutter over the posts, the water being carried off through down spouts inside the posts. One design is for platforms flanked by tracks used exclusively for passenger trains. It extends out to within 4 ft. of the center line of track and has an under clearance at eaves of 14 ft. 10 in. As will be seen from the outline of a standard passenger coach, the canopy affords almost complete protection when a train is standing at the station. In this design the posts are made up of four light angles, latticed, and decreasing in size at the top. The ridge pole is a similar latticed box girder, the roof carlines are light plate girders and the purlins are I-beams, with channels at the eaves. This construction gives a graceful and pleasing appearance to the finished structure.

The other design shown is for station platforms flanked by tracks used for both freight and passenger traffic. The eaves are 6 ft. from the center of the track so as not to strike men riding on box cars. A somewhat simpler construction is used, two channels placed back to back, forming the posts and two Z-bars the ridge pole. No purlins are employed, the roof boards being nailed to nailing strips secured to the tops of the Z-bars and the channel eaves, which are riveted to the ends of the I-beam carlines. Both types of canopies will have composition roofing laid on the roof boards and deck lamps will be put in at frequent intervals under the ridge pole.



Butterfly Canopy for Platform With Tracks for Passenger Traffic Only.



Butterfly Canopy for Platform With Tracks for Passenger and Freight Traffic.

Regarding the name "butterfly canopy" which has been adopted by the railroad company an officer writes: "The term 'butterfly canopy' is expressive of the inverted type of umbrella sheds. In other words, the term 'umbrella sheds' applies to all classes of canopies supported by a single row of posts; and this class is in turn sub-divided into two types, one of ordinary 'A' construction and the other with an inverted covering which appears to be well named 'butterfly.'"

The advantages claimed for the butterfly canopy are: (1) Better opportunities for drainage and avoidance of drip from the eaves. (2) Better appearance. (3) Better protection for passengers, especially where tracks are operated exclusively with passenger equipment, for the reason that the outer edges of the canopies project over the car far enough to shield the platforms from storms.

Canadian Railroad Notes.

Ottawa, May 14. In the third reading of the statute law amendment act in the Ontario Legislative Assembly extensions of time

to railroads were announced as follows: Central Ontario to Dec. 31, 1908; Brucebridge & Bracebridge Lake to Dec. 31, 1905; Bruce Mines & Algoma to June 30, 1909, and Manitoba & North Shore, two years from Dec. 1, 1907. As the act respecting the securities for the "Soo" guarantee the date was changed from 1906 to 1907.

The Grand Trunk Pacific surveyors are all working in the Yellow Head Pass now. The Pine and the Wapati passes through the Rockies have been abandoned, and attention is being given to the Yellowhead as the gateway through the mountains. The evident intention at the present time is to build up the Athabaska to the Miette, up the Miette to the Continental Divide, over the Yellowhead Pass to Moose Lake, which is the headwaters of the Fraser river; follow the Fraser to Fort George, then up the Nechace to Fraser Lake and its tributaries, and across the second divide to the headwaters of the Bulyley, by following which they reach the Skeena at Hazelton, and thence to the terminus at Kaien Island. The advantages of this route are apparent when compared with other lines across the Rockies to the coast.



Reinforced Concrete Highway Bridge Over Tracks of the Big Four near Binney, Ill.

Reinforced Concrete Highway Bridges on the Big Four.

The two interesting designs of highway bridges illustrated herewith are on the Hillsboro-Mitchell short line of the St. Louis division of the Cleveland, Cincinnati, Chicago & St. Louis. The construction of this line under the name of the Chicago, Indianapolis & St. Louis Railway was described in detail and several of its bridges illustrated in the *Railroad Gazette*, March 11, 1904. These two bridges have been completed since that time. One is at Heerens and the other near Binney, Ill.

Both are of reinforced concrete construction. The chief feature of difference in the appearance of the two designs is the center span, which in each case is 33 ft. c. to c. of piers, spanning a double-track line. In the Binney bridge the girders of this span are much deeper than in the other, this dimension being 4 ft. 8 in., with a width of 1 ft. 4 in. The cross-section at this point shows a through girder design with the floor slab formed integral with the girders. The floor is 14 in. thick at the center and 12 in. at the side, giving a 2 in. side drop for drainage. The width between girders is 16 ft. The remaining spans of the bridge are of different lengths, those on the right hand of the center span in the drawings being 16 ft. and 15 ft. respectively, and those on the left 14 ft. each. The floor slabs have a uniform thickness of 12 in. except at the side, where the thickness is increased to 16 in. for a width of 18 in. to form a low parapet.

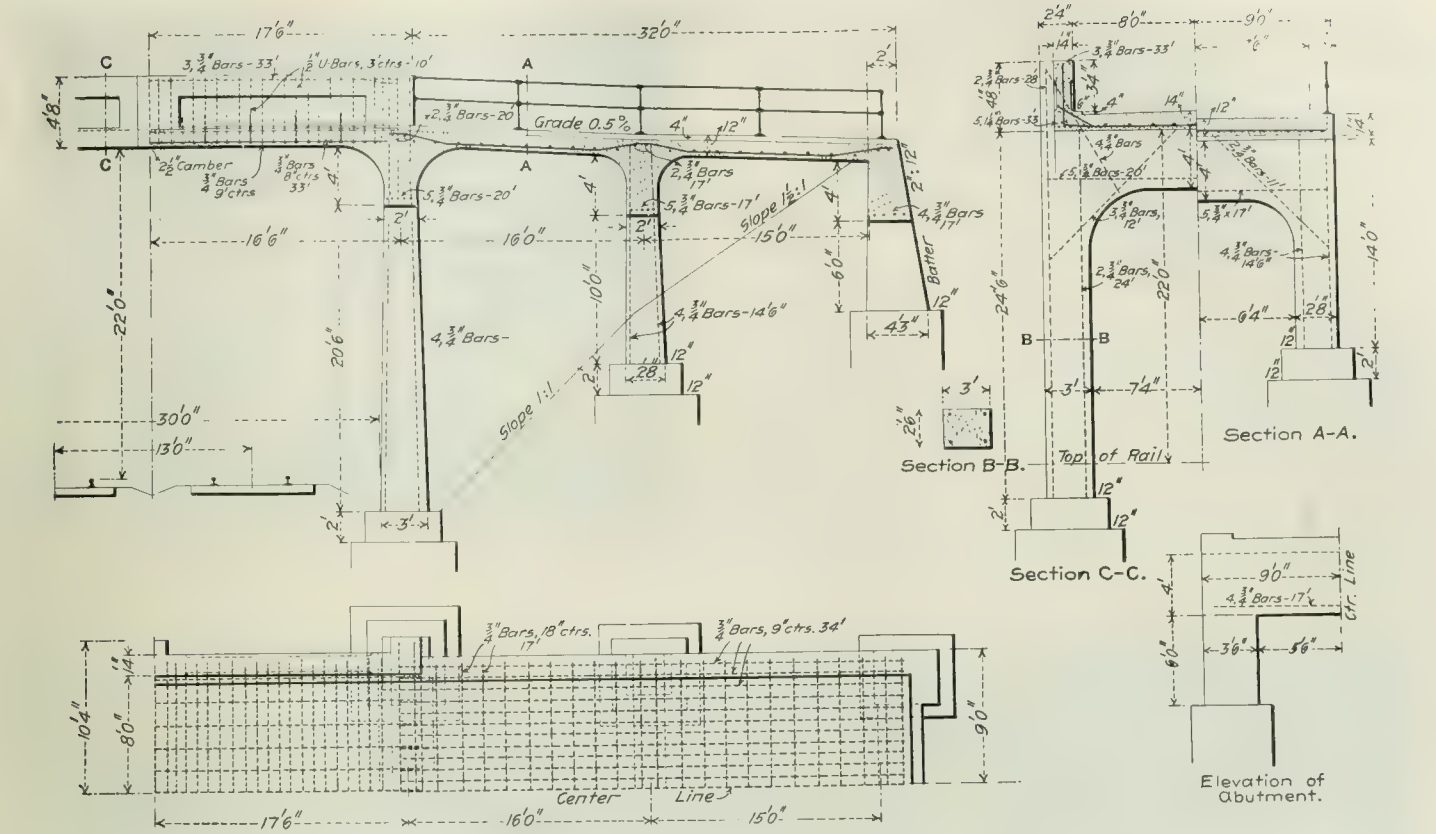
The Heerens bridge is a deck girder design throughout, with a central girder of the same depth below the floor slabs as the side girders. For the center span the side girders have a total depth of 3 ft., with a distance from bottom of floor slab, which is 8 in. thick, to bottom of girder of 2 ft. The center girder is 4 in. wider, however, these respective dimensions being 12 in. and 16 in. For the other spans the side girders are 2 ft. 8 in. deep with a distance below floor of 1 ft. 8 in. The width of side and center girders is the same, being 10 in. This bridge crosses the railroad at a slight skew.

The spans are supported by a transverse girder and reinforced concrete column construction, the girders being of varying depths, as indicated by the drawings. The columns for the center span are 3 ft. square at the bottom and 2 ft. x 3 ft. at the top, and for the side spans are 2 ft. 8 in. square at the bottom and 2 ft. x 2 ft. 8 in. at the top. Heavy fillets are formed at all junctures of girders, columns, floor slabs, etc., except at the abutments. The abutments of the Binney bridge have a 6 ft. x 11 ft. opening above foundations, but on the Heerens bridge the abutments being very low, are made solid.

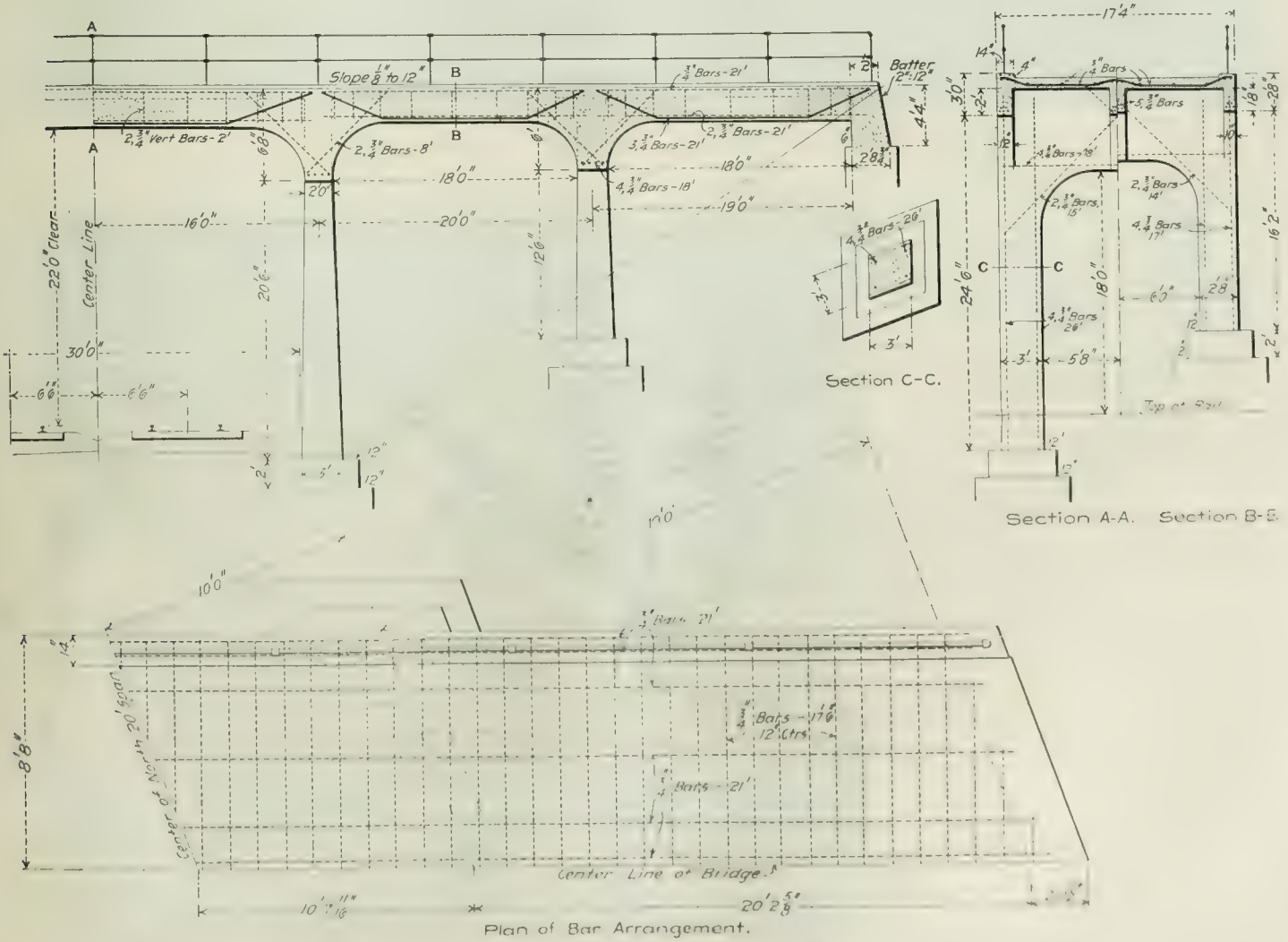


Reinforced Concrete Highway Bridge Over the Tracks of the Big Four at Heerens, Ill.

The steel reinforcing by Johnson corrugated steel bars is clearly shown in detail in the drawings. The bars vary from ½ in. to 1¼ in., there being five of the latter 33 ft. long in the bottom of each center-span girder of the Binney bridge, and three vertical



Reinforced Concrete Highway Bridge Over the Big Four near Binney, Ill.



Reinforced Concrete Highway Bridge Over the Big Four at Heerens, Ill.

rods 8 ft. long extending from the ends of each of these girders down into the columns. Passing around the five 1¼ in. longitudinal bars in the girders are ⅝ in. U-shaped bars 10 ft. long and 3 ft. on centers the arms of which extend to the top of the girder. Also, every other floor bar extends up through the girder as shown. Other details of the reinforcing may readily be ascertained from the plans. Both bridges have 2-in. gas pipe railings.

These bridges were designed and built under the supervision of Mr. W. M. Duane, Superintendent of Construction of the Big Four, to whom we are indebted for the drawings.

Dining Car for Argentine Railroad.

A handsome dining car has recently been completed at the shops of the J. G. Brill Company and shipped to the Tramway Rural, of Buenos Aires, Argentine Republic. This car is for use on a 200-mile line running southwest from Buenos Aires. The Brill Company has furnished nearly all the rolling stock of the lines of this company, including the equipment for its extensive street railway system in Buenos Aires, which has now a population of nearly one million. It ranks fourth among the shipping ports of the world and has a Spanish population of over 100,000. The Brill Company is building 85 of its semi-convertible type of cars for the city lines of the Tramway Rural. This road's equipment in general is thoroughly modern and not surpassed by any of the large systems in this country.



Interior of Kitchen—Dining Car for Argentine Road.



Dining Car for Rural Tramway, Buenos Ayres, Argentine Republic.

The dining car recently delivered measures 50 ft. over the corner posts, 56 ft. over crown pieces, and is 8 ft. 6 in. wide over the side sheathing. It is finished in mahogany richly carved and inlaid with marquetry designs of flowers, and the alcove between each pair of windows has a fluted design which is very effective. The empire ceiling is tinted light green and ornamented with a festooned ribbon design in gold. Hand-carved grill-work transoms are at either end and the side ventilators have art glass of the same style as that which is used in the upper part of the windows. Lamp brackets of a special design which have oil burners as well as incandescent electric lamps are placed at frequent intervals in the dome. These and the double lights over each sash have frosted bulbs, and the metal is silvered and frosted. Unfortunately, it was necessary to use parcel racks which detract somewhat from the appearance, but utility had to be considered before beauty. Dark green silk draperies will be used at the windows, and together with the carpet and leather chair seats of the same color, will contrast richly with the dark red woodwork. The tables and chairs are also of mahogany, and all the woodwork is rubbed to a dull finish.

The kitchen is provided with the usual equipment of range, water-tanks, steam-table, sinks, lockers and refrigerators, all contrived to economize space to the best advantage. Push-buttons in the posts at each table are connected with a signal arrangement at the entrance to the kitchen. The entire equipment, even to the silver,



Interior of Dining Room—Dining Car for Argentine Road.

glassware, china and kitchen utensils, was furnished by the builders. Electric fans are placed in the dining compartment under the roof lining. Brass dust screens run the entire length of the car at the side of the deck ventilators. At the end of the dining compartment next to the door leading to the platform are two closets, one on each side, for linen, etc. Large provision boxes are placed under the car at each side.

The exterior of the car is painted in dark blue and ornamented in gold. To enable it to be shipped in sections, the body of the car was arranged to be divided at the center and the roof into three sections. The bottom and deck sills and long pieces upon which the main strength of the car depends were shipped whole. When set up at Buenos Aires the car will be as strong as any could be which was solidly constructed without the intention of taking apart. The trucks are made by the Brill Company and are of the six-wheel M. C. B. type, with steel-tired 33-in. wheels.

Controlled Manual Block Signals of the Chicago & Eastern Illinois.

In the article on "Chicago & Eastern Illinois Improvements" published in the *Railroad Gazette* of March 16, reference was made to the installation of the manual block signal system over certain portions of the lines. On single track these signals are electrically locked by a specially devised apparatus, preventing an operator from pulling his signal to clear until the operator at the other end of the block has unlocked it for him. The mechanism to accomplish this is illustrated herewith.

Fig. 1 is a diagram of the circuits. The apparatus at the two stations A and B is identical and a grounded circuit is used. Assume that A wishes to clear his signal for the movement of a train toward B. Having notified B by telegraph, telephone or bell code, A presses his key against front point k^1. If B is ready to clear A's signal, B throws his key to contact with its back point k^2. This closes the circuit from the ground, G, through B's battery B^1 and key, to the line and through A's key, and "stick" relay *r*, to the ground. This causes the stick relay to lift its armature and thereby close the circuit of battery B^2 through A's latch magnet m, withdrawing the latch and releasing A's lever. As soon as B presses his key, and actuates A's stick relay, he may at once release it, as magnet m and the circuit through it and r are now energized by battery B^2. A's lever now being free to move he pulls it, and the instant he does so the circuit through the latch magnet is broken at *a*, permitting the latch to drop again and rest on top of the bar. The opening of the circuit at *a* de-energizes *r* so that it is also opened at *rp*; so that the signal cannot be cleared a second time without another restoration of the current from B, with, of course, the concurrent action of A. The action is the same in the reverse direction. The operator, after getting an "unlock," may hold it indefinitely and may delay clearing his signal until time to do it in accordance with the rule to clear it in view of an approaching train; but as long as he is unlocked he cannot give the other operator a release, for his battery is cut off at c. A circuit-breaker, CB, is placed on the signal post to be worked by the semaphore arm. If the arm is not in the stop position the circuit is broken and neither station can clear the other.

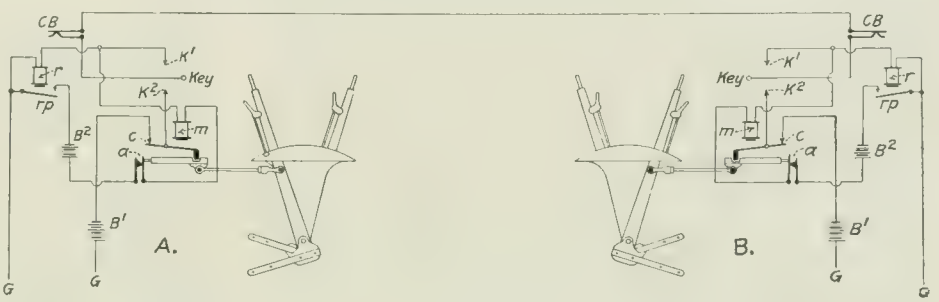


Fig. 1—Electrical Control of Manual Block Signals—Chicago & Eastern Illinois.

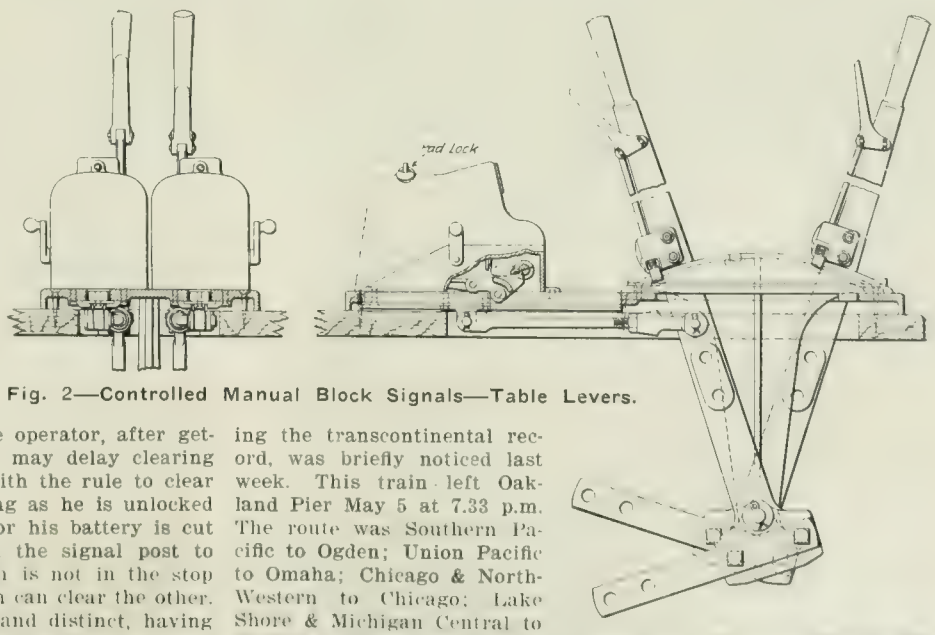


Fig. 2—Controlled Manual Block Signals—Table Levers.

The apparatus for each block is separate and distinct, having no connection with adjoining blocks. There are two levers at each station, a northbound and a southbound, with the corresponding semaphores, and separate locking mechanisms and circuit connections as illustrated. The scheme was arranged by Mr. V. I. Smart, Signal Engineer of the Chicago & Eastern Illinois. The electric lock used is made by the Union Switch & Signal Company, and Mr. Smart has combined it with his existing manual signal apparatus in such a way that the cost of installation is not high.

The Southern Pacific's Earthquake Relief Work and Mr. Harriman's Transcontinental Run.

The splendid work done by the railroads in transporting refugees from San Francisco after the earthquake and fire disaster of April 18, the major portion free of charge, and in carrying free to the stricken city supplies of all descriptions, has been already noticed in the *Railroad Gazette*; but the real magnitude of the work is not generally appreciated without a study of the figures compiled by the Southern Pacific. In the eight days following the earthquake the rail lines of that company carried from San Francisco proper, and from Oakland, to main line or interior points east, north and south, 115,295 passengers. Of this number, 78,560 were carried free. These figures do not include passengers carried from San Francisco by the company's ferry boats to Berkeley, Oakland and Alameda. The Southern Pacific's eastern connections also carried the destitute passengers free, and many were thus transported through the gateways at Ogden, Denver, Omaha, Kansas City and El Paso. The Chicago & North-Western and the Chicago, Milwaukee & St. Paul carried large numbers from the Missouri river to Chicago. Through the co-operation of the railroads and the citizens' committees at the principal points, and the Relief Committee at Chicago, these passengers were provided with meals and were also the recipients of many garments. Many of the free passengers were carried in special trains as far east as Chicago.

During the 18 days following the earthquake the lines of the Southern Pacific Company carried into San Francisco a total of 1,252 cars of foodstuffs, tents, blankets, cots and clothing, given by citizens of the cities and towns throughout the United States. These cars were transported free by all of the railroads which participated in their movement, and on arrival at Oakland were taken in charge by Captain J. M. Baker, Quartermaster, U. S. A. The distribution of the supplies was under the charge of C. A. Devol, Deputy Quartermaster, U. S. A.

The trip of Mr. E. H. Harriman, President of the Union and Southern Pacific roads, from San Francisco to New York, breaking the transcontinental record, was briefly noticed last week. This train left Oakland Pier May 5 at 7.33 p.m. The route was Southern Pacific to Ogden; Union Pacific to Omaha; Chicago & North-Western to Chicago; Lake Shore & Michigan Central to Buffalo, and New York Central to New York. The total distance was 3,255 miles, and the total time 71 hrs. 27 mins., the average speed being, therefore, 45.6 m.p.h. A condensed summary of the run follows:

Date.	Stations.	Miles.	Local Hour.	Local Time h. m.	Local Speed m.p.h.	Through Miles.	Through Time h. m.	Through Speed m.p.h.
May 5	Lv. Oakland Pier		7.33P.					
" 6	Ar. Sparks	243	5.36A.	10 03	24.1	243	10 03	24.1
" 6	Lv. Sparks		6.47A.	11			10 14	
" 6.	Ar. Green River	714	10.05P.	15 18	46.7	957	25 32	37.6
" 6	Lv. Green River		10.15P.	10			25 42	
" 7	Ar. Omaha	824	2.45P.	15 30	53.2	1781	41 12	43.2
" 7	Lv. Omaha		2.58P.	13			41 25	
" 8	Ar. Chicago	490	12.10A.	9 12	53.6	2271	51 07	44.4
" 8	Lv. Chicago	8	1.25A.	15		2279	51 22	
" 8	Ar. Buffalo	536	10.55A.	9 30	56.4	2815	61 27	45.9
" 8.	Lv. Buffalo		1.00P.	1 05			62 32	
"	Ar. New York	440	10.00P.	9 00	48.8	3255	71 27	45.6

The stops at the above named terminals aggregated 2 hours 24 minutes, as follows: Sparks, 11 min.; Green River, 10; Omaha, 13; Chicago (transfer), 15; Buffalo, 65. Pacific time is the standard to Sparks; Mountain time to North Platte; Central time to Buffalo, and Eastern time to New York, so that one hour is lost at Sparks; one between Sparks and Omaha, and one at Buffalo. A special train of three cars was used as far as Buffalo, and from

there the journey was made by the Empire State Express of the New York Central. The fastest running of the entire trip was made on the Union Pacific where the stretch of 137 miles from North Platte to Grand Island, Neb., was covered at the rate of 66.8 m.p.h.; and between Cheyenne, Wyo., and Sidney, Neb., 102 miles, at 64.7 m.p.h.

Car Service Questions.*

The committee on per diem made a report embodying the decisions of the Arbitration Committee of the American Railway Association on the question, Who should pay the per diem on a car loaded to a destination which is a point common to two or more roads, no specific track delivery being stipulated, and the car on arrival at billed destination being turned over, for delivery to consignee, to a road which does not pay per diem? The committee decides that the last per diem road, the one making the delivery to the non-per diem road, is responsible.

The committee on office methods reported a code of rules for tracing interline car load freight. These in brief require all tracers to go through the car service department; not to be started until the shipment has had time to reach destination, and not to be sent by wire except in the case of perishable, or highly important, or unreasonably delayed freight. Each intermediate agent must reply direct to originating office and then forward tracer. When originating with the consignee, the tracer is to be transmitted backward until the shipment is located, and then sent forward. The committee recommends the taking of a letter ballot on the adoption of this code.

The committee on railroad service mail offered for discussion the following propositions:

1. Railroad business mail consists of correspondence of such classes as are not prohibited by the United States Postal Laws and Regulations; all classes of printed matter and such light articles as may be properly handled in the form of parcels or packages.

2. As railroad companies are not restricted in the forwarding of printed matter, packages containing such matter should be of uniform limited size and weight.

3. Pouches should be used for important local and terminal points, the number of pouches to be determined upon by the department having the oversight of handling railroad business mail; the pouches to be forwarded on stated trains and to be regularly entered on report of train baggage men.

4. (A) Preference mail which requires prompt handling should be enclosed in a special envelope of distinctive color and proper instructions issued for handling the same. Forwarding office should date the envelope containing this matter and show the number of train on which it is to be forwarded.

(B) Waybills should be enclosed in a special envelope provided for that purpose, which shall bear the imprint "Waybills." Forwarding office should date the envelope containing this matter and show the number of train on which it is to be forwarded.

5. A dating stamp should be used on waybill envelopes and other preference mail, to be fixed in the baggage room or on the baggage car.

6. Regular pouch service should be maintained for valuable letters and packages in order to reduce the number of receipts which otherwise must be signed by each employee handling separate pieces.

7. In the interests of economy and expedition in handling, railroads should adopt standard size envelopes so far as may be possible, for enclosing railroad business mail.

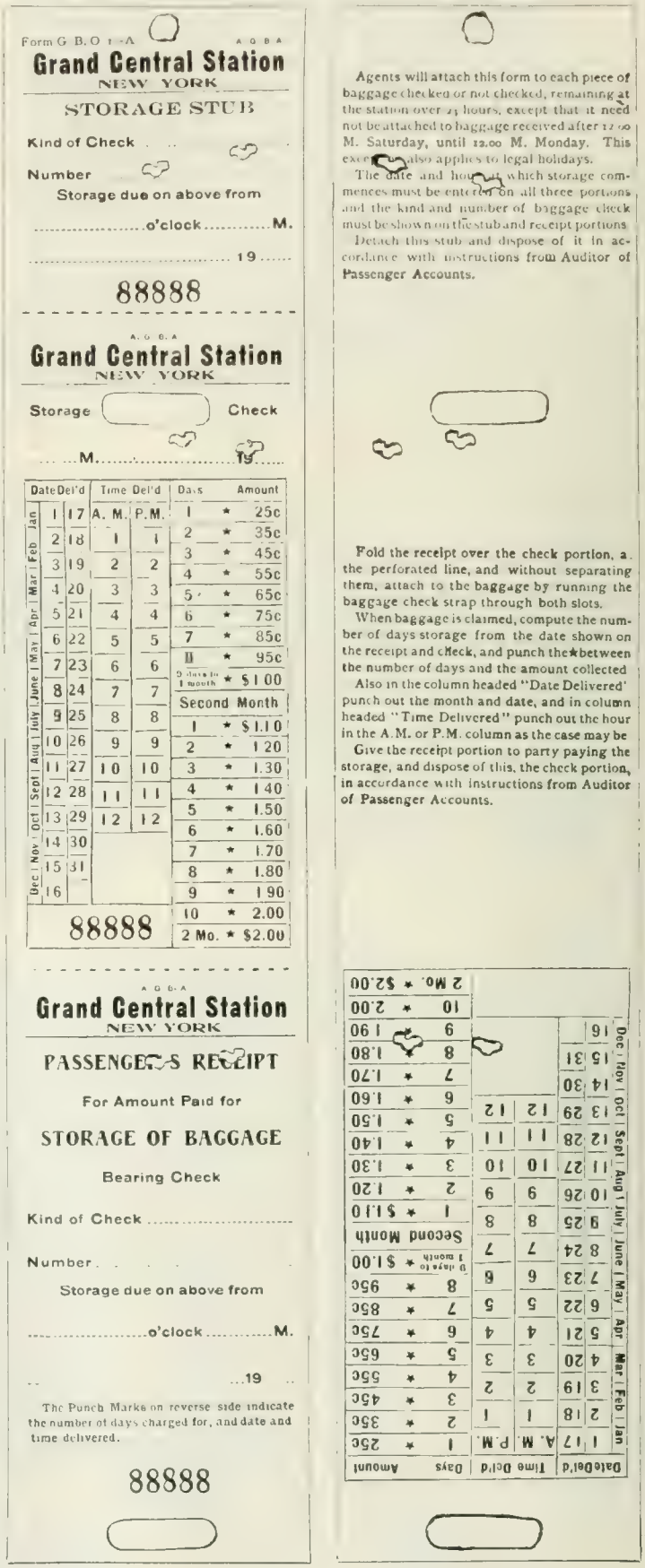
8. The initials R.R.B. are used most extensively. The initials R.R.S. are second in general use to initials R.R.B. The committee was favorably impressed by a suggestion that the initials R.R.M. be used, indicating railroad mail, and recommend that the Association determine by letter ballot, which of the three forms is most desirable. Marks indicating that the contents are railroad business should appear in the upper right hand corner of each envelope, and each envelope should bear the name or trade-mark of the railroad in the upper left hand corner.

9. The service could be improved by harmonizing the instructions on different roads.

*From Reports of Committees to meeting of Association of Transportation Officers at Denver, May 17.

A Check for Baggage on Storage.

The accompanying illustrations show the front and reverse sides of a check introduced a few months ago on the New York Central Lines, used in handling baggage on which storage charges accrue. As will be seen by examining the different parts of the check and the instructions printed on the back, one of these checks is attached to each piece of baggage on the expiration of the free limit of storage, the top stub, perforated with the round hole, at the same time being sent to the Auditor of Passenger Accounts as a preliminary check to be accounted for after payment for storage has been made. When the check is attached to a piece of baggage the date and hour at which storage charges begin to run are entered on each of the three parts of the check. The two lower parts fold over, so that the strap can be put through both pieces. In this way the portion on the reverse side, which appears upside down in the illustration, folds over right side up, back of the middle portion of the check, similar columns of figures falling directly under each other. When the piece of baggage is claimed and payment for storage made, the baggageman punches the time of day, day of the month and month on which the piece of baggage was claimed, as



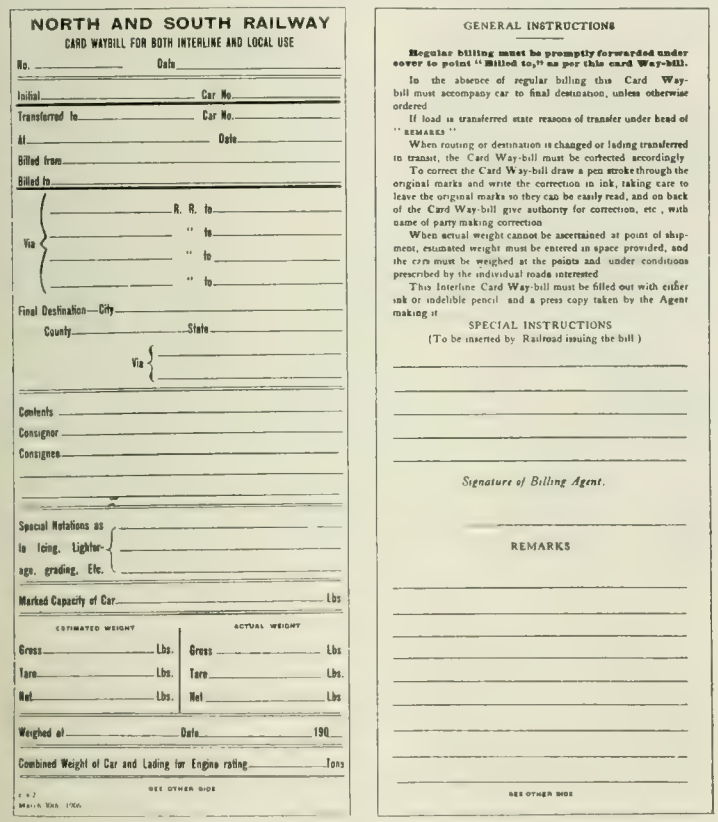
Storage Check for Baggage—New York Central Lines.

well as the star opposite the number of days for which storage is charged. He then gives the lower slip to the passenger as his receipt for the payment. The amount paid by the passenger is shown along with the number of days charged for. After payment has been made, the middle part of the check is sent to the Auditor of Passenger Accounts, who checks up the amount punched with the amount of money received, and also checks up the numbers of all the stubs previously received with the numbers of the checks sent in. The payment then goes through the regular process of being entered in the accounts.

In this way there is a check on every one concerned in the transaction, a receipt to the passenger for his payment, and a convenient record of all amounts received for storage. This form has been in use on the New York Central & Hudson River since Sept. 1, 1905, and has been a most satisfactory improvement over the former method. It is now standard on all of the New York Central Lines. For the information we are indebted to Mr. J. L. Ferris, Auditor of Passenger Accounts of the New York Central.

Proposed Card Way Bill; Diversion of Cars.

At the meeting of car service officers in Denver, May 17, the committee on car service made a report recommending for adoption a uniform card way bill for use both in local and interline business. A reduced fac-simile of this waybill is shown herewith.



NORTH AND SOUTH RAILWAY
CARD WAYBILL FOR BOTH INTERLINE AND LOCAL USE

No. _____ Date _____

Initial _____ Car No. _____
Transferred to _____ Car No. _____
At _____ Date _____
Billed from _____
Billed to _____
Via _____ R. R. to _____
" _____ to _____
" _____ to _____
" _____ to _____
Final Destination—City _____
County _____ State _____
Via _____
Contents _____
Consignor _____
Consignee _____
Special Notations as to Icing, Lighterage, grading, Etc. _____
Marked Capacity of Car _____ Lbs

ESTIMATED WEIGHT		ACTUAL WEIGHT	
Gross	Lbs.	Gross	Lbs
Tare	Lbs.	Tare	Lbs.
Net	Lbs.	Net	Lbs

Weighed at _____ Date _____ 190__
Combined Weight of Car and Lading for Engine rating _____ Tons
SEE OTHER SIDE

GENERAL INSTRUCTIONS

Regular billing must be promptly forwarded under cover to point "Billed to," as per this card Way-bill.

In the absence of regular billing this Card Way-bill must accompany car to final destination, unless otherwise ordered

If load is transferred state reasons of transfer under head of "REMARKS"

When routing or destination is changed or lading transferred in transit, the Card Way-bill must be corrected accordingly

To correct the Card Way-bill draw a pen stroke through the original marks and write the correction in ink, taking care to leave the original marks so they can be easily read, and on back of the Card Way-bill give authority for correction, etc., with name of party making correction

When actual weight cannot be ascertained at point of shipment, estimated weight must be entered in space provided, and the cars must be weighed at the points and under conditions prescribed by the individual roads interested

This Interline Card Way-bill must be filled out with either ink or indelible pencil and a press copy taken by the Agent making it

SPECIAL INSTRUCTIONS
(To be inserted by Railroad issuing the bill)

Signature of Billing Agent.

REMARKS

SEE OTHER SIDE

Proposed Uniform Card Way Bill

The committee deems the necessity for a uniform card waybill urgent and recommends that the matter be referred at once to the American Railway Association.

This committee also reported on the diversion of cars, setting forth that when traffic is heavy the transferring of loads at junctions is too costly to be tolerated; that diversion for the purpose of breaking penalty is a "uniform practice;" and that immediate action ought to be taken to devise means to protect car owners. The committee, however, throws no light on the way to carry out this recommendation. A table is given with the report showing the number of apparent diversions of box cars shown in the records of cars, of 1,000 consecutive numbers, on each of 52 different roads, taken from the records for the month of November, 1905. Some of the typical items in this report are:

Item No. 1; number of cars 1,000; times off line 938; diversions 241.

Item No. 6; number of cars 1,000; times off line 350; diversions 94.

Item No. 17; number of cars 1,000; times off line 1,275; diversions 17.

Item No. 23; number of cars 993; times off line 986; diversions 866.

The officers of the several roads responding to the request for data for this table make some significant comments. One of them says that the handling of cars and of records on certain roads is "very rotten." One says that his equipment is misused, and is misused more than before the per diem rule went into effect; but he cannot afford the clerical service necessary to make up the data asked for. One officer, who on January 1 had only 27 per cent. of his cars at home, declines to make up a detailed statement, because he believes that a rule for penalizing diversions is impracticable; the benefits of such a penalty rule would not be sufficient to warrant the cost of fixing the responsibility for diversions.

Leaves from a Railroad Officer's Note Book.

[Mr. W. W. Hoy, of Johannesburg, South Africa, Chief Traffic Manager of the Central South African Railways, spent about half of the year 1905 inspecting American and European railroads. The appendix to his formal report to his company, consisting of "brief notes on various railway practices," has the freshness and charm which belongs to honest jottings of first impressions, although a trifle more care would have prevented his occasional errors.]

Trains are unpunctual in America as elsewhere, but there is more room for improvement in the west than in the east. I should have thought that this branch of railroad working would have received more attention from the American railway administrations.

The fast trains in the east maintain exceptionally good time, and I quote the arrival of the "Twentieth Century Limited" in New York, for the period May 16th to June 14th inclusive, as an example of the good running maintained:

23 days	on time.
1 day	6 minutes late.
2 days	7 minutes late.
2 days	10 minutes late.
1 day	22 minutes late.
1 day	24 minutes late.

If the express trains are more than a hour late, a refund of the difference between the express fare paid and the ordinary fare is made to the passengers.

The practice of starting the train by the guard's "rightaway" whistle, or by a warning bell, has been abolished.

Trains do not carry destination boards; the names of stations are called out by the porters who travel on the train.

I saw only one destination board during the whole of the time I was in America, and that was only brought into use during the time the train was in the station.

Two, three and even four baggage vans are run on the same train although not one may be even a quarter full.

Baggage on American railroads is generally very roughly handled.

As a rule the guard's and baggage vans are next to the engine, but the guard or brakesman generally rides in the rear vehicle of the train.

The staff of a train generally consists of:

1 Company's conductor.
1 Brakesman.
1 Baggageman to each baggage car attached to the train.
1 Pullman porter to each car.
1 Pullman conductor—occasionally—for inspecting.
1 Inspector in charge of dining car.
2 Cooks.
1 Pantryman.
4 Waiters.

Passenger trains consist of from five to 15 vehicles.

Conductors and trainsmen are supplied with food on the dining car during the "last call" for meals.

Certain trains are provided with additional facilities in order to popularize particular routes of transport, *e.g.* "The Twentieth Century Limited" has, in addition to the usual accommodation afforded on express trains, the following traveling facilities which add very materially to the comfort of the traveler: Barber's shop and bath room; library in the observation car; woodwork and decorations of a most costly description; drawing room and compartment cars; a smoking-room car—generally placed at the end of the train opposite to the observation car—similar in all respects to that of a club house; a shorthand writer and typist, a bulletin containing all the latest news and the most recent share quotations; telephonic communication on board the train to the last moment before departure and from the moment of arrival at destination.

I observed several instances of railroad officials in uniform smoking whilst in attendance on passenger trains, and many cases where the conductors, car attendants and porters were characterized by their rudeness, want of courtesy, and familiarity with the passengers. There was a distinct lack of supervision on the part of the inspector on most of the cars.

Lighting of trains is performed by gas and electricity. The latter system of lighting is gaining ground rapidly and is generated by steam turbine power or by axle driven motors. Repairs of a minor kind to rolling stock are effected whilst the trucks are being unloaded in the station yards.

The coaling, watering and sanding of engines is generally performed in two or three minutes.

When trains move in the station yards or approach level crossings a bell is kept continuously ringing as a warning to the staff, and in large stations where many engines are employed the deafening noise of bell ringing seemed to me to be more perplexing than anything else.

Combined locomotive and maintenance shops are under the control of the Superintendents of Motive Power.

In all orders for new passenger stock the construction is now generally stipulated to be of steel.

No smoking is allowed in locomotive works or carriage repair shops.

Piece work is in general operation, except on the western lines, where the labor organizations still have considerable power.

Smaller wheels are used on goods rolling stock in America than in Europe.

Electric car lines are contemplated between San Jose and San Francisco, a distance of 50 miles, and New York and Washington, a distance of 225 miles.

Through freight bookings are in force from America to Great Britain and the Continent, and also to some of the British Colonies.

Inter-line invoicing and payment of charges is in daily operation with foreign roads amongst American railroads.

"Paid on" traffic is generally checked every day.

In providing for the conveyance of fruit traffic every effort is made to arrange for through truck loads. The senders combine and arrange so that with a regular fruit traffic through trucks can be arranged.

Fencing of railroads is compulsory in the western states, but only optional in the east. However, owing to the remarkable value placed upon all stock killed on the railroad line, the majority of the eastern railroads fence all their tracks.

The Pullman porters travel continuously in their cars wherever the latter are sent, and are responsible for all fittings and equipment of the car. They are responsible for the boot cleaning, the brushing of passengers' clothes, and the cleanliness of the interior of the carriages, besides their ordinary duty of having to account for the linen equipment which necessarily accompanies each car.

In addition to being responsible for all the equipment of the car, the porters are liable to a fortnightly check being exercised upon the car and its contents. Clean linen is only given in exchange for its equivalent in soiled equipment.

The brass work of saloons, both interior and exterior, is not very well kept.

Refreshments, mineral waters, fruit, cigars and cigarettes can be obtained on all through trains, as well as books, papers and magazines.

Iced filtered spring water is provided on all trains, both through and local, and the arrangements for refilling and cleansing the filters are excellent. The handling of ice, however, is performed by an employee who is at other times engaged in work of a decidedly dirty nature.

The saloons on through trains are very hot; no fans or other means of ventilation are provided, with the exception of wind gages.

One feature of the Denver-Rio Grande route is the provision of open observation cars. The open balcony has fixed seats with accommodation for 16 persons, and camp stools and chairs for another 36 passengers. An additional open observation car is attached to the train while passing through the Royal Gorge, and the vehicle has a seating capacity of 70.

This railroad also issues about 15 various publications—magazines and descriptive pamphlets—and it is estimated that the company has spent close on $2,000,000 in this connection. It is contended, however, that this sum has been more than recouped long ago.

The bedding arrangements are well organized. The clean mattresses are kept in the top bunks, whilst the pillow slips are removed from the pillows and are placed in a box at the back of the passenger's seat. Clean slips are provided every night. Bedding and linen are excellently kept and scrupulously clean.

Compartments have tapestry lace antimacassars for each passenger's head rest. These are renewed before every journey, and oftener if required.

All goods must be properly protected before being accepted by the railroad companies for despatch and transport. Fragile goods must be packed in crates. No goods are allowed to be left on railroad platforms.

A feature on some lines is that maintenance gangs are not stationed along any particular section, but large "flying squads" are sent out by ballast trains for the purpose of examining and effecting the necessary repairs at periodical intervals. An inspection and report of the line is made before the special ballast or repairing train is despatched.

The Delaware & Hudson boasts of a "dustless" track, due to the application of crude petroleum oil to the permanent way. After the first cost of installation the process is said to be carried out at an infinitesimal cost compared with the benefits derived therefrom. Renewals of the oil covering are carried out during the spring months.

Regrading, tunnelling and improvement of the permanent way is a subject which is receiving constant attention. Steel bridges are replacing those of wood, and in most large cities, and more particularly in the Northern states, overhead viaducts are being constructed so as to avoid the numerous level crossings.

Most main line stations are only provided with very low level platforms. The platforms at suburban stations, however, are of the high level type.

The signals on the Southern Pacific are placed on the center of the platform, and worked by one wire for each signal from the booking office.

Discs, some distance from the points, and worked in conjunction with the latter, are in common use.

Telephones, in boxes, are placed at appointed spots along the line, for use in cases of emergency.

All the up-to-date stations are provided with subways for dealing with the baggage and express company's traffic. In fact, the general practice seems to be to provide subways in preference to overhead bridges, space being thereby largely economized in buildings where a large area is required for other purposes.

There are several powerful associations connected with the railroads of the North American continent. These make for progress in all directions, and it is only possible to comprehend their influence after a study of the railroad history of the states.

The principal organizations are the Railway Supply Men's Association, the Master Car Builders' Association, the Master Mechanics' Association, Railway Accountants' Association and the American Railway Association.

This last body of officials is the most powerful in its authority, and its influence is very far reaching. It represents 95 per cent. of the North American railroads.

It has introduced standard time, framed a uniform code of signals, a standard code of train rules with all their variations covering movements by telegraphic orders, block signals, interlocking, etc., uniform couplers, the regulation of principles governing the use of safety appliances, standard and wheel track gages, car service rules, and more recently the per diem car rules and regulations.

An instruction car for training railroad employees in the use of the air-brake is employed on the several railroads of the states. The Westinghouse Air-Brake Company supply the car, fit it up with every description of air-brake appliances, and furnish an instructor free of cost to the railroad companies. Free transportation for training purposes is afforded by all the companies interested in the employment of the car. The car has won a well deserved reputation for utility wherever it has been in use.

At Chicago the street transport question has become so acute that a company has been formed to connect all the principal warehouses in the city by means of an underground railroad transport service. The first section was just about to be opened whilst I was in Chicago. The scheme presented itself as being of great assistance in the solving of a problem which is a vexed question in other cities besides Chicago.

(To be continued.)

A Graphical Solution of the Knee-brace Problem.

BY MALVERD A. HOWE.
Director, Dep't Civil Engineering and Architecture, Rose Polytechnic Inst.

The actual stresses in knee braces between columns and roof trusses will probably never be known exactly as there are so many variable factors entering the question. In the usual construction where columns are bolted to masonry pedestals at the bottom, either

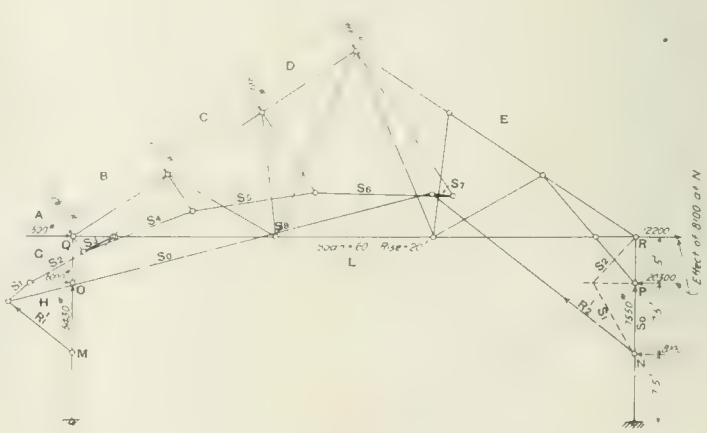


Fig. 1.

riveted or bolted to the trusses at the top and with the knee-braces riveted at both ends, the degree to which these connections may be considered fixed is a question leading to many arguments and differences of opinion. It is not proposed to enter into this question at

all but to show how the stresses in all the members of the framework can be found graphically under a given assumption.

Assume, for example, that the bottom of the columns are sufficiently fixed so that the point of zero moment is midway between the bottom and the attachment of the knee-braces, and that the top attachments and those of the knee-braces to the columns such that they may be considered as pin connections. Taking the truss and loading shown in Fig. 1, it is evident that the external forces must be in equilibrium, and, unless the points M and N are unlike in some particular, the reactions at these points will be parallel to the resultant of the given forces and the sum of the two reactions equal this resultant in magnitude. This is shown by HE, Fig. 2, which represents the direction and magnitude of the resultant of the given forces. Assume a convenient point as a pole and con-

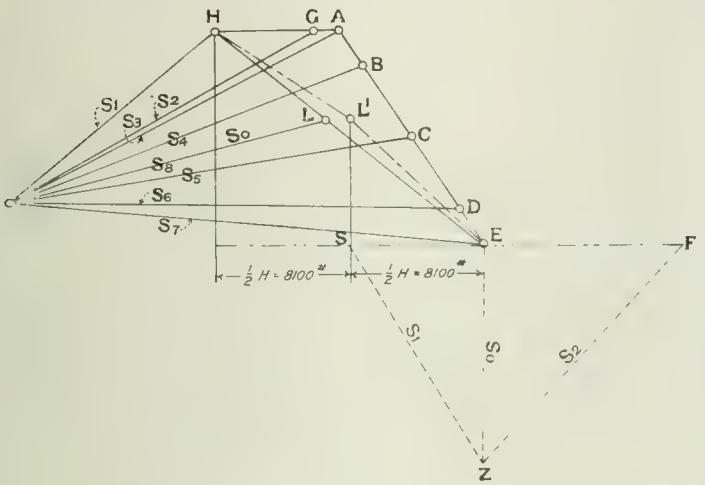


Fig. 2.

struct an equilibrium polygon in the usual manner and draw the string So, dividing HE into two parts at L. HL = R'_1 = the reaction at M and L E = R'_2 = the reaction at N. These reactions are correct in direction and magnitude unless some condition is imposed to change them.

If there are no bending moments at M and N and these points are prevented from moving vertically, the vertical components of the reactions must remain constant even in the extreme case where M may be assumed as a pin and N as resting on rollers.

Any assumption may be made as to the horizontal reactions at these points as long as their sum equals the horizontal component of HE, Fig. 2. It is customary to assume these reactions as equal. If this is the case, then the reaction at M is HL^1 and that at N, L^1E, as shown in Fig. 2.

The next step is to find the effect of these reactions at the points O, Q, P and R. The vertical components will act as vertical reactions at O and P. The horizontal components will produce bending moments at O and P, and, in effect, horizontal forces at O, P, Q and R. To determine these forces, in Fig. 2, assume a pole vertically below E and draw the strings S_1 and S_0 from the extremi-

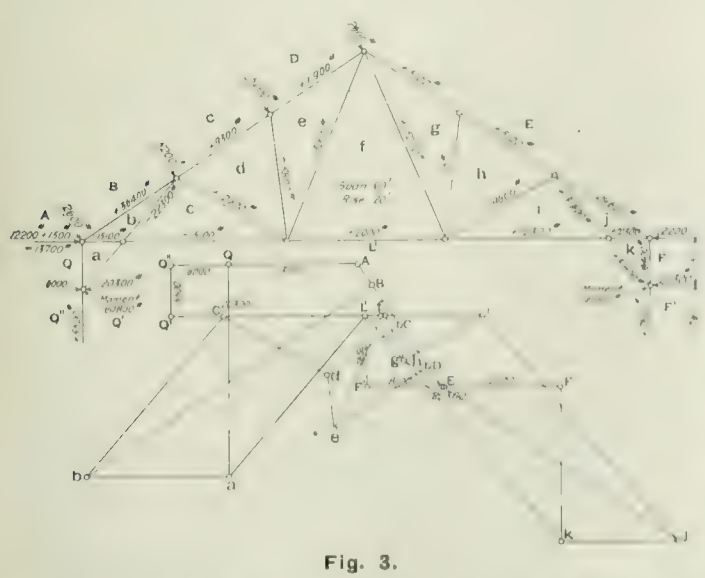


Fig. 3.

ties of the horizontal component as shown. Then, in Fig. 1, from N draw S_1 and S_0 in the usual manner and *complete the equilibrium polygon* with S_2. In Fig. 2 draw ZF parallel to S_2 of Fig. 1, then SE is the force at P and FE the force at R, *produced by the action of the horizontal reaction at* N. The forces at O and Q are, of course, the same as found at P and R respectively. With these forces determined the problem is solved in the usual manner as shown in Fig. 3.

The Denver, Northwestern & Pacific.

The city of Denver, although far and away the most important city between the Missouri river and the Pacific coast, has always been handicapped commercially by the fact that it is not on any of the direct through routes to Pacific tidewater. Situated as it is at the eastern base of the Rocky Mountains, with numerous railroads entering it from the east, it lacks a direct route to the westward towards California and the great Puget Sound region. The barrier of the Rocky Mountain range, which stretches north and south some 25 miles west of the city, has always until recently been effective in preventing direct railroad connection with the west. In order to reach the coast from Denver it is necessary to go either 119 miles southeast to Pueblo before starting west over the Denver & Rio Grande, thence to bend almost as far north again on the way across Colorado, or to go north 107 miles to Cheyenne, Wyo., and thence west over the Union Pacific.

From the east, the Chicago, Burlington & Quincy, two lines of the Union Pacific, the Chicago, Rock Island & Pacific by trackage rights over the Union Pacific, the Atchison, Topeka & Santa Fe, and the Colorado & Southern, all converge at Denver. There have been numerous plans in years past to build a line straight westward from the city which, in addition to providing a direct outlet for Denver and its eastern connections, should open up a large territory in northwestern Colorado and eastern Utah to settlement. Owing to the great cost of construction immediately west of Denver necessary in crossing the Continental Divide of the Rocky Mountains no such direct line has until recently been built.

It remained for Mr. David H. Moffat, a banker and prominent citizen of Denver, to bring about the construction of such a line. The Denver, Northwestern & Pacific, more generally known as the Moffat road, already extends across the summit of the Continental Divide and is being steadily built westward toward Salt Lake City, Utah. In the *Railroad Gazette* of March 17, 1905, there was published a description of this line, including many of its engineering features. In order to include more recent developments, and to give a general summary of the project brought down to date, this further description is presented.

The Denver, Northwestern & Pacific was organized in July, 1902. The object of its promoters was twofold: First, to develop by a railroad the great area from Denver to Salt Lake City lying between the Union Pacific on the north and the Denver & Rio Grande on the south, an extent of territory larger than the whole area of the state of Pennsylvania; and second, to build a line which should furnish a main artery for traffic east and west and secure a large through business.

The region to be developed by this railroad between the Continental Range in Colorado on the east and the Wahsatch Range in Utah on the west, untouched by existing railroads, is approximately 300 miles long by 100 to 180 miles north and south. It includes Grand, Routt and Rio Blanco Counties in Colorado and Uintah and Wahsatch Counties in Utah. This is a region rich in natural resources, both agricultural and mineral. Immediately west of the Continental Divide are extensive forests of white pine and white spruce timber which finds a ready market in Denver. At Hot Sulphur Springs and also at Steamboat Springs are fine groups of mineral springs which should make these places desirable health and pleasure resorts. Throughout most of Routt County and a large part of Rio Blanco County are extensive deposits of both bituminous and (Colorado) anthracite coal. The area of the anthracite coal is estimated to be 100 square miles in extent, with 12 distinct veins overlying each other to an aggregate thickness of 75 feet. In northeastern Utah are immense beds of hydrocarbon products, such as gilsonite, grahamite, elaterite and asphaltum, which are of large commercial value and should furnish a large traffic to a railroad. The Denver, Northwestern & Pacific is to run most of the way through this region in the river valleys, where there are good opportunities for agriculture. Back from the rivers are large tracts of grazing lands suitable for stock raising. Throughout this whole length of 300 miles there are no stretches of waste or desert land, the country all the way being capable of some kind of useful development.

The second purpose of the promoters—to make the road an efficient through route—can be best discussed after noting conditions met with and progress already made in the construction of the road. The distance from Denver to Salt Lake City by the Moffat road is approximately 575 miles. Of this, 109 miles to Sulphur Springs has been in operation since last September and track is laid on 20 miles more to Kremmling. Beyond Kremmling the building of 70 miles is already under contract, with grading work under way with a large force of men. Completion of this section will bring the road into the coal fields of Routt County early in 1907.

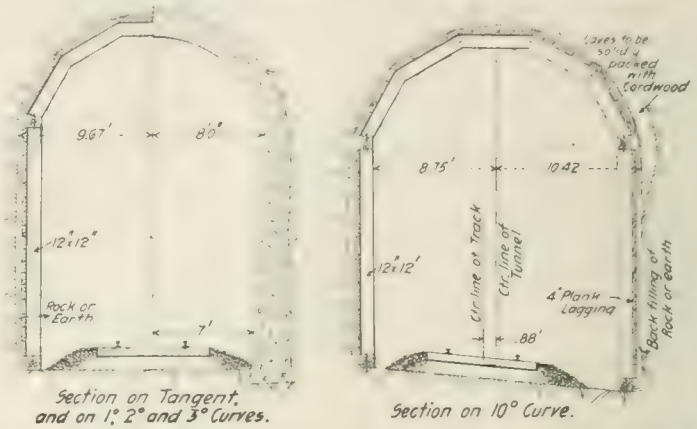
The road has two principal divides or summits to cross and

one minor summit. The Continental Divide and the Wahsatch Range are the principal summits and the divide between the Grand and Yampa rivers the minor summit. The rest of the line, amounting to about three-quarters of the work, is to be in river valleys where grades and curvature are favorable. On those parts of the line which cross the three principal summits the maximum grade of the completed road is to be 2 per cent. On the other parts of the line 1 per cent. is the maximum. The heavier grades will be bunched so that by using helper engines the train load which can be handled on a 1 per cent. grade with one locomotive can be maintained solid over the whole line. On the mountain parts of the line, 10 deg. is to be the maximum curvature, with the exception that in a few close canyons, 11 or 12 deg. curves have been temporarily used in first construction in order to save excessive tunneling. The line is so laid out at these points, however, that eventually these curves can be reduced to the standard maximum of 10 deg. curve. On the valley portion of the line 6 deg. will be the maximum curvature.

The accompanying photographs give a good idea of the character of the country through which the Denver end of the line runs. From the Denver terminal the road strikes a little north of west straight for the mountains. The development along the Trout Range of the Rockies is shown in the photograph which includes the second, third and fourth tunnels on the line. The engineering policy has been to avoid high trestles on side hills and to preserve a good alinement by tunneling the spurs of the hills and keeping the line well into the side of the mountain. On the line between mile posts 23 and 36 west of Denver, along the ragged sides of the South Boulder river valley, there are in the 13 miles of road 30 tunnels, from 73 to 1,729 ft. long, aggregating 16,000 ft. long. In this same distance there are only two trestle bridges. These were built because there was no material for the openings readily available. They are later to be filled in, the drainage to be carried underneath by cast-iron pipe. Normal sections of the standard tunnel both for straight and curved line are given herewith; also a plan of the standard trestle bridge.

After traversing the South Boulder canyon the line reaches the head of the South Boulder river about two miles north of James Peak. This is on the Atlantic slope of the range. Near here in actual distance on the Pacific slope of the Continental Divide the east branch of the Fraser river is close to the summit of the range. Careful surveys have shown that at this point, 52 miles out of Denver, is the shortest distance through the range, and that a tunnel 2.6 miles long at an elevation of 9,930 ft. (2,200 ft. below the summit) will bring the line to the other side of the Continental Divide without exceeding a 2 per cent. maximum grade. Starting with the tunnel elevation of 9,930 ft. at each portal, a grade of 0.25 per cent. rising towards the tunnel center from each end is projected. The same grade is to be extended outside the tunnel at each end to accommodate a small yard. Work on the Continental Divide tunnel is already under way and it is hoped to have it finished early in 1908.

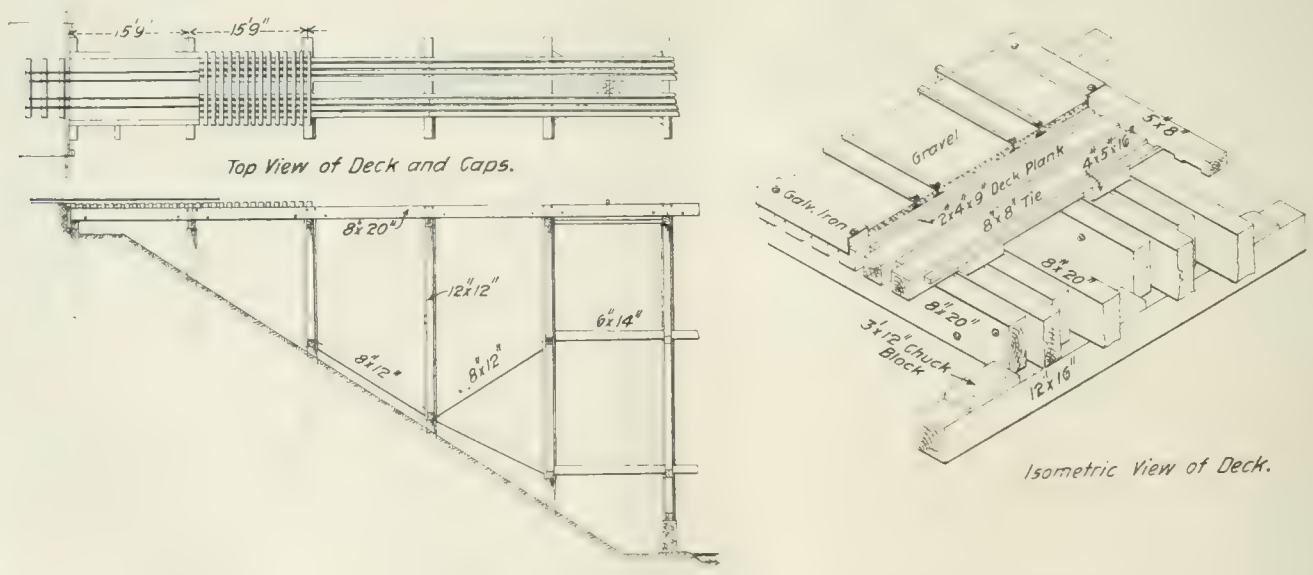
Pending the completion of this tunnel, the road has been extended over the summit of the Continental Divide by means of a temporary line over the main range. By building this, it has been possible to push construction beyond the Divide into Middle Park. Thus, by the time the tunnel is finished, more than half of the whole line will be in operation. The temporary line is 28 miles long, from Ladora Junction, the site of the tunnel portal on the east side of the range, to Vasquez Junction, the site of the portal of the tunnel on the west side. Vasquez, now 81 miles from Denver, will therefore be only 56 miles away when the tunnel line is in operation. There is over the Divide a practically even 4 per cent. grade equated 0.035 ft. per degree of curvature, except at sidings, where a slack grade of about 2 per cent. is introduced for about 2,000 ft. The maximum curvature is 16 degrees. There are two tunnels, one of them underneath an overhead loop on the descent of the west side of the range between the summit and Arrow, a new town formerly called Arrowhead. After the completion of the main range tunnel it is not likely that the temporary line will be abandoned, but instead operated during the summer months for excursions. It crosses the summit of the Divide at an elevation of 11,660 ft. through remarkably wonderful mountain scenery.



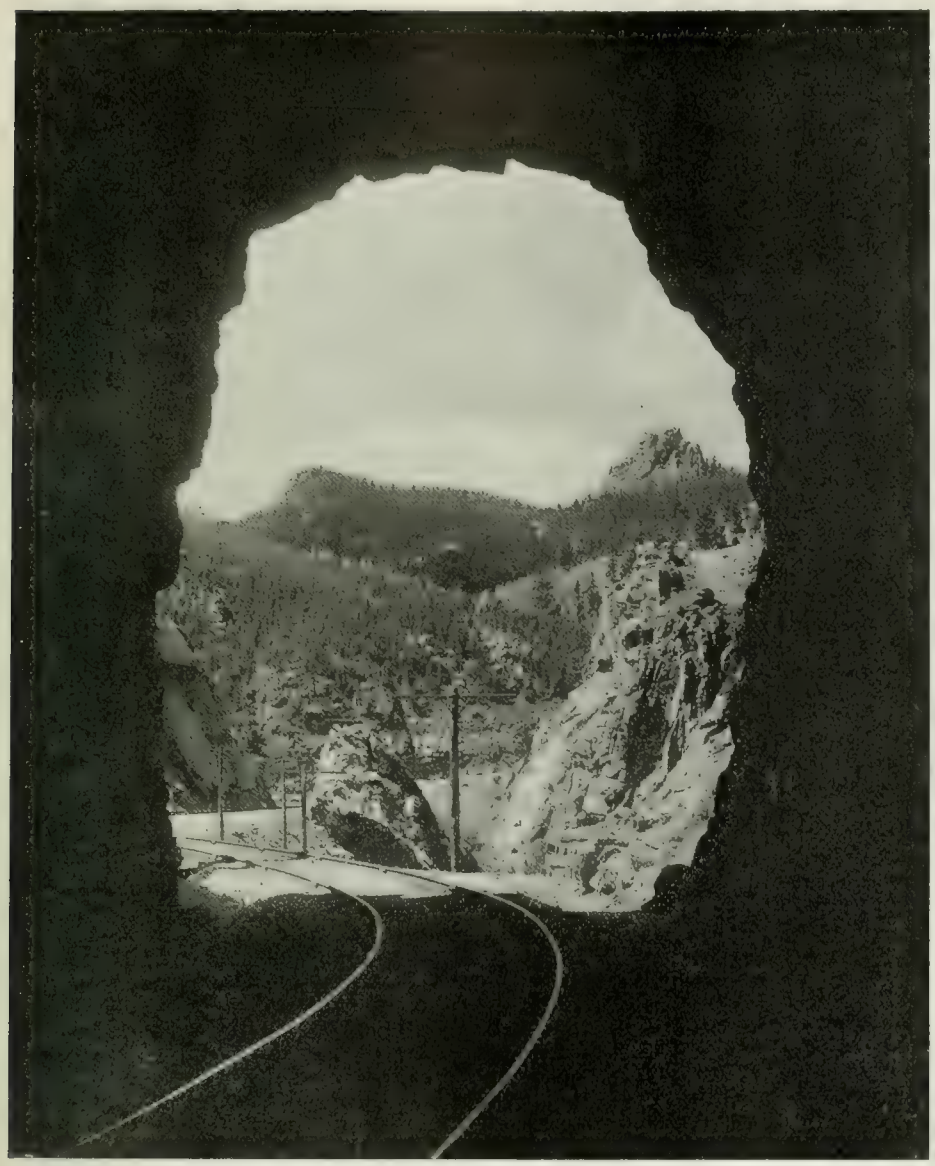
Cross Sections of Standard Tunnels—Denver, Northwestern & Pacific.

In view of the difficult character of the construction, there are included in this description certain engineering data, some of which was referred to in the previous article. The mountainous portions of the line are generally in a granite formation; the valley portions, in alternating granite and sandstone, with a large percentage of loose disintegrated material, clay and soil. Widths of roadbed and excavations are 20 ft. in rock and 22 ft. in loose materials. Rock fills on embankments are 16 ft., and fills of earth and loose material 18 ft. wide. Side slopes are regulated according to the material encountered in excavation, ranging from ¼ to 1 in rock cuts to 1 in earth. Rock embankments stand 1⅓ to 1; earth and loose material, 1½ to 1. The normal tunnel section is 16 ft. wide and 24 ft. high from sub-grade, or 22 ft. high above top of rail. On curves the width is increased to a maximum of 17½ ft. for a 10 deg. curve, in which case, as shown on the plan, the tunnel center is thrown 0.88 ft. towards the inside of the curve to preserve proper clearance on both sides. The mountain ridges over the tunnels through the South Boulder Canyon range from 60 ft. to 600 ft. above grade. The rock is in many cases seamy or "blocky," requiring timber lining. This is all 12 x 12 material, the posts set on a sill tapped with a wall plate on which are five segment arch timbers of equal length. Where, in a few cases, wet decomposed material was found, 8 in. x 20 in. timbers were inserted for posts and segment stuff and wall plates were left out.

In addition to the resources of the country west of the Con-



Standard Trestle Bridge—Denver, Northwestern & Pacific.



View of Canyon Country from Tunnel 28—Denver, Northwestern & Pacific.

tinental Divide, in the plains region near Denver are good agricultural lands and extensive deposits of lignite coal, which is now being mined and shipped over the Denver, Northwestern & Pacific to Denver. Between the foothills and the main range and in the mountains west of the range are valuable deposits of precious minerals. Gilpin County, through which the road passes, is the oldest and one of the most extensive mining counties in the state.

The Denver, Northwestern & Pacific has had some difficulty in securing satisfactory terminals at Denver. Construction westward was begun from Utah Junction, on the Colorado & Southern and Chicago, Burlington & Quincy, four miles northwest of the Denver Union Station. Later the Northwestern Terminal Railroad Company was incorporated to build a line for the Denver, Northwestern & Pacific from Utah Junction into the central part of the city of Denver. About 229 acres of ground in the freight district of Denver and near the grounds of the other railroads entering the city have been secured, and a good sized brick freight and passenger station is now being built on Fifteenth street about four blocks from the Union Station used by the other roads.

In regard to the desire of the promoters to make the road an important through line a brief comparison of grades and distance over the new road and over existing lines is interesting. By the Denver & Rio Grande it is 119 miles from Denver to Pueblo and 624 miles from Pueblo to Salt Lake City —total 743 miles from Denver to Salt Lake. The ruling grade westbound is 2.40 per cent. and eastbound 4 per cent. By the Union Pacific, it is 107 miles from Denver to Cheyenne, and 485 miles from Cheyenne to Ogden, or 522 miles from Cheyenne to Salt Lake City, a total of 592 miles from Denver to Ogden, or 629 miles from Denver to Salt Lake. The maximum grades on this section are 82 ft. to the mile (1.55 per cent.) between Cheyenne and Laramie westbound, and 96 ft. to the mile (1.82 per cent.) between Ogden and Wahsatch eastbound. The highest elevation reached is 8,011 ft. at Sherman, just west of Cheyenne, and another summit 7,225 ft. high is crossed at Alta-



Development on Pacific Slope of the Continental Divide—Denver, Northwestern & Pacific.



Typical Canyon Scenery; South Boulder Creek Near Rollinsville, Colo.—Denver, Northwestern & Pacific.



View from Rainbow Cut in the Foothills, Showing Development Along Trout Range of the Rockies and Tunnels 2, 3, and 4—Denver, Northwestern & Pacific.



South Boulder Canyon and Tunnel 28—Denver, Northwestern & Pacific.



View of Rollins Pass, Crest of the Continental Divide, Crossed at Elevation of 11,600 Feet by Temporary Main Line of the Denver, Northwestern & Pacific.

mont, nearly 100 miles east of Ogden. By the Denver, Northwestern & Pacific it is 570 miles from Denver to Salt Lake City, and with the completion of the Main Range tunnel, the maximum grade will be 2 per cent. both east and westbound. The highest summit, as already mentioned, is 9,930 ft. The Moffat road, therefore, will be shorter than either of the other routes and will have lower grades in each direction than the Denver & Rio Grande and steeper grades in each direction and higher summits to cross than the Union Pacific. It appears, therefore, that its completion should have small effect on the through traffic of the Union Pacific, but it is not at all impossible that it may be a severe competitor of the Denver & Rio Grande for through traffic across the state of Colorado.

Ever since the road was organized there have been numerous rumors of its sale to one or other of the existing systems, but thus far it seems to have remained independent. The extent of its success when completed, particularly as a through carrier, is one of the most interesting conjectures in the western railroad situation.

A British View of Large Locomotive Boilers.

Mr. J. G. Churchward recently presented a paper on "Large Locomotive Boilers" before the Institution of Mechanical Engineers, which he opened with the statement that locomotive engineers have now apparently settled down to the use of one of two types of boiler for very large engines; the wide firebox extending over the frames and wheels, and the long narrow box sloping up over the axles behind the main drivers.

In Great Britain the contracted loading-gage prohibits the use of the wide firebox type over wheels larger than 4 ft. 6 in. diameter, so that it is not being used so generally as in America, where it is becoming practically universal. In America the great power of engines now employed renders the wide firebox a necessity, but in Great Britain, where the coal burnt per mile is much less, few boilers of this kind have been built.

Much more experience has been gained with the wide box in America than in England and, so far as the author has been able to ascertain, it has been found there that the poorer coals in large quantities can be burnt with much greater facility and economy in this type than in the narrow pattern. This advantage is offset to some extent by the fact that, when standing there is considerable waste in the wide grates as compared with the narrow, and this is, of course, serious when goods trains are kept standing about, as is often the case.

A much more serious trouble has been found in the leaking of tubes in these boilers. All methods of tube-expanding have been tried, and also much wider spacing, even up to and over 1 in., without curing the trouble. The reduction of the depth of the firebox, in order to get a long box sloping over the trailing wheels of coupled engines, certainly increased the trouble from leakage of stays, but the alternative of a wide firebox entails a much heavier engine for most of the types, and then apparently tube-trouble is increased. The wide firebox evidently requires a higher standard of skill in the fireman, for unless the grate is kept well and evenly covered, there is a tendency to have an excess of air, reducing efficiency and increasing tube-trouble. With modern high pressures the temperature of evaporation is so much increased that the provision for circulation which was sufficient for the lower pressure formerly used is doubtless insufficient. Boilers in which this provision has been made have shown a very marked reduction in tube and stay troubles.

It is probable that, in the wider boxes, the main mass of the fire being so much nearer the tube plate has a bad effect on the tubes as the intensity of the temperature at the tube plate must necessarily be much increased. The extra width of box has enabled the tubes to be put much too near the sides of the barrel. When this is done, the water, to feed up the spaces between the tubes near the back tube plate, has to be drawn almost entirely from the front of the barrel, and it is possible that in some cases the space left for this purpose is inadequate. It will probably be found that neglect of this consideration is the cause of three-fourths of the tube trouble. In some boilers, an effort has been made to provide for this upward circulation near the back tube plate by leaving a space between the tube sand barrel from top to bottom, of a sectional area equal to the combined area of the vertical spaces between the tubes at all points, with a balance to provide for the water coming back from the front of the barrel to feed the water spaces of the firebox. There is no doubt that the upward draught of water through the spaces between the tubes for two feet from the back tube plate is very strong indeed, and in all probability this is enough to prevent the necessary feed of water down the spaces of the firebox unless ample area is given, so causing stay as well as tube trouble.

By putting the clack box or check for both injectors under the barrel, and providing an internal nozzle directing the feed back towards the firebox, considerable assistance is probably given in feeding "solid" water back to the firebox and the hottest part of the tubes. It is generally supposed that the circulation in a locomotive boiler proceeds along the bottom of the barrel from the front end down the firebox front and up the sides and back of the firebox. The author two or three years ago fitted a number of vanes in a boiler with spindles passing through lightly packed glands to the outside, with indicators to show the direction of the flow of water. Observations showed that the circulation was generally as stated above, but a little alteration of the firing had the effect of materially changing the direction of the currents and even of completely reversing them.

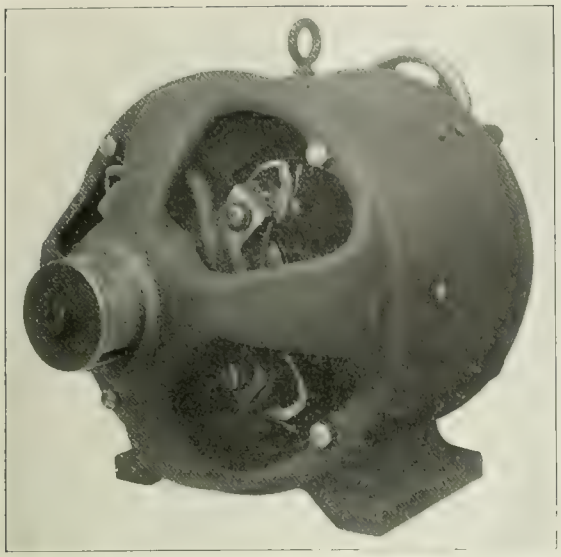
These experiments suggested the desirability of bringing a circulating pipe from the front of the barrel, bifurcated to each side of the firebox at the foundation ring, but the consideration of possible danger from an outside pipe open to the boiler, caused the experiments to be abandoned. The experiment has since been made in America, and it is reported that great reduction of trouble with slide sheets resulted. The extended length of tubes seen in some designs of wide firebox boilers is due to the use of six-coupled wheels in front of the firebox. Experience of long tubes appears to be quite satisfactory, and they certainly keep up the economical efficiency of the boiler when it is being forced to the limit of its capacity. In this respect the long tube fulfils the same function as the Serve tube (which is favored so much on the Continent) performs in boilers with shorter barrels.

The ratio of diameter to length of the tube undoubtedly has a most important bearing upon the steaming qualities of the boiler and upon the efficiency of the heat absorption. This is more particularly noticeable when the boilers are being worked to the limit of their capacity. If 2-in. tubes are employed in barrels 11 to 12 ft. long, when the boiler is being forced the length is not sufficient to absorb the heat from the amount of gases that a 2-in. tube will pass, and overheating and waste result. The amount of tube-leaking which is experienced with modern wide boxes in America has brought up again the idea that the spacing should be wider, 1 in. instead of ¾ in., but, from the investigations of a Master Mechanics' Committee, it appears that the wider spacing does not cure the trouble. It is clearly of no use to provide wider spaces for the upward current, unless equivalent area is provided for the downcoming water.

The gradual extension of the practice of making the top of the firebox and casing flat instead of round is noticeable. On the Great Western Railway (England) less trouble has been experienced with the flat top firebox than with the round top, although no slingstays of any kind are used. The flat top has the important advantage of increasing the area of the water line at the hottest part of the boiler, and so materially contributes to the reduction of foaming. This, combined with the coned connection to the barrel, has enabled the dome, always a source of weakness, to be entirely dispensed with and drier steam obtained. The author some years ago made an experiment to settle this much-disputed point. Two identical engines and boilers were taken, one boiler having a dome in the usual position on the barrel, the other having no dome, the steam being taken by a pipe from the top of the flat firebox casing. The engine without the dome proved to be decidedly freer from priming than the other. The liberal dimension of 2 ft. between the top of the firebox and the inside of the casing no doubt contributed to this satisfactory result. The coned barrel connection, in addition to providing a greater area of water line, also gives a larger steam capacity, and, by the larger diameter being arranged to coincide with the line of the firebox tube-plate, much more waterspace at the sides of the tubes is possible. On consideration of the great intensity of temperature at the firebox plate as compared with that at the smoke-box plate, the advantage of the arrangement is obvious.

There is really little to be said as to firebox stays. The stay question is in very much the same position in which it has always been. For the present high pressures, copper is still being used below the fire-line with closer spacing down to 3¼ in. pitch. Bronze is often used above the fire, and the boilers of the De Glehn compounds are so fitted. In America Yorkshire iron is still used, and recently Professor Hibbard, experimenting there on some iron stays, arrived at the astonishing fact that the ductility of iron stays increased instead of diminished with the higher pressures now common. The author is using a few Taylor-iron stays experimentally with a view of ascertaining whether this material is more durable than copper, under the conditions brought about by the increased temperatures in modern boilers. Experiments are being made by many engineers with water-tubes in fireboxes—notably by Mr. Drummond, of the London & South Western Railway, who is so satisfied with the results that he is building this type entirely. Unfortunately, it is a necessity to have a deep firebox in order to employ water-tubes effectively, or it is probable that many engineers would be following Mr. Drummond's example.

The employment of a superheater is having an extended trial in Germany and also in Canada. This affords the prospect of obtaining the same steam efficiency by the use of, say, 175 lbs. pressure, as by employing the pressures of, say, 200 lbs. to 225 lbs. This, no doubt, offers some prospect of success, and is attractive



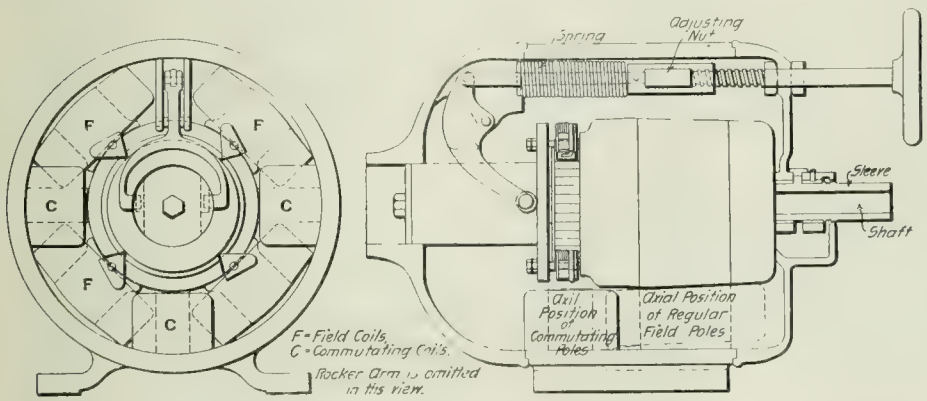
The Lincoln Variable Speed Motor.

from the fact that the alternative of compounding necessitates the use of the higher pressures and consequently presents no hope of relief from boiler troubles. The Great Western Railway is fitting one of its Standard No. 1 boilers with the Schmidt arrangement, to see what advantage can be gained with the simple engine. Formerly the power of a locomotive was estimated largely from the capacity of its cylinders, and this led occasionally to the use of cylinders of such dimensions that the boilers provided were not capable of generating sufficient steam to enable them to be worked at their maximum economical power for any length of run. To-day this is changed, and the first consideration is the capacity of the boiler.

A table is presented showing the dimensions of cylinders and diameter of driving wheels used in connection with the various boilers illustrated, to illustrate how much more heating surface is now provided for a given area of cylinder than used to be considered necessary. The higher pressures now common have undoubtedly produced much more efficient locomotives, both in respect of hauling power and coal consumption. This improvement has been very marked with every increment of pressure, right up to 227 lbs. carried by the De Glehn compounds. These have been most successful compounds, and the high pressure carried is no doubt an important factor. By employing 225 lbs. per sq. in. in the simple engine, and making the necessary improvements in the steam distribution, enabling higher cut-offs to be used, corresponding improvements in efficiency and economy of fuel have been obtained. Great increase in the drawbar pulls at high speed has also resulted. Of course, the price for these improvements has to be paid in the matter of firebox repairs and renewals, but it is probably better to submit to this expense than to employ the very much heavier and more costly machines which would be necessary to give the same hauling power at speed.

The Lincoln Variable Speed Motor.

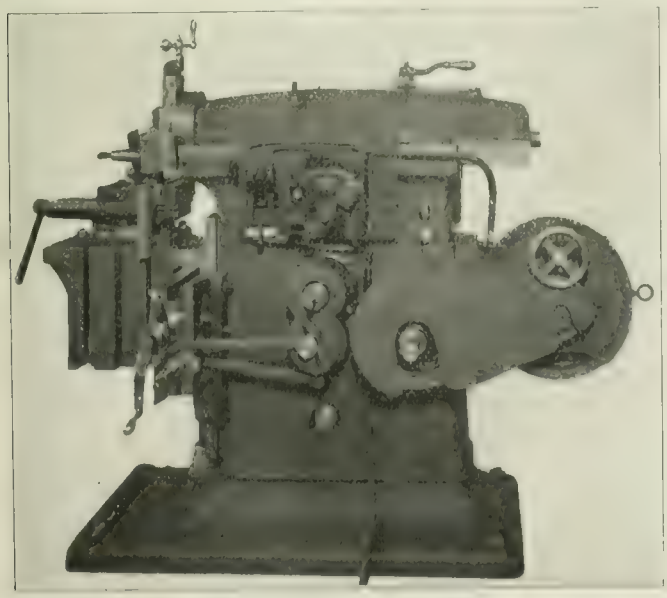
The Lincoln variable speed motor illustrated herewith is unique in its method of obtaining the speed variation, which, it is claimed, yields a much wider variation in speed than is possible by the ordinary method of field weakening. Motors with speed ranges up to 10 to 1 are regularly built. The method in question provides for the withdrawal of the armature from the influence of the field poles, thereby decreasing the field area and magnetic flux, increasing the air gap and resistance, and therefore increasing the speed. The conical armature used, by a more rapid increase in the air gap, gives a greater increase in speed for a given lateral adjustment than is possible with a cylindrical armature. The horse-power of the motor is uniform, the torque varying inversely with the revolutions per minute.



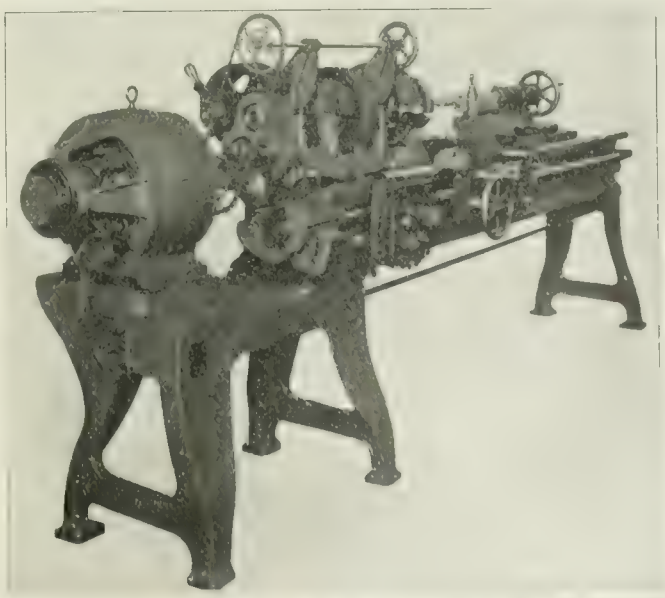
The Lincoln Motor Showing Method of Armature Movement.

To accomplish this, there has been perfected a thrust bearing that supports the commutator end of the armature, carrying an annular ball bearing to take both thrust and radial loads. This thrust bearing is actuated by a split lever having a central pull on opposite sides of the thrust bearing. Movement of the lever is accomplished by means of a screw mechanism and hand wheel as seen in the illustrations, a spring around the lever connecting rod being adjusted to balance the magnetic pull of the armature. The motor is a two-wire direct-current shunt-wound type, the same as any ordinary d.c. machine so far as installation is concerned.

This system admits of speed variation inside the motor, doing away with the electric controller with its complicated wiring, necessary to the ordinary method of speed variation by field weakening, and the necessity of finding room for its accompanying resistance. The speed variation is under the immediate control of the machinist.



Sixteen-Inch Shaper Driven by 2-H.P. 5:1 Lincoln Motor Showing Armature Moving Hand Wheel and Motor Starting Box.



The Lincoln Motor as Applied to an Old Lathe—Showing Method of Bringing Speed Control Close to the Hand of the Operator.

who with his eye on the tool and his hand on the regulating wheel can immediately increase or decrease the speed. Gradually he can increase the cutting speed up to what the work will stand, or with work of varying diameter keep his cut at the maximum speed throughout, without the abrupt changes liable to occur where a controller is used. It is so easily accomplished, it is claimed that a careful workman will make an involuntary saving on his product of 10 to 30 per cent. of the labor cost.

The efficiency is claimed to be high, comparing favorably with good constant-speed motors. Efficiency at full load on a 5-h.p., 5 to 1 motor is said to show by test from 86 per cent. at 300 r.p.m. to 75 per cent. at 1,500 r.p.m. Of quite as much if not more importance is the statement that it compares very favorably with good constant-speed motor practice in the maintenance of any given speed under varying load conditions—which is impossible with the ordinary method of field weakening by controller.

The perfection of this motor was attended with more than ordinary difficulty. Every feature—the thrust bearing, the special commutating field into which the armature is drawn at high speeds to insure sparkless commutation from no load to 100 per cent. overload, and the sleeve which carries the pulley or pinion allowing the armature to slide through it in its lateral adjustment—was tested and tried for requisite efficiency before the motor was placed on the market. The makers claim that the motor will run in either direction with equal results. This is an important point of merit. A simple reversing switch is all that is required.

Views are shown of the application of the motor to machine tools. The lathe view shows a simple arrangement for bringing the speed control up to the hand of the workman. This arrangement costs between $2 and $3 complete. The motor on the lathe is one of the older styles. The view of the motor alone shows the latest style of motor, just perfected. The Lincoln Electric Manufacturing Co., Cleveland, Ohio, is the maker.

How Canada Regulates Its Railroads.

BY THE HON. A. C. KILLAM,
Chief Commissioner, Board of Railway Commissioners for Canada.

The Board of Railway Commissioners for Canada exercises authority over the railroad companies which are subject to the jurisdiction of the general Parliament of Canada, except Government railroads. We have a federal constitution under which a general Parliament exercises legislative authority over the whole Dominion of Canada, and Provincial Legislatures over the different provinces. In the division of legislative powers between these bodies, the Parliament of Canada is empowered to make laws upon the subject of railroads connecting one province with another or extending beyond the limits of any province and any others which are declared by the Parliament of Canada to be maintained for the general advantage of Canada, or for the advantage of two or more of the provinces.

Under this class of subjects the Parliament of Canada has incorporated many companies to build and operate railroads, and has authorized such building and operation usually by companies, but in some instances by the Government of Canada. It has also in many cases declared railroads built under authority of provincial legislatures to be works for the general advantage of Canada and has thereafter assumed legislative authority over them. Although the establishment of courts of civil and criminal jurisdiction and proceedings in civil matters are subjects of legislation by Provincial Legislatures, the Parliament of Canada has special power to provide for the establishment of additional courts for the better administration of the laws of Canada.

The Board of Railway Commissioners was constituted by the Railway Act of 1903, which came into force on the first day of February, 1904. The powers and duties assigned to the board are numerous and of varied character. Before building is begun, location plans must be approved by the board. Leave to cross highways or other railroads must be given by the board, and the board must determine what precaution, if any, shall be taken at such crossings, and whether they shall be made at grade or overhead or underneath. Lines or wires for telegraphs, telephones, for the conveyance of light, heat, power or electricity cannot be carried across railroads without the leave of the board, which establishes the precautions to be observed. Before a railroad is opened for traffic it must be inspected by an engineer, and its opening authorized by the board. Naturally the Railway Act deals with many details to be observed by railroad companies. The board is empowered to make general regulations dealing with many matters with which the statute has not specificaliy dealt.

The board is authorized, by general provisions, to order a railroad company to do anything required by statute, and to forbid the doing or continuing of anything contrary to statute. The board is made a Court of Record, and is given full jurisdiction to hear and determine all matters, whether of law or of fact; and, as respects the enforcement of its orders and other matters, it is given all such powers, rights and privileges as are vested in a Superior Court. The decision of the board upon any question of fact is binding and conclusive upon all companies and persons, and in all courts. There may be an appeal from an order of the board to the Supreme Court of Canada upon any question of law, under certain conditions. An unlimited right of appeal from the board to the Governor-General in Council is given. The board may exercise its jurisdiction on complaint of any party interested, or it may, of its own motion, and is obliged at the request of the Minister of Railways to inquire into, hear and determine any matter or thing which, under the Act, it might inquire into, hear and determine upon application or complaint.

The rules of the board require applications and complaints to be made in writing and to be signed by the applicant or his solicitor, or, in the case of a corporate body or company, by its manager, secretary or solicitor. The application is required to contain a clear and concise statement of the facts, the grounds of the application, the section of the Act under which the same is made, and the nature of the order applied for, or the relief or remedy to which the applicant claims to be entitled. It has to be divided into paragraphs, each of which, as nearly as possible, is to be confined to a distinct portion of the subject, and the paragraphs are to be numbered consecutively. The application or complaint is to be endorsed with the name and address of the applicant, or, if there be a solicitor acting for him in the matter, with the name and address of the solicitor. In many cases it is required to be accompanied by maps, plans, etc. The applicant is to serve the application, and ten days are given for the respondent or respondents to answer it. The applicant may also reply to the answer. Any party is entitled to have a matter in which he is interested heard in open court, otherwise matters are frequently disposed of in an informal way by the board upon correspondence.

As the board has power to inquire into matters of its own motion, it is not strict in requiring applicants, and particularly illiterate persons, to conform strictly to such rules, but often calls upon a railroad company, upon a mere letter or informal complaint, to state its position.

Experts are appointed to advise the board, chiefly in engineering and traffic matters, and the board also has officials who inquire into accidents upon railroads, and it is empowered to require railroad companies to discharge employees responsible for accidents.

Tariffs of tolls for passenger carriage are divided into two classes: standard passenger tariffs and special passenger tariffs. Tariffs of tolls for the carriage of goods are divided into three classes: standard freight tariffs, special freight tariffs and competitive tariffs. All tariffs are required to be filed with the board, and are to be published in a certain way, unless otherwise ordered by the board. Standard freight and passenger tariffs are subject to the approval of the board. Special tariffs and competitive tariffs do not require the express sanction of the board, but must specify tolls lower than those in the standard tariffs. The competitive tariffs deal with the tolls to or from specified points which the board may consider, or may have declared, to be competitive points not subject to the long and short haul clause under the provisions of the Act. The board may disallow any tariff, or any portion of it, which the board considers to be unjust or unreasonable, or contrary to the provisions of the Act, and may require a company to substitute a tariff satisfactory to the board in lieu thereof, or may prescribe other tolls in lieu of those disallowed.

The classification of freight is subject to the approval of the board, and it is to be made uniform throughout Canada, as far as may be, having due regard to all proper interests. A company may, with the approval of the board, or when so directed by the board, place any goods specified by the board in a stated class, or remove them from any one class to any higher or lower class. There are the usual provisions against discrimination between persons or localities, and railroad companies are forbidden to charge any money for any services as common carriers except under the provisions of the Act.

There are also wide provisions regarding reasonable and proper facilities for traffic to be provided, and requiring the interchange of traffic between railroads. Companies whose railroads connect may be required to agree upon joint tariffs for a continuous route over both, and if they cannot agree upon the amounts of their rates and the division thereof, the board may determine the matters of difference.

The provisions requiring railroad tolls to be approved, and making them subject to revision by some authority, are not new. Such provisions have ben found in all the railroad acts of Canada from 1851 down to the present time. Before the Act of 1903 the sanction of the Governor-General in Council was necessary, and tolls were subject to revision by the Governor in Council. There was a Committee of the Privy Council for Canada, known as the "Railway Committee," to which complaints and aplications on many matters could be made, among which were complaints respecting tolls, discrimination, etc. A certain time was given, after the coming into force of the Act, for railroad companies to present their standard tariffs for approval by the board. Those which have been approved are practically similar to the tariffs that had previously been sanc-

tioned by the Governor in Council. The tolls provided for by these tariffs are generally used for local traffic for short distances, but most commodities are moved at rates provided for by the special tariffs, which the railroad companies may increase or decrease as they see fit, so long as they keep below the rates in the standard tariffs, and subject to the authority of the board to direct changes.

The following are some of the most important orders that the board has made since its inauguration upon the subjects of rates, facilities, etc.: An order requiring certain railroad companies to abolish discriminatory and prohibitive rates, which they had been in the habit of charging for years, on cedar lumber, cedar ties, etc., in order to keep down prices for their own construction purposes, and compelling them to make the rates uniform with those charged on other kinds of lumber, ties, etc. An order abolishing discrimination in rates on glass bottles from Wallaceburg, a point in the Province of Ontario, near Detroit, as compared with rates from United States points, and applying the same rates as from Detroit. Prohibitive rates on cooperage stock to Montreal, for export, lowered; and an order made requiring cooperage stock between local points to be carried on the same basis as ordinarily charged on lumber. Split peas, for export, directed to be reinstated in a list of articles in which they had formerly appeared, and which take the same rates as flour for export. An application by a railroad company for permission to make lower rates on coal to manufacturers than to dealers and ordinary consumers was disallowed. Rates on metallic shingles, which railroad companies had raised, were ordered to be restored to the former basis.

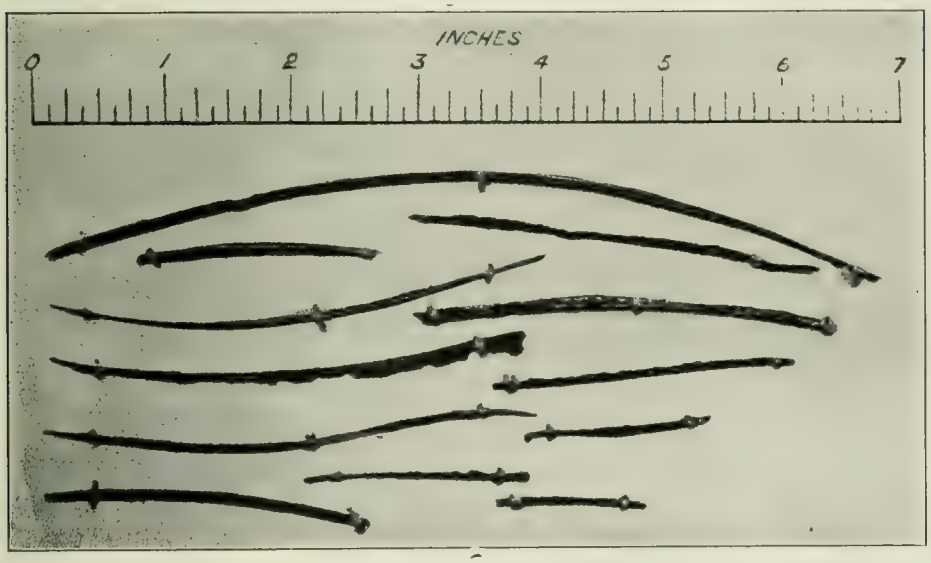
Export rates on cattle, which had been higher from points in the Province of Ontario than from points in the western states were ordered to be lowered so as to be more in harmony with those paid by United States shippers. Railroad companies were ordered to discontinue charging higher rates on grain between local points than were charged on flour, etc. Rates on flour, etc., from points in the Province of Ontario to Montreal for export were lowered so as to do away with discrimination in favor of United States shippers from western states.

Rates on beans were lowered. The board determined that cartage allowances by carriers, to off-set disadvantages of location as between shippers, unless they are published in the regular tariffs and made general in their operation, should not be allowed. Railroad companies have been compelled to enter into joint tariffs with connecting railroads, although the rate was calculated to introduce competition with the local business of one company.

The board took into consideration the question of what are known as car service charges, and the rules regulating them, and prescribed an entirely new set of rules, after hearing from Boards of Trade and other interests in all parts of Canada, as well as the railroad companies. The board also proposes, under a special section of the Act, to prescribe forms of bills of lading, and the conditions on which goods shall be carried.

In some instances, the board has directed railroad companies, whose railroads connect with each other in or near a city or town, to interchange traffic so that shippers having immediate connection with only one railroad can have their goods transferred at the point of connection to the other line, and has fixed the rates for the short haul. In some cases companies have been given authority to meet the competition of local water carriers not subject to the Act, without publication of their rates, other than filing with the board, and to put them in force before the tariffs can reach the office of the board. The board also, in one case lately, made a temporary order as to the method of distribution of cars for traffic from certain lake ports eastward in order to meet what appeared to be unfair discrimination in the allotment of rolling stock.

Under the provisions prohibiting railroad companies from charging rates not authorized by the Act, the board assumes to investigate claims of over-charge. Usually the railroad companies, upon notice of the complaint, settle the matter summarily to the satisfaction of the parties, or show that their charges are justifiable. This summary jurisdiction, exercised in this way, has proved most beneficial, as it enables parties to have their complaints speedily determined at slight trouble and expense.



Slivers Cut by Switch Point from Steel Wheels.

Picked Up on the Road.

BY GULF.

I suppose there are very good reasons why the dining car service on some roads is on the *a la carte* plan while on others it is *table d'hote*. Speaking personally, the former is exceedingly unsatisfactory where a comfortable dinner, promptly served, is desired. For lunch only, the *a la carte plan* will do. In first place it is much more expensive, and the variety that one can order is quite limited. The kitchen of a car is so small that whenever a few persons order simple repasts, the ranges are overloaded to such an extent that the delays are sure to be annoying. I was in a crack car the other evening and waited 25 minutes for a cup of cocoa, and that with the temperature of the car at 50. That the *a la carte* plan is not in favor with the public is shown, to my mind, by a comparison of two trains running out of the same depot and practically to the same destination a half hour apart in the evening. One of these hauls an *a la carte* diner and the other a *table d'hote*. The latter is crowded so that there are people waiting, while the former is not half filled.

It is not an uncommon thing for slivers to be cut from rails by the action of the flanges of the wheels, especially where the rails are old and have been checked by the rolling action of heavy loads. It is, however, a little unusual to find slivers cut from the treads and flanges of steel wheels, especially of the lengths indicated by the accompanying engraving. These slivers were cut by a manganese steel switch point on an electric road using steel wheels. The reason for the cutting is attributed not to the hardness of the switch point or the softness of the steel of the wheel but to the fact that the trucks running over this particular piece of track did not curve readily beneath the cars. All of which goes to show that it is apparently quite an essential element for the protection of the wheels that the center plates and side bearings should be in good condition.

The loose wheel pops up perennially and apparently will not down. Years ago it was tried thoroughly, patiently and carefully, and results were obtained that were satisfactory mechanically, but the deep gulf that frequently lies between mechanical and commercial possibility prevented the passage from the former to the latter. In short, the advantages of the loose wheel in traction are not as great as one would be led to expect, but the field of invention and experiment is an attractive one. I suppose those who are ignorant of the failures of the past will continue to plough this well-tilled field for all time to come. As yet, the fruits have been disappointed expectations.

I had a rather startling and not altogether amusing experience on a Pullman car the other day. The conductor came into the car, and as he stopped I asked if he wanted the railroad ticket. "No, Pullman fare, one dollar," was the reply. I handed him the money and turned to my book. A few moments later he demanded my fare again, which I naturally declined to pay. He went away, but soon returned with a demand and a threat of ejection if I refused. I again protested, but he said he would give me a cash receipt and I could settle the matter with the company, giving me to understand that it would probably refund. So I paid my second dollar under protest. I then drew up a statement of the case which I proposed to submit and showed it to him. In about a half hour he came back and said that he had been counting his cash and found that he was a dollar over and so would refund. The amusing part lay in the assumption of uncommon virtue on the part of the men, who said that he always liked to be square and wouldn't keep money that he had obtained in that way, for, and here is the startling fact, "You never would have been able to get your money back, for the company would not refund, especially if I had not turned it in." The moral of which is, do not pay money to Pull-

man conductors unless you have one hand on the seat check, or unless there is a witness to the payment.

There seems to be one place at which there are really no bargains to be obtained, and that is in the domain of Nature. Somehow she demands an inexorable *quid pro quo*, and what you get in effect you have put in power. Yet the struggle for the unattainable that we inherit from those who strove for perpetual motion still continues in the efforts to procure an abnormal development of power from microscopic appliances. Does it happen that a gentleman from Minnesota invents an engine that will develop ever so many horse-power, that can be carried in a lady's reticule; some eastern genius straightway eclipses the west by the invention of another engine that will develop ever so many more horse-power and which can be carried around in a man's watch pocket. This is the expected and regular course of events. The engine is built, particulars as usual still kept quiet. Then the people who put their thousands into the first engine usually throw up their hands, or perhaps they pull out their thousands. At any rate there never seems to be any extensive closing of the ordinary engine shops, or haste on the part of users to part with their present power plant at less than market figures.

Station signs are presumably for the benefit of the traveling public and serve to indicate to the stranger where he may be. Usually these signs are put in some definite position and there they stay regardless of the convenience of the people for whose benefit thy are supposed to exist. Under the eaves of the roof of the station platform is probably the worst place. On the ends of the station does well provided there is a free approach and no obstructions. Where a building stands close to the station this location is about as bad as beneath the eaves. The curious part of it is that when the location has once been decided upon it becomes a law like unto that of the Medes and Persians that cannot be changed. There are exceptions, however, that serve to emphasize the prevalence of the rule. One of these rarities is to be found on a progressive road where the station sign was put on a signal tower a hundred and fifty feet away, which would otherwise have obscured it.

I was on a dining car the other day in which the General Passenger Agent had placed some fairly well mounted photographs of the scenery of the line, which the patrons of the car were at liberty to carry away. This suggests the query why the passenger departments of roads running through country of more or less scenic beauty have not made a more extensive use of the souvenir postal card. It seems as though for such a road doing a summer excursion business of any magnitude a card given by the ticket agent to the purchaser of each ticket would be sure to be sent to a friend who is thus made a possible traveler in the same direction. Such a card should be a true photograph and printed upon sensitized paper, thus bearing all the earmarks of genuineness and free from the atrocities that characterize the "Made in Germany" article. The cost of such a card would be insignificant and its value as an advertising medium considerable.

Washington Correspondence.

Washington, May 15.—When it has been finally passed by the Senate the Hepburn railroad rate bill will be a very different measure from that passed by the House of Representatives. The action of the Senate has shown that there was no foundation for the fear that was entertained in some quarters that the House bill would be emasculated and weakened at the Senate end of the capitol. Instead of being weakened and having its scope narrowed, it has been broadened and strengthened by the Senate amendments. The Allison amendments having to do with judicial review have not in any way subtracted from the powers conferred upon the Interstate Commerce Commission by providing in explicit terms for the review of its orders. Every power conferred upon the Commission by the House bill remains and the courts are given no more authority to review an order issued by the Commission than Mr. Hepburn and other champions of the House bill have contended was given by implication in the original draft of the bill. It is possible that the Commission may have been given more latitude in the making of rates by the striking out of the words "fairly remunerative," though no definite statement can be made as to this until the courts have passed upon the meaning of the requirement that rates made by the Commission shall be "just and reasonable." If a broad view of this language is taken by the courts a "just and reasonable" rate must be one that will be "fairly remunerative" to the carrier.

Of the many amendments adopted that were not covered by the Allison agreement practically every one is designed to broaden the scope of the bill in some direction. As it passed the House the bill applied to railroad corporations alone except when water carriers and rail carriers were under common control and management. Senate amendments bring within its scope all pipe lines crossing state lines, except those used for carrying water or gas, all sleeping car companies, and express companies. The sleeping car amendment, taken in connection with the amendment requiring the giving of "equally good service and accommodations to all persons paying the same compensation for interstate transportation of passengers," may give rise to controversies involving the separate coach laws of the southern states, and, if they are held by the courts to require the giving of equal accommodations to white and colored passengers on interstate trains the result may be disastrous to the political future of some of the Senators from that section of the country.

The amendment designed to prevent railroad companies from engaging in the business of mining and selling coal or producing other articles of commerce is looked upon by many Senators as one of the most important of the amendments that have been adopted. There is considerable doubt among lawyers as to the constitutionality of this provision, so far as it may apply to railroad companies expressly authorized by their charters to engage in the mining of coal or in any other business, but if it is held to be unconstitutional the other parts of the law will not be affected. If it had been adopted as originally presented by Senator Elkins its effect would have been to bring about great confusion in the coal business, as it would have gone into effect at once, but, at the suggestion of Senator Dryden it was modified so as not to become operative until May 1, 1908, thus giving nearly two years for the railroads to dispose of their coal properties.

While the Hepburn bill does not undertake to change the provisions of the Elkins act, so far as they relate to the method of procedure for putting a stop to rebates and punishing the receiver as well as the giver, amendments adopted by the Senate propose to increase the severity of the penalties very much. Under these amendments, in addition to the penalties of the Elkins act, any official or employee of a railroad granting a rebate, concession or discrimination is liable to imprisonment for not more than two years, and the beneficiary of a rebate or other favor is liable to a fine of three times the value of the rebate or favor received.

The Allison amendment has been strictly adhered to by the Republican Senators, with the exception of Senator La Follette, who has not co-operated with any group of Senators on the railroad question. Every amendment embraced in that agreement has been carried through just as agreed upon, and the agreement to allow the words "in its judgment" to remain in the bill has been adhered to up to this time, though many Senators are of the opinion that they endanger the constitutionality of the entire rate-making provision. Senator Dolliver still insists upon the retention of these words, and he may be able to keep them in the bill by insisting that all those Republicans who were parties to the Allison agreement are bound to resist striking them out. There are Democratic Senators, however, who believe that the retention of these words in the bill will insure its being held to be unconstitutional, and a motion to strike out will probably be made by a Democratic Senator. Such a motion will embarrass those Republicans who believe that the elimination of these words is necessary to make the bill constitutional, and it may be that enough of them will vote for the motion to put it through.

The defeat of the Foraker amendment proposing to provide an alternative method of procedure by permitting proceedings to be commenced in the United States circuit courts in the first instance was a disappointment to those who believe that the rate-making feature of the Hepburn bill is fundamentally unconstitutional, and who hoped that this amendment would be adopted so as to insure effective legislation remaining on the statute books even if the courts should hold the grant of authority to the Commission to make rates to be unconstitutional. The defeat of this proposition was assured when it was not included in the Allison agreement, and it was impossible to secure its incorporation in that agreement because there are several Republican Senators who could not have been brought to support the agreement if it had embraced the Foraker proposition. Its introduction by Senator Foraker and his speeches on it may have good results, however, for if the Hepburn bill is held to be unconstitutional they will stand in the Congressional Record as indications of the line along which an effective and constitutional law can be framed.

Senator Lodge's proposition to increase the membership of the Interstate Commerce Commission to nine, and to fix the salaries at $12,000, with $12,500 for the chairman, aroused unexpected opposition to any increase in the commission or in salaries, and the Senate not only refused to adopt this but struck out section eight of the House bill which proposed an increase to seven members and an increase in salaries to $10,000. Unless this action is reconsidered the bill, as it goes to conference, will leave the membership and compensation of the Commission just as at present.

J. C. W.

The French Minister of Public Works has recently called the attention of the railroads of the country to the desirability of equipping passenger locomotives with speed recorders. The companies have been directed to draw up a program for such an installation so that all engines in service may be equipped by Dec. 31, 1908.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

Economies in Heavy Transportation..... 513
Railroad Building Without Bonds..... 513
Reduced Detention of Cars on New Haven Road..... 513
Self-Incriminatory Testimony..... 514
The Persistency of Railroad Values..... 515
April Accidents..... 515
Proposed Investigation of Block Signals. 516
Supreme Court on Hay Rate Decision... 516
Telephone Monopoly or Competition?.... 516
The Erie Suburban Vote..... 516
New Trains for Summer Business..... 516
Pittsburg & Lake Erie..... 517
Bessemer & Lake Erie..... 517
General Electric Co..... 518
New Publications..... 519

ILLUSTRATED:

New Wabash River Bridge for the Lake Erie & Western..... 520
The Pennsylvania Railroad's Extension to New York and Long Island..... 522
Destruction of Creosoted Piles..... 531

CONTRIBUTIONS:

The Clover Creek Junction Collision. ... 519

MISCELLANEOUS:

President Cassatt and Rebates..... 519
Comparative Locomotive Efficiency..... 520
What Stops a Moving Train?..... 521
Demurrage Managers' Annual Meeting... 527
Railroad Officers' Stock in Coal Companies 527
Reply of the Standard Oil Co..... 528
Train Accidents in the U. S. in April.. 530
Washington Correspondence..... 531
Instruction of German Employees..... 532
Lumber Cut of the U. S. in 1905..... 532
W. C. Brown on the R. R. Y. M. C. A... 533
The Railroad Rate Bill..... 533

GENERAL NEWS SECTION:

Notes..... 151
Trade Catalogues..... 151
Obituary..... 152
Meetings and Announcements..... 152
Elections and Appointments..... 152
Locomotive Building..... 153
Car Building..... 153
Bridge Building..... 154
Railroad Construction..... 155
Railroad Corporation News..... 156

VOL. XL., No. 21. FRIDAY, MAY 25, 1906.

The results of last year's operation on two coal and ore carrying roads, the Pittsburg & Lake Erie and the Bessemer & Lake Erie, reviewed in this issue of the *Railroad Gazette*, are in certain respects little short of marvelous. When two railroads are able to show average revenue train-load figures, one of 937, the other of 1,076 tons, it is remarkable enough; but when we learn that the average tonnage southbound on one of them is 1,406 tons per train, there is a chance to realize the immense economies of modern methods of handling heavy tonnage. The Bessemer & Lake Erie, which shows this exceptional figure, is largely an ore-carrying road, ore furnishing nearly six of the nine and a half million total tonnage. As part of the machinery developed by the United States Steel Corporation for transferring Lake Superior iron ores to the Pennsylvania mills, the road shares in the tremendous economies which have been brought about by modern methods of handling and transportation. On the Pittsburg & Lake Erie, on the other hand, coal and coke furnish over fourteen of the nearly twenty-five million tons, ores amounting to not quite three million and a half tons. A large tonnage of manufactured iron and steel products in addition helps to make the road nearly twice as heavy an earner on a mileage basis as the Philadelphia & Reading which, has the next largest gross earnings per mile of any American railroad. The fact that the Vanderbilt road is operated at 43.4 per cent. of gross for expenses and the Steel Corporation's line at 48.99 per cent., goes to show how profitable railroad operation can be when sufficient traffic is available.

The fact that President James J. Hill, in his new railroad project in Canada, proposes to build some 1,300 miles of trackage on "cash" stock, which can hardly amount, counting cost of equipment, to less than $30,000,000, is both a present-day novelty in railroad finance, and has a historical suggestiveness, past and future. Looking back to the dawn and first lights of railroading, one finds the original lines built generally on paid-in stock, the railroad corporations naturally following the analogy of ordinary chartered industrial enterprise of those early days, of which, perhaps, the turnpike companies were precedents nearest to the railroads. Progressively the "bond idea" has since been overtopping the "stock idea" in new railroad construction; but the stock idea is far from extinct. Probably if we were to interview the leading railroad presidents of the country, we should find a good many of them not only extolling the stock theory for railroad extension, but also for railroad conversion; that is, substituting stock for present bond issues. Their reasoning is based on the idea of a flexible dividend adjusting itself to net earnings, and to times good or bad, as contrasted with the binding and imperative fixed charge. That an uncertain dividend as compared with a more definite underlying charge on earnings would really create a pleasanter financial situation for railroad managers is, however, open to considerable doubt, especially when the temper and moods of shareholders are reckoned in as also the fact that the accepted and looked-for dividend rate is apt to be considerably in excess of the interest rate. On the other hand, what is not doubtful, is that the "all-stock" theory is sounder as a financial system—simpler, more straightforward and lending itself much less easily to tricks of inflation and high finance. Will that theorem gain force and the original and simpler method of railroad financing repeat itself? Certainly present tendencies and the enormous emissions of railroad securities senior to shares and stock capital do not look that way. Nor do the long periods for which so many issues of bonds run. But, on the affirmative side, may be set the recent large issues of convertible securities and the puzzling complexities which issues of securities outside of stock are reaching, to the confusion of even fairly experienced investors. If railroad sinking funds, to extinguish time debt, become more common, we shall see a more distinct approach to the "all-stock" proposition. We do not need, therefore, President Hill's fiscal example to prove that the stock question is not entirely an academic one, and that a future not so very far away may reinforce in new railroading his Canadian plans. If it could only have been applied in time to the street railways, what a Niagara of capitalization would have been averted!

For the nine months ending March 31 last the New York, New Haven & Hartford used foreign freight cars so much less than in the same months of the previous fiscal year that its adverse balance decreased from $1,246,098 to $493,976, or about 60 per cent. In March the decrease was 70 per cent. This is a remarkable showing. With the four days free limitation imposed by Connecticut law

and with the fixed bad conditions existing in the cotton traffic, the New Haven road had a peculiarly hard situation, and the sharp cry put up by the officers of the road when the per diem exchange rule was forced on them found sympathetic ears throughout the railroad world. Nobody claimed that the alarm was based on imaginary things. But it is evident that the New Haven people can smite as well as cry. The wonder is that the consignees have not risen in their wrath. It must be that thousands of them have been made to reform their dilatory unloading practices, yet we do not recollect hearing a word of complaint from any one of them. More remarkable yet, we have not heard of a single New Haven freight solicitor complaining that the harshness of the operating department prevents him from getting business. There cannot be much need of softening the penalty rule for the New Haven road, for the 30-day limit will evidently give it, for the most of its foreign cars, about 20 or 25 days more than it needs. Superintendents of other roads, who have become weary in the car-detention fight will do well to sit up and take notice how things are done in Connecticut.

SELF-INCRIMINATORY TESTIMONY.

Before the ratification of the Constitution of the United States could be secured it was necessary to add to it no less than ten amendments which together constitute, in effect, a Federal bill of rights. Among these the fifth contains the familiar prohibition that follows:

"No person . . . shall be compelled in any criminal case to be a witness against himself. . . ."

Judge Cooley in his "Principles of Constitutional Law," says of the first ten amendments that they:

"took from the Union no power it ought ever to have exercised. . . ."

And, in another place in the same book, he speaks of the particular prohibition against compulsory self-incrimination, as follows:

"This was a Common Law principle, and it has been incorporated in the Constitution to prevent the possibility of a recurrence to the inquisitorial proceedings which in arbitrary periods were sometimes had, and which are now admitted in some countries under systems of jurisprudence differing from our own."

In 1868 Congress sought to avoid some of the restrictions attending the prosecution of persons accused of criminal violations of Federal statutes by limiting the effect of the quoted portion of the fifth amendment. To this end a law was enacted (R. S. 860) providing that:

". . . no evidence obtained from a party or witness by means of a judicial proceeding in this or any foreign country, shall be given in evidence, or in any manner used against him or his property or estate, in any court of the United States, in any criminal proceeding, or for the enforcement of any penalty or forfeiture."

The theory of the foregoing was that the privilege of refusing to give self-incriminatory evidence was solely to protect the individual against the use of his testimony against himself in a criminal trial, and that if it could not be so used the privilege could not be set up as an excuse for refusal to respond to relevant inquiries. This notion received further sanction by the enactment of a similar provision as a part of the Interstate Commerce law. Section 12 of the Act of 1887 contained the following sentence:

"The claim that any such testimony or evidence may tend to criminate the person giving such evidence shall not excuse such witness from testifying, but such evidence or testimony shall not be used against such person on the trial of any criminal proceeding."

The foregoing was in such force as its enactment by Congress could constitutionally give it when, on Nov. 21, 1890, Charles Counselman, of Chicago, was before a Federal grand jury, in that city, which was investigating certain alleged violations of the Interstate Commerce law. Mr. Counselman refused to respond to certain inquiries on the ground that his answers might tend to criminate him. Persisting in this refusal the witness was fined $500 and remanded to the custody of the United States marshal until he should answer the questions. A writ of habeas corpus in his behalf was discharged by the Circuit Court and he appealed to the Supreme Court of the United States. The latter court unanimously sustained (see Counselman vs. Hitchcock, 142 U. S. 547) the right of the witness to refuse to testify and directed his discharge from custody. The following is from the opinion, written by Justice Blatchford:

"This of course protected him against the use of his testimony against him or his property in any prosecution against him or his property, in any criminal proceeding in a court of the United States. But it had only that effect. It could not, and would not, prevent the use of his testimony to search out other testimony to be used in evidence against him or his property, in a criminal proceeding in such court. It could not prevent the obtaining and the use of witnesses and evidence which should be attributable directly to the testimony he might give under compulsion, and on which he might be convicted, when otherwise, and if he had refused to answer, he could not possibly have been convicted. The Constitutional provision distinctly declares that a person shall not 'be compelled in any criminal case to be a witness against himself;' and the protection of Section 860 is not coextensive with the Constitutional provision. Legislation cannot detract from the privilege afforded by the Constitution."

This failure did not lead to an abandonment of the attempt to avoid the consequences of the constitutional prohibition adopted by the fathers of the nation. Indeed, the decision merely led to a further step in that direction. It was rendered on Jan. 11, 1892, and on Feb. 11, 1893, a new statute went into effect. This statute, so far as it is material to the present discussion, is as follows:

"No person shall be excused from attending and testifying or from producing books, papers, tariffs, agreements, and documents before the Interstate Commerce Commission, or in obedience to the subpœna of the Commission, whether such subpœna be signed or issued by one or more Commissioners, or on any cause or proceeding, criminal or otherwise, based upon or growing out of any alleged violation of the Act of Congress, entitled, 'An Act to Regulate Commerce,' approved February fourth, eighteen hundred and eighty seven, or any amendment thereof, on the ground or for the reason that the testimony or evidence, documentary, or otherwise, required of him, may tend to criminate him or subject him to a penalty or forfeiture. But no person shall be prosecuted or subjected to any penalty or forfeiture for or on account of any transaction, matter or thing, concerning which he may testify, or produce evidence, documentary or otherwise, before said Commission, or in obedience to its subpœna or the subpœna of either of them, or in any such case or proceeding."

Subsequently, when the Department of Commerce and Labor was created and the Commissioner of Corporations of the new department invested with powers and duties of investigation concerning other classes of interstate commerce corporations similar to those over railroads possessed by the Interstate Commerce Commission, a substantially similar provision as to this sort of testimony was placed in the new law. Although the validity of these laws has been sharply contested and one of the most learned and distinguished of American jurists held the first one to be unconstitutional the other view has prevailed, and to-day they are unquestionably a part of the law of the land. An extract from the opinion of the Supreme Court, upholding the law, in Brown vs. Walker (opinion rendered by Justice Brown, Justices Shiras and Field dissenting) follows:

"A person who commits a criminal act is bound to contemplate the consequences of exposure to his good name and reputation and ought not to call upon the courts to protect that which he has himself esteemed to be of such little value. . . . If he secure legal immunity from prosecution, the possible impairment of his good name is a penalty which it is reasonable he should be compelled to pay for the common good. If it be once conceded that the fact that his testimony may tend to bring the witness into disrepute, though not to incriminate him, does not entitle him to the privilege of silence, it necessarily follows that if it also tends to incriminate, but at the same time operates as a pardon for the offense, the fact that the disgrace remains, no more entitles him to immunity in this case than in the other. . . . while the Constitutional provision in question is justly regarded as one of the most valuable prerogatives of the citizen, its object is fully accomplished by the statutory immunity, and we are therefore of opinion that the witness was compellable to answer."

Since the foregoing decision was rendered it has been reasonable to suppose that the law was in a shape wholly satisfactory to those reformers who freely confess their ability to improve upon the Federal Constitution. At any rate, no complaint has been heard from them until very recently. But lately it has been discovered, as reasonable men might have suspected at the outset, that if an alleged violation of law is thoroughly investigated and all those who know anything summoned to testify concerning it, there will really be no one left who can be prosecuted or punished for the violation. Thus when the Department of Commerce and Labor preceded the Department of Justice in an inquiry, in Chicago, into the doings of the beef packers, and a criminal trial followed, it was found that the first named department had, in the eyes of the law, given an extensive series of "immunity baths," including every natural person whom the law could otherwise have held responsible. President Roosevelt, with accustomed vigor of expression, regards this as a "miscarriage of justice," and clearly thinks it remarkable that the immunity should be held to extend to any one not actually compelled to give testimony; i.e., subpoenæd and put upon oath or affirmation. But there is plainly common sense in Judge Humphrey's conclusion that such an interpretation would extend the especial favor of the law to those who most strongly resist the efforts of the government to acquire information. Even the layman appreciates the fact that if witnesses generally availed themselves of the opportunities to harass and annoy the investigating officers by recourse to strictly legal rights there could be little progress in any inquiry. The consequences of a law which would impel every one asked for information to demand that a

subpœna be issued are quite evident. Nevertheless the administration is urging that what the President deems the correct interpretation of the law shall be fixed by what he is pleased to regard as a declaratory statute. In other words, he would have it provided by law that immunity shall extend only to those witnesses who are regularly subpœnaed and give testimony under oath. Bills to that effect are now pending both in the Senate and House of Representatives. They may pass, but perhaps it would be wiser to go back to the plain rule of the Constitution. There is the ring of genuine truth in what Judge Grosscup said of this constitutional privilege in deciding the case of the United States vs. James. We quote a sentence or two:

"Happily, the day when this immunity is needed seems to be over. It is difficult for us, who live in a time when there are few, if any definitions of crime that do not meet with the approval of general intelligence and conscience, to appreciate these conceptions of our fathers. The battle for personal liberty seems to have been attained, but, in the absence of the din and clash, we cannot comprehend the meaning of all the safeguards employed. When we see the shield held before the briber, the liquor seller, the usury taker, the duelist, and other violators of accepted law, we are moved to break or cast it aside, unmindful of the splendid purpose that first threw it forward. But, whatever its disadvantages now, it is a fixed privilege, until taken down by the same power that extended it. It is not certain, either, that it may not yet serve some useful purpose. The oppression of crowns and principalities is unquestionably over, but the more frightful oppression of selfish, ruthless, and merciless majorities may yet constitute one of the chapters of future history."

THE PERSISTENCY OF RAILROAD VALUES.

It is a fact, unfortunate but inflexible, that at present we have no crucial or even approximate measure of the real value of American railroads as investments, taken in their entirety. It is true that we have returns, accurate enough for general purposes, which show total capital, bonded debt, floating liabilities, and, along with these, statistics of traffic; and, on the other side of the account, cost of construction, equipment and cognate entries. But the basis of return for capitalization and debt is always the par value. It takes no account of variation in actual value from year to year or from decade to decade. The high value of Delaware, Lackawanna & Western stock, now selling around $546 on the par of $100, goes in equated with the shares of a pauper line. Nor can any real estimate be made. It is true that some States through their tax boards make up, for certain dates, appraisals of stocks of the railroad lines of the State—including the State proportion of interstate lines. But the dates vary, the appraisal is usually below real market prices, and generally no consideration is given to market values of bonds, whether above or below par. So that even in the few States referred to, no precise values of railroad property are reached, and, if they were reached, they would afford no criterion for the whole country. But certain general facts relating to what we may call the persistency of railroad values are steadily becoming conspicuous, and just now, when the railroads are targets of State and Federal legislation, have fresh import.

First, for an example, may be noted for all the roads of the country an increase of the dividend rate in the last 14 years from 1.93 per cent. to what is now probably almost 3.50 per cent., while during the same time the interest rate on bonded debt has fallen from 4.25 per cent. to somewhat less than 4 per cent. The first measures profit, the second the growth of railroad credit; and the two together are infallible tests not merely of existing prosperity—a somewhat relative term often of transient significance—but of firm and solid advance that interprets itself in values. As to those values themselves, by the credential of market price we do not need to cite them for a period of years in long columns of figures. Let anyone take the stock list and schedule the non-guaranteed railroad shares of properties east and west selling near a 4 per cent. investment basis or below. If it be answered that some of those values are affected by prospective stock distributions that raise the investment return, does not that very fact emphasize confidence on the part of capital in future railroad values? Just now there happens to be a plethora of new issues of railroad bonds, somewhat depressing the price by the inexorable law of supply and demand. Hence a new tendency, along with other devices, toward the convertible bond idea. The convertible bond is necessarily a bit speculative. But, quite apart from that lure for the holder, does not the extensive issue show as a sentiment not merely of Wall Street, but of the investing public, a belief in the future of the American railroad?

That belief enlarges when one looks back on the obstacles to value which the American railroad has had to overcome. We need not hark far away to such historical episodes as the granger movement of the early seventies, or the panic and crisis of 1873 and the "long drag" of five years following it, but confine ourselves to the last decade and to novel factors not connected with stress in the money market. There has been in the foreground the rise of the electric railway—which, particularly in the East and Middle West, for several years in considerable areas of business cut local steam railroad passenger traffic down to the roots. In the case of the New Haven system, for a sample, it for a long time checked absolutely the growth of steam passenger traffic. Another comparatively recent and still increasing influence not yet fully realized outside of railroad circles has been, and is, what may be termed the new urban terminal necessity. The expanded fixed charge due to new terminals, freight and passenger, in our great cities, without any important coefficient of resulting increase of business for many years to come, stands very high in the railroad liability scale. If we could compute it, interesting also would be the power of the long-distance telephone as an absorbent of passenger traffic. To these we must add hostile and restrictive legislation, never more marked than during the last few months; and, finally, those tricks of high finance which have played fast and loose with the capitalization of great railroad systems, and the competitive demand for new capital by the great group of industrial corporations, not to mention the street railways.

What have been the leading and efficient causes why such obstacles to railroad value have been overcome are obvious enough. Consolidation, economy of operation relative to volume of traffic, better mechanical work on the line and office efficiency, and, pervading all, a remarkable stimulus of national prosperity and production, are things that need only to be named. It is less a marvel, perhaps, that with such forces at work the railroads should have surmounted drawbacks than that they should have distanced them so completely and gone far ahead on the road of rising values. Of ulterior influences, however, making for solid railroad values is one of a psychological rather than visible character, but not less potent because it is obscure. We all know how, in certain large regions covered by strong railroad systems like those of the New Haven, the Pennsylvania and the New York Central in the East and the St. Paul, the North-Western and old Burlington & Quincy in the West, the name of the local system has been a synonym for fiscal strength and confidence. The corporate title attached to any extension or any security has been enough to carry financial persuasion alike to banker, broker, the large and small investor and even to the familiar "widow and orphan" with funds to place. Now, a striking feature of the last decade has been the extension of this localized confidence of the investing public in a particular system to a much more general confidence of the same sort to the American railroad system as a whole. In an unconscious but very real fashion the public, seeing the railroads weathering one adverse influence after another, has come to realize the fundamental nature of transportation as a business and the institutional character of the railroad. We have had steam railroads in this country for some seven full decades. But in no period have we seen the sentimental factor of value so developing and so strong as during the last ten years, and especially so during the last five.

The appraisal of this sentiment as a railroad asset must be very high, and not less exalted because it cannot be expressed in exact terms. Will the future of the railroads dissipate or confirm it? That depends, we think, less upon the strain of events during hard times and "long drags" yet to come, and certain to come, than on the policies of railroad managers and the "great" capitalists during periods of prosperity. If, on the one hand, we are to have high finance, flashy speculation on a vast scale, bonding of old stocks and bonusing of new stocks "for purposes of control," we shall have one sequel and a sinister one. If, on the other hand, the general railroad policy is preservative and conservative, at once far-sighted and economical in physical and fiscal administration, obedient to good law and resisting bad law, not by subtle evasion but by open contest in the courts, we shall have quite another sequel. The outcome, we repeat, depends not so much on general events as on railroad policies, and the corporations themselves will have to answer the long time question whether railroad values so persistent and so triumphant through obstructions during the last decade, are to reach far, forcefully and beneficently into the years ahead.

April Train Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of April printed in another column, contains account of 18 collisions, 21 derailments and five other accidents. Those which were most serious, or which

are of special interest by reason of their causes or attending circumstances, occurred as follows:

April	Place.	Killed.	Injured.
17th	Richmond, Ky.	3	2
27th	Chadron, Neb.	0	5
29th	Reid, Mont.	2	3
30th	Forks Creek, Colo.	0	21

April maintains its reputation as the lightest month in the year in the accident record, and we find in the present list no accident in which a passenger was fatally injured. The length of the foregoing list of prominent accidents is exactly the same as that of the similar list printed one year ago. Two years ago there were only three in the list, though there were six passengers killed. Three years ago there were only three accidents in the list, but there were four passengers killed. The accidents in to-day's list are notable more for their peculiarities than for their magnitude. The accident at Wister Junction, Ind. T., on the 3d, when three passenger cars were ditched and one overturned, seems notable on account of the small number of passengers injured (10); and all of the injuries are reported as slight. Likewise in the accident at St. Michael, Neb., on the 5th, where seven well-filled passenger cars were derailed, only four passengers were reported injured. The rear collision at New Florence, Pa., on the 17th, also belongs, apparently, in this class of lucky accidents. Two other accidents, those at Swanton, Md., and Statesville, N. C., may perhaps be included among the notable cases, although we have no particulars beyond those we print.

The number of electric car accidents reported in the newspapers in the United States in the month of April was 16; in which two persons were killed and 82 injured.

So far as can be judged on the surface, it is quite evident that few members of Congress take any intelligent or active interest in the question of preventing collisions; of lessening the great loss of life by train accidents on the railroads of the United States. This being so, the joint resolution introduced by Representative Mann, of Illinois, directing the Interstate Commerce Commission to investigate the question of block signals, is to be commended. Whether it is or is not desirable to enact compulsory legislation on this subject, there is no question that the matter ought to be aired. More than two years ago the Interstate Commerce Commission reported that the great loss of life in collisions was preventable by the use of the block system, and the opinion was made definite by a draft of a proposed law. A year later Mr. Esch, of Wisconsin, introduced his bill, embodying the recommendations of the Commission, and proposing to require the use of the block system on all roads in from two to five years. No action was taken by Congress and this year Mr. Esch has introduced his bill again. By reason, apparently, of the rate-bill disturbance block signals still remain buried, and Mr. Mann's resolution evidently aims at arousing interest in another way. The Interstate Commerce Commission has since repeated its warning of two years ago, and with added emphasis, but collisions continue. Reports of the death of five, ten or more persons at a time in a collision continue to blacken the pages of the *Railroad Gazette* every month or two. It will be a good thing to put the facts of the situation on record in formal shape. If the Government is not going to investigate accidents directly it may usefully do so indirectly by gathering and systematizing the reasons why some railroads have adopted the block system and why others have not; why block signals are introduced on lines where passengers have been killed and the time-interval retained on lines where the killing is yet in the future.

The Supreme Court of the United States has affirmed, by a divided court, the decision of the Circuit Court for the Northern District of Ohio in the interstate commerce suit known as the hay rate case. The case grew out of the change of hay from the sixth to the fifth class by the railroads in Central territory, and the Interstate Commerce Commission applied for an injunction forbidding the enforcement of the higher rates. This the Circuit Court refused to grant, and the Supreme Court now sustains that action. Justice Holmes declined because of his interest in one of the roads involved to take part in the decision. There was no written opinion. The decision of the Interstate Commerce Commission in this case (reported in the *Railroad Gazette* Oct. 31, 1902, page 842), was written by Commissioner Clements, and was based on a long and involved statement which might well be expected to divide the Supreme Court, or any other body of nine judicial-minded men. The value of hay at the point of shipment, the total volume of the traffic, the profit to the carrier as compared with that on grain, the interests of the middlemen, the effect of the duty on Canadian hay, the rights of consignees as affected by the long time the sixth class rate had been in effect, and many other things, tangible and intangible, were solemnly discussed and—then the occult decision was issued. The higher rate was held unreasonable. This case would be a good one to use in a moot-court exercise with which to try the Hepburn bill when it becomes law. It would afford a fine opportunity for showing how a judge can exercise his "judgment" in a case and yet not exercise it. Commissioner Clements would be held by any critic to have exercised his judgment (or his guessing faculties), in this case for no critic could deduce from the facts which were marshalled in the opinion anything remotely resembling a rule for making a rate on hay. On the other hand, the honorable commissioner's dictum that such and such rates were just would be thoroughly impregnable without any mention of judgment; and this for the very same reason that sustained the previous conclusion—that no one could find any way to introduce "judgment" or anything else to support a countervailing opinion.

In a debate before the Nineteenth Century Club, President Hadley began by saying he was not willing to discuss the question, "Are Trusts Injurious?" but was willing to speak to the question, "Are Trusts Dangerous?" Old Sledge, he said, is a good game of cards; it is not very dangerous. Poker is a better game; it is quite dangerous; it is better because it is more dangerous. In any city the ideal telephone system must be either a monopoly, or else be conducted under an agreement by the competing companies to permit free communication between subscribers to either. Such an agreement was tried for five years (1877-1882) in the city of New York, and was found to be so costly that, with rates to subscribers higher than now, there was little return on the capital. Throughout Great Britain the Post Office Department operates telephone systems and has permitted competition by a rival, the National Telephone Company, but always with compulsory free interchange. The cost of this has compelled undue economies in operation, has prevented the installation and use of improved exchanges, and the service is so dilatory and exasperating that the Government has now set a date for taking over the private lines, and no competition will hereafter be allowed. Two exchange systems in any one locality compel many users to subscribe to both of them, and afford incomplete service to all who do not do this. It is almost as wasteful as to permit rival street car companies to operate in the same streets.

The Erie Railroad has been taking a letter ballot and finds that only 11 per cent. of its suburban passengers going into New York City use the Twenty-third street ferry. (The number voting was 10,836.) As that ferry has been running many years one may well believe that, as an Erie officer says, lower Manhattan is growing up in the air—not up town. At all events it seems to be trying as hard as it can to stay below Chambers street. The vista of tall buildings from any high window south of the city hall is now absolutely bewildering in its magnitude. Evidently, the same influences that drive people from country to city tend not only to keep them in it after they get there but to drive them with a constant force toward the center of the city; that is to say, in this case, the business center. When the horizontal pressure meets impassable resistance it turns upward, like the gravel which railroads drop into sunken lakes, only to see it rise in the swamps at the sides of the track. How conclusive these Erie figures may be we cannot tell. Undeniably there has been an important movement of business northward, as is shown by the tall buildings on Twenty-third, Forty-second and other streets above Union Square. Possibly the traffic statistics of the West Shore Railroad, which lands its passengers by a short ferry at Forty-second street, would show a growth quite different from that of the Erie. The Erie ferry to Twenty-third street is a long one while its older ferry to Chambers street is a short one. But the most interesting part of the Erie announcement is the fact that an actual vote was taken on a matter affecting public service. We do not know what specific use the Erie officers mean to make of this vote; whether they intend to increase downtown facilities, decrease uptown facilities, or do neither of these things, but they have made their commuting customers put themselves on record as regards the relative importance of the two services. It seems as if this might be a useful precedent in many cases where there are traffic majorities and minorities to be dealt with.

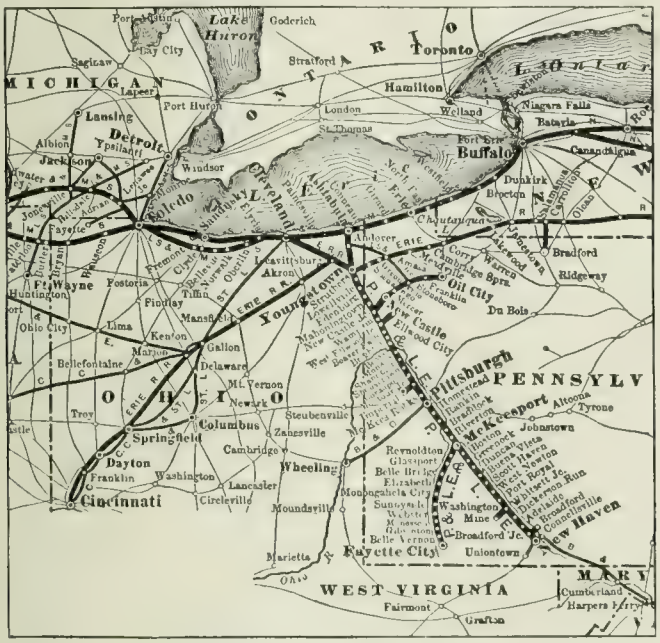
The continued remarkable activity in all kinds of business is leading to important increases in passenger facilities. On the adoption of the summer time-table the New York, New Haven & Hartford is to put on an additional five-hour limited train each way between New York and Boston. The trains will leave each city at 8 a.m. This makes the fourth train between these cities on which the fare, including parlor car seat, is $7 (one dollar more than on ordinary trains). The other five-hour trains start from both ends of the route at 10 a.m. and 1 and 5 p.m. The New York Central is to have a new train between New York and St. Louis and the Big Four is to have an additional fast train between Cleveland and Columbus. The Chicago, Burlington & Quincy is to put on a new through day train from Chicago to St. Paul, starting at 9 a.m., and a new through night train from St. Paul to Chicago, starting at 10.30 p.m. On May 19 the Northern Pacific put on a third through train between St. Paul and Seattle, at the same time

equipping its present "North Coast Limited" with new cars. The Pennsylvania Railroad is to put on a number of additional fast trains between New York and Philadelphia and one between New York and Pittsburg. Some notes concerning the fast trains on the Pennsylvania Railroad and the enormous growth of the company's traffic, may be found in another column. The new Pittsburg trains are to travel all the way at 50 miles an hour or faster, almost as fast as the Chicago 18-hour trains.

Pittsburg & Lake Erie.

The Pittsburg & Lake Erie is an exceptional railroad. With a total of 191 miles operated, of which only 68 miles is listed as main line, it has gross earnings of over $12,800,000, or $67,825 per mile, the highest figure of any important American railroad. The main line runs from Pittsburg northwest to Youngstown, just across the Ohio line, and furnishes the New York Central Lines an entrance into the Pittsburg traffic territory. The road also runs through the great manufacturing district south of Pittsburg, and near McKeesport separates into two branches, one following the windings of the Monongahela and the other of the Youghiogheny river, these lines penetrating a coal and coke territory.

The income account is a remarkable showing. Freight earnings increased from $8,800,000 in 1904 to $11,500,000 in 1905. They furnished most of the increase of $2,800,000, or 28 per cent., in gross earnings. Operating expenses, to offset this great increase in gross, grew by only $207,600, or less than 4 per cent. On this basis the operating ratio was 43.4 per cent. It is, however, given in the report as 77 per cent., owing to the system now adopted as standard in reports of New York Central roads, of including in total expenses, new construction (additional betterments) and new equipment (additions). These two items together amounted to $4,310,707, of which $2,400,000 was for new construction and $1,900,000 for new equipment, principally freight cars. The net earnings given in the report, after deductions of these expenses for additions, were $2,950,000 against $2,314,000 in 1904. The real net earnings, however, show very different figures, amounting to $7,260,000 in 1905 and $4,666,000 in 1904, an increase of over 50 per cent. ($2,614,562) in net earnings after ordinary operating expenses. There was an increase of 21.57 per cent. in net earnings after addition betterments. The net income was $2,142,927, and dividends required $1,000,000, leaving a surplus for the year of $1,142,927, an increase of $670,000 over the previous year. The surplus was in large part credited to profit and loss, making the profit and loss surplus at the end of the year $7,319,552, against $6,180,318 on Dec. 31, 1904.



Pittsburg & Lake Erie.

This is a most unusual showing, and at once suggests the exceptional nature of the Pittsburg & Lake Erie's traffic. For a road with 191 miles operated to appropriate well over $4,000,000 for extraordinary expenditures in one year is most remarkable. It can be due only to a very high traffic density. As a matter of fact, the freight density last year was 8,828,236 tons one mile per mile of road, an exceptional figure. The freight density of the heaviest traffic division of the Pennsylvania is 6,335,638. Freight density increased 1,827,168 tons one mile per mile of road over the previous year, or several times as much as the freight density of many railroads. The total tonnage of 24,900,574 revenue tons (an increase of nearly 5,000,000 tons over 1904) was made up almost entirely of bituminous coal, which furnished 9,500,000 tons; coke, 4,800,000 tons; ores, 3,460,000 tons; stone, sand, etc., iron (pig and bloom), castings and machinery, bar and sheet metal, and other manufactures. Strangely enough, as compared with the experiences of most other roads, last year miscellaneous commodities decreased from 984,642 tons in 1904 to 657,105 tons in 1905, a loss of one-third in presumably high-class traffic. It is necessary to take the heavy tonnage figures and the short main line into consideration to make reasonable the size of the train load, which amounted to 1,076 tons of revenue freight and 1,107 tons of all freight; the former an increase of 64 and the latter an increase of 68 tons over the preceding year's loading. The average number of tons per loaded car was 30 and the average freight train carried 61 cars.

Freight earnings were $60,707 per mile of road, an increase of $14,357; and passenger earnings, $7,118 per mile. The 68 miles of main track, Pittsburg to Youngstown, includes a like amount of second track, 24 miles of third track, 16 miles of fourth track and 194 miles of sidings, a total of 370 miles of track on 68 miles of line. Extension of the third and fourth tracks is steadily under way. Naturally, maintenance of way expenses are exceptionally heavy, being $7,000 per mile of road, or nearly $20,000 per mile of main line. Repairs and renewals cost $2,072 per locomotive in 1905, against $2,005 in 1904; per passenger car $537, against $449 in 1904, and per freight car $52, against $53 in 1904. Although the freight car maintenance figure is not high, the fact that 1,000 steel gondolas, two 150,000-lb. capacity flat cars, and four caboose cars were acquired during the year, less 76 cars destroyed or sold, increasing the freight equipment 930 numbers, shows that equipment was by no means neglected. For delivery during the present year five passenger, five freight and three switching locomotives, 14 passenger cars, 250 low side gondolas, 1,000 steel gondolas, 1,000 steel coke cars and 1,000 box cars have been ordered. As a heavy traffic road it may be interesting to compare results of operation on the Pittsburg & Lake Erie with those on the Bessemer & Lake Erie, which are reviewed below.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	191	191
Freight earnings	$11,576,738	$8,838,911
Passenger earnings	1,137,817	1,063,964
Gross earnings	12,837,736	10,035,510
Maint. way and structures	1,333,963	1,385,495
Maint. of equipment	1,276,144	1,221,741
Conducting transportation	2,777,735	2,585,059
Operating expenses	5,576,918	5,369,253
Net earnings	7,260,818	4,666,256
Addition betterments	4,310,707	2,352,389
Net income	2,142,947	1,472,890
Surplus	1,142,927	472,890

Bessemer & Lake Erie.

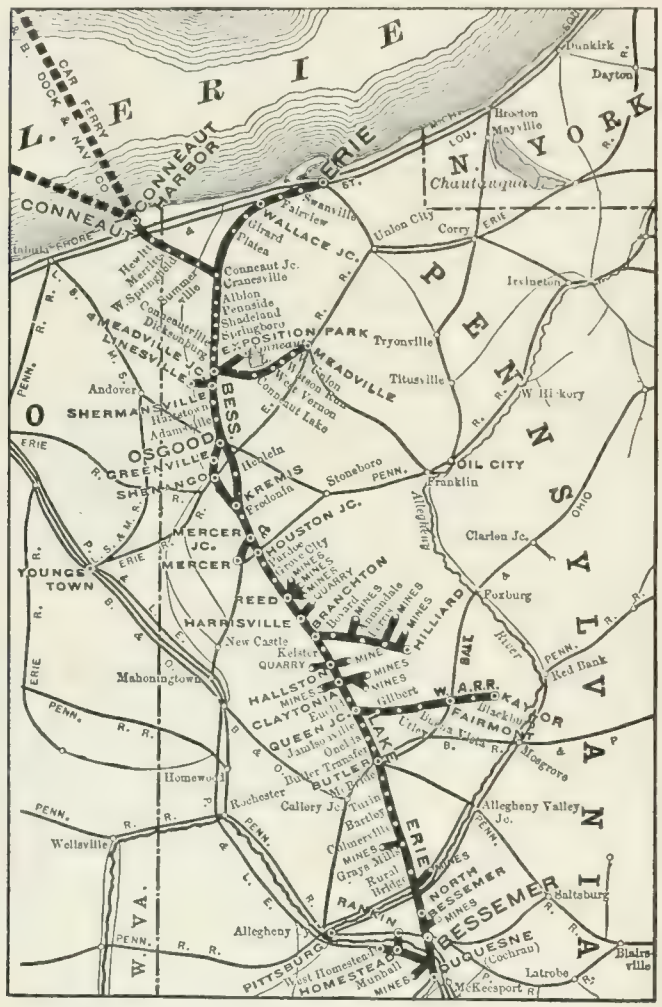
This road, the property of the United States Steel Corporation, is used for carrying ore from the corporation's lake port of Conneaut, Ohio, south to its various mills in the region around Bessemer and Homestead, Pa. The main line from Conneaut to Bessemer is 152 miles long. The average mileage operated, not including the Western Allegheny Railroad, shown on the map, nor seven miles of line leased to the Union Railroad of the United States Steel Corporation, is 212 miles. Like the Pittsburg & Lake Erie, reviewed in this issue of the *Railroad Gazette*, the road's traffic is exceptional. The number of tons of revenue freight carried one mile in 1905 was 1,172,794,522. This was an increase of 284,556,179 ton miles, or 32 per cent. over the previous year. The freight density was 5,748,147 tons one mile per mile of road, an increase of 1,394,678 over the preceding year, an increase, like that of the Pittsburg & Lake Erie's, far larger than the total freight density of many railroads. But the most striking figures covering the road's operation are those of train loading. The average revenue train load last year was 937 tons, a decrease of 16 tons from 1904. This is not as high as the Pittsburg & Lake Erie average figure, but further figures are given of the average train load north and south bound. The north bound loading in 1905 was 470 tons, an increase of 24 tons over 1904, while the average train load south, although it showed a decrease of 31 tons from the previous year, reached the remarkable figure of 1,406 tons.

For a 212 mile road, only 50 miles of which is double track, these are wonderful figures. The General Manager speaks of the fact that for a single track line with a tonnage of nearly 10,000,000 tons the limit of economical operation is about reached, as the number of trains required overtax the capacity of the single line. Last year 18 miles of double track was laid, and by the end of the present year 19 miles more is to be finished, so that by that time nearly half of the main line will be double tracked. It is the hope of the management to have the double tracking of the whole main line finished within the next two years succeeding.

Freight earnings increased from $3,877,000 in 1904 to $4,998,000 in 1905, a gain of 29 per cent. Smaller increases in the other sources of earnings brought up the increase in gross to $1,430,546. With the much larger amount of traffic carried (2,298,000 revenue tons) it is

interesting to observe that with a gain of 26 per cent. in gross earnings, net earnings increased 29 per cent. The operating ratio decreased from 50.44 per cent. in 1904 to 48.99 per cent. in 1905, figures which show how economically a road can be operated when such large quantities of traffic are available. Freight earnings were $24,500 and passenger earnings $1,424 per mile of road, a total of $25,924 per mile of road.

Expenses for maintenance of way and structures increased $118,000; for maintenance of equipment, $154,000, and for conducting transportation $221,000. The total increase in operating expenses was $504,484. Per mile of road, maintenance of way shows its increase more clearly, the unit figure rising from $2,205 per mile in 1904 to $2,760 in 1905. Per unit of equipment, repairs and renewals cost $2,006 per locomotive, against $1,937 in 1904; $600 per passenger car, against $526 in 1904, and $42 per freight car, against $34 in 1904. Twelve new locomotives were put in service last year. The 1,678 wooden gondolas owned are, according to the General Manager, beginning to show signs of depreciation and are becoming unfitted for ore traffic. Although they will for some time be available for coal and miscellaneous freight, an equivalent tonnage in steel cars



Bessemer & Lake Erie.

will shortly have to be provided for the ore tonnage. During the year 30 wooden gondolas were converted into flat cars.

The passenger earnings were $263,436, or $1,424 per mile of road. The average distance traveled was 24 miles; the average amount received from each passenger, 42 cents, and the average passenger mile rate, 1.74 cents. This last is a decrease of 0.10 cents from the 1904 figure. The average number of passengers per train mile shows a large increase, from 34 in 1904 to 42 last year. The passenger, mail, and express earnings per train mile were 80 cents against 70 cents in 1904, an increase of 10 cents, or 14 per cent.

Considering freight traffic statistics more in detail, the number of tons carried, including company freight, was 9,749,841, an increase of 2,389,591 over 1904. The total ton mileage was 1,187,797,528, an increase of 290,924,967 tons over 1904. This is a 32 per cent. increase. Two-thirds of the tonnage was southbound. Of the total revenue tonnage of 9,505,439 tons, ore furnished 5,820,268 tons, and other freight 3,685,171 tons. The average number of tons of revenue freight per freight engine mile (including assistant engines) was 637 tons, against 604 tons in the previous year, showing that, although there was a decrease in the average train load, fuller service was obtained from the locomotive equipment. The Bessemer & Lake Erie is handicapped at certain points by grades which require helper service, so that its operation is not as economical as might be possible. On the other hand, the heaviest types of locomotives and the largest capacity cars in general use are in service.

Figures are given for the cost of repairs of wooden and steel cars separately. The average cost for the wooden cars was $71.14 against $58.31 in 1904, the increase no doubt due to the increasing age of the wooden equipment. Per steel car, repairs cost $27.83 against $23.52 in 1904. Unfortunately, these figures do not establish any uniform basis of comparison on account of the different age of the cars. There were 116 wooden cars rebuilt, at a cost of $37,682, or $325 per car, and two steel cars rebuilt at a cost of $896, or $448 per car.

The report records that during 1905 there were brought from the Homestead Works of the Carnegie Steel Company 25,000 steel ties and fastenings, most of which were placed in track during the year. In the fall of 1904 one-half mile of steel ties was laid and thoroughly tested. These held up satisfactorily under the heavy traffic of 1905. For the present year's requirements 80,000 additional steel ties have been bought; a total of 105,000 on the road, weighing 9,550 tons and sufficient for 42 miles of track.

The principal operating statistics follow:

	1905.	1904.
Mileage worked	212	212
Freight earnings	$4,998,613	$3,877,547
Passenger earnings	263,436	237,742
Gross earnings	5,107,601	4,277,146
Maint. of way and struc.	585,120	467,371
Maintenance of equipmen	667,731	513,397
Conducting transportation	1,305,561	1,084,088
Operating expenses	2,649,097	2,144,613
Net earnings	2,758,595	2,132,533

No further income figures given.

General Electric Company.

The total profits of the General Electric Company for the year ended Jan. 31, 1906, after a deduction of all patent, general and miscellaneous expenses, allowances for depreciation and losses, and $1,800,000 from factory plants and machinery account, were $7,300,000, against $6,700,000 in the previous year. They included $173,000 received from securities sold and $798,000 received from royalties, dividends, etc. Dividends amounting to $3,800,000 were paid, leaving the year's net profit $3,458,000. From this was deducted $1,000,000, 50 per cent. of the patent account written off, leaving the year's surplus at $2,458,000, which, added to the surplus at the end of the preceding fiscal year, gives the company a total profit and loss credit of a little over $12,000,000. The $1,000,000 written off patent account corresponds with $594,000 written off in 1904.

With a great manufacturing company like the General Electric allowances such as these for accounts written off and depreciation are of the utmost importance in determining its real financial position. That the General Electric Company has been conservative in this respect can be shown from the record of the balance sheet account "factory plants" for the past 13 years. On Jan. 1, 1893, the book value of the Schenectady, Lynn and Harrison plants was $2,950,000. During the 13 years since that date, besides all ordinary maintenance expenditures, additions have been made at a cost of $19,400,000, making the total book cost of the plants $23,370,000. During the same period there has been written off for depreciation $15,370,000, leaving the book value of the plants at the close of the last fiscal year $8,000,000. The practical effect of this process can even better be shown by the figures for the last two years. The total additions of lands, buildings, machinery, etc., during 1905 added $2,338,000 to the book value of the plants. At the same time, allowances for depreciation were written off which made the increase in the book value at the close of the fiscal year only $500,000. Of this, $300,000 is in the Schenectady plant and $200,000 in the Lynn plant. The size of the company's business for the past year as well as the more than $2,000,000 added to value of plants make it clear that depreciation has been liberally charged off.

The total sales, i.e., the amount billed to customers, were $43,146,000, or about $4,000,000 more than for the previous year, an increase of about 10 per cent. The total orders received amounted to $50,000,000, as against $35,000,000 in 1904, an increase of 14 per cent. Sales in 1895 amounted to $12,700,000. There has been an average increase of 13 per cent. a year for the intervening 10 years. The amounts for both sales and orders are the record figures in the company's history, surpassing in both cases the previous high record made in the year ended Jan. 31, 1904.

A commendable feature of the report is the analysis, item by item, of the various entries on the balance sheet, showing in considerable detail the facts on which these figures are based. This exhibit is lacking, however, in details of the amounts of stocks of security holding and other companies held. For example, the United Electric Securities Company, of Boston; the Electric Securities Corporation, of New York, and the Electric Bond & Share Company, of New York, the last an acquisition during the year which has taken over the Stanley Electric Manufacturing Company, are grouped under one item: "Stocks of security holding companies," $5,991,375.

The General Electric Company's capital stock outstanding has increased during the year from $48,248,000 to $54,287,000, most of the new stock having been issued for cash to stockholders at par. The total stock now authorized is $60,000,000.

Orders are reported for over 300,000 h.p. of heavy traction motors (from 125 h.p. to 200 h.p. capacity) such as are used on the New York elevated and subway, the London underground and the Metropolitan underground of Paris, usually operated in conjunction with the Sprague-General electric train control system. There were on January 31st, 4,026 cars equipped with the Sprague-General Electric control against 2,997 cars so equipped one year earlier. Orders for all railroad motors for the year were about 750,000 h.p. capacity. Several contracts have been taken for single phase alternating current railways similar to the car placed in operation in August, 1905, between Schenectady and Balston, N. Y., the first single-phase alternating current car put in commercial operation in the United States. These include the Pontiac & Joliet Railway, the Toledo & Chicago Interurban Railway, the Milwaukee Electric Railway & Light Company, the Central Illinois Construction Company, the Richmond & Chesapeake Bay Railway, and the Anderson (S. C.) Traction Company.

The first of the 35 New York Central 100-ton locomotives has during the year undergone a mileage test on the experimental track west of Schenectady. The total mileage run to January 31 was 29,568 miles. On April 2d the total was 40,324 miles. Maintenance cost, as reported by the railroad company, has been only about one-fourth of the average maintenance cost of a steam locomotive. Actual running time of the locomotive was 172 days, during which the average daily run was 171 miles. The maximum for a day was 347 miles in 8 hours and 45 minutes.

Successful long distance transmission of electricity has resulted in a great increase in the number of such plants, electrical energy in some cases being transmitted over 100 miles. Even greater distances are now considered practicable. Two interesting examples are the Kern river development, where four 7,000 h.p. General Electric generators are being installed for transmitting electric power 115 miles to Los Angeles, Cal., and that on the Jhelum river in Kashmir, India, where 5,500 h.p. of electric generators are to be used to transmit power about 60 miles for industrial purposes, and eventually for the operation of 156 miles of electric railway. Perhaps the most notable contract taken during the year is for the electrification of the West Jersey & Seashore division of the Pennsylvania between Camden and Atlantic City, 64 miles; the first instance of the electrical equipment of an important steam railroad from terminus to terminus.

NEW PUBLICATIONS.

Railways of the Future. A series of articles appearing in *Scribner's Magazine.*

In the April issue of *Scribner's Magazine* there appears the first article of this series. It deals with the proposed Pan-American Railroad, projected to link up a connection between the existing railroad system of Mexico and the existing railroad systems of South America, so that passengers and freight can be carried through from New York to Rio de Janeiro or Montevideo. In the May number Lieutenant-Colonel Sir Percy Girouard describes the railroads of Africa. In Africa and in South America alike there is a continent to be traversed before a north and south connection can be established, and in Africa and South America alike water competition, to mention only the first and most obvious thing, renders it wholly unlikely that such through rail connection will be established within the memory of the grandsons of any one now living. Such systems must come to pass not from the illusory through traffic, which can be moved so much more quickly and so much cheaper by water, but from the gradual development of points of local traffic, generation after generation, which will eventually come together. But if the reader is firmly convinced that neither one of these "railways of the future" will ever be built, he will nevertheless be repaid by reading the papers, which excellently describe the existing systems, or so-called links, and which are illustrated most entertainingly, especially in the case of the so-called Pan American project, where the author has shown some of the bewildering scenery of the Peruvian Andes.

Questions and Answers. By G. E. Collingwood. 110 pages. Toledo: The Train Despatchers' Bulletin. Price, $1.00.

This book is now issued in its fourth edition. It is a catechism, with questions numbered up to 622, on the standard code of train rules. It has the well understood defect of not fitting the practice of any particular road, but that is inevitable, for there is no way to manage the difficulty, unless one is to go thoroughly into detail and reasons, as Mr. Forman has done; and this book is far narrower in scope than Forman's. But almost any catechism is preferable to none at all, and the student who does his own thinking and carefully compares Mr. Collingwood's dicta with the requirements of his own road, can get many useful ideas from this little book. Its small size, 4 in. x 5¾ in., is in its favor, but to reduce it to this size the type was made too small. Twenty-five pages are taken up with reprints of Rulings of the Train Rule Committee of the American Railway Association.

CONTRIBUTIONS

The Clover Creek Junction Collision.

Altoona, May 22, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Although, as is well said in the note printed on the first page of our last issue, the remedy for collisions like that at Clover Creek Junction is the universal adoption of the block system, your readers will nevertheless be interested in some of the details of the causes which led up to that collision as they were brought out at the inquest held last week and this week in this city. Testimony was given by the train despatchers and operators interested, by the conductor and the engineman of the eastbound train, by the other trainmen, and, finally, by Pilot J. D. Dougherty himself, on whose shoulders rested the chief responsibility for the collision, he being the only man on train No. 21 who was fully acquainted with that division of the road on which the collision occurred.

There appears to be no doubt that Engineman Dougherty has practically admitted the chief or the whole responsibility, as was reported in the press despatches a day or two after the collision, but yet, the evidence shows something very like contributory negligence on the part of others. The section of single track on which the collision occurred extends from Springfield Junction (S J) on the west to "S T" tower on the east. The pilot boarded the westbound train at Huntingdon, a short distance east of the point where it was to leave the main line for the branch. At Petersburg, the junction with the branch, an order was delivered to the conductor, the engineman and the pilot "to run as an extra from Petersburg to S T." At S T the train stopped and the pilot sent the fireman back to see if the conductor had received further orders. The fireman found that none had been received and then the pilot himself went back to see the conductor. Returning to the engine the pilot informed the fireman (and presumably the engineman) that the orders read S J and not S T. The train-order signal showed white and the switch was set right for the train to enter upon the single track. The train proceeded and soon came into collision with No. 18.

The testimony of the conductor of No. 21 appears to be somewhat confused, but it would seem that being unacquainted on the branch he depended wholly on his time-table for his knowledge of the location of the stations. He examined the table, found a station S J but did not find any S T, and therefore concluded that the T, which, it is said, "could be mistaken for a J" was meant for J. The pilot, knowing that there were two stations with the two names, appears to have too readily accepted this explanation.

Engineman Dougherty read to the jury a written statement in which he endeavored to explain how others than himself ought to share the responsibility. He emphasized the fact that at S T he received a "clear block" (meaning the clear train-order signal), and that some one at the switch with a hand lamp gave him the signal to move forward. He proceeded at a low rate of speed and so was able to see the opposing train a few seconds before he hit it; and had succeeded in bringing his train nearly to a stop before the collision occurred.

Dougherty has been an engineman 33 years, and is a regular passenger runner. How can we explain such an unfortunate lapse by a man of such long experience? In starting from S T at low speed, Dougherty, apparently, was actuated by his doubt whether the train order actually did mean S J; but what could have led him to thus resolve the doubt on the side of danger instead of the side of safety? Surely the rule forbidding this must have been read by him a hundred times.

The coroner's jury decided that Dougherty was responsible for the collision.

K. M.

President Cassatt and Rebates.

In 1899 a committee of Pennsylvania directors offered A. J. Cassatt the vacant Presidency. It was a critical time. The rebate system had so fastened itself that the freight receipts of the Pennsylvania had sunk to the lowest ton-mile rate in its history. Expenses could be reduced no further; nothing could save the Pennsylvania position but expansion.

Cassatt's first characteristic act was to stop all secret rates and rebates. At the same time he won over Vanderbilt, so that the New York Central became a supporter of the war against discrimination. Standard Oil had its pipe lines and was no longer a factor; but there was Andrew Carnegie, chiefest of the rebaters. He shipped $10,000,000 of freight a year over the Pennsylvania, the rebates alone on which ran up to great sums. Carnegie protested in vain. Then he threatened a line from the west through Pittsburg to the sea that would destroy the Pennsylvania property. There was no man better able to understand that threat than Cassatt, but he had planned out his fight and summed up his resources, and he summarily refused Carnegie. That was the decisive moment

in the real war against secret rates. Everything since has been merely an echo of Cassatt's historic reply.

It was in this work of exterminating secret rates that Cassatt applied the "community of interest" scheme. Quickly, also, he reached out for control of one road after another. He secured the Long Island and control of Baltimore & Ohio, Norfolk & Western and Chesapeake & Ohio, established intimate affiliations with the Vanderbilts, and became a director in the New Haven. In seven years he spent over $200,000,000 and bought over $150,000,000 stocks of other companies. All this time he set his face against secret rates and persuaded the heads of other systems to follow his example.

Mr. Cassatt said to me a few weeks ago: "I have for several years believed that the Interstate Commerce Commission ought to be in a position to fix rates whenever unreasonable rates are found, provided there shall be right of appeal to the courts. Let the government regulate us. For my part, and for my associates, we are generally heartily in accord with the position of President Roosevelt. But it is equally important that the people should recognize the grave necessity for greater harmony of action and interests between the railroads. We have trampled out the secret rate and rebate system, and it can never be revived again unless the railroads are prevented by unwise legislation from maintaining such relations as will ensure reasonable and stable rates."—*James Creelman, in Pearson's Magazine.*

Comparative Locomotive Efficiency.

According to Mr. Thomas McHattie in an address before the Canadian Railway Club, the Grand Trunk Railway has been conducting a series of tests for the determination of locomotive efficiencies. The comparison was made between a simple class mogul engine 20 in. x 26 in. cylinders, 63 in. driving wheels, carrying 200 lbs. steam pressure, with a long narrow firebox having 33.43 sq. ft. grate area, which has been taken as a base in making the comparison, and a two-cylinder compound class mogul engine, 22½ in. and 35 in. x 26 in. cylinders, and the diameter of wheel, the steam pressure and the grate area the same as on the engine before mentioned; they were practically sister engines with the exception of the compounding feature.

The third engine put under test was also one of the two-cylinder type mogul class, sister to the former engine, with the exception that it was one of the semi-wide firebox class with 41.51 sq. ft. of grate area. The steam pressure, size of cylinders, and the diameter of driving wheels were the same as the previous engine mentioned.

The fourth engine under trial was a consolidation two-cylinder compound class, size of cylinders, 22½ and 35 in. x 32 in., diameter of driving wheels 57 in., carrying 210 lbs. steam pressure, and having a firebox with 53 sq. ft. of grate area.

Each engine was submitted to the test for six consecutive days. All engines were given the same grade of coal and were handled by the same engineer, fireman and train crew.

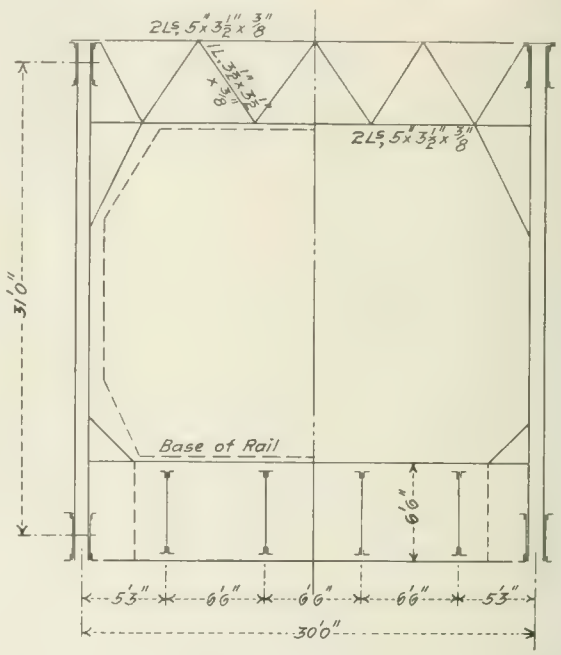
Among the more important points brought out by these tests was the fact that the coal consumed per ton-mile on all the compounds showed over 20 per cent. decrease. The water evaporated per pound of coal also gave a considerable increase in the percentage in comparison with the simple class engine. Better average speed was made with the compound engines, while a greater tonnage was handled. It was also found that the average amount of coal consumed per ton-mile was practically the same in the long narrow firebox as in the wider firebox class, from which it would appear that in the matter of fuel economy there was no practical advantage in the wide firebox.

The deductions gathered from the test showed that the compound engines are much superior to the simple class engine in the matter of fuel economy; while, at the same time, the repairs to this class are not more excessive than on the simple engines; on the contrary, it has been found that greater mileage can be obtained from the compound engines than from the simple classes, better average monthly mileage and greater mileage between shopping periods. While the boiler and tube repairs on the compound engines have shown particularly good results.

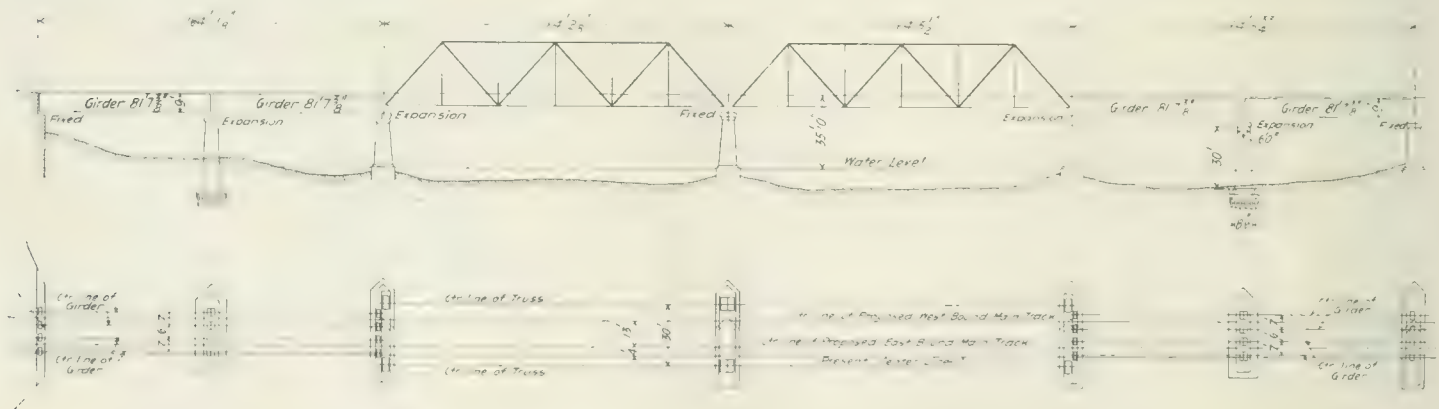
New Wabash River Bridge for the Lake Erie & Western.

The first crossing of the Lake Erie & Western over the Wabash river at La Fayette, Ind., was built in 1873. It consisted of four spans of through Howe trusses on masonry piers. About nine years later the Howe trusses were replaced with combination trusses. At the end of another nine years it again became necessary to provide a stronger structure and steel spans were substituted, the same piers being used. The steel bridge consisted of four single-track Pratt trusses, 164 ft. center to center of end pins.

To accommodate the present heavy locomotives it has once more become necessary to renew this bridge, which is used jointly by the Big Four and Lake Erie & Western. Plans have therefore been made for a double-track structure composed of two riveted through-truss river spans, 161 ft. 6¾ in. center to center of end pins,



Cross Section of Wabash River Bridge; Lake Erie & Western.



General Layout of Wabash River Bridge at LaFayette, Indiana; Lake Erie & Western.

and two deck girder spans at each end, 81 ft. 8 in. end to end. The existing piers will again be used and will be extended to provide for the additional width of the bridge needed for the second track. Also the replacing of the present shore spans by plate girder spans of approximately half the length will require the building of two new piers.

A plan and elevation of the new bridge is shown herewith. The pier extensions will be made on the upstream end. The bridge is designed for Cooper's E-60 loading and to Lake Shore & Michigan Southern specifications, which require open hearth steel of 60,000 lbs. ultimate strength and an elastic limit of not less than 60 per cent. of this ultimate. The dead load on the through truss spans is 5,200 lbs. per lineal foot and on the deck girders, 1,410 lbs. The impact stress is calculated by Pritchard's formula, the total stress being taken as the sum of the live and dead load and impact stresses.

We are indebted to Mr. G. P. Smith, Chief Engineer of the Lake Erie & Western, for the drawing and information.

What Stops a Moving Train.*

When a train is brought to rest from a high speed the statement is often made that the brakes have stopped the train. And they have certainly had something to do with it, for without them the length of stop would undoubtedly have been somewhat longer. But there are many factors which enter into the operation of bringing a moving train to a standstill besides the brakes themselves. Some of these other factors are at once apparent when the problem is given careful thought, but some are not so evident.

It must be understood that one, and only one, fundamental cause brings a moving train to rest. This is friction. Now the friction concerned in stopping a train is by no means confined to one place. We have friction between the moving parts within the train itself, between the train and the atmosphere (and this is astonishingly great at high speeds), between the brake-shoes and the wheels, and between the wheels and the rails.

Let us consider the latter for a moment. It is this friction between the wheels and the rails on which they roll which is really the most important factor of all. Very often, however, it is entirely overlooked, along with the first two frictional resistances mentioned above, and we say, "The brakes stopped the train." But suppose, for example, that there is absolutely no friction between the wheels and the rails. This may be easily imagined by supposing the rails to be made of ice. Would any amount of brake-shoe pressure bring the train to a stop quickly? . . .

The coefficient of friction and, consequently, the frictional resistance, varies with the nature and condition of the surfaces. This is by far the most important and firmly established of the laws of friction. . . .

In the case of a car wheel rolling on a rail we may consider that the point in contact with the rail is, *at that instant*, at rest so far as the rail is concerned. For, at each successive instant a new portion of the tire comes in contact with the rail. This part of the tire surface, for the moment during which it is on the rail, is not moving with reference to the rail. Consequently, the friction which prevents the wheel from sliding along the rail is not the friction of motion, but the friction of rest; that is, between the wheel and the rail we have to do with static friction. This may be most clearly seen in photographs showing a wheel rolling along the ground or on a rail. The part of the wheel near the point of contact with the surface over which it rolls is clearly and sharply defined, while the upper part of the wheel is blurred, showing that the point in contact with the ground or rail was at rest relatively to the camera. The case is different when we come to the brake-shoe, for here the wheel is always moving on the brake-shoe, and we have always to do with the friction of motion or kinetic friction. The coefficient of friction in this case is always less, and as a rule it is very much less, than the coefficient of static friction.

We now approach the question of wheel sliding, and for a thorough comprehension of this a careful analysis of what occurs must be made step by step.

Suppose the brakes to be applied with a light pressure. This pressure multiplied by the coefficient of friction (kinetic) between the brake-shoe and wheel gives the frictional force acting with a tendency to stop the rotation of the wheel. But the weight on the wheel multiplied by the static coefficient of friction between wheel and rail gives the frictional force resisting the tendency of the wheel to stop rotating, or, as we say, slide. A little thought will make it clear that as we increase the pressure on the brake-shoe the frictional force tending to stop the rotation of the wheel increases, and that this increase in retarding frictional force will continue until the point is reached where this force becomes equal to the frictional force (static) between the wheel and the rail. Then the slightest increase in brake-shoe pressure makes the frictional force acting to stop the wheel rotating the greater, and naturally it must then stop rotating. The condition of things is now entirely changed. The wheels are locked and are sliding along the rails. What have we now between wheel and rail? Evidently sliding or kinetic friction, where before it was static friction.

But we have just seen that up to the point of sliding a retarding force was being exerted by the brake-shoes, which, when the point of sliding was reached, equaled the static frictional resistance between wheel and rail. Now, with the wheels sliding, a retarding force is being exerted only between the wheels and rails, equal to the kinetic frictional resistance between the wheels and the rails on which they slide, which, as we have already seen, is very much less than is the case when the wheels roll without sliding. Therefore, our retarding force is greatly decreased by the sliding of the wheels and the distance required in which to make the stop is correspondingly lengthened. We have thus arrived at the answer to the question so often asked, "Why is the distance traversed in stopping a train so greatly increased if the wheels slide during the stop, instead of continuing to roll?" It is plain that if the brakes are to be most effective in bringing the train to a stop the wheels must not slide; and the greater the resistance to sliding, due to the friction between the wheels and rails, the greater is the retarding force which may be exerted at the brake-shoe and the shorter is the stop.

Another point frequently misunderstood or lost sight of is the relation between the brake-shoe pressure and the weight carried by the wheel on which it acts, and in particular the amount of brake-shoe pressure required to slide a wheel. In order to avoid complication let us imagine the wheel to slide at once—that is, as soon as the pressure is applied. What relation existed between the forces at the instant of sliding, or, in other words, what made the wheels slide? The fact is that the wheels slide because the weight on the wheel x coefficient of friction (static) between wheel and rail is less than the pressure on the brake-shoe x coefficient of friction (kinetic) between the shoe and the wheel. They do not slide because of the coefficient of friction alone, or because of the pressure alone, but according to the product of these two, namely, the total frictional force, is greater at the shoe than at the rail. Let us take an example which will illustrate just what is meant.

Suppose we have a car weighing 80,000 lbs. having four-wheel trucks. Each wheel supports a load of 10,000 lbs. An average value for the static coefficient of friction between the wheel and rail under ordinary conditions is .20. It may run as high as .30 or as low as .18, according to the condition of the rail. Calling the coefficient of friction .20 the total frictional resistance to sliding between wheel and rail is 10,000 x .20, or 2,000 lbs. This is then the force which must be overcome if the wheels are to be made to slide.

At 60 miles per hour the coefficient of friction between brake-shoe and wheel is about .07. Suppose the braking power on our 80,000-lb. car to be 90 per cent. of its weight. We have then a total braking power, in pounds, of .90 x 80,000, or 72,000 lbs., which gives a brake-shoe pressure for each shoe, there being eight shoes of 72,000 ÷ 8 = 9,000 lbs.

The retarding frictional force is then, as we have seen, the pressure x the coefficient of friction, or 9,000 x .07 = 630 lbs. We have here then 630 lbs. acting to stop the rotation of the wheel and 2,000 lbs. acting to prevent it from being slid. We shall expect it to continue to revolve under these conditions, and for some time; in fact, until the condition of 630 lbs. trying to overcome 2,000 lbs. changes materially.

But it is asked, "What changes must take place in order to slide the wheels? and what changes of condition can take place?" From what has been said it is plain that the wheel can only slide when the total frictional force between brake-shoe and wheel exceeds that between wheel and rail. Notice the expression "total frictional force," not "coefficient of friction." This is the one necessary and sufficient condition required to slide the wheel. Two possibilities are evident. The friction between the wheel and rail may decrease, which would occur if the wheel should suddenly come upon a greasy rail surface and cause the wheel to slide. Such causes will not be considered, as we assume a straight, level track with a uniform condition of rail surface. The only place left where any change may occur is between the brake-shoe and wheel. To this then we must confine our attention. To slide the wheel, then, the total frictional force between brake-shoe and wheel must increase until it becomes greater than that between the wheel and the rail, as has been already explained. This can occur in only two ways. Either the brake-shoe pressure must increase or the coefficient of friction between brake-shoe and wheel (kinetic) must increase. These two methods of sliding the wheels are the only possible methods, and it may be confidently stated that whenever a wheel slides (assuming the train to be on a straight, level track with uniform rail surface condition) either the brake-shoe pressure or the coefficient of friction between shoe and wheel must have increased.

Taking the case cited above, if we consider .07 as the coefficient of kinetic friction at 60 m.p.h., the brake-shoe pressure required to slide the wheel would be 2,000 ÷ .07, or approximately 28,500 lbs. This means a braking power, total of 28,500 × 8 = 228,000 lbs., which is 285 per cent. braking power. Yet an 80,000-lb. car can hardly be found braking at over 90 per cent. Apparently we might increase our braking power very considerably and still be in no danger of sliding the wheels.

But this is only half the story. We have seen how much the brake-shoe pressure must be increased before sliding will occur. On the other hand, the coefficient of friction may increase, and so the wheels be slid, even with the same brake-shoe pressure of 9,000 lbs. In order to do this the coefficient of friction must be equal to 2,000 ÷ 9,000, or .22. This may seem large when compared with .07, the average value for a speed of 60 m.p.h., but the fact has now become well established that the coefficient of kinetic friction between brake-shoe and wheel is very different at different speeds. At 60 m.p.h. the average value for this coefficient of friction is about .07, while at 30 m.p.h. it is about .16, and at 10 m.p.h. about .24. We can now see what would happen in the case we have been considering. Although at the start, running 60 m.p.h., we had only 630 lbs. retarding force attempting to overcome 2,000 lbs. tending to prevent sliding (often called the adhesion of the wheel to the rail), yet at 10 m.p.h. we would have 9,000 x .24 or 2,160 lbs. retarding force at

*Extracts from a paper presented at the May meeting of the Western Railway Club, by S. W. Dudley, Asst. to Mech. Engr., Westinghouse Air Brake Company.

the brake-shoe, which is more than enough to slide the wheels.

So we may not hasten to increase our brake-shoe pressure or per cent. braking power without careful consideration. And upon investigation we do find still further factors which have influence tending to modify this rapid increase in coefficient of friction due to decreasing speed. These may be briefly comprehended in the term, "the time element." While it is impossible to go fully into the interesting and complicated changes which the friction between the brake-shoe and wheel undergoes during the time in which the surfaces continue in contact it may be said that tests have fully demonstrated that the heating, wearing away and polishing of the surfaces in contact have, as time goes on, a constantly increasing influence tending to reduce the coefficient of friction; the lubricating effect of the molten particles, the roller-like action of the larger particles which become torn off during violent and prolonged rubbing, and the smoothing and polishing of the surfaces, where melting or abrasion does not take place, all these tend to off-set, and may often considerably reduce the tendency for the coefficient of friction to increase as the relative speed of two surfaces in contact diminishes. The retarding effect of the brake-shoe pressure at any instant depends, therefore, on the sum total of these opposing influences at that instant. Numerous experiments which have been made along this line show that under ordinary conditions the increase in coefficient of brake-shoe friction and consequent increase in retarding force, which takes place as the speed is decreased, is the predominating influence, and that the retarding effect of a given brake-shoe pressure increases, as a whole, as the speed diminishes. But recent tests have further demonstrated that this increase in retarding force, due to the increase in the coefficient of brake-shoe friction as the speed decreases, is considerably less than has heretofore been supposed, and that under certain conditions the "time element" effect may become equal to and thus neutralize the increase in the coefficient of friction due to decreasing speed. Under such conditions the coefficient of friction is the same at the end as at the beginning of the stop. This is modified by the degree of hardness of the brake-shoe.

Having thus far been concerned with the kind of forces which operate to bring a moving train to a standstill, and the ways in which these forces act to produce the desired effect, it now remains to obtain some idea of the magnitude of the forces involved. This may be done by simple, yet exceedingly instructive consideration of the energy created and destroyed in the process of bringing a train up to speed and in making a stop. First, what must be done before a train can attain a speed of say 65 m.p.h.

We know that all matter is, as we say, inert; that is, it has no power of itsellf to change its state, either of rest or motion. A stone will always remain where it lies, unless some force from the outside acts upon it and overcomes its natural or inherent tendency to remain without motion. Furthermore, a stone thrown into the air would go on forever were it not for external forces, such as the attraction of the earth, air resistance, or obstructions which may be in its path, which retard and finally stop its motion. This property of matter to remain at rest, if at rest, or to continue to move uniformly, if in motion, has been universally recognized as something as definitely a characteristic of all material bodies as is size, mass or hardness, and it is called the inertia of the body.

To start a train then its inertia must be overcome, and in addition the very considerable frictional resistances between the moving parts within the train itself. Having the train once in motion a constantly increasing amount of force is required in order to continue to increase its speed, for we have just seen that instead of continuing to move uniformly the air and other frictional resistances would all tend to decrease its speed. All of the force which is required to overcome these resistances, and, in addition, constantly increase the speed of the train until it is moving at the rate of 65 m.p.h. must come from the steam in the locomotive cylinders. Some of the energy developed here has disappeared in the form of heat, but the rest has been put into the train, constantly adding to its store of energy, until at 65 m.p.h. the train has stored up within itself an amount of energy equal, in destructive power, to that contained in a huge magazine of gun powder. Anyone who has witnessed the effects of a "head-on" collision, even at slow speed, will bear witness to the truth of this statement.

In round numbers a train of five cars moving at the rate of 65 m.p.h. possesses 150,000,000 ft. lbs. of energy, and if run against a solid wall the result would be the same as if it were allowed to fall to the earth from a height of about 150 ft. But such a stop would not be considered as according to the best recommended practice, and as speeds of 65 or even 70 m.p.h. are becoming by no means rare, some knowledge of how we may safely come to a stop is not only interesting but of vital importance.

Let us imagine the train, moving as described above, to be stopped within say 1,100 ft. About 150,000,000 foot pounds of energy have been destroyed, harmlessly, and almost without the notice of those within the cars. Evidently some very powerful force has been at work to do this, and, as we have already seen, this is the force of friction. The natural frictional resistances of the air and the moving parts within the train would certainly have stopped the train in time, but it is plain that something more than these is required if a stop within any reasonable distance is to be made. The frictional resistance to the motion of the train is, therefore, artificially increased in such a case by means of some form of brake apparatus.

The power which is thus exerted may be roughly measured by the distance within which the moving train is brought to rest and its energy destroyed. In such a stop as described above more power has been used than the heaviest locomotive ever built is capable of exerting. The truth of this statement is evident when we remember that from five to six miles is required, even under the most favorable circumstances, for a locomotive to bring such a train up to a speed of 65 m.p.h., while the stop may be made within 1,400 ft., which is about one-nineteenth of that distance. Of course the frictional resistances existing outside of the brakes hindered the locomotive in accelerating the train and assisted the brakes in reducing its speed, but after all allowances are made it is clearly evident that the brakes have acted much more powerfully in stopping the train than did the locomotive in starting it. And this is just what we should expect when we remember that only one unit, namely, the locomotive, is concerned in starting the train, while not only the locomotive, but every car in the train is concerned in making the stop.

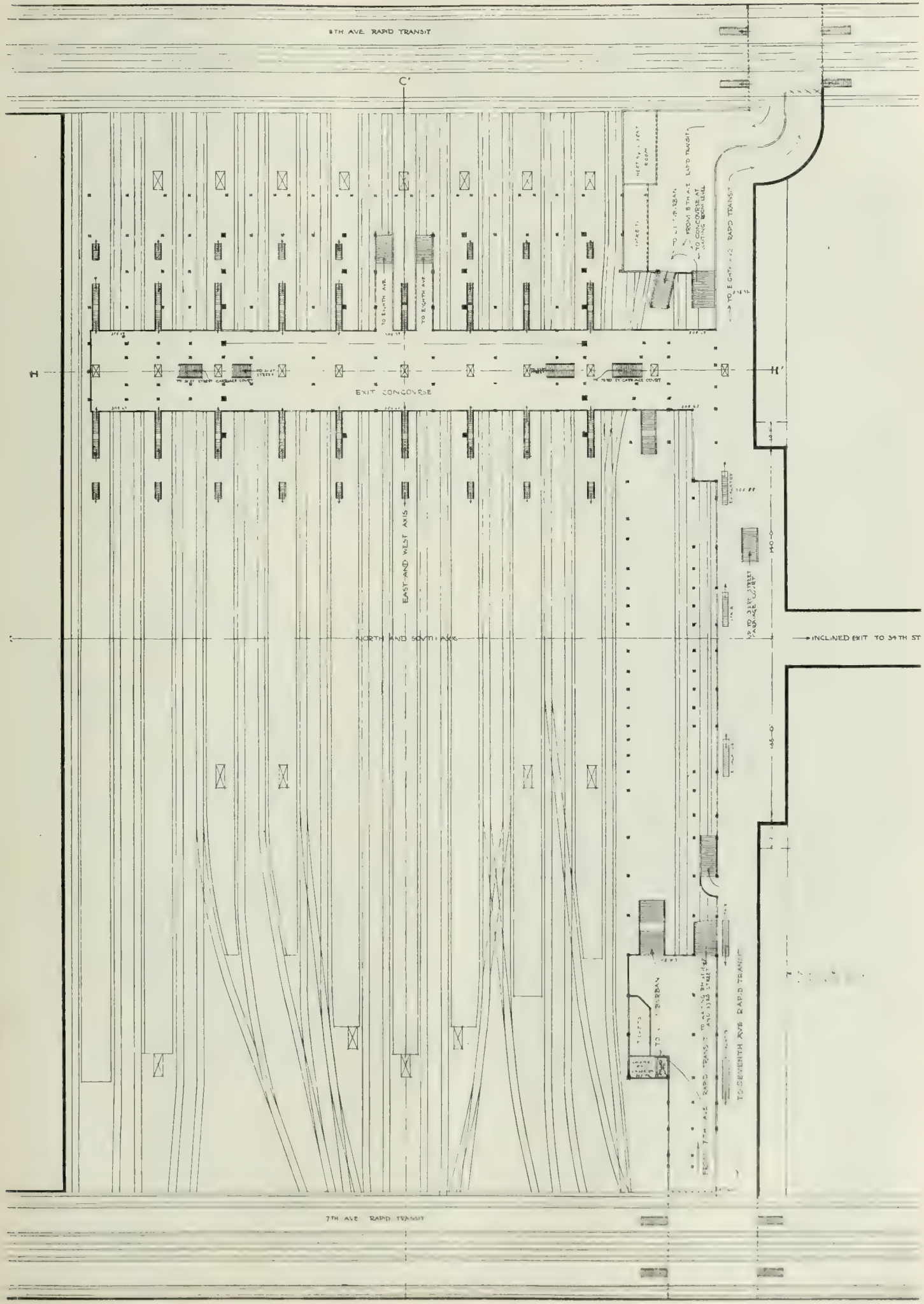
To start the train the total force exerted by the engine on the train at any time cannot exceed the frictional force between the driving wheels and the rails, sometimes called adhesion, otherwise the drivers would slip and simply turn without moving the train ahead. Evidently this adhesion depends upon the weight on the drivers and the static coefficient of friction between the drivers and rails, just as in the case of the car wheel already considered. But when we make a stop each wheel in the train, as we have seen, may be retarded up to the limit set by the frictional resistance to motion between that particular wheel and the rail. Consequently, assuming that the coefficient of static friction between wheels and rails is the same throughout the train, the retarding power may be proportional to the weight of the entire train, while the accelerating power depends upon the weight on the engine drivers alone. This explains at once the advantages of a multiple unit system, such as a train of all motor cars, as compared with the single unit sysem of locomotive and train. In reality, when the brakes are applied upon a moving locomotive and train the system is changed from a single accelerating unit to a multiple retarding unit system, which is much more powerful in the aggregate, as we have just seen, than is the former.

The Pennsylvania Railroad's Extension to New York and Long Island.

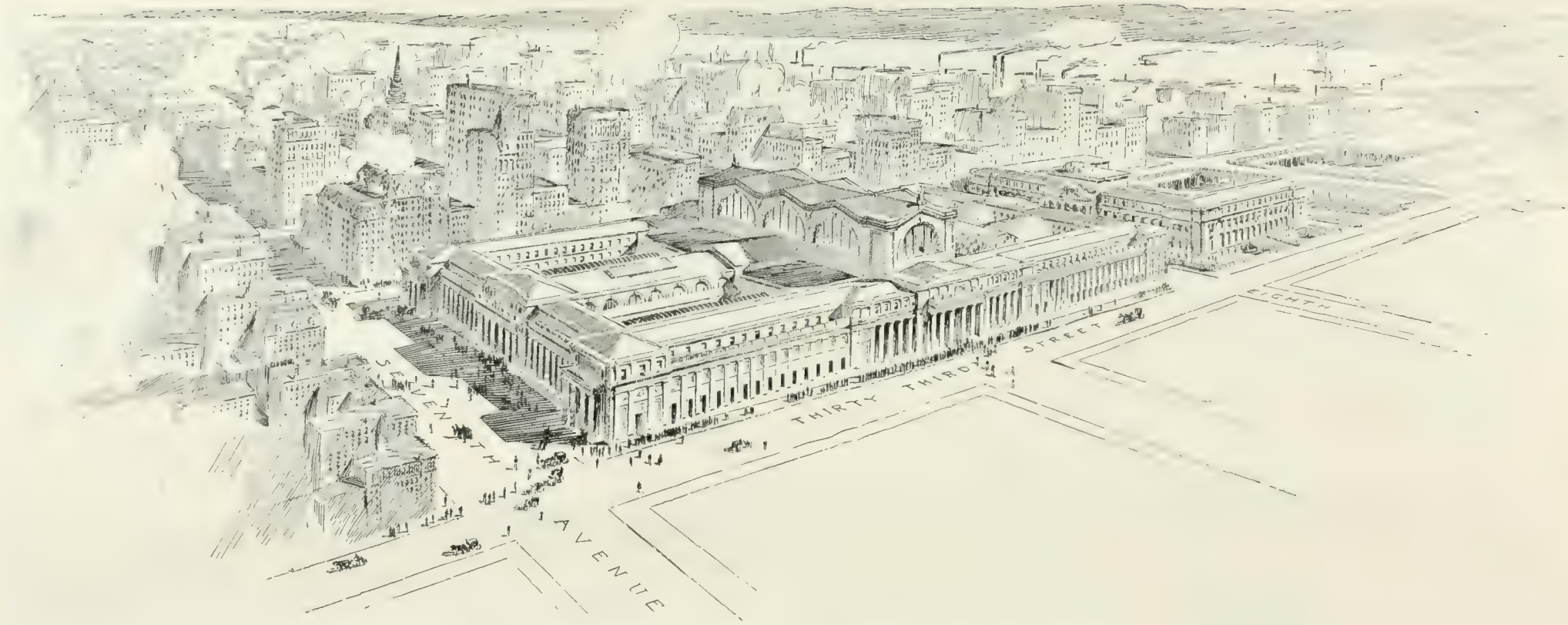
The new Pennsylvania Railroad station in New York, for which the plans are now practically perfected, will be unique among all the railroad stations of the world in the number and convenience of its entrances and exits. This condition is due to the fact that each of the four sides of the structure is a front, opening respectively on two wide avenues and two important streets, which latter have been widened by the company to 80 ft. each.

The geography of the station is interesting. It is bounded on the east by Seventh and the west by Eighth avenue; on the south by Thirty-first and the north by Thirty-third street, Thirty-second street having been closed and included in the station site. In the center of the hotel, theater and shopping district the advantage of its location is obvious. The frontage on the avenues is 430 ft. and on the streets 780 ft., the sides of the structure forming a perfect parallelogram. As the tracks are 40 ft. below the surface of the streets the station is divided into three levels. From the street level upward the walls of the structure rise to the height of 60 ft., except in the center, where the roof of the general waiting room reaches a height of 150 ft., and the corner of Eighth avenue and Thirty-third street, where there is an elevation of four stories for office purposes. The architectural design of the entire exterior is a Doric colonnade, 35 ft. high, surmounted by a low attic, raising the general elevation to 60 ft. The unusual extent of the building in area and its general type are suggestive of the great baths of ancient Rome. In fact, the baths of Caracalla, still magnificent in their ruins, were the inspiration of this architectural plan.

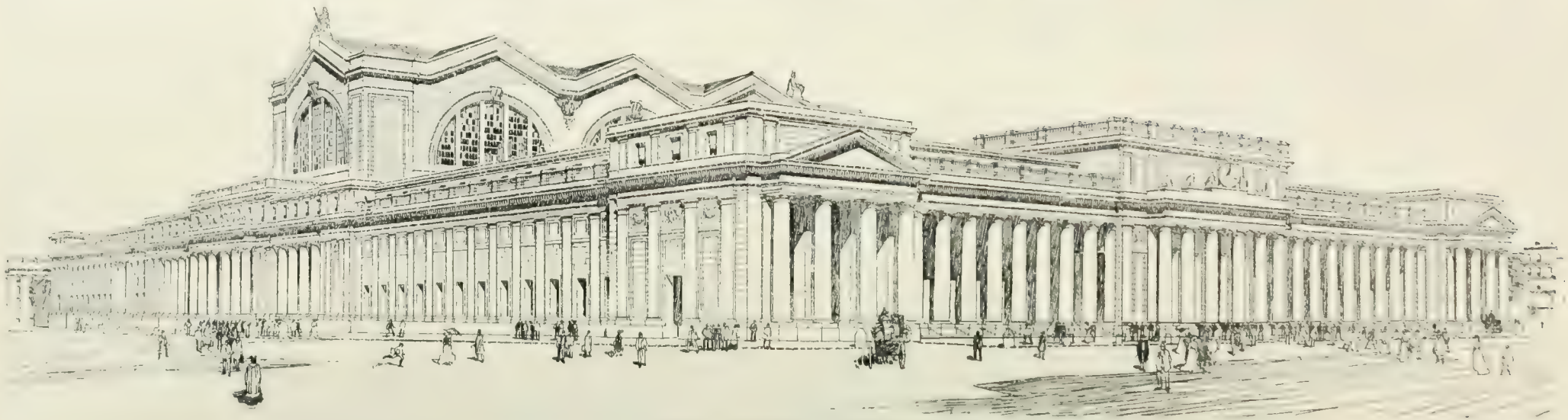
Although the building is low by contrast with its skyscraping neighbors, its scope makes it impressive, and the lofty roof of the waiting room, rising high above the top of the surrounding structure, with its eight large semi-circular openings, 72 ft. in diameter, adds dignity to the group of buildings and at the same time makes them a conspicuous landmark, when seen in perspective from the streets. In appearance it is a wide departure from the conventional railroad station. One misses the turrets and towers and more than all the lofty arched train shed, but as the principal function of this station is performed underneath the streets, the upward and visible signs of the ordinary railroad station are naturally absent. It will rather resemble some vast auditorium constructed



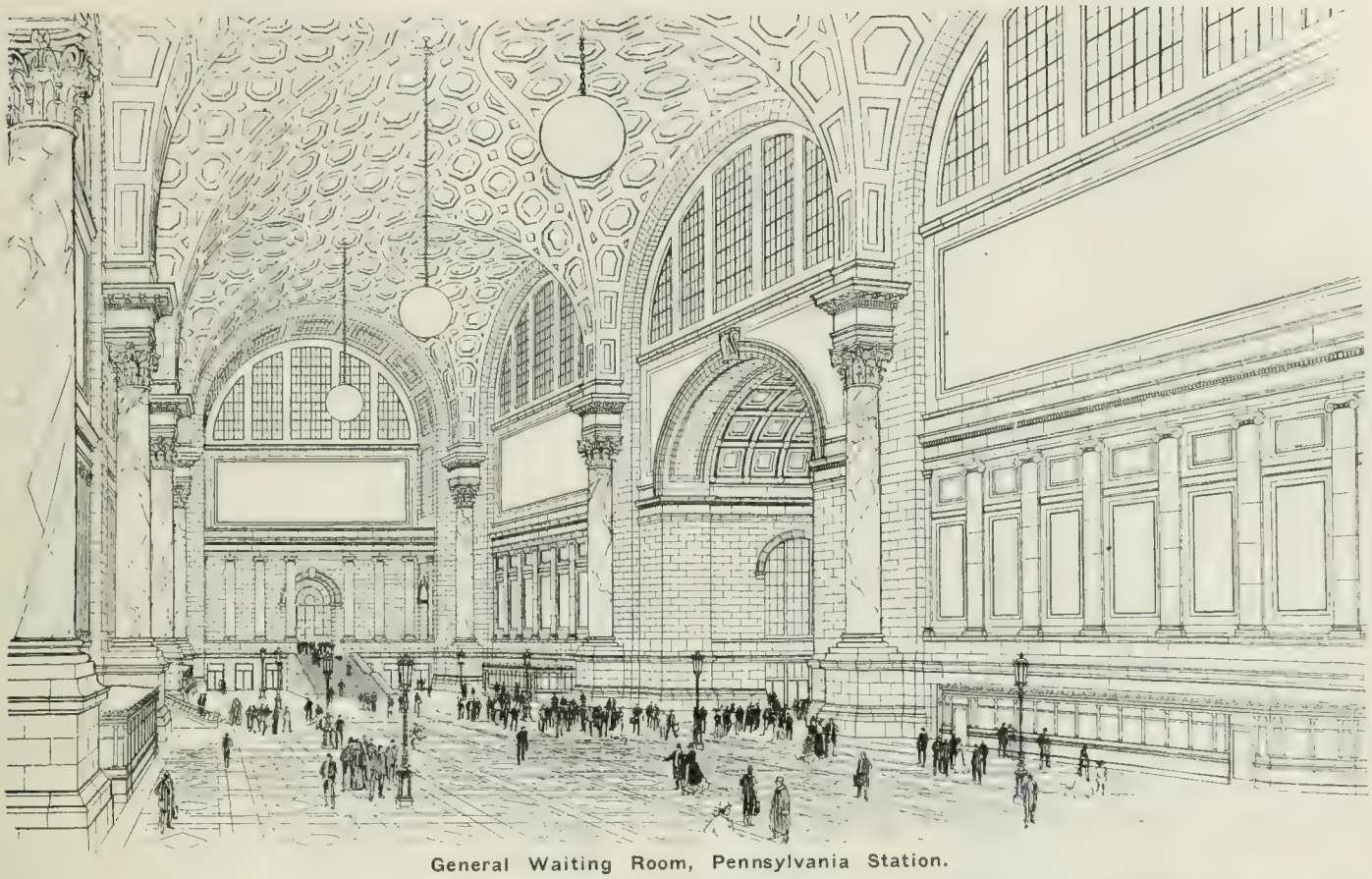
Track Plan, Pennsylvania Station.



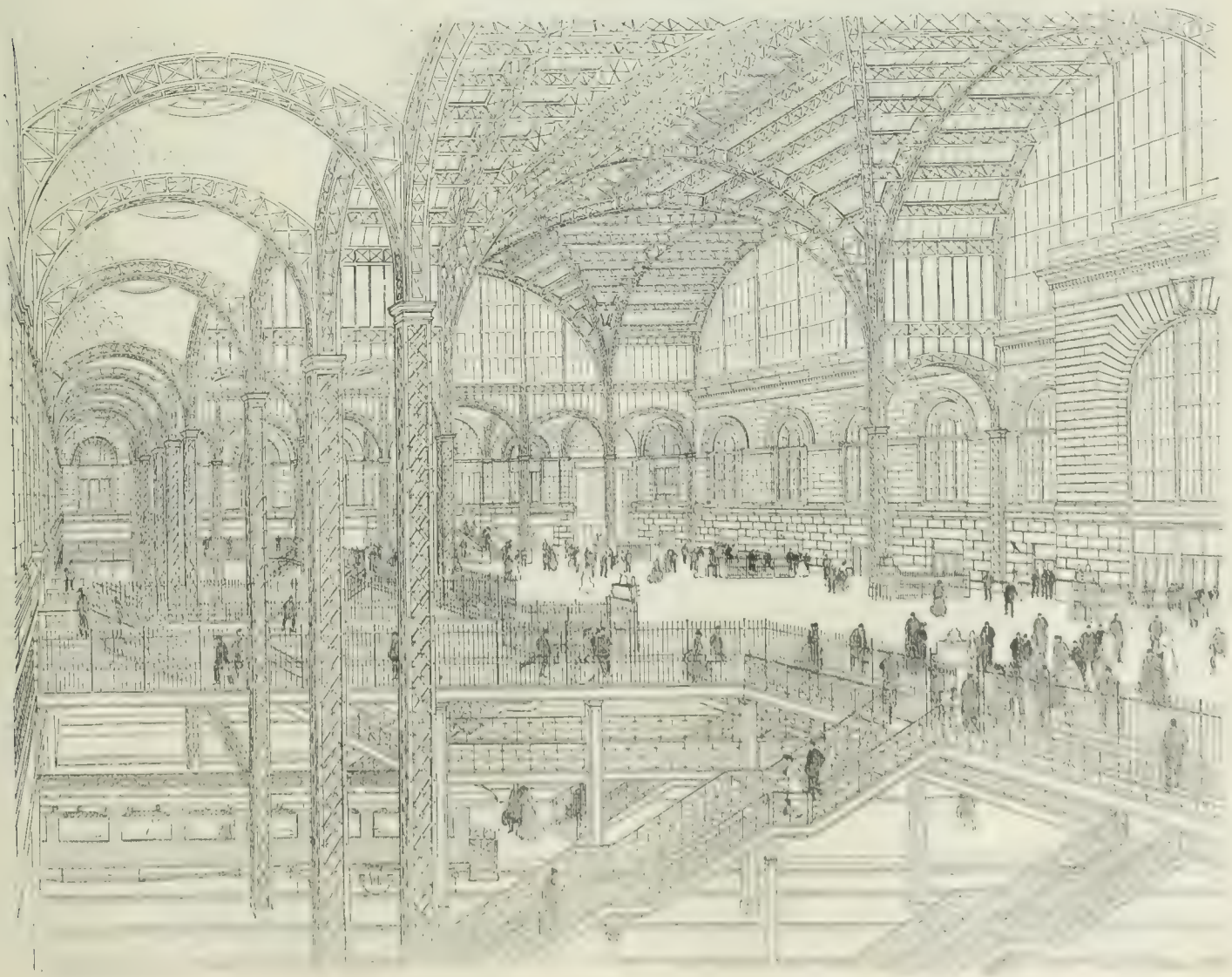
Bird's Eye View Showing Location of Pennsylvania New York Terminal.



General Elevation of Station.



General Waiting Room, Pennsylvania Station.



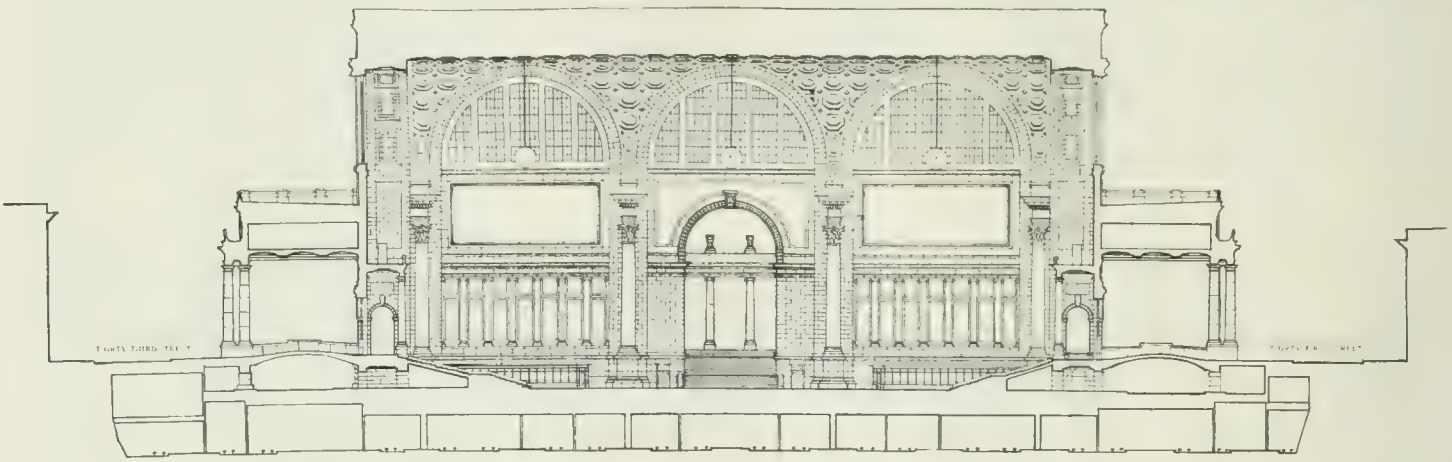
Concourse and Tracks, Pennsylvania Station.

on low lines for the easy ingress and egress of a multitude of people. The exterior construction is to be of pink Milford granite, similar to the building stone of the Boston Public Library, the University Club in New York, the Court House in Pittsburg, and the Chamber of Commerce in Cincinnati.

The main entrance is in the center of the structure on Seventh avenue, opposite the intercepted end of Thirty-second street. This is for foot passengers only, and from the street entrance to the stairway to the main waiting room there extends an arcade 225 ft. long and 45 ft. wide flanked by shops, which will be occupied by merchants, whose wares will appeal especially to the requirements of travelers. On either side of the Seventh avenue entrance there are also a series of stores. At the further end of the arcade the restaurant, lunch rooms and the café are established, with proper kitchens and service connections. Beyond is the general waiting room and the concourse, all easy of access by convenient stairways.

At the corners of Thirty-first and Thirty-third streets and Seventh avenue are open pavilions, which furnish carriage entrances for incoming and outgoing traffic. Under cover carriages descend from the street level by a slight gradient about 20 ft. to the level of the station proper, the Thirty-first street incline being assigned as an entrance and the Thirty-third street ascent as an exit. By this arrangement carriage passengers are delivered at the most convenient entrance to the general waiting room.

Apart from the main entrance there are other convenient entrances for foot passengers from the street level to the general waiting room and concourse from both the streets and the avenues. At a central point in both streets wide bridges leading into the street floor of the station span the carriage subway. On the intermediate plane or level the real business of the passenger preparatory to his journey is transacted.



Section of Station on North and South Axis.

The general waiting room, the largest of its kind in the world, 320 ft. long, 110 ft. wide and 150 ft. high, is the central section of the plan. Within its spacious walls will be located the ticket offices, parcel rooms, telegraph and telephone offices and baggage checking windows, all so disposed as to situation that a passenger may proceed from one to the other seriatim, with a minimum amount of exertion and without retracing his steps.

Adjoining the general waiting room on the west are two subsidiary waiting rooms, 58 by 100 ft., for men and women respectively, provided with seats, and opening into retiring rooms, with lavatories attached.

To the east of the general waiting room the main baggage room, with 450 ft. of frontage, for the use of the transfer wagons, is located, covering the full area occupied by the arcade and restaurants on the plane above. The baggage is delivered and taken away through a special subway, 30 ft. wide, extending under and along the entire length of Thirty-first street and Seventh and Eighth avenues. From the baggage room trunks are delivered to the tracks below by motor trucks and elevators.

The cabstands will also occupy this level. There will be maintained an ample service of electric vehicles of varying capacities to meet the requirements of travelers.

Parallel to and connecting with the main waiting room by a wide thoroughfare and west of the subsidiary waiting rooms is the concourse, a covered assembling place over 100 ft. wide, extending the entire width of the station and under the adjoining streets. An idea of the width of this concourse is gained by a comparison of it with the lobby of the Jersey City trainshed, which is narrower by 25 ft. This may be termed the vestibule to the tracks, as two sets of stairs descend from it to each of the train platforms on the track level. The concourse and adjacent areas are open to the tracks, forming a courtyard 340 ft. wide by 210 ft. broad, roofed by a lofty trainshed of iron and glass, similar in design to the famous trainsheds of the new stations in Frankfort and Dresden, Germany. In addition to the entrances to the concourse from the waiting room there are also direct approaches from Thirty-first, Thirty-third streets and Eighth avenue.

The gates of the stairs descending from the concourse to the trains will bear signs announcing the name, destination and the time of departure of the train on the particular platform where the stairs land.

Auxiliary to the main concourse and located between it and the tracks is a sub-concourse, 60 ft. wide, which will be used for exit purposes only. This passageway is 18 ft. above the tracks, but is connected with the track level by two stairways and one elevator from each platform. From it ample staircases and inclines lead directly to Thirty-first, Thirty-third and Thirty-fourth streets, to Eighth avenue and to future rapid transit stations under Seventh or Eighth avenues. Direct connection may also be made with the proposed subway stations on Herald Square without ascending to the street level.

The northern side of the station extending along Thirty-third street will be assigned to the suburban service of the Long Island Railroad, into which trains will run from all points on Long Island by way of the East River tunnels. Ample entrances and exits are provided on Seventh and Eighth avenues and Thirty-third street, so that this traffic can be handled in connection with the adjacent subways and the surface lines on the surrounding streets independently of the rest of the station.

The third level, which is at a depth below the surface of the street corresponding to the height of a four-story building, is the track level. When the two tracks emerge from the tubes under the Hudson and reach the entrance to the station yards at Tenth avenue they begin to multiply, and at Ninth avenue, and extending into the station, the total number has grown to 21. There is also a reduction in the number of tracks leading out of the station to the east, to a total of four for the main line, two passing under Thirty-second and two under Thirty-third street, and thence under the East River to the Long Island City yards. The track surface of the station may be compared to two unfolded fans joined together at the open ends, the handle of one extending under the Hudson and that of the other under East River. Within the station area, covering 25 acres of ground space, there are 16 miles of tracks. This trackage area will afford ample facilities for easy movement of many hundred trains per day by the prompt and efficient means of electric power. Through trains from the western side of the Hudson, after discharging passengers, will proceed at once to Long Island City, where the train yards and terminals will be located, thus leaving the station tracks clear of any idle equipment, and likewise the westbound through trains made up at the Long Island City terminal will pass through the station, stopping only to take up their quota of passengers. The suburban service of the Long Island Railroad will be operated on the "shuttle" plan, by which the trains are kept in continuous motion in and out of the station.

The planning of the station, with its numerous entrances and exits independent of each other and separating the incoming from the outgoing throng, was worked out to facilitate, in greatest measure, the prompt and uninterrupted movement of the traffic.

The exposure of the building on all four of its sides to main arteries of street traffic gives the plan a flexibility, which is rarely obtainable in a building of such enormous proportions situated in the heart of a great city, and also insures easy connections by underground subways with the future extensions of the city's rapid transit system under Seventh and Eighth avenues and the cross streets.

The designs for the station were made by McKim, Meade & White, and will be executed under their direction. The drawings shown with this article supplement those shown in our issue of Feb. 9, 1906, to which reference should be made.

Demurrage Managers' Annual Meeting.

The seventeenth annual meeting of the National Association of Car Service Managers was held at Denver May 15 and 16. The association includes the managers of all demurrage bureaus in the country, 41 in number. Twenty-five members were in attendance.

The President of the association, Major Charles B. Peck, of Houston, Texas, died in June, 1905, and Vice-President C. W. Sanford is seriously ill, so that Commissioner E. E. Hill, of the Denver association, presided.

The Secretary's report showed 33,366,361 cars reported during 1905, an increase over the previous year of 4,216,484. The average detention to cars while loading and unloading, during the year 1905, was 1.4 days per car. The association has published in pamphlet form all legal decisions bearing upon car service rules, and the pamphlet may be obtained by anyone interested by application to A. G. Thomason, Secretary, Scranton, Pa., or any car service manager. At the request of the Association of American Railway Accounting Officers the following committee of car service managers was appointed to meet at Bluff Point, N. Y., June 26, 1906, to confer on proper methods of accounting for car service earnings: E. B. Stevenson, of Nashville, Tenn.; B. H. Garrigues, of Kansas City, Mo.; J. O. Klapp, of Milwaukee, Wis.; C. W. Bradley, of Buffalo, N. Y.; A. G. Thomason, of Scranton, Pa.

The committee on claims reported on the manner of adjusting claims caused by refusal of freight by consignees, provoking a lively discussion. The committee is to be continued from year to year in an effort to arrive at uniformity in treatment of claims. The committee on office methods and accounting reported a form of daily report and form of car service bill. This committee was instructed to confer with the Association of Transportation and Car Accounting Officers, looking toward a combined form of daily report to be made to the transportation officer and the car service association.

A paper was presented by J. E. Challenger, of Philadelphia, entitled "Publication of Detention Statistics." The association decided to appeal to each railroad in the country for an expression of opinion as to how these statistics should be compiled and published. A. J. Elliott, of Peoria, read a paper on charging for Reconsigning Privileges. A committee of three managers was appointed to further the ideas advanced in this paper. F. R. Hanlon, of Seattle, read a paper advocating a uniform rule to govern detention to cars delayed by improper loading by shippers. J. E. Duval, of Montreal, addressed the convention on car service conditions in Canada.

C. W. Sanford, of Chicago, was elected President, and E. B. Stevenson, of Nashville, Vice-President; and A. G. Thomason, of Scranton, Pa., was re-elected Secretary-Treasurer.

The selection of time and place of next meeting was left to the Executive Committee, with the preference expressed for Norfolk, Va., in May or June, 1907.

Most of the Car Service Managers are associate members of the Association of Transportation and Car Accounting Officers, and remained at Denver to attend the meeting of that association on the 17th.

Railroad Officers' Stock in Coal Companies.

The investigation being made by the Interstate Commerce Commission into the relations of prominent railroads to the coal companies shipping over their lines was continued last week in Philadelphia, where many officers of the Pennsylvania were examined. Evidence was given tending to show many irregularities in furnishing cars to different shippers. The railroad company had an established schedule of percentages of cars to be delivered to different collieries. Instances cited by the Government of excessive numbers of cars delivered to alleged favored shippers were explained by the assertion that in times of stress important consignees, such as municipal lighting plants and large public institutions, were favored. A number of instances were cited where in the great scarcity of cars, three or four years ago, the railroad company permitted large numbers of new coal cars—500 in one case—which had been ordered by it to be sold and delivered by the maker to coal companies instead of to the railroad company. The Morrisdale Coal Company, shipper of bituminous coal in the Clearfield region, charged that the Pennsylvania had furnished it with far less than its rightful share of cars, and, in 1902 and 1903, had practically destroyed the coal company's business by not furnishing cars, while the mines of larger shippers were able to ship their normal quantities.

A large part of the inquiry at Philadelphia was taken up with the examination of officers of the Pennsylvania concerning their ownership of the stocks of coal companies. From the reports of the hearings of May 16, 17 and 18, as given by the Associated Press, we take the following paragraphs:

George W. Creighton, General Superintendent, admitted that he held stock in several coal companies, and that stock had been presented to him. . . . Among the companies in which Superintendent Creighton admitted that he held stock which had been presented to him are the following: Mitchell, Watson & Co., 667 shares; Cochran Coal Company, 250 shares; Cabot Creek Coal Co., 50 shares; Commercial Coal Company, 33 shares; Big Bend Coal Company, 17 shares; Monterey Coal Company, 40 shares. In addition he holds 200 shares of the Saltsburg Coal Company stock, which he purchased, according to his statement, at half par value.

President J. M. Jamison, of the Jamison Coal & Coke Co., testified that his company had presented to Pennsylvania Railroad officials stock in his company with the object of securing better treatment and facilities from the corporation. Through J. R. McGinley, of Pittsburg, 500 shares of stock in the Jamison Company had been offered to Robert Pitcairn, assistant to the President. Pitcairn did not want the stock and the witness bought it back from him for $5,000; he was told by McGinley that Pitcairn said he preferred the money to the stock. Witness said that he held in trust 400 shares which belonged equally to Edward Pitcairn, trainmaster of the Pittsburg division, and R. L. O'Donnel, General Superintendent of the Buffalo & Allegheny Valley division. The stock was presented to the men named. George W. Clark, car distributer at Altoona, held 100 shares, and Joseph Boyer, employed in the office of A. W. Gibbs, Superintendent of Motive Power of the Pennsylvania Railroad, held 200 shares.

George W. Clark told of having received monthly a check for $50 from Capt. Alfred Hicks, a mine operator, and stated that he did not know why the money was sent to him.

R. K. Cassatt told the commission that at a time when the Pennsylvania Railroad Company was suffering from a scarcity of coal cars it had relinquished its claim to 500 cars ordered from the Pressed Steel Car Company, and that the cars had been purchased by the Keytsone Coal & Coke Company.

Charles E. Pugh, Second Vice-President, asked as to his policy regarding sidings said: "We have refrained as far as possible from putting in new sidings." The company was not inclined to place a siding for an operation of small promise. Mr. Pugh said he had several shares in the Brubacher Coal Company, which is a holding company only; nine $500 bonds in the Aroma Gas Coal Company, five $1,000 bonds of the Pittsburg & Chicago Gas Coal Company, 550 shares, par 55, of the Thacker Coal Company, on the Norfolk & Western, and 50 shares and $10,000 worth of bonds of the Thacker Fee Company, a holding company.

R. L. O'Donnel said he had 300 shares of the Keystone Coal & Coke Company, which were given him in exchange for 100 shares of the Madison Gas Coal Company, which was merged with the Keystone. The Madison shares were given to him. His holdings in the Latrobe-Connellsville Company are 400 shares, received in exchange for Saxman Company and Superior Company stock when these companies were absorbed. Mr. O'Donnel said he purchased no bonds, but shared in the free stock issue. J. Howard Patton, he said, gave him 120 shares of the Lucesco Coal Company. He received 200 shares in the Jamison Coal & Coke Company from Edward Pitcairn, trainmaster of the Pennsylvania Railroad. In the Preston Company Mr. O'Donnel has 25 shares, Gilpin Company 20 shares, Aronwall 20 shares, and Bagdad 20 shares. He said he paid $3,000 for the stock in the last three companies and had been receiving from $75 to $125 a month dividends on the stock.

George W. Clark, being asked about his dividends from Capt. Alfred Hicks, replied that he never received any dividends.

"Did you ever get any money from Capt. Hicks?"

"I received checks from Capt. Hicks."

"To what amount?"

"Fifty dollars each."

"How often did you get those checks?"

"About once a month for three or four months."

The witness was asked why the money was sent to him, and he replied that he did not know. He had never asked Capt. Hicks why he sent the checks, and when they ceased coming he did not ask Capt. Hicks why he had stopped sending them. After further questioning, Mr. Clark said he had received various gifts from mine operators during the past three or four years.

F. L. Sheppard, General Superintendent of the United Railways of New Jersey, was examined as to his stockholdings in coal companies and alleged pier privileges given the Berwind White Company at tidewater.

Edward Pitcairn, trainmaster on the Pittsburg division, admitted having accepted stock in coal companies, and R. B. Freeman, another trainmaster, said he received Christmas presents of money from coal companies.

Major Richard Coulter, Jr., in his testimony said that Frank Thomson, an ex-President of the Pennsylvania Railroad, had participated in stock distribution.

E. J. Cleave, Superintendent of the Cambria & Clearfield division, said he had 250 shares of stock in the Cochran Coal Company which he received in part payment for land sold to the company. He said he had had stock in coal companies offered him, but had declined to accept it.

Mr. Sheppard said he owned stock in several mining companies. He could not recall the names of some of these companies. The

stock in one, which is a subsidiary company of the Berwind-White Coal Company, the witness said, he received from Edward Berwind. It was paying dividends, but he did not remember the amount.

Mr. Sheppard said he owned 50 or 100 shares in the Pine Run Coal Company. He received this, he said, from Frank Patton. He had invested $2,500 in another company, which failed. This money was returned to him, and he received the Pine Run Coal Company stock. He also received, he said, 60 or 70 shares in the Pittsburg Coal Company for his work in negotiating the sale of the stock.

Mr. Sheppard testified that the Berwind-White Company rented a pier at Harsimus from the Pennsylvania Railroad for $1,800 a year. This pier, he said, was improved at a cost of $40,000 before the coal company rented it. The railroad company allows the Berwind-White company 7 cents a ton for unloading at Harsimus, and other companies at South Amboy are allowed 5 cents a ton for the same work.

Edward Pitcairn testified that the income from his coal stock amounted to about $30,000 annually.

J. K. Russell, a road foreman on the Pittsburg division, said he had 300 shares in the Keystone Coal & Coke Company, and was interested in the Ligonier Coal Company, the Altoona Coal & Coke Company, the Greenwich Coal Company and the Connellsville Coal & Coke Company. He had helped to organize the Claridge Coal Company, he said, and, when it was absorbed by the Keystone Company, he received 300 shares. Most of the other stock, he said, was given to him.

John Aldred, chief clerk in the office of S. C. Long, Superintendent of the Pittsburg division, said he owned stock in a number of companies which he secured through the payment of 10 per cent. at the time of organization. His income from his holdings was about $8,000 annually, he said.

On May 18, Vice-President John P. Green issued a statement saying: The recent developments at the hearing in progress before the Interstate Commerce Commission in this city in respect to the acquisition and ownership of the stocks of coal companies and the acceptance of gratuities by its employees are a surprise to the management. While it is not believed that these have caused injustice to the public or the company, the facts with respect thereto will be thoroughly investigated, and no ownership or practice calculated in any manner to affect the full and impartial discharge of the duty owed by the company, its officers and employees to the public will be tolerated.

Reply of the Standard Oil Co.

The Standard Oil Company makes the following full and interesting reply to the Garfield charges:

26 Broadway, New York, May 16, 1906.

To the Shareholders of the Standard Oil Company:

On May 4 the President of the United States submitted a special message to Congress transmitting a report to him by Commissioner Garfield of the Bureau of Corporations, in which the Commissioner charges that this company "has habitually received from the railroads, and is now receiving, secret rates and other unjust and illegal discriminations."

Preliminary disclaimers were at once made to Commissioner Garfield's allegations, but we feel that you may naturally anticipate a more elaborate and technical reply, which we submit hereunder, as to the more important points to which reference is made in Mr. Garfield's report.

It must be borne in mind that when shipments are made between two points located in different States or Territories such shipments are interstate and the rates thereon are within the jurisdiction of the Federal authorities. Shipments which are made between two points within the same State or Territory are State or intrastate shipments, and the rates thereon do not come within the jurisdiction of the Federal authorities.

NEW ENGLAND.

Mr. Garfield opens his detailed instances with the alleged refusal of the New York, New Haven & Hartford Railroad and the Boston & Maine Railroad to prorate on oil, the inference being that this gave an undue advantage to the Standard, because the latter reached coast points in New England by water and distributed oil thence by rail to the interior.

It was pointed out to the Commissioner that competitors distributed oil in the same way from Bridgeport, Conn., enjoying exactly the same rates to points on the New Haven system as those paid by the Standard from Wilson's Point, Norwalk, Conn., to the same stations, and that the same was true as to the rates given to a competitor at Beverly, Mass., as compared with the rates given to the Standard Oil Company at East Boston, Mass. Corroborative of the foregoing, President C. S. Mellen of the New York, New Haven & Hartford road has stated that "there are others operating upon our lines with the Standard Oil Company under the same circumstances and conditions." President Lucius Tuttle of the Boston & Maine Railroad says: "No man can say with the slightest semblance of truth that the Boston & Maine has ever shown any discrimination between the Standard Oil Company and any other oil producers."

THE RATES FROM OLEAN.

The Vacuum Oil Company has a refinery at Olean, N. Y., and a refinery at Rochester, N. Y. The refinery at Olean is not equipped to refine, finish and turn out the high grades of oil required by the Vacuum Oil Company's trade. The rate of nine cents per barrel was put in as a between refinery rate, and has been in force for a great many years. Why the Western New York and Pennsylvania Railroad decided to blind bill, which means that no rate was shown on the manifest, we do not know, but Vice-President Thayer of the Pennsylvania Railroad, the carrier concerned, in a published statement, says:

"It is true that there has been in effect a special rate of nine cents per barrel from Olean to Rochester, and it has not been withdrawn. This rate was originally made in 1888 by the Western New York & Pennsylvania Railroad, twelve years before the acquisition of that company by the Pennsylvania Railroad, in order to retain the railroad traffic which would otherwise have gone by pipe line. The traffic to be transported was crude oil and unfinished products moving from one refinery to another belonging to the same owners. Attention having been recently called to the wording of the tariff, which might be construed to include a refined oil and perhaps was so erroneously construed and applied in a few instances, insignificant as compared with the total traffic, the wording of the tariff was corrected so as to clearly confine the rate to crude oil and unfinished products thereof, as intended. It is not a secret rate and never has been secret. The tariff was not filed with the Interstate Commerce Commission because it applies to traffic solely within the State of New York, and tariffs upon such traffic are never filed with the commission, whose jurisdiction covers only interstate traffic."

"Reference," Vice-President Thayer continues, "is made to 'blind-billing' as if it were some secret device. This also is untrue. Its purpose is to save clerical work. This was fully explained to Commissioner Garfield's representative."

While the Commissioner dwells with emphasis upon the low rate of nine cents between Olean and Rochester, he makes no mention of a tariff of which he has knowledge showing a rate of nine cents per barrel on crude oil and ten cents on refined oil from Freemansburg, Pa., to New York Harbor, a distance but little less than that between Olean and Rochester, the rates from Freemansburg being used entirely by competitors of the Standard.

Mr. Garfield, in connection with the Olean rate, charges that owing to a certain "virtually secret" rate from Norwood, N. Y., to Burlington, Vt., the Standard enjoyed lower rates than competing shippers to the same territory. The facts are as follows: Many, perhaps fifteen, years ago the road running from Norwood, N. Y., to Burlington, Vt., asked for some of the oil traffic and issued and filed with the Interstate Commerce Commission a rate of twenty-three dollars per car. The rate from Rochester, N. Y., to Norwood, N. Y., was nine cents per 100 pounds. There was no through rate from Rochester to Burlington, via Norwood, and the Standard used, openly and without rebate, the State rates from Olean and from Rochester plus the local open published rate of twenty-three dollars per car from Norwood, N. Y., to Burlington, Vt., which had been filed at the time of issue with the Interstate Commerce Commission. There was nothing illegal in this method of shipment. The right of a shipper to use a combination of State and interstate rates as against a single rate higher than the combination has been upheld by the courts.

It is difficult to understand why the twenty-three dollar rate from Norwood, N. Y., to Burlington, Vt., is called "virtually a secret rate" when it was not only covered by a tariff filed with the Interstate Commerce Commission, but as far back as 1899 was applied to a shipment made by a competitor of the Standard. It was pointed out to Mr. Garfield that it was not at all necessary for the Standard to ship via Norwood in order to reach Burlington; that for years an interstate rate of 12 cents per 100 pounds had been in effect from New London, Conn., to Burlington, Vt., by means of which rate the Standard Oil Company could place oil in the Burlington district to as great advantage as via Norwood, and that it had made shipments via that route.

SHIPMENTS INTO THE SOUTH.

Mr. Garfield charges that the Standard Oil Company has maintained "absolute control" of the section of country south of the Ohio River and east of the Mississippi through "secret" rates and open discriminations from Whiting, Ind.

The charge covers many rate points. First comes that as to the oil entering the South through what is termed the Grand Junction, Tenn., combination. For years and by way of both the Illinois Central and the Chicago & Eastern Illinois railroads running south from Chicago the rate on refined oil from Whiting, Ind., to Grand Junction, Tenn., was 13 cents per 100 pounds, and this rate was covered by published tariffs filed with the Interstate Commerce Commission. The latter fact Mr. Garfield has omitted to state in his report. The Southern Railway had a tariff also published and

filed with the Interstate Commission, naming rates from Evansville, Ind., via Grand Junction, Tenn., to a great many points through the South. A printed division sheet issued by the Southern Railway as part and parcel of the tariff applying from Evansville bore the following notation: "On shipments of oil from points north of Evansville, via Evansville, the Southern Railway will apply rates (as shown in the division sheet) south of Grand Junction." These rates have been in force since 1898, and collections have always been made from the Standard Oil Company at the net figures; no rebates or secret settlements being involved.

It was specifically shown to the Commissioner that the combination of rates into the South via Grand Junction was not of great importance to the Standard Oil Company, because during all the time the rates to and from Grand Junction were in force the Standard Oil Company shipped fully as much oil from Whiting via Evansville and other routes at the rates prevailing to and beyond the Ohio River. The use of the Grand Junction route was simply an incident in the distribution of a part of a very large tonnage into the South. Hundreds of cars were shipped yearly into that section from Ohio and Pennsylvania shipping points by the Standard and its competitors. Shipments were also made from Buffalo and Rochester, N. Y., from Philadelphia, Pa., Baltimore, Md., Savannah, Ga., Wilmington, N. C., and New Orleans, La.

So far as the rates from Whiting to Evansville are concerned, the fact is that these rates were openly quoted by the railroads and were in force a great many years. The Standard had nothing to do with the railroad's method of manifesting. It simply paid the rates quoted to it without rebate or secret settlement of any kind.

RATE TO EAST ST. LOUIS.

Mr. Garfield complains of the application of a rate of six cents per 100 pounds on oil from Whiting, Ind., to East St. Louis, Ill., claiming that it was a "secret" rate, and that in the matter of way billing by the railroads manipulation was resorted to with the knowledge of the Standard Oil officials.

About 1890, when the refinery had been established at Whiting, Ind., the Chicago, Burlington & Quincy Railway named to the Standard Oil Company a rate of six cents per 100 pounds and issued and sent to the Standard Oil Company a rate sheet from Chicago, Ill., to East St. Louis, Ill. At the same time it advised the Standard Oil Company that under its rules the State rate of six cents per 100 pounds would apply not only from Chicago proper but from all points both in Illinois and Indiana within the so-called Chicago switching limits, and that under such rules it would absorb the switching charge per car from Whiting to its own rails, thus applying the six cent rate from Whiting to East St. Louis. Subsequently the Chicago & Alton and the Chicago & Eastern Illinois solicited a share of the business at the same rate and the business was divided between the three roads. For several years the three roads applied the six cent rate from Whiting under their widely known rule, understood by every carload shipper in Chicago and vicinity, viz., that Chicago rates would apply to and from all points within the switching limits. A number of these points are just across the border in Indiana and are the seat of important industries, viz., Whiting, East Chicago, Hammond and Indiana Harbor. The application of Chicago rates to and from these points within the switching limits is of long usage and concerns not only the shipment of oil from Whiting to points in Illinois but the shipments of many other lines of goods to similar points.

Several years ago the railroads covered the matter more specifically by filing with the Interstate Commerce Commission so-called "application sheets," providing that any rate named from Chicago to a point in Illinois or beyond down to a minimum of six cents per 100 pounds in carloads would apply from all points in Illinois or Indiana within the Chicago switching limits. Common usage established the principle of applying Chicago rates from points within the Chicago switching limits up to the time the practice was covered by application sheets filed with the Interstate Commerce Commission.

With the method of way billing, which is purely an accounting matter between the railroad agents and the railroad auditor, the shipper necessarily has nothing to do. Commissioner Garfield insisted that the Standard Oil Company must have known of the method of manifesting until it was pointed out to him with extreme care that the Chicago-East St. Louis roads hauling the traffic did not reach Whiting, and that the cars were switched to them by a Chicago switching road. All the Standard Oil Company knows of this transaction is that it delivered cars to the switching road at Whiting, consigned to East St. Louis, and that the carrying roads collected freight from the Standard Oil Company at the regular rate of 6 cents per 100 pounds. There was no secrecy about it.

While dwelling upon what he considers a low rate used by the Standard from Whiting to East St. Louis, Mr. Garfield fails to mention that in 1896 and later the same rate on oil was in force by the Illinois Central Railroad from Kankakee, Ill., to East St. Louis, for the benefit of a plant located at Kankakee and in which the Standard was in no way interested. The same road made a rate for the same shipper of 1½ cents per 100 pounds from Kankakee to Chicago, a distance of fifty-six miles. During the time the competitive plant was in operation at Kankakee the roads running west and northwest from Chicago absorbed on shipments destined to points on their lines $8 per car of the rate from Kankakee to Chicago, and as the rate was only 1½ cents per 100 pounds, it resulted in the application of Chicago rates from Kankakee, the same as were applied from Whiting.

KANSAS.

In this section of the report the only reference to Kansas is that there are some "unfair open rates"—a matter too vague to answer, and the statement that "a more important discrimination lies in the arbitrary weight fixed by the railroads on crude and fuel oil. As known to every shipper of oil in the United States it has been the general custom of the railroads to assess the weights of all the liquid products of petroleum at an estimated average of six and four-tenths pounds per gallon, and it is so expressed in the tariffs. This includes fuel oil, which weighs more than six and four-tenths pounds per gallon, and gasolene and naphthas, which weigh less. Every refiner in the United States makes interstate shipments under these conditions. An exception, however, to this general rule was made by the roads running out of Kansas. Shortly after oil was produced in large quantities in Kansas the Kansas railroads decided that since the producers of crude oil had no light products—gasolenes, naphthas—to offer that would go toward constituting an average, they should pay the actual weight on the individual product that they offered for transportation. On the theory that crude oil was not included in the general average of six and four-tenths pounds, the Kansas railroads applied a weight of seven and four-tenths pounds to crude oil. The Standard Oil Company, as explained to Mr. Garfield, objected to the advanced weight on crude oil; but its objection was unheeded by the railroads, and yet, notwithstanding the foregoing explanation, the commissioner includes the Kansas weight rule in the list of things making for favoritism from the railroads to the Standard Oil Company.

CALIFORNIA.

In California, the commissioner charges that rebates as well as discriminations by secret rates have been given on oil. This refers to State rates not within the jurisdiction of the Federal authorities. Here it is no question of the Standard Oil Company alone, but of many producers and consumers of oil.

There is no law in California requiring the railroads to file tariffs. When, therefore, the problem was presented of hauling a new and large production of oil, used to a large extent for fuel, they quoted rates to shippers according to the conditions existing from time to time. No class rates were applied to these shipments; hence overcharges were inevitable, and when made were refunded, to make the freight charges correspond with the rates quoted. There was not the slightest favoritism shown the Standard. The same rates quoted to it were quoted to others, and in many cases the rates were obtained and used by others before the Standard knew of their existence. Whenever the situation in California is such that all shipments can be covered by regular tariffs the Standard will welcome the change.

Mr. Garfield mentions certain California state rates used "in connection with interstate shipments." In reply it may be said that where the state rates were used from any point in California in connection with interstate rates from some other point in California to a point in Arizona it was necessary, because no through rates were in force from the point of shipment to destination. For example: Through rates were in force from Redondo, Cal., via the Atchison, Topeka & Santa Fe Railway, to points in Arizona on that road. On the other hand, the Southern Pacific, for reasons best known to itself, did not join in through rates from Redondo. On shipments from Redondo to points in Arizona on the Southern Pacific it was necessary to use the local rates, no matter what they might be, from Redondo to Los Angeles, plus the published tariff rates filed with the Interstate Commerce Commission from Los Angeles to point of destination. The wharf at Redondo is public, and the wharf, the state rates and the interstate rates were open to the use of any shipper.

ALLEGED SAVINGS.

The large sums of money which Mr. Garfield sets down as one year's "savings" to the Standard through the operation of certain freight rates—sums which the President aggregates as $750,000—could only have been arrived at by theorizing.

FAVORITISM THROUGH OPEN RATES.

If the claim of Commissioner Garfield was true that the Standard is favored by open rates it would involve not only collusion between the railroads and the Standard Oil Company, but collusion by the railroads with each other. It would also involve the consent of a railroad not reaching Whiting, Ind., for example, to the establishment of rates out of that point which would be ruinous to business out of another point at which the consenting railroad was receiving traffic. To bring about such an arrangement would be impossible. It may be said generally that there is a competing re-

finery in almost every section of the United States where the Standard has a refinery, except at Whiting, Ind.

No rates can be made applicable to the Standard which will not be equally applicable to the Standard's competitors.

In conclusion: After an investigation of shipments during a period of about fifteen years over more than 200,000 miles of railway the commission is not able to show that the Standard Oil Company received a single rebate on its interstate shipments. He has only been able to call attention to a few instances in which the rate situation in his opinion required explanation. This explanation was freely given and we believe would be satisfactory to any man familiar with transportation problems.

If the commissioner had any doubts as to the regularity of these rates he might have brought them to the attention of the Interstate Commerce Commission when the questions at issue could have been heard and determined. In the absence of such determination it is surely not within the limits of fairness for the Bureau of Corporations to cast aspersions upon a great corporation.

The company owns and controls only a very moderate percentage of the crude oil production of the United States, and with at least one hundred and twenty-five rival refineries in existence it is a palpable absurdity to call it a monopoly. For the last quarter of a century more than 60 per cent. of its output has been shipped to foreign countries. In creating and sustaining this vast foreign trade the company has encountered innumerable obstacles and incessant competition from other petroleum industries possessing the advantages of geographical location and cheaper labor, and which are oftentimes developed under the fostering care of their respective governments. If the company maintains a gratifying percentage of the world's commerce it is because it keeps its agreements and delivers products of reliable quality at reasonable prices. Whatever measure of prosperity it has enjoyed is not traceable to illegal or reprehensible methods, but to its economic and elaborate industrial organization, covering, as it does, every detail of transportation, manufacture and administration. By order of the board of directors. C. M. PRATT, Secretary.

Train Accidents in the United States in April.[1]

unx, 2d, Pennsylvania road, Rockland, Pa., a work train going to pick up a wreck was derailed and the fireman and one other trainman were killed. Four employees on the ground were injured.

unx, 2d, Chesapeake & Ohio, Mentor, Ky., freight train No. 65 was derailed and wrecked and one brakeman was killed.

o, 2d, Lake Shore & Michigan Southern, Amherst, Ohio, the locomotive of a freight train was wrecked by the explosion of its boiler, and two men were injured, one of them fatally.

dr, 3d, St. Louis & San Francisco, Wister Junction, Ind. T., passenger train No. 6 was derailed by a broken rail and three passenger cars were ditched, one of them, a sleeping car, being overturned. Ten passengers were injured, but all of the injuries were slight. The sleeping car conductor was seriously injured.

dn, 4th, Norfolk & Western, Juniper Siding, Va., a passenger train was derailed at a misplaced switch. Four trainmen were injured, one of them fatally.

dr, 5th, Chicago, Burlington & Quincy, St. Michael, Neb., westbound passenger train No. 41 was derailed by spreading of rails, and two baggage cars were overturned. The first seven passenger cars were badly damaged. The train was well filled with passengers, but, according to the report, only four persons were injured. The gas tank in one of the chair cars caught fire, but was thrown out of the car before it exploded. An explosion took place and the wreck caught fire, but the flames were soon extinguished.

dn, 6th, 9 p.m., Baltimore & Ohio, Swanton, Md., a westbound freight train ascending a grade with a pushing engine at the rear was derailed by the buckling of the train in the middle, and one car fell on the eastbound track. Eastbound passenger train No. 12, coming along a moment afterward, ran into the wreck and was derailed. The passenger engine was thrown against the side of the mountain and the engineman was killed. Two other trainmen were injured.

unx, 6th, Southern Railway, Salisbury, N. C., freight train No. 72 was derailed and 15 loaded cars broke through an iron bridge, knocking it down.

unx, 9th, Mobile & Ohio, Sugar Creek, Ill., passenger train No. 2 was derailed and the engine and first four cars were ditched. The engineman, fireman and four other persons were injured.

unx, 9th, Erie road, Buffalo, N. Y., an eastbound passenger train was derailed and the engine was overturned. The engineman was killed and the fireman and three passengers were injured.

unx, 9th, West Virginia Central & Pittsburg, Dawson, Md., a work train going to the relief of a passenger train which had been detained by a landslide, was derailed and the engine was overturned. The engineman and fireman were killed.

rc, 10th, 5 a.m., New York, Philadelphia & Norfolk, Exmore, Va., a freight train which had broken in two was run into at the rear by a following passenger train, and the engine and several cars were wrecked. The engineman and fireman were killed. There was a dense fog at the time.

eq, 10th, 9 p.m., Atlantic Coast Line, Winona, S. C., fast mail train No. 82 was derailed by the failure of the tire of one of the wheels of the tender, and the first four cars were thrown at right angles to the track and badly damaged. It is said that none of the occupants of the train were injured.

bc, 13th, Southern Railway, Statesville, N. C., butting collision between a regular freight train going down grade and an extra freight going up, badly damaging both engines. It is said that the regular train was running at 50 miles an hour. The men on both engines jumped off and all except one escaped with slight injuries. The failure of an operator to deliver an order is said to have been the cause of the collision.

unx, 13th, Chicago & North-Western, McNaughton, Wis., a freight train was derailed and several cars were wrecked; one man was killed.

unx, 16th, Louisville & Nashville, Zion, Ky., a passenger train was derailed and the engine was overturned. The engineman was killed and the fireman and four other trainmen were injured.

rc, 17th, Pennsylvania road, New Florence, Pa., an eastbound express train which had been stopped on account of the breaking out of a fire in the baggage car was run into at the rear by a following freight train, badly damaging the rear passenger car. Eight passengers were injured. It is said that a block signalman gave a clear signal to the freight, ignoring the fact that the passenger train had not passed out of the block section.

bc, 17th, Louisville & Nashville, Richmond, Ky., butting collision between southbound freight train No. 45 and a work train running north, making a bad wreck. Eight employees were injured, three of them probably fatally. It is said that the men in charge of the work train had overlooked a change in a new time-table.

o, 17th, Atlantic Coast Line, Manchester, Va., a locomotive was wrecked by the explosion of its boiler and the fireman was scalded.

19th, Cumberland Valley, Shippensburg, Pa., collision of switching freight trains; one trainman killed, one injured.

xc, 25th, Shreveport, La., a switching train of the Kansas City Southern collided with a passenger train of the Texarkana, Shreveport & Natchez at the crossing of the two roads and two cars were wrecked. The baggageman and a mail clerk were injured.

25th, Lehigh Valley, Yatesville, Pa., the engine and three cars of a freight train were derailed by an explosion of dynamite, evidently malicious, and the engineman and fireman were injured.

bc, 26th, Southern Railway, Marion, N. C., butting collision of freight trains; three trainmen injured.

dn, 26th, Southern Railway, Chatham, Va., a freight train was derailed, evidently by running too fast; one employee killed and two injured.

unx, 26th, Southern Railway, Pomona, N. C., a freight train was derailed and the engine was overturned. The fireman was killed and the engineman injured.

o, 27th, Pennsylvania road, Harrisburg, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler; the engineman was killed and two other trainmen were fatally injured.

*unf, 27th, Chicago, Burlington & Quincy, Chalco, Neb., a passenger train was derailed by running into the wreck of an overhead bridge which had taken fire and fallen to the track. The train was brought to a stand with the two passenger cars in the midst of the fire, and these were destroyed. The gas tanks of the cars exploded and blew the cars to pieces. The engineman, fireman and one passenger were slightly injured.

*unx, 29th, Northern Pacific, Reid, Mont., a freight train was derailed and three trainmen and several tramps were injured, and the engineman and fireman were burned to death in a fire which consumed most of the wreck.

dr, 29th, 8 p.m., Southern Railway, Anniston, Ala., westbound passenger train No. 37 was derailed at a defective switch and the baggageman was killed. Twelve passengers were injured.

dn, 30th, Colorado & Southern, Forks Creek, Colo., a passenger train, narrow gage, which was being separated at the top of a grade, became uncontrollable and a part of the cars broke loose and ran down the steep grade without attendance. Hand-brakes were applied, but without effect, and at the first sharp curve the cars were thrown down a bank, and 21 passengers were injured.

unx, 30th, Baltimore & Ohio, Triadelphia, W. Va., a special

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

train, carrying officers of the road, was derailed, and the superintendent was injured.

unx, 30th, Atchison, Topeka & Santa Fe, Orange, Cal., a passenger train was derailed while running at full speed, and the first three cars were wrecked. Several passengers and trainmen were injured.

Destruction of Creosoted Piles.

These pictures show creosoted piles that are very badly eaten by teredos and limnoria. In the vicinity of Puget Sound, according to Mr. A. Stewart, Assistant Chief Engineer of the Great Northern at Seattle, a stick of timber, rough sawed, will last about eight months, a peeled pine will last a year, a pile with the bark on will last a year and a half, while a creosoted pile will last from 15 months to 15 years. The unfortunate part of it is that two piles treated and driven under the same conditions will be affected differently by the teredo and limnoria.

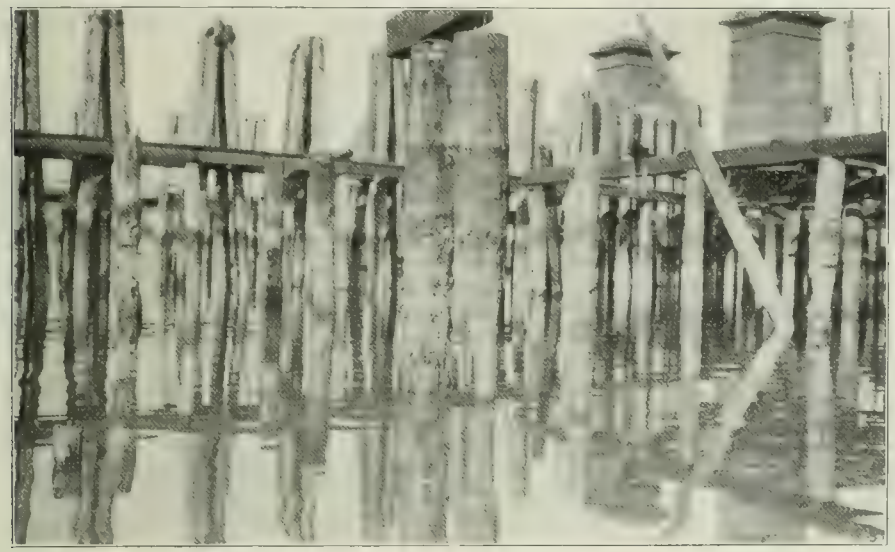


Fig. 1.



Fig. 3.



Fig. 2.

Washington Correspondence.

WASHINGTON, May 22. The Hepburn railroad rate bill is now in its last legislative stage and the finishing touches will be put on it by the conferees of the Senate and House of Representatives. As it is usually the case with a bill that is materially and hastily amended, some of the amendments made by the Senate are not satisfactory even to the men who were chiefly instrumental in securing their adoption, and some of them conflict with each other. It is probable that more men in both Houses of Congress are dissatisfied with the anti-pass amendment than with any other that was adopted by the Senate. It is now generally recognized that the Senate amendment fails to permit the giving of passes to many persons who should be entitled to receive them. For instance, under the amendment as it now stands, passes or free transportation could not be given to Pullman employees, railroad mail clerks, representatives of baggage transfer companies, employees of contractors working on the line of a road and to many other classes for whom free transportation is almost necessary. In the opinion of some of the conferees the Senate amendment, by prohibiting free transportation generally and then making a long list of exceptions, many of which are ridiculous, goes at the matter from the wrong end. They believe that it would be better to specify the classes of persons who shall not be given free transportation and allow the roads to use their discretion as to all others. An effort will be made in conference to put the amendment into this shape. It is contended that unless this is done, even though the list of exceptions should be greatly extended, there would be danger of leaving out some classes who should have free transportation.

There is serious conflict between the amendment making the act apply to pipe line companies and declaring them to become common carriers and that providing that from and after May 1, 1908, it shall be unlawful for any common carrier to transport in interstate or foreign commerce any article or commodity, other than timber and the manufactured products thereof, manufactured, mined, or produced by it or under its authority or which it may own in whole or in part, or in which it may have any interest, direct or indirect, except such articles or commodities as may be necessary and intended for its own use in the conduct of its business as a common carrier. These two amendments taken together would prevent the transportation across state lines by means of any pipe line of any oil or other commodity, except water or natural or artificial gas, that might be owned by the owner of the pipe line or in which the owner of the pipe line might have any interest. It is obvious that this would put many of the pipe lines out of business or would compel oil companies owning such lines to sell them to independent corporations. It is expected that the conferees will change these amendments so as to remove the existing conflict between them.

An effort is to be made to have the provision requiring the filing with the Interstate Commerce Commission and the posting for public inspection of all rates, fares and charges so amended as not to require the filing and publication of through rates to points in foreign countries not contiguous to the United States. As the bill now stands it would require the filing and publication of every through rate, whether by an all rail route, by pipe line or by rail in conjunction with water. It is contended that the application of this requirement to transoceanic rates would tend to hamper the foreign commerce of the United States.

Another amendment that is being much criticised is that re-

lating to bills of lading which proposes to make the road on which the traffic originates liable to the holder of the bill of lading for any loss, damage or injury whether such loss, damage or injury is caused by the originating road or by any common carrier, railroad, or transportation company to which the property may be delivered or over whose line or lines it may pass, subject to a provision entitling the originating road to recover from the carrier, road or company responsible for the loss or damage. This is criticised as being virtually a requirement that the originating road shall insure the safe transportation of property beyond its own lines. It is not certain, however, that the conferees will change this provision in any way.

As the bill passed the House the provision for the enforcement by the courts of any order of the Interstate Commerce Commission, other than for the payment of money, required the court to enforce the order if it was found that it was regularly made and duly served. The Senate amended this by substituting the word "lawfully" for "regularly." This amendment has been much criticised by some of the members of the House Committee, and such a conservative Senator as Mr. Spooner has declared that it was a mistake. It is probable, therefore, that the word "regularly" will be restored. This might have been a matter of great importance to the railroads if the Senate had not incorporated in the bill express provision for judicial review without denying to the courts authority to suspend an order pending review. With the review provision in the bill it is not probable that the Interstate Commerce Commission will often be called upon to institute proceedings for the enforcement of an order and some railroad attorneys take the view that it makes very little difference which word is used.

It is possible that the conferees may do something with the Senate amendments putting the express companies and sleeping car companies under the provision of the law and requiring carriers engaged in interstate commerce to give equally good service and accommodations to all persons paying the same compensation for interstate transportation of passengers. Some of the southern men in Congress are very much afraid that these two amendments taken together will have the effect of nullifying the "Jim Crow" car laws of the southern states so far as they apply to interstate passengers, and they are endeavoring to have these amendments eliminated. In this they are obtaining assistance from an unexpected source, as there has been a delegation of negroes from Boston at the Capitol opposing the retention of these provisions on the ground that it is better for the negroes of the United States to base their contention for equal treatment on the broad general language of the Fourteenth Amendment to the Constitution rather than upon a statutory provision.

All indications now point to a speedy agreement by the conferees and to the adoption of the conference report in both houses without serious opposition. There has been some loose talk about the possibility of President Roosevelt's vetoing the bill on account of the elimination of the words "in its judgment" from the rate-making section. This is perfectly absurd, however. As a matter of fact the President gave his approval to the proposition for the elimination of these words before the Senate had voted on Senator Teller's motion to strike them out. Even if he had not consented to this amendment there is every reason to believe that Mr. Roosevelt would sign the bill. On the whole, it is a substantial victory for him and carries out the spirit of his original recommendation to Congress on this subject that "the Commission should be vested with the power, where a given rate has been challenged and after full hearing found to be unreasonable, to decide, subject to judicial review, what shall be a reasonable rate to take its place; the ruling of the Commission to take effect immediately, and to obtain unless and until it is reversed by the court of review." J. C. W.

Instruction of German Employees.

There has been a course of instruction established at Dresden for the education of railroad officials and employees. The following courses of lectures were given, all by officials practically engaged in the state service; six on safety precautions in railroad operation, five on the relations of railroad construction to railroad operation, four on traffic geography, six on passenger traffic, five on railroad freight law and on rates, six on the constitution of the German Empire and its development, six on operation service, eight on railroad superstructure, tunnels and bridges; 12 on questions of railroad policy, and six on hygiene.

Lumber Cut of the United States in 1905.

The Forest Service of the United States Department of Agriculture sends this preliminary statement:

The work of gathering and compiling the figures on the lumber cut during 1905 has been done by the Forest Service in co-operation with the National Lumber Manufacturers' Association. The summary here presented is based upon the reports of 11,649 firms.

The results given are necessarily incomplete, since many firms have as yet failed to furnish the necessary information. In completing these figures the secretaries of the various lumber associations are co-operating most effectively. A more complete statement will be issued when all reports have been received.

Lumber.

State.	Number of Firms Reporting.	Lumber, Mill Hon Feet, B. M	Total Cut, Per Cent.	Conifers, Mill Hon Feet	Hard woods, Million Feet.
Washington	425	3,010	10.8	3,010	....
Louisiana	209	2,043	7.3	1,987	56
Wisconsin	408	1,990	7.2	1,640	350
Minnesota	173	1,718	6.2	1,692	26
Michigan	437	1,676	6.0	1,095	581
Arkansas	853	1,457	5.2	1,080	377
Pennsylvania	701	1,342	4.8	998	344
Oregon	319	1,252	4.5	1,246	6
Mississippi	342	1,226	4.4	1,014	212
California	196	1,219	4.4	1,219	....
North Carolina	633	999	3.6	835	164
Texas	159	881	3.2	865	16
Alabama	326	841	3.0	754	87
Georgia	349	710	2.5	676	34
Virginia	452	708	2.5	554	154
Maine	364	695	2.5	659	36
Florida	122	652	2.3	652	....
West Virginia	284	545	2.0	309	236
Tennessee	499	544	2.0	40	504
Kentucky	431	467	1.6	36	431
New York	1,014	446	1.6	360	86
Missouri	223	353	1.3	185	168
South Carolina	194	351	1.3	325	26
Indiana	461	350	1.3	....	350
Ohio	541	331	1.2	329	2
New Hampshire	269	329	1.2	300	29
Vermont	284	265	1.0	170	95
Massachusetts	249	239	.9	217	22
Montana	23	231	.8	231	....
Idaho	54	197	.7	192	5
Maryland	113	164	.6	116	48
Illinois	176	120	.4	34	86
Iowa	29	107	.4	98	9
All others	337	279	1.0	206	73
Total	11,649	27,738	100.0	23,225	4,613

The following table separates the cut by species and shows the relative position each species occupies in the lumber cut of the country. The stock on hand January 1, 1906, is also given, and its percentage of the amount cut. The stock of western white pine is doubtless in excess of the true figure, due to confusion in reporting sugar and other related pines with this species.

Kind.	Total Cut.—Million Feet.	Total Cut.—Per Cent.	Stock on Hand.—Million Feet.	Stock on Hand.—Per Cent. of Cut.
Yellow pine	8,217	29.8	1,175	15
Douglas fir	3,614	13.0	455	13
Northern pine	3,229	11.6	743	23
Hemlock	2,569	9.3	436	17
Spruce	1,128	4.0	142	13
White oak	1,071	3.9	284	27
Western pine	1,013	3.7	205	20
White pine	849	3.5	813	96
Cypress	697	2.5	341	49
Red oak	603	2.2	101	17
Poplar	580	2.1	193	33
Maple	507	1.8	167	33
Redwood	497	1.8	120	24
Red gum	307	1.1	97	32
Birch	275	1.0	80	29
Basswood	227	.8	81	36
Cottonwood	219	.8	86	39
Elm	214	.8	56	26
Chestnut	214	.8	54	25
Cedar	208	.7	59	28
Beech	206	.7	52	25
Ash	152	.7	40	26
Sugar pine	107	.4	32	30
Western white pine	105	.4	146	139
Hickory	93	.3	11	12
Larch	67	.2	35	52
Tamarack	62	.2	16	26
Tupelo	35	.1	15	43
Balsam	34	.1	7	21
Walnut	28	.1	9	32
Mixed	467	1.7	453	97
Total	27,738	100.0	6,504	....

Shingles.

	No. Firms Reporting.	No. Millions.	Per Cent. of Total Cut.
Washington	379	8,438	60.8
California	71	562	4.1
Oregon	47	139	1.0
All others	1,448	4,729	34.1
Total	1,945	13,868	100.0

Species.	Cut.—Millions.	Cut.—Per Cent.
Western red cedar	7,523	54.2
Cypress	1,415	10.2
Eastern cedar	1,248	9.0
Fir	911	6.6
Redwood	498	3.6
Yellow pine	440	3.2
White pine	368	2.7
Hemlock	134	1.0
Mixed white and Norway pine	82	.6
Port Orford cedar	72	.5
Spruce	54	.4
Larch	47	.3
Mixed	1,076	7.7
Total	13,868	100.0
Total	80,051,000	100.0

LATH.

The total output of laths for all states and species is 2,910,000,000.

CROSS-TIES PURCHASED BY THE STEAM RAILROAD COMPANIES DURING 1905.

Probably no product of the forest has been the subject of more

discussion and diversity of opinion than the annual consumption of cross-ties in the United States.

The following statements are made possible by the almost unanimous co-operation of the steam railroads with the Forest Service in furnishing the necessary data. While these statements are nearly complete for the purchases of cross-ties by steam transportation companies, they are below the total number of cross-ties used, since no reports from electric lines are included. The figures given are based upon reports from 750 companies, having an aggregate trackage of 278,262 miles. Since, according to Poor's Manual for 1905, the total trackage of the railroads in the United States is 293,937 miles, it follows that the mileage reported is 95 per cent. of the total. Switch ties have been figured into the equivalent number of cross-ties.

The total number of ties reported is 80,051,000, of which 22,569,000, or 36 per cent., were to be used for the construction of new track.

On this basis the total number of ties used by the steam railroads would be 84,400,000, representing nearly 3,000,000,000 feet of lumber, board measure.

Cross-ties Purchased, 1905.

Kind.	Number.	Per Cent. of Total.	Hewed, Per Cent.	Sawed, Per Cent.
Oak	38,055,000	47.5	88.1	11.9
Pine	17,496,000	21.9	67.3	32.7
Cedar	6,911,000	8.7	69.3	30.7
Chestnut	4,675,000	5.8	69.5	30.5
Fir	3,485,000	4.4	39.8	60.2
Cypress	3,383,000	4.2	88.9	11.1
Tamarack	3,335,000	4.2	99.0	1.0
Hemlock	1,675,000	2.1	93.4	6.6
All others	1,036,000	1.2	76.0	24.0
Total	80,051,000	100.0	....	....

The per cent. of the total number of ties of each kind obtained from the various regions is as follows:

Source of Supply.

Kind.	Regions. North Atlantic States.	Southern States.	Central States.	Lake States.	Rocky Mountain States.	Pacific Coast States.	Total.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Oak	12	33	54	1	..	..	100
Pine	..	81	..	4	10	5	100
Cedar	11	..	..	88	..	1	100
Chestnut	93	3	4	..	..	..	100
Fir	..	..	..	..	35	65	100
Cypress	..	100	..	..	..	..	100
Tamarack	1	..	..	91	7	1	100
Hemlock	7	..	..	93	..	..	100
All others	16	7	1	5	14	57	100

Preservative treatment was given to 7,615,000 ties, representing nearly 10 per cent. of the total number reported. Although the species of timber treated have not been separated in most cases, it is safe to say that almost all of the ties treated were softwoods.

The regions referred to in the preceding table include the following states:

North Atlantic States.—New England states, New York, Pennsylvania, New Jersey, Delaware, Maryland.

Southern States.—Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Texas, Indian Territory.

Central States.—Ohio, West Virginia, Kentucky, Tennessee, Indiana, Illinois, Missouri.

Lake States.—Michigan, Wisconsin, Minnesota.

Rocky Mountain States.—Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico.

Pacific Coast States.—Washington, Oregon, California.

W. C. Brown on the Railroad Y. M. C. A.*

Great and gratifying as has been the material improvement of the last 30 years in the railroad world, it is dwarfed into insignificance by the marvelous improvement in and the grand uplifting of railroad men; and it is because I appreciate and rejoice in this improvement and recognize from whence in a very large measure it has come, that I am glad to participate in the dedication of this building to the service of God and to the comfort and convenience of railroad men, located, as it is, almost at the birthplace of the railroad department of the Young Men's Christian Association. The work of the Young Men's Christian Association among railroad men was commenced in Cleveland in 1873 by earnest, Christian men in evangelical services held in railroad shops, roundhouses and depots. General John H. Devereaux, afterwards President of the Big Four road, was deeply interested in the work, and set apart a room in the passenger station for the use of the little association at that time founded. How wisely he builded, how much he did for railroads, as well as for railroad men, in thus encouraging this work in its infancy, no one can undertake to estimate.

Eliminate from consideration if you will the religious and the educational features entirely—inestimably important as they are—and consider only the simple proposition of a clean, wholesome place to sleep and eat, free from the temptations which surround the young man employed on a railroad, under the most favorable circumstances, when thrown upon his own resources, and in my opinion no investment of a similar amount of money has ever paid or can ever pay, so large a return as the money devoted to the construction and maintenance of these railroad departments of the Young Men's Christian Association.

If a railroad officer, seeking an excuse to decline to make a contribution of this character, propounds the ancient interrogatory "Am I my brother's keeper," the reply should be emphatically in the affirmative. The railroad which annually draws thousands of young men from the villages and farms to fill up its ranks, depleted by age, accident and disease, owes something to this army of young men. They owe it to the men themselves; they owe it to anxious, loving fathers and mothers back in the homes from whence these young men came; above all, they owe it to the public who daily place in the care and custody of these men their lives and property, to do everything within their power to make them the best, safest, most efficient men possible; and in doing this, in my opinion, no agency can be enlisted so adapted, so consecrated, so devoted to the work, and so successful in the work, as the railroad branch of the Young Men's Christian Association.

*From an address by W. C. Brown, Vice President of the New York Central Lines, at the opening of a new railroad Y. M. C. A. building at Collinwood, Ohio, on the Lake Shore & Michigan Southern, May 1.

The Railroad Rate Bill.

As we go to press, the Hepburn bill, much modified by amendments, has gone to conference. We are reproducing it in full, in the form in which it went into the hands of the Committee, and subsequent changes will be noted.

AN ACT

To amend an Act entitled "An Act to regulate commerce," approved February fourth, eighteen hundred and eighty seven, and all Acts amendatory thereof, and to enlarge the powers of the Interstate Commerce Commission.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section one of an Act entitled "An Act to regulate commerce," approved February fourth, eighteen hundred and eighty-seven, be amended so as to read as follows:

"Section 1. That the provisions of this Act shall apply to any corporation or any person or persons engaged in the transportation of oil or other commodity, except water and except natural or artificial gas by means of pipe lines or partly by pipe lines and partly by railroad or partly by pipe lines and partly by water, who shall be considered and held to be common carriers within the meaning and purpose of this Act, and to any common carrier or carriers engaged in the transportation of passengers or property wholly by railroad (or partly by railroad and partly by water when both are used under a common control, management, or arrangement for a continuous carriage or shipment), from one state or territory of the United States or the District of Columbia, to any other State or Territory of the United States or the District of Columbia, or from one place in a territory to another place in the same territorly, or from any place in the United States to an adjacent foreign country, or from any place in the United States through a foreign country to any other place in the United States, and also to the transportation in like manner of property shipped from any place in the United States to a foreign country and carried from such place to a port of transshipment, or shipped from a foreign country to any place in the United States and carried to such place from a port of entry either in the United States or an adjacent foreign country: Provided, however, That the provisions of this Act shall not apply to the transportation of passengers or property, or to the receiving, delivering, storage, or handling of property wholly within one state and not shipped to or from a foreign country from or to any state or territory as aforesaid.

DEFINITION OF TERM "COMMON CARRIER."

"The term 'common carrier,' as used in this Act, shall include express companies and sleeping car companies. The term 'railroad,' as used in this Act, shall include all bridges and ferries used or operated in connection with any railroad, and also all the road in use by any corporation operating a railroad, whether owned or operated under a contract, agreement, or lease, and shall also include all switches, spurs, tracks and terminal facilities of every kind used, or necessary in the transportation of the persons or property designated herein, and also all freight depots, yards and grounds used or necessary in the transportation or delivery of any of said property; and the term 'transportation' shall include cars and other vehicles and all instrumentalities and facilities of shipment or carriage, irrespective of ownership or of any contract, express or implied, for the use thereof and all services in connection with the receipt, delivery, elevation, and transfer in transit, ventilation, refrigeration or icing, storage, and handling of property transported; and it shall be the duty of every carrier subject to the provisions of this Act to provide and furnish such transportation upon reasonable request therefor, and to establish through routes and just and reasonable rates applicable thereto.

"All charges made for any service rendered or to be rendered in the transportation of passengers or property as aforesaid, or in connection therewith, shall be just and reasonable, and every unjust and unreasonable charge for such service or any part thereof is prohibited and declared to be unlawful.

PENALTIES FOR GRANTING FREE TRANSPORTATION TO PASSENGERS

No carrier subject to the provisions of this Act shall hereafter, directly or indirectly, issue or give any interstate free ticket, free pass or free transportation for passengers, except to its employees, exclusively for their use, physicians, actual and bona fide attorneys, and members of their immediate families; to ministers of religion, local and traveling secretaries of Young Men's Christian Associations, inmates of hospitals and charitable and eleemosynary institutions, and persons exclusively employed in the transportation service, and the families of such persons; to officers, agents, employees, and members of the families of officers, agents, and employees of other carriers transporting passengers or property; to persons who, for the purpose of entering upon the service of any railroad, as officers, agents, employees, or members of the families of officers, agents, or employees, are about to travel for such railroad, and to persons who have been in the service of any railroad, as officers, agents, employees, or members of the families of officers, agents, or employees, and who, on account of old age, sickness, infirmity, or other disability, are unable to continue in the service of such railroad, and to the families of such persons; to persons who are traveling for the purpose of entering the service of any railroad, as officers, agents, employees, or members of the families of officers, agents, or employees

monitary institutions for the relief of destitute and homeless persons, and to such persons when transported by charitable societies or hospitals, and the necessary agents employed in such transportation, to inmates of the national homes or state homes for disabled volunteer soldiers, and of soldiers' and sailors' homes, including those admitted to enter and those returning home after discharge, under the charge of agents with boards of managers, and female nurses that served during the Civil War, to ex-Union soldiers and sailors and ex-Confederate soldiers and nurses, and to owners and caretakers of livestock when traveling with such livestock in charge of which going to point of shipment or returning from point of destination: Provided, that this provision shall not be construed to prohibit the interchange of passes for the officers, agents, employees of carriers and members of their immediate families, nor to prohibit any carrier from carrying passengers free with the object of providing relief in cases of general epidemic, pestilence or other calamitous visitations, nor prevent such carrier from giving free or reduced transportation to laborers transported to any place for the purpose of supplying any demand for labor at such place. Any carrier violating this provision shall be deemed guilty of a misdemeanor and shall for each offense pay to the United States a penalty of not less than $100 nor more than $2,000, and any person, other than the persons excepted in this provision, who uses, or who solicits or accepts for himself or other person any such interstate free ticket, free pass or free transportation, shall be subject to a like penalty and fine. Jurisdiction of offenses under this provision shall be the same as that provided for offenses in an Act entitled "An Act to further regulate commerce with foreign nations and among the states," approved Feb. 19, 1903, and any amendment thereof.

"From and after May next, nineteen hundred and eight, it shall be unlawful for any common carrier to transport from any state, territory or district of the United States to any other state, territory or district of the United States or to any foreign country any article or commodity, other than timber and the manufactured products thereof, manufactured, mined or produced by it or under its authority or which it may own in whole or in part, or in which it may have any interest, direct or indirect, except such articles or commodities as may be necessary and intended for its own use in the conduct of its business as a common carrier.

INSTALLATION OF PRIVATE SWITCHES COMPULSORY.

"Any common carrier subject to the provisions of this Act shall promptly, upon application of any shipper tendering interstate traffic for transportation, construct, maintain and operate upon reasonable terms a switch connection with any private sidetrack which may be constructed to connect with its railroad, where such connection is reasonably practicable and can be put in with safety and will furnish sufficient business to justify the construction and maintenance of the same; and shall furnish cars for the movement of such traffic to the best of its ability without discrimination in favor of or against any such shipper.

"If any common carrier shall fail to install and operate any such switch or connection as aforesaid, on application therefor in writing by any shipper, such shipper may make complaint to the commission, as provided in section thirteen of this Act, and the commission shall hear and investigate the same and shall determine as to the safety and practicability thereof and justification and reasonable compensation therefor, and the commission may make an order, as provided in section fifteen of this Act, directing the common carrier to comply with the provisions of this section in accordance with such order, and such order shall be enforced as hereinafter provided for the enforcement of all other orders by the commission, other than orders for the payment of money.

"It shall be the duty of carriers engaged in interstate commerce to give equally good service and accommodations to all persons paying the same compensation for interstate transportation of passengers."

Sec. 2. That section six of said Act, as amended March second, eighteen hundred and eighty nine, be amended so as to read as follows:

"Sec. 6. That every common carrier subject to the provisions of this Act shall file with the commission created by this Act and print and keep open to public inspection schedules showing all the rates, fares, and charges for transportation between different points on its own route and between points on its own route and points on the route of any other carrier by railroad, by pipe line or by water when a through route and joint rate have been established. The schedules printed as aforesaid by any such common carrier shall plainly state the places between which property and passengers will be carried, and shall contain the classification of freight in force, and shall also state separately all terminal charges, storage charges, icing charges, and all other charges which the commission may require, all special privileges or facilities granted or allowed and any rules or regulations which in any wise change, affect or determine any part, or the aggregate of such aforesaid rates, fares, and charges of the value of the service rendered to the passenger, shipper, or consignee. Such schedule shall be plainly printed in large type, and copies for the use of the public shall be kept posted in two public and conspicuous places in every depot, station, or office of such carrier where passengers or freight, respectively, are received for transportation, in such form that they shall be accessible to the public and can be conveniently inspected. The provisions of this section shall apply to all traffic, transportation, and facilities defined in section one of this Act.

"Any common carrier subject to the provisions of this Act receiving freight in the United States to be carried through a foreign country to any place in the United States shall also in like manner print and keep open to public inspection, at every depot or office where such freight is received for shipment, schedules showing the through rates established and charged by such common carrier to all points in the United States beyond the foreign country to which it accepts freight for shipment; and any freight shipped from the United States through a foreign country into the United States the through rate on which shall not have been made public, as required by this Act, shall, before it is admitted into the United States from said foreign country, be subject to customs duties as if said freight were of foreign production.

"No change shall be made in the rates, fares, and charges or joint rates, fares, and charges which have been filed and published by any common carrier in compliance with the requirements of this section, except after thirty days' notice to the commission and to the public published as aforesaid, which shall plainly state the changes proposed to be made in the schedule then in force and the time when the changed rates, fares, or charges will go into effect; and the proposed changes shall be shown by printing new schedules, or shall be plainly indicated upon the schedules in force at the time and kept open to public inspection: Provided, That the commission may, in its discretion and for good cause shown, allow changes upon less than the notice herein specified, or modify the requirements of this section in respect to publishing, posting, and filing of tariffs, either in particular instances or by a general order applicable to special or peculiar circumstances or conditions.

"The names of the several carriers which are parties to any joint tariff shall be specified therein, and each of the parties thereto, other than the one filing the same shall file with the commission such evidence of concurrence therein or acceptance thereof as may be required or approved by the commission, and where such evidence of concurrence or acceptance is filed it shall not be necessary for the carriers filing the same to also file copies of the tariffs in which they are named as parties.

"Every common carrier subject to this Act shall also file with said commission copies of all contracts, agreements, or arrangements with other common carriers in relation to any traffic accepted by the provisions of this Act to which it may be a party.

"The commission may determine and prescribe the form in which the schedules required by this section to be kept open to public inspection shall be prepared and arranged and may change the form from time to time as shall be found expedient.

PASSENGER RATES MUST BE FILED AND PUBLISHED.

"No carrier shall, unless otherwise provided by this Act, engage or participate in the transportation of passengers or property, as defined in the first section of this Act, unless the rates, fares and charges upon which the same are transported by said carrier have been filed and published in accordance with the provisions of this section; nor shall any carrier charge or demand or collect or receive a greater or less or different compensation for such transportation of passengers or property, or for any service in connection therewith, between the points named in such tariffs than the rates, fares, and charges which are specified in the tariff filed and in effect at the time; nor shall any carrier refund or remit in any manner or by any device any portion of the rates, fares, and charges so specified, nor extend to any shipper or person any privileges or facilities in the transportation of passengers or property, except such as are specified in such tariffs.

"That in time of war or threatened war preference and precedence shall, upon the representation of the President of the United States of the need therefor, be given, over all other traffic, to the transportation of troops and material of war, and carriers shall adopt every means within their control to facilitate and expedite the military traffic."

That section one of this Act entitled "An Act to further regulate commerce with foreign nations and among the states," approved February nineteenth, nineteen hundred and three, be amended so as to read as follows:

"That anything done or omitted to be done by a corporation common carrier subject to the Act to regulate commerce and the Acts amendatory thereof, which, if done or omitted to be done by any director or officer thereof, or any receiver, trustee, lessee, agent, or person acting for or employed by such corporation, would constitute a misdemeanor under said Acts or under this Act, shall also be held to be a misdemeanor committed by such corporation, and upon conviction thereof it shall be subject to like penalties as are prescribed in said Acts or by this Act with reference to such persons, except as such penalties are herein changed. The willful failure upon the part of any carrier subject to said Acts to file and publish the tariffs or rates and charges as required by said Acts, or strictly to observe such tariffs until changed according to law, shall be a misdemeanor, and upon conviction thereof the corporation offending shall be subject to a fine of not less than one thousand dollars nor more than twenty thousand dollars for each offense; and it shall be unlawful for any person, persons, or corporation to offer, grant, or give, or to solicit, accept or receive any rebate, concession or discrimination in respect to the transportation of any property in interstate or foreign commerce by any common carrier subject to said Act to regulate commerce and the Acts amendatory thereof whereby any such property shall by any device whatever be transported at a less rate than that named in the tariffs published and filed by such carrier as is required by said Act to regulate commerce and the Acts amendatory thereof, or whereby any other advantage is given or discrimination is practiced. Every person or corporation, whether carrier or shipper, who shall knowingly and willfully offer, grant, or give, or solicit, accept, or receive any such rebates, concession, or discrimination shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine of not less than one thousand dollars nor more than twenty thousand dollars: Provided, That any person, or any officer or director of any corporation subject to the provisions of this Act, or the Act to regulate commerce and the Acts amendatory thereof, or any receiver, trustee, lessee, agent, or person acting for or employed by any such corporation, who shall be convicted as aforesaid, shall, in addition to the fine herein provided for, be liable to imprisonment in the penitentiary for a term of not exceeding two years, or both such fine and imprisonment, in the discretion of the court. Every violation of this section shall be prosecuted in any court of the United States having jurisdiction of crimes within the district in which such violation was committed, or through which the transportation may have been conducted; and whenever the offense is begun in one jurisdiction and completed in another it may be dealt with, inquired of, tried, determined, and punished in either jurisdiction in the same manner as if the offense had been actually and wholly committed therein.

"In construing and enforcing the provisions of this section, the act, omission, or failure of any officer, agent, or other person acting for or employed by any common carrier or shipper, acting within the scope of his employment, shall in every case be also deemed to be the act, omission, or failure of such carrier or shipper, as well as that of the person. Whenever any carrier files with the Interstate Commerce Commission or publishes a particular rate under the provisions of the Act to regulate commerce or Acts amendatory thereof, or participates in any rates so filed or published, that rate as against such carrier, its officers or agents, in any prosecution begun under this Act shall be conclusively deemed to be the legal rate, and any departure from such rate, or any offer to depart therefrom, shall be deemed to be an offense under this section of this Act."

PENALTY FOR REBATES TO CORPORATIONS.

"Any person, corporation, or company who shall deliver property for interstate transportation to any common carrier, subject to the provisions of this Act, or for whom, as consignor or consignee, any such carrier shall transport property from one state, territory or district of the United States to any other state, territory or district of the United States or foreign country who shall knowingly and willfully, by employee, agent, officer, or otherwise, directly or indirectly, by or through any means or device whatsoever, receive or accept from such common carrier any sum of money, or any other valuable consideration, as a rebate or offset against the regular charges for transportation of such property, as fixed by the schedules of rates provided for in this Act shall, in addition to any penalty provided by this Act, forfeit to the United States a sum of money three times the amount of money so received or accepted and three times the value of any other consideration so received or accepted, to be ascertained by the trial court, and the Attorney-General of the United States is authorized and directed whenever he has reasonable grounds to believe that any such person, corporation, or company has knowingly or willfully received or accepted from any such common carrier any sum of money or other valuable consideration as a rebate or offset as aforesaid, to institute in any court of the United States of competent jurisdiction a civil action to collect the said sum or sums so forfeited as aforesaid; and in the trial of said action all such rebates or other considerations so received or accepted for a period of six years prior to the commencement of the action may be included therein, and the amount recovered shall be three times the total amount of money or three times the total value of such consideration so received or accepted, or both, as the case may be. Provided, That the foregoing penalties shall not apply to rebates or considerations received prior to the passage and approval of this Act."

Sec. 3. That section fourteen of said Act as amended March second, eighteen hundred and eighty nine, be amended so as to read as follows:

"Sec. 14. That whenever an investigation shall be made by said commission, it shall be its duty to make a report in writing in respect thereto, which shall state the conclusions of the commission, together with its decision, order, or requirement in the premises; and in case damages are awarded such report shall include the findings of fact on which the award is made.

"All reports of investigations made by the commission shall be entered of record, and a copy thereof shall be furnished to the party who may have complained, and to any common carrier that may have been complained of.

"The commission may provide for the publication of its reports and decisions in such form and manner as may be best adapted for public information and use, and such authorized publications shall be competent evidence of the reports and decisions of the commission therein contained in all courts of the United States and of the several states without any further proof or authentication thereof. The commission may also cause to be printed for early distribution its annual reports."

Sec. 4. That section fifteen of said Act be amended so as to read as follows:

"Sec. 15. That the commission is authorized and empowered, and it shall be its duty whenever, after full hearing upon a complaint made as provided in section thirteen of this Act, or upon complaint of any common carrier, it shall be of the opinion that any of the rates, or charges whatsoever, demanded, charged, or collected by any common carrier or carriers, subject to the provisions of this Act, for the transportation of persons or property as defined in the first section of this Act, or that any regulations or practices whatsoever of such carrier or carriers affecting such rates, are unjust or unreasonable, or unjustly discriminatory, or unduly preferential or prejudicial, or otherwise in violation of any of the provisions of this Act, to determine and prescribe what will be the just and reasonable rate or rates, charge or charges, to be thereafter observed in such case as the maximum to be charged; and what regulation or practice in respect to such transportation is just, fair, and reasonable to be thereafter followed; and to make an order that the carrier shall cease and desist from such violation, to the extent to which the commission find the same to exist, and shall not thereafter publish, demand, or collect any rate or charge for such transportation in excess of the maximum rate or charge so prescribed, and shall conform to the regulation or practice so prescribed. All orders of the commission, except orders for the payment of money, shall take effect within such reasonable time, not less than thirty days, and shall continue in force for such period of time, not exceeding two years, as shall be prescribed in the order of the commission, unless the same shall be suspended or modified or set aside by the commission or be suspended or set aside by a court of competent jurisdiction. Whenever the carrier or carriers, in obedience to such order of the commission or otherwise, in respect to joint rates, fares, or charges, shall fail to agree among themselves upon the apportionment or division thereof, the commission may after hearing make a supplemental order prescribing the just and reasonable proportion of such joint rate to be received by each carrier party thereto, which order shall take effect as a part of the original order.

INTERSTATE COMMISSION MAY ESTABLISH MAXIMUM JOINT RATES

"The commission may also, after hearing on a complaint, establish through routes and joint rates as the maximum to be charged and prescribe the division of such rates as hereinbefore provided, and the terms and conditions under which such through routes shall be operated, when that may be necessary to give effect to any provision of this Act, and the carriers complained of have refused or neglected to voluntarily establish such through routes and joint rates, provided no reasonable or satisfactory through route exists, and this provision shall apply when one of the connecting carriers is a water line.

"If the owner of property transported under this Act directly or indirectly renders any service connected with such transportation, or furnishes any instrumentality used therein, the charge and allowance therefor shall be no more than is just and reasonable, and the commission may, after hearing on a complaint, determine what is a reasonable charge as the maximum to be paid by the carrier or carriers for the service so rendered or for the use of the instrumentality so furnished, and fix the same by appropriate order, which order shall have the same force and effect and be enforced in like manner as the orders above provided for in this section.

"The foregoing enumeration of powers shall not exclude any power which the commission would otherwise have in the making of an order under the provisions of this Act."

Sec. 5. That section sixteen of said Act as amended March second, eighteen hundred and eighty-nine, be amended so as to read as follows:

"Sec. 16. That if, after hearing on a complaint made as provided in section thirteen of this Act, the commission shall determine that any party complainant is entitled to an award of damages under the provisions of this Act for a violation thereof, the commission shall make an order directing the carrier to pay to the complainant the sum to which he is entitled on or before a day named.

"If a carrier does not comply with an order for the payment of money within the time limit in such order, the complainant, or any person for whose benefit such order was made, may file in the circuit court of the United States for the district in which he resides or in which is located the principal operating office of the carrier, or through which the road of the carrier runs, a petition setting forth briefly the causes for which he claims damages, and the order of the commission in the premises. Such suit shall proceed in all respects like other civil suits for damages, except that on the trial of such suit the findings and order of the commission shall be prima facie evidence of the facts therein stated, and except that the petitioner shall not be liable for costs in the circuit court nor for costs at any subsequent stage of the proceedings unless they accrue upon his appeal. If the petitioner shall finally prevail he shall be allowed a reasonable attorney's fee, to be taxed and collected as a part of the costs of the suit. All complaints for recovery of damages shall be filed with the commission within two years from the time the cause of action accrues, and not after, and a petition for the enforcement of an order for the payment of money shall be filed in the circuit court within one year from the date of the order, and not after: Provided, That accrued claims may be presented within one year.

"In such suits all parties in whose favor the commission may have made an award for damages by a single order may be joined as plaintiffs, and all of the carriers parties to such an order awarding such damages may be joined as defendants, and such suit may be maintained by such joint plaintiffs and against such joint defendants in any district where any one of such joint plaintiffs could maintain such suit against any one of such joint defendants; and service of process against any one of such defendants as may not be found in the district where the suit is brought may be made in any district where such defendant carrier has its principal operating office. In case of such joint suit the recovery, if any, may be by judgment in favor of any one of such plaintiffs, against the defendant found to be liable to such plaintiff.

HOW ORDERS OF THE COMMISSION MAY BE SERVED.

"Every order of the commission shall be forthwith served by mailing to any one of the principal officers or agents of the carrier at his usual place of business a copy thereof; and the registry mail receipt shall be prima facie evidence of the receipt of such order by the carrier in due course of mail.

"The Commission shall be authorized to suspend or modify its orders upon such notice and in such manner as it shall deem proper.

"It shall be the duty of every common carrier, its agents and employees, to observe and comply with such orders so long as the same shall remain in effect.

"Any carrier, any officer, representative, or agent of a carrier, or any receiver, trustee, lessee, or agent of either of them, who knowingly fails or neglects to obey any order made under the provisions of section fifteen of this Act, shall forfeit to the United States the sum of five thousand dollars for each offense. Every distinct violation shall be a separate offense, and in case of a continuing violation each day shall be deemed a separate offense.

"The forfeiture provided for in this Act shall be payable into the Treasury of the United States, and shall be recoverable in a civil suit in the name of the United States, brought in the district where the carrier has its principal operating office, or in any district through which the road of the carrier runs.

"It shall be the duty of the various district attorneys, under the direction of the attorney-general of the United States, to prosecute for the recovery of forfeitures. The costs and expenses of such prosecution shall be paid out of the appropriation for the expenses of the courts of the United States. The commission may, with the consent of the attorney-general employ special counsel in any proceeding under this Act, paying the expenses of such employment out of its own appropriation.

FAILURE TO OBEY ORDER OF COMMISSION

"If any carrier fails or neglects to obey any order of the commission, other than for the payment of money, while the same is in effect, any party injured thereby, or the commission in its own name, may apply to the circuit court in the district where such carrier has its principal operating office, or in which the violation or disobedience of such order shall happen, for an enforcement of such order. Such application shall be by petition, which shall state the substance of the order and the respect in which the carrier has failed of obedience, and shall be served upon the carrier in such manner as the court may direct, and the court shall prosecute such inquiries and make such investigations, through such means as it shall deem needful in the ascertainment of the facts at issue or which may arise upon the hearing of such petition. If, upon such hearing as the court may determine to be necessary, it appears that the order was lawfully made and duly served, and that the carrier is in disobedience of the same, the court shall enforce obedience to such order by a writ of injunction, or other proper process, mandatory or otherwise, to restrain such carrier, its officers, agents, or representatives, from further disobedience of such order, or to enjoin upon it, or them, obedience to the same; and in the enforcement of such process the court shall have those powers ordinarily exercised by it in compelling obedience to its writs of injunction and mandamus.

"From any action upon such petition an appeal shall be by either party to the Supreme Court of the United States, and in such court the case shall have priority in hearing and determination over all other causes except criminal causes, but such appeal shall not vacate or suspend the order appealed from.

"The venue of suits brought in any of the circuit courts of the United States against the commission to enjoin, set aside, annul or suspend any order or requirement of the commission shall be in the district where the

carrier against whom such order or requirement may have been made has its principal operating office, and may be brought at any time after such order is promulgated. And if the order or requirement has been made against two or more carriers then no suit shall be instituted where any one of said carriers has its principal operating office, and if the carrier has its principal operating office in the District of Columbia, then the venue shall be in the district where said carrier has its principal office, and the jurisdiction to hear and determine such cases is hereby vested in such courts. The provisions of 'An act to expedite the hearing and determination of suits in equity, and so forth,' approved February eleventh, nineteen hundred and three, shall be, and are hereby, made applicable to all such suits, including the hearing on an application for a preliminary injunction, and are also made applicable to any proceeding in equity to enforce any order or requirement of the commission, or any of the provisions of the Act to regulate commerce approved February fourth eighteen hundred and eighty-seven, and all Acts amendatory thereof or supplemental thereto. It shall be the duty of the attorney-general in every such case to file the certificate provided for in said expediting Act of February eleventh, nineteen hundred and three, as necessary to the application of the provisions thereof, and upon appeal as therein authorized to the Supreme Court of the United States, the case shall have in such court priority in hearing and determination over all other causes except criminal causes: Provided, That no injunction, interlocutory order or decree suspending or restraining the enforcement of an order of the commission shall be granted except on hearing after not less than five days' notice to the commission. An appeal may be taken from any interlocutory order or decree granting or continuing an injunction in any suit, but shall lie only to the Supreme Court of the United States: Provided, further, That the appeal must be taken within thirty days from the entry of such order or decree and it shall take precedence in the appellate court over all other causes, except causes of like character and criminal causes.

COPIES OF SCHEDULES TO BE PRESERVED AS PUBLIC RECORDS.

"The copies of schedules and tariffs of rates, fares and charges, and of all contracts, agreements, or arrangements between common carriers filed with the commission as herein provided, and the statistics, tables and figures contained in the annual reports of carriers made to the commission as required by the provisions of this Act, shall be preserved as public records in the custody of the secretary of the commission, and shall be received as prima facie evidence of what they purport to be for the purpose of investigations by the commission and in all judicial proceedings; and copies of or extracts from any of said schedules, tariffs, contracts, agreements, arrangements, or reports made public records as aforesaid, certified by the secretary under its seal, shall be received in evidence with like effect as the originals."

Sec. 6. That a new section be added to said act immediately after section sixteen, to be numbered as section sixteen a, as follows:

"Section 16a. That after a decision, order, or requirement has been made by the commission in any proceeding any party thereto may at any time make application for rehearing of the same, or any matter determined therein, and it shall be lawful for the commission in its discretion to grant such a rehearing if sufficient reason therefor be made to appear. Applications for rehearing shall be governed by such general rules as the commission may establish. No such application shall excuse any carrier from complying with or obeying any decision, order, or requirement of the commission, or operate in any manner to stay or postpone the enforcement thereof, without the special order of the commission. In case a rehearing is granted the proceedings thereupon shall conform as nearly as may be to the proceedings in an original hearing, except as the commission may otherwise direct; and if, in its judgment, after such rehearing and the consideration of all facts, including those arising since the former hearing, it shall appear that the original decision, order, or requirement is in any respect unjust or unwarranted, the commission may reverse, change, or modify the same accordingly. Any decision, order, or requirement made after such rehearing reversing, changing or modifying the original determination shall be subject to the same provisions as an original order."

"Section 16b. Nothing in this Act shall prevent any common carrier subject to its provisions from giving free transportation or reduced rates to the officers of the organizations of such employees for the purpose of transacting the business of such organizations with such railroads: Provided, That such reduced rates or free transportation are not issued with the view of discriminating in favor of or against any particular class of employees."

Sec. 7. That section twenty of said Act be amended so as to read as follows:

Sec. 20. That the commission is hereby authorized to require annual reports from all common carriers subject to the provisions of this Act, and from the owners of all railroads engaged in interstate commerce as defined in this Act, to prescribe the manner in which such reports shall be made, and to require from such carriers specific answers to all questions upon which the commission may need information. Such annual reports shall show in detail the amount of capital stock issued, the amounts paid therefor, and the manner of payment for the same; the dividends paid, the surplus fund, if any, and the number of stockholders; the funded and floating debts and the interest paid thereon; the cost and value of the carrier's property, franchises, and equipments; the number of employees and the salaries paid each class; the accidents to passengers, employees, and other persons, and the causes thereof; the amounts expended for improvements each year, how expended, and the character of such improvements; the earnings and receipts from each branch of business and from all sources; the operating and other expenses; the balances of profit and loss, and a complete exhibit of the financial operations of the carrier each year, including an annual balance sheet. Such reports shall also contain such information in relation to rates or regulations concerning fares or freights, or agreements, arrangements, or contracts affecting the same as the commission may require; and the commission may, in its discretion, for the purpose of enabling it the better to carry out the purposes of this Act, prescribe a period of time within which all common carriers subject to the provisions of this Act shall have, as nearly as may be, a uniform system of accounts, and the manner in which such accounts shall be kept.

"Said detailed reports shall contain all the required statistics for the period of twelve months ending on the thirtieth day of June in each year, and shall be made out under oath and filed with the commission, at its office in Washington, on or before the thirtieth day of September then next following, unless additional time be granted in any case by the commission; and if any carrier, person, or corporation subject to the provisions of this Act shall fail to make and file said annual reports within the time above specified, or within the time extended by the commission for making and filing the same, or shall fail to make specific answer to any question authorized by the provisions of this section within thirty days from the time it is lawfully required so to do, such parties shall forfeit to the United States the sum of one hundred dollars for each and every day it shall continue to be in default with respect thereto. The commission shall also have authority to require said carriers to file monthly reports of earnings and expenses or special reports within a specified period, and if any such carrier shall fail to file such reports within the time fixed by the commission it shall be subject to the forfeitures last above provided.

"Said forfeitures shall be recovered in the manner provided for the recovery of forfeitures under the provisions of this Act.

"The oath required by this section may be taken before any person authorized to administer an oath by the laws of the state in which the same is taken.

COMMISSION MAY PRESCRIBE FORMS OF ACCOUNTS.

"The commission may, in its discretion, prescribe the forms of any and all accounts, records, and memoranda to be kept by carriers subject to the provisions of this Act, including the accounts, records, and memoranda of the movement of traffic as well as the receipts and expenditures of moneys. The commission shall at all times have access to all accounts, records, and memoranda kept by carriers subject to this Act, and it shall be unlawful for such carriers to keep any other accounts, records, or memoranda than those prescribed or approved by the commission, and it may employ special agents or examiners, who shall have authority under the order of the commission to inspect and examine any and all accounts, records, and memoranda kept by such carriers. This provision shall apply to receivers of carriers and operating trustees.

"In case of failure or refusal on the part of any such carrier, receiver, or trustee to keep such accounts, records, and memoranda on the books and in the manner prescribed by the commission, or to submit such accounts, records, and memoranda as are kept to the inspection of the commission or any of its authorized agents or examiners, such carrier, receiver, or trustee shall forfeit to the United States the sum of five hundred dollars for each such offense, and for each and every day of the continuance of such offense, such forfeitures to be recoverable in the same manner as other forfeitures provided for in this Act.

"Any person who shall willfully make any false entry in the accounts of any book of accounts or in any record or memoranda kept by a carrier, or who shall willfully destroy, mutilate, alter, or by any other means or device falsify the record of any such account, record, or memoranda, or who shall willfully neglect or fail to make full, true, and correct entries in such accounts, records, or memoranda of all facts and transactions appertaining to the carrier's business, or shall keep any other accounts, records, or memoranda than those prescribed or approved by the commission, shall be deemed guilty of a misdemeanor and shall be subject, upon conviction in any court of the United States of competent jurisdiction, to a fine of not less than one thousand dollars nor more than five thousand dollars, or imprisonment for a term not less than one year nor more than three years, or both such fine and imprisonment.

"Any examiner who divulges any fact or information which may come to his knowledge during the course of such examination, except in so far as he may be directed by the commission or by a court or judge thereof, shall be subject, upon conviction in any court of the United States of competent jurisdiction to a fine of not more than five thousand dollars or imprisonment for a term not exceeding two years, or both.

"That the circuit and district courts of the United States shall have jurisdiction, upon the application of the attorney-general of the United States at the request of the commission, alleging a failure to comply with or a violation of any of the provisions of said Act to regulate commerce or of any Act supplementary thereto, or amendatory thereof by any common carrier, to issue a writ or writs of mandamus commanding such common carrier to comply with the provisions of said Acts, or any of them.

"And to carry out and give effect to the provisions of said Acts, or any of them, the commission is hereby authorized to employ special agents or examiners who shall have power to administer oaths, examine witnesses, and receive evidence.

"That any common carrier, railroad, or transportation company receiving property for transportation from a point in one state to a point in another state shall issue a receipt or bill of lading therefor and shall be liable to the holder thereof for any loss, damage, or injury to such property caused by it or by any common carrier, railroad, or transportation company to which such property may be delivered or over whose line or lines such property may pass, and no contract, receipt, rule, or regulation shall exempt such common carrier, railroad, or transportation company from the liability herein imposed: Provided, That nothing in this section shall deprive any holder of such receipt or bill of lading of any remedy or right of action which he has under existing law.

"That the common carrier, railroad, or transportation company issuing such receipt or bill of lading shall be entitled to recover from the common carrier, railroad, or transportation company through whose negligence the loss, damage, or injury shall have been sustained, the amount of such loss, damage, or injury as it may be required to pay to the owners of such property."

Sec. 8. That all existing laws relating to the attendance of witnesses and the production of evidence and the compelling of testimony under the Act to regulate commerce, and all Acts amendatory thereof shall apply to any and all proceedings and hearings under this Act.

Sec. 9. That all laws and parts of laws in conflict with the provisions of this Act are hereby repealed, but the amendments herein provided for shall not affect causes now pending in courts of the United States, but such causes shall be prosecuted to a conclusion in the manner heretofore provided by law.

Sec. 10. That this Act shall take effect and be in force from and after its passage.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

Enclosed Disk Signals. 537
"Normal Danger" Automatic Signals. . . . 537
Further New Haven Trolley Expansion. . 537
The Jungle 538
The Coal Carriers. 538
The Chicago Freight Subway. 539
Carrying Grain in Russia. 540
New Publications. 540

ILLUSTRATED:

Chicago, Indiana & Southern 544
New Gravity Yard: Peoria & Pekin Union 546
Graphics of a Transcontinental Line. . . . 549
Railroads and Transportation in Siam. . 550
70th Anniversary of an English Railroad 554
The Gasolene Car for Interurban Service 556

CONTRIBUTIONS:

Grafton, Hall, Patenall, et al. 541

MISCELLANEOUS:

Collateral Trust Mortgage in R.R. Finance 541
How to Get Your Percentage of Competitive Business. 545
New Railroad Law in Ohio. 545
A Railroad Engineer's Note Book. 547
Railroad Officers' Coal mine Stock. 554
Canadian Railroad Notes 560
Electrification of West Jersey & Seashore 560
The Inter-Pole Railway Motor. 560
Foreign Railroad Notes: Steam Motor Car in India. 560
American Cars in Africa. 560

GENERAL NEWS SECTION:

Notes. 157
Trade Catalogues 158
Obituary 158
Meetings and Announcements. 159
Elections and Appointments 159
Locomotive Building 159
Car Building 159
Bridge Building 160
Railroad Construction 160
Railroad Corporation News 162

VOL. XL., No. 22. FRIDAY, JUNE 1, 1906.

The disk signal, enclosed in a case, can compete with the three-position semaphore, if it chooses to, as well as with the two-position. With a large rectangular case the right, left and upper sides can be utilized for three openings, or the three colors can be shown at a single opening, one color at a time. (At night the semaphore has no advantage over the disk in any respect.) We state these elementary truths, though the question is somewhat academic, because our correspondent, "N. E. P.," whose letter we print, seems to think that to support and defend the enclosed disk he must vanquish the three-position and the upward inclination. The semaphore is beautifully adapted to the three-position principle; but a combination of three dots on a large solid-color background also makes an effective image. Poker players seem to be well satisfied with the dot idea. The notion that we must stick to the semaphore because we must insure a far-away view is gradually being demolished by the increased use of distant signals, as our correspondent well says, and by the growing necessity, in cities and on crowded lines, of getting along without far-away views. The final argument for the three-position semaphore is based on economy, for the argument that it simplifies the duty of the engineman is not universally accepted. It is claimed in behalf of some enginemen that the simple, compound or composite idea that must be formed in the mind on coming in sight of an automatic block signal is formed more easily when there are two arms to convey the desired information, as in the automatics east of Pittsburg, than when there is only one arm, as in the signals west of Pittsburg. Economy being the issue, the enclosed disk asks no odds of any signal which has moving parts exposed to wind, snow and frost.

The other points presented by "N. E. P." are as sound as this one—and perhaps as seriously in need of friends! He need not fear that the semaphore will be made more popular by the change to the upper quadrant, for its popularity is about as general as could be imagined already. Now is a good time, however, to open the question of the merits of the semaphore, on any ground, for the spirit of inquiry seems to be in the air. The discussion at the last meeting of the Railway Signal Association, with its suggestions of putting arms on the left of the post, and of having arms pivoted in the middle, showed that the upward inclination is not the only change that is being seriously thought about. Relief from high posts seems likely to come, after a time, from the same causes as the relief from the distant-view idea. The necessity of keeping clear of overhead structures, as in the New York Subway and on other roads in cities, will gradually compel the use of lower signals. On the fundamental issue of cheapness—and in this case simplicity goes with cheapness—N. E. P. must reinforce the argument by the records of successive years. The signal engineer or the manager who is wedded to the semaphore is not likely to look upon it as an extravagant consumer of money until he sees overwhelming evidence of the cheapness of the simpler signal. To overwhelm him is likely to take time. The disk-ussion will have to be supported by figures as well as by rhetoric. In the matter of "normal-danger" the interesting point is that we are hearing from an advocate who speaks from intimate and intelligent experience; for questions of this sort have been settled in far too many cases by theory and persuasion, without due consideration of the results of actual use. But as for passing an opinion in this place, with a view to scientifically settling the question—why, what would the rival signal companies do for fuel to feed the fires of their far-fetched controversies?

Repeated and somewhat insistent reports come from Boston of a project for a new electric long-distance line between that city and Providence paralleling the old Boston & Providence steam line leased to the Old Colony, and now a part of the New Haven system. This opens out and delineates an interesting stage of President Mellen's rapid and picturesque campaign of acquiring electric railways. To continue the strategic metaphor, the New Haven, as a territorial whole, has seven important points for protective outworks. They are New York, Pittsfield, Springfield, Worcester, Boston, Fall River and Providence. Assuming the correctness of the asserted purchase of the Worcester street railway system by the New Haven the first four points named—New York, Pittsfield, Springfield and Worcester—are now practically intrenched against parallel railway attack, as is the whole of Connecticut, except at the cities—Bridgeport, Norwalk, Derby, Ansonia, Waterbury and New Britain—reached directly by the Connecticut Railway & Lighting Corporation. Westward and centrally, President Mellen, with

more than 700 miles of street railway, thus holds the fort. But eastward the case is different, and his system is still vulnerable in the large and intricate network of steam roads of the Old Colony group lying southward of Boston and north of Providence and Fall River. The key of the position is Providence and the suggested protective step, the buying up of the street railway system there, which means the purchase of the whole street railway system of Rhode Island, which has been twice recapitalized with very liberal injections of water. It will be a bold venture, even for President Mellen in the ardor of success of his expansive electric policy so far as it has gone, which last year was financially more than self-supporting, and which this year will probably show a net balance of not less than 2½ per cent. on the stock of his great holding company, the Consolidated Railway Corporation. In connection with the possible purchase of the Rhode Island street railways is not to be overlooked that amazing piece of legislation some years ago, by which certain limits of taxation were worked into the form of a permanent contract with the state—a contract which may yet have to be tried out in the United States Supreme Court. The greater subject of immediate interest, however, is the shifting to the eastward of President Mellen's electric "fortification" policy, and the directions, tactics and strategy of his next Napoleonic campaign.

THE JUNGLE.

The reader of Upton Sinclair's "The Jungle," the book which was the direct cause of the Beveridge bill, providing for the rigid inspection of packing house products, finds much that causes him to reflect on the literature and on the fact which the present-day public is receiving. The reviewer who has made some personal study of Packingtown and its conditions, sees in this book a succession of caricatures—actual scenes and incidents of the meat industry so twisted and distorted that they make a picture which is indeed horrible, and would be yet more horrible if it were true. The picture is not true, and yet it has, as its basis, enough stern fact so that it would be very hard to disprove as a whole. There are unwholesome conditions, bad facts, to be found in every walk of life and in every modern industry. If a historian with a poor digestion and a bad temper should care to take as his hero an uneducated foreigner from an unenlightened part of Europe, and should so arrange it that he was ensnared by all the possible ills and evils that had been the collective experience of a thousand immigrants for ten years, his hero would be pretty sure to have a hard time of it, whether he engaged in the packing business, whether he worked in a cotton mill, or a ship yard, or a gun factory, or whether he simply became a farmer on the western plains, got into debt and always had his crops destroyed by the elements. In other words, Mr. Sinclair, considering the packing business bad for the workmen engaged therein, takes his hero and puts him successively through every kind of badness that he has been able to ferret out, using extreme examples of each, liberally seasoned with imagination. Even if the reader has never been to Chicago, Kansas City or Omaha, and does not know a packing house from a grain elevator, he can check up a good part of what may be called the non-technical experiences of Mr. Sinclair's unhappy hero from his own information. He knows, for example, that there are a good many days between Thanksgiving and the first of March when the temperature in Chicago does not go below zero; yet the Chicago winter pictured by this lurid writer is one succession of blizzards and of cold so intense that it is practically unlivable. This is only one instance of almost countless examples in the book where Mr. Sinclair has used the exceptional worst for the ordinary occurrence.

The book is more crudely written than any other notable piece of muck raking which we have seen. The author seems incapable of writing a narrative without resort to all the effects of the twenty-cent melodrama. Yet he has brought out one terrible truth amidst a most tremendous lot of foolishness, a truth exaggerated and distorted, but nevertheless most needful of remedy. His paragraphs relating to the way that condemned meat is doctored for use as food, convey a picture which is probably overdrawn, but they nevertheless describe a state of affairs which even in the least degree is insufferable, and the action taken to remedy this by Congress is as correct as it has been rapid.

But in his method of righting a wrong, the author of "The Jungle" has done much harm in his outspoken assumption that the fundamental methods of the packing business are horrible and inhuman. They are not. The industry has its peculiar limitations, requiring concentration of plants, great haste in the manufacture of perishable products, and a military form of discipline to govern an army of employees. The conditions of labor in Packingtown do not seem exceptionally severe and the rate of pay is good, as compared with that of other industries. One is scarcely disposed to deny that the ideal labor condition for the workingman of the humbler type is the small shop—the craft and the guild of three centuries ago. But civilization cannot be set back three centuries; we must just do the best that we can with the economics of modern life. It is highly important that the evils in the modern system should be eradicated, but it is also much to be desired that they should be eradicated by some other means than that of high-colored, overdrawn sensationalism. It is a reflection on the body politic that the condemned meat industry should have lived and flourished without check by the National or the Local Government, until exploited by the horror story of a journalist.

THE COAL CARRIERS.

Shall railroads control coal companies, shall coal companies control railroads, or shall joint control of both be lodged in the hands of outside capitalists? Since transportation is the biggest item affecting the conduct of the coal business, while coal is the biggest single item in a railroad's expense account, and also furnishes a very desirable branch of traffic, with an infinitely greater tonnage per acre of territory than that from any other natural source, it is most reasonable that railroads and coal companies should be correlated. The subject is now prominent in public attention. The Supreme Court in the Chesapeake & Ohio case held that a company acting in the joint capacity of a coal producer and a common carrier could not so manipulate its rates that a discrimination should result thereby. In April the Baltimore & Ohio sold its control of the Consolidation Coal Co., which was considered a most excellent purchase at the time it was made by Mr. Loree, and now Congress has under consideration, with strong likelihood of acceptance, the Elkins amendment providing that railroads engaging in interstate commerce may not own coal mines at all.

What is to be accomplished by the enactment of such legislation? Are discriminations to be prevented? The Supreme Court apparently found the existing law sufficient for this purpose. As a matter of general public policy it occurs to the layman that the effect of the passage of legislation similar to that proposed by Senator Elkins will be to place joint control of railroads and coal mines precisely where it will be least amenable to governmental control. That is to say, if the railroads are prevented from engaging in the coal business, coal owners, not subject to the Act to Regulate Commerce or the Hepburn Bill, will be most likely to engage in the railroad business. This need not be done—it doubtless will not be done—by any process as direct as the actual control of securities under a corporate title, but there are many ways by which mutuality of interest can be secured through the personal co-operation of individuals; mutuality of interest similar to that which causes the Chicago & North-Western to be classed as a Vanderbilt property. The areas of unmined coal in this country are very great, but they are not unlimited, and possession of them in railroad interest is so vital a thing that no president of a great railroad, facing strong competition, would be satisfied that a theoretical independence of these properties was true independence. When legislation sets itself against strong economic motives it fights an unequal battle. The Northern Securities Company was dissolved, but has there been any change in the co-operative attitude of the Great Northern, the Northern Pacific and the Chicago, Burlington & Quincy? Only this, that the real element of competition in the Securities Company, the Harriman interest, was driven into a minority by the prorating of securities approved by the courts, which substituted the single Hill control for joint control by Hill and Harriman. So far as the amalgamation of parallel and competing lines is concerned, they are still amalgamated, and they do not yet compete in the sense read into the Elkins Act by the Supreme Court.

We are inclined to believe that Congressional enactment can no more prevent railroads and coal companies from acting in harmony than it can make "parallel and competing" lines quarrel in the public interest, under the outworn assumption that a continuous rate war is a continuous benefit. What it can undoubtedly do is to drive the relationship out of its own sight and reach, and force a roundabout and indirect method of accomplishing what is now done directly and above board. The principal coal carrying railroads, both anthracite and bituminous, are listed below. In the case of the anthracite roads it has been possible to print an estimate—

probably a rough one—of the coal unmined. Two statisticians of the anthracite industry, Griffiths and Ruley, have published such estimates, differing considerably. We use the estimate of Mr. Ruley, because it is the more recent of the two. He makes no separate estimate for the Pennsylvania or the Northern Central, apparently grouping their unmined holdings under the general head of "others."

Principal Anthracite Roads.

	Tons, unmined.*	1905 shipments, tons.
Philadelphia & Reading.†	3,155,000,000	18,600,898
Pennsylvania	.....	15,579,307
Lehigh Valley (including Del., Sus. & S.)	470,000,000	11,157,902
Lackawanna	400,000,000	9,333,069
Delaware & Hudson	260,000,000	5,276,797
Erie	180,000,000	5,711,173
Northern Central	.....	5,050,859
Others	219,000,000	.....

*Estimate of W. W. Ruley.
†Including C. R. R. of N. J., and Lehigh Coal & Navigation Co.

The Philadelphia & Reading Coal & Iron Company is the principal producing company tributary to the Reading; the Lehigh Valley Coal Co. and Coxe Bros., the principal Lehigh Valley companies; the Susquehanna Coal Co., the principal anthracite producer for the Pennsylvania; the Hudson Coal Co., Jackson Coal Co., and D. & H. Co., the principal producers for the Delaware & Hudson; the Pennsylvania Coal Co., Hillside Coal & Iron Co., Blossburg Coal Co., and Northwestern Mining & Exchange Co. supply the Erie, and the Lackawanna owns direct. The New York, Ontario & Western (N. Y., N. H. & H.) also produces some 3,000,000 tons annually through the Scranton and Elkhart coal companies. The Lehigh Coal & Navigation Co., organized in 1822, was the first corporation which engaged in anthracite development.

So far as we are able to ascertain, no statistics of unmined bituminous have ever been prepared. The supply is tremendous, and comes from many parts of the country. The best that can be done is to print figures showing bituminous output and originating tonnage. To accomplish this, letters were sent to all the large carriers of soft coal, and the following table, which is in many respects incomplete, is made up from replies received, supplemented by such statistics as are printed in the companies' annual reports.

Principal Bituminous Roads.

	Tonnage in 1905. Originated.	Carried.
Pennsylvania	48,000,000*	49,130,949
Pennsylvania Company	40,000,000*	44,720,196
Baltimore & Ohio	22,262,717†	20,125,514
P., C., C. & St. Louis	12,000,000*	13,224,459
New York Central	5,300,000*	10,585,577
Norfolk & Western	8,000,000*	8,158,733
Chesapeake & Ohio	7,582,344	7,780,895
Lake Shore & Michigan Southern	Very little.	6,970,313
Erie	No data.	6,900,215
Louisville & Nashville‡	6,252,692	6,377,677
Buffalo, Rochester & Pittsburg	No data.	6,329,743
Southern	No data.	6,114,313
Chicago & Eastern Illinois	No data.	5,551,720
Hocking Valley	3,856,074	5,111,921
St. Louis & San Francisco	4,117,773*	4,627,249
Cumberland Valley	None.	4,050,142
Cleveland, Cincinnati, Chicago & St. Louis	No data.	3,808,462
Vandalia	No record kept.	3,793,325
Toledo & Ohio Central	1,780,827	3,744,671
Missouri Pacific	No data. (1904)	3,599,179
Northern Central	3,000,000*	3,488,802
Boston & Maine	None.	3,044,927
Chicago, Rock Island & Pacific	No data.	2,893,037
Wheeling & Lake Erie	No data.	2,864,736
Michigan Central	No data.	2,693,393
New York, New Haven & Hartford	None.	§2,664,020
Wabash	No data. (1901)	2,512,772
Chicago, Milwaukee & St. Paul	Very little.	2,473,150
Denver & Rio Grande System	2,289,407	2,399,081
Cincinnati, Hamilton & Dayton	No data.	2,222,218
Kanawha & Michigan	1,642,893	1,865,130
Pere Marquette	737,277	1,759,570
Colorado & Southern	1,366,796	1,401,122

*Estimated from best sources obtainable.
‡Total bituminous originating on B. & O. and lateral lines.
†The figures in each column include a small amount of anthracite.
§March 31, 1906.

In addition to these roads, the following large carriers of bituminous should be listed, although they do not furnish information as to their tonnage:

Chicago & North-Western,	Burlington,
Chicago & Alton,	Union Pacific,
Great Northern,	Northern Pacific,
Illinois Central,	Western Maryland.

These statements show two things: the hugeness of the bituminous traffic, and the scarcity of information about it. The roads listed are those which carried 2,000,000 tons or over in 1905, except for a few with less tonnage, which it seemed advisable to include. Even this partial statement records a movement (including some duplication) of 252,987,211 tons of bituminous per year. We shall not be far wrong if we estimate the total annual bituminous movement of the country at 300 million tons.

The Pennsylvania and its interests have a tremendous preeminence both as carriers and as producers of bituminous, and if we include the Baltimore & Ohio, Chesapeake & Ohio, etc., in the community of interest, it will be seen that these roads produce and carry about half the entire amount of soft coal which is moved annually. Which is better—that this movement should be under the through-and-through surveillance of the Interstate Commerce Commission, or that we should have all the complexities of an ownership supposed by the law to be divided?

THE CHICAGO FREIGHT SUBWAY.

Some interesting details of the Chicago freight subway, which has been building quietly for the past five years, part of the time entirely without the knowledge of Chicago's public and even now practically without visible surface evidence of its existence, were printed in the *Railroad Gazette*, July 28, 1905, April 20 and May 4, 1906. The subway will soon be ready for general traffic. Already a moderate amount of business is being done, affording an index of results to be looked for later.

The magnitude and unique character of the project make it one of the most notable and interesting engineering feats ever undertaken in connection with the problem of affording to a great city relief from congested conditions. The Chicago situation is well known to many of our readers. The chief business district is comprised in an area of about 1¼ square miles, being circumscribed on three sides by the lake and rivers. Perhaps a better idea of its extent may be gained from the statement that there are only nine north-and-south streets and eleven east-and-west streets in the section. Surrounding this district are the great railroad terminals and freight houses of the principal roads entering the city. The density of street traffic in this relatively small area is very great, causing highly congested conditions. As a result, teaming transportation is exceedingly slow and correspondingly costly. Other great cities, in this country and Europe, in endeavoring to alleviate congested conditions, have diverted a portion of their passenger transportation below ground, but the pressure of freight traffic through the crowded streets continues unrelieved. Chicago, if its subway proves the practical succeess that its promoters expect, will have reversed this condition, and a goodly proportion of the heavy teaming traffic will have disappeared beneath the streets. With the heavily-laden, slow-moving trucks and vans off of these now crowded thoroughfares, as well as a reduction in the amount of traffic by lighter vehicles, the problem of surface transportation of passengers obviously becomes simplified.

At the time of opening the subway will have upward of 40 miles of tunnels. Practically every street in the business section is duplicated below the surface. The bores also extend under and beyond the rivers for connection to the railroad freight and passenger terminals. Connections have already been made to most of the freight houses adjoining the district mentioned and other connections are being made or are contracted for. All of the passenger terminal stations but one, and the general postoffice, have already had connections installed for carrying the mails, for which the subway company has a bulk contract with the government. A large number of connections to stores, warehouses, etc., have been made, and these are being increased as rapidly as possible. Connections will be made to all establishments desiring them, which can assure a minimum of 50 tons of freight a day.

The more important of the useful functions the subway is designed to serve are: the transfer between railroad freight houses of less-than-carload freight not too bulky to be loaded into its cars of 15 tons capacity and 2-ft. gage; carriage of merchandise between freight houses and mercantile establishments; delivery of coal to office buildings, stores, hotels, etc., and removal of ashes from same; transmission of newspapers, mail matter, packages and parcels; removal of material from excavations on building sites and debris from old buildings being demolished. Doubtless the most important single functions of the foregoing list will be the transfer of freight and carriage of merchandise. Estimates on this total daily movement in Chicago vary, but it appears to be in excess of 150,000 tons. The subway will undoubtedly receive all of this business it is able to care for. It competes with teaming transportation and therefore will base its charges on teaming prices. Its advantage, of course, lying in the expedition with which the traffic will be handled, the convenience of the facilities with which the articles are received from and delivered to the subway, and the fact that the weather is not in any sensse a factor in the matter. This last advantage is expected to be especially manifest in the transportation of cold storage products from the storage depots to the large consumers.

What the capacity of the subway will be in tons per day no

one attempts to say at present. The effectiveness of the operating scheme is the controlling factor in determining the allowable maximum density of traffic. The scheme being yet untried, there is no precedent on which to base estimates. The officers think they will be able easily to handle 40,000 tons daily on the present mileage. How much in excess of this the scheme is good for will be one of the future developments.

The operating problem has to do with a network of single-track parallel bores crossing at right-angles with two, three or four-way intersections as conditions require; that is, the intersecting lines are joined by two, three or four curves. Each city square below ground therefore is, in effect, a loop around which any train may be diverted in the event of an obstruction of whatever nature on the section (city block) ahead. There are 120 of these loops in the business district. A telephone is placed at each street intersection and building connection, and a switch tender at each street intersection. The maximum train speed is 8 miles an hour. We suppose that certain lines or routes will be designated for movements in given directions to avoid confusion; though just what is planned in this respect we are not informed.

The possible effect of the subway service on present conditions at the freight houses and yards furnishes interesting material for speculation. For instance, the rapidity with which freight to or from the subway can be handled as compared with teams, should, in effect, materially increase present capacities both within the freight houses and on the tracks. The greater expedition with which the railroad cars can be loaded and unloaded will reduce the number waiting to undergo these respective operations. The subway cars will be delivered on the freight house floor and can be moved from one end to the other of the house under power, saving a large amount of trucking and increasing the efficiency of the freight handlers, making it possible to reduce the number necessary to handle a given amount of business. Other advantages occur, but mention of these few will suffice to indicate the possibilities of the project in this respect.

Consideration of the unique character of the subway would be incomplete without reference to the novel methods of excavating building sites and of removal of old buildings in Chicago's business district made possible by its existence. The scheme is simply the removal of the excavated material or the building debris by way of the tunnels instead of the usual teaming method. But in the difference of the two methods is comprehended a convenience and economy that the contractors were quick to appreciate and avail themselves of. In instances where it is desired to occupy a building until the last possible moment before demolition, as with stores, the greater part of the excavations for the new building are made and the footings built before the old structure is torn down; and this with scarcely any surface indication of the work going on below. Also, changes in the methods of erecting the new buildings have been made possible by the subway service. New buildings are going down to the subway level, 40 ft. below the surface, for more convenient access thereto.

The friendly relations of the railroads and the subway is indicated by the personnel of the board of directors, which is made up almost entirely of the highest railroad officers in Chicago. The results, not only to the railroads but to all of the interests involved, from this new system of handling a great city's freight traffic will undoubtedly be watched with interest by the entire commercial world. Chicago's freight subway must unquestionably be a vital factor in the city's future growth.

The official journal of the Russian Ministry of Transportation publishes an elaborate review of the experience of the Russian railroads in carrying grain in bulk, which was introduced 15 years ago. That the shippers have found the method advantageous is shown by the fact that now four-fifths of all the grain shipments are in bulk. But the review finds that the shippers' advantage has been at the cost of the railroads, and enumerates 10 causes therefor, among which are some which make an American railroad man stand aghast. We can understand the necessity for tight and clean cars, and the cost of grain doors, etc., but that loading, unloading and transfers from car to car should take more time and cost more for grain in bulk than for grain in sacks indicates that the Russian railroads have not taken advantage of the appliances so long in universal use here, and which make a return to the sacking of grain unthinkable. Yet in Russia grain forms a larger proportion of the total freight than in any part of this country, except perhaps the western prairie states. One of the Russian railroads carrying grain to a Black Sea port reports that when grain was shipped in sacks it had been able to unload 330 to 400 carloads daily, while the best it can do with grain in bulk is 160 carloads in a day. To discharge a load of bulk grain it takes 90 minutes; of sacked grain, 10 minutes. If Maxim Gorky, who has carried many a sack on his shoulders at Odessa, will visit the elevators and transfer tracks in Chicago he will doubtless be able to tell why.

NEW PUBLICATIONS.

Twentieth Century Machine Shop Practice. 1906. By L. Elliott Brookes. Frederick J. Drake & Co., Chicago. Cloth, 5 in. x 7½ in.; 423 illustrations, 630 pages, including index. Price, $2.

This work is intended for the use of machinists, engineers and others who are interested in the use and operation of the machinery and machine tools in a modern machine shop. The author deals with the various subjects discussed in as practical and non-technical a manner as possible, and where necessary he has gone into academic discussion and has clearly explained the fundamental principles of operation. A number of rules, formulas and tables are also given. These will be found of use in connection with the subject matter of the book, as well as in every-day shop problems.

The Manual of Statistics. 1906. Published by The Manual of Statistics Company, 25 West Broadway, New York. Cloth; 5x8 in.; 1056 pages; 22 maps. Price, $5.00.

The twenty-eighth annual number of this financial publication has just been issued. As usual it contains in condensed form information about railroad and industrial companies and their securities, government securities, and produce and cotton statistics, together with a three-year record of high and low prices of a wide variety of stocks and bonds in different markets. A table at the end of the railroad department sums up for some 60 roads, tonnage, ton mileage, freight density, average rate received, earnings per freight train mile and average train load. Other tables give by years statistics of railroad construction, foreclosures and receiverships together with a list of the railroads sold at foreclosure and for which receivers were appointed in 1905. The book is a convenient handbook of a great deal of condensed information which it makes readily available.

Electric Transmission of Water Power. By Alton D. Adams, A. M. New York: McGraw Publishing Co. Cloth; 6x9 in.; 335 pages; 105 figures. Price, $3.00.

In some respects the title of this book is misleading in that the text is by no means limited to those items of electrical transmission of power that are characteristic of water power developments only. It embraces the whole wide range that may be properly classified as belonging to electric transmission in general, whether the current be generated by water, steam or gas. In this respect the book is of much greater value than its title indicates. The opening chapter relates to water power in electrical supply. There is a brief review here of what has been done in this country in the electric transmisson of water power over moderate and long distances ranging from three to 142 miles. This general rounding up of what has been done is followed by a discussion of the utility of water power, in which it is shown that while "in comparatively few systems is the available water power sufficient to carry the entire load at all hours of the day and during all months of the year," there is still every reason for using that which is at hand. This is demonstrated by concrete instances from experience. There are chapters on the development of water power for electric stations, the location and the design of electric water power stations, all of which are illustrated by examples so that the reader, student or engineer is furnished with ample precedent for contemplated action. These chapters are illustrated not only by pictures of the buildings in which the plants are housed but by maps and plans showing the methods followed in the various developments.

The balance of the book is occupied with a discussion of the general problems of transmission. In one chapter there is an interesting comparison of the relative advantages of direct and alternating current. The method of operating and the means of securing high potentials under either system are fully and clearly explained and the evidence on both sides carefully weighed, though evidently in the mind of the author, the direct-current system presents preponderating advantages; for, in the concluding paragraph he says that "either of the three systems of transmission by continuous-current, that have been considered, requires a smaller total capacity of electrical apparatus for a given rate of mechanical power delivery than any system using alternating current except where both dynamos and motors operate at line voltage."

It is shown that the physical limits of transmission are defined by the voltage that is obtainable and permissible, permissible not only from an electric but a commercial standpoint, for if the "present transmission pressures of 50,000 to 60,000 volts are to be greatly exceeded, the line structure will involve the use of a separate pole for each wire of a circuit." Other matters touched upon and handled with all of the thoroughness possible in a book of such wide scope are alternators, transformers, switches, fuses, circuit-breakers, regulation, guard wires, lightning arresters, materials, voltages and losses, conductors, pole lines, insulators and steel towers.

The book is exceptionally free from mathematics and formulæ

and presents its information in a way that can be readily grasped by any who will take the pains to read carefully.

CONTRIBUTIONS

Grafton, Hall, Patenall et al.

Boston, May 14, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of April 20 you say that "the upward inclination is looking up"; and from what you have said at other times, joined with what is going on in the Railway Signal Association and among the signal manufacturers, one may conclude that the three-position signal is also "looking up"—it is growing in popularity. Does this mean that our signal practice is to be rapidly revolutionized? Let us look around a bit. Are we not going too fast in our craze to refine the semaphpore to some imaginary state of perfection, that is only an incident after all?

The upward inclination and the three-position are both put forward on the plea of economy; the first on the ground that with less counterweight to lift there is less expenditure of energy, and the second on the ground both of economy in battery power and of the reduction in cost of installation by halving the number of blades. But why put such emphasis on these moderate and questionable economies, while we all the time ignore the marked economy of the enclosed disk signal? Experience has shown that these "banjo" signals cost 30 per cent. less to install and 30 per cent. less to maintain. The simplicity of their apparatus is so marked, as compared with the power semaphores used in automatic block signaling, that the wages of maintainers may be and are kept $5 a month lower.

Simplicity and cheapness are two cardinal elements that can never be safely ignored if one intends to adhere to the fundamentals of economy. In exalting the semaphore we are losing sight of these fundamentals. We are indulging in excessive zeal for an ideal, the same as when we try all sorts of schemes to get a third night color for distant signals, in the face of the complete success of the English roads in carrying on their enormous traffic for many years with only two night colors. The fallacy that the semaphore is a necessity because it can be seen farther (in practice it can't) is exploded by the success of the Chicago & North-Western and the Philadelphia & Reading with their hundreds of disk signals for the past dozen years. Does any one know of any roads that have fewer collisions in proportion to signal operations than these two? Or of any road where the enginemen find less fault with the signals?

I have had experience with the enclosed disks through four northern winters; and the days in which the signals have caused delays because hidden by sticky snow on the glass windows of the signal case have not been over four—or one a year. This point about the snow is one of the academic objections, as devoid of real force as that about yellow lights looking like red. The reflection of sunlight by the glass is equally unimportant as a difficulty. Any signal which really causes annoyance in that way can be cured by a slight change in location. As enginemen (and superintendents) come to more generally use and more fully appreciate the distant signal, this alleged sunlight fault, like others depending on the supposed necessity of seeing signals a mile or two before you reach them, vanishes into nothingness.

While I am glorifying the enclosed disk I may as well say a word for the "normal danger." Five years' practice under this, with a considerable though shorter experience with normal clear, has made me a pronounced advocate of normal danger. In this statement I am speaking only from the standpoint of the operating officer. I leave economy to be discussed by others. With normal-danger, whenever you see a signal at clear you know that it has just been put into that position. This affords constantly renewed assurance that the apparatus is in working order; and this constant assurance comes to be a marked satisfaction. It is to be borne in mind that this is a merit in automatic signals which stands on its own bottom. We do not need to depend on the analogy between normal danger here and normal danger in interlocking signals. In interlocking the signals are kept normally in the stop position for convenience and celerity, that is all. In automatic signals it is an important desideratum for another reason—the reason that I have just given.

In fact, from the operating officer's standpoint, all considerations are in favor of the normal danger. Your readers are already informed as to the principal arguments from a technical standpoint; that it is dangerous to neglect flagging with normal clear, because false clear signal indications are more likely to occur than with the normal danger; that the normal danger consumes less battery current; that derangements may be as readily discovered under one system as the other; that the normal danger is really less liable to derangement.

My plea is for rational treatment of the signal question in all of its phases and details. The fundamental element of simplicity, to which I have already referred, includes the question of size. We should not keep on forever using posts 30 ft. high, with large and heavy castings, just because the practice throughout the country has for many years been dominated by men who are determined to make signals visible two miles away. These same men have persistently tried all these years to get along without distant signals, presumably because they thought that that course was a good way to save money. But the distant signal has had to be used, because it is a necessity, and its use is constantly growing, thanks largely to the persistent advocacy of the *Railroad Gazette*. The conservatives (to call them by a mild term) have been beaten. Having been beaten on that point, logic demands that their theories of size be also thrown overboard. On one division of an important road, the automatic disk (clock work) signals for 40 miles are nearly all of the old pattern, with oblong disks about 24 in. long (transversely to the track), and 6 in. to 8 in. high, and they are on posts about 20 ft. high; and these signals are just as satisfactory as semaphore signals that are one-fourth higher, and more than a fourth heavier, larger and more costly. Why do we ignore lessons of experience like this? Automatic signals have been in use on the division referred to for more than 20 years.

The signal manufacturer and the capitalist sitting in the railroad president's chair (usually short-sighted except on purely financial questions) have long had their way in signal matters, and have decided many questions almost solely on their own notions of expediency. It is high time that operating officers put forward more boldly some of the considerations of expediency that arise in the operating department. The disk signal has permanent merit because it can be enclosed and thus be worked by a few ounces of power. The "normal-danger" principle has incontestable advantages because it compels an additional test of the apparatus on the occasion of every movement. Signals should always be of as small size as will satisfactorily serve their purpose, because larger structures are a standing evidence of unnecessary expenditure. N. E. P.

The Collateral Trust Mortgage in Railroad Finance.*

An account of the origin of the collateral trust mortgage is of interest because it furnishes an illustration of corporate ingenuity in the matter of doing illegal things in a legal way. The construction of the Union Pacific Railroad, among others, was subsidized by the United States Government, which took a second lien upon all that company's property to secure its loan. In 1873, in order to prevent the impairment of the government's lien, Congress passed a law prohibiting the Union Pacific from increasing the bonded debt of the property subject to this lien. Now railroads are built largely out of the proceeds of bond sales. The result of this law was that the Union Pacific could build no branch lines or extensions under its charter. If built at all, these branches must be built under separate charters and legally distinct companies. But these companies must be controlled by the Union Pacific, or they might fall into the hands of its competitors. Furtner, the bonds of small subsidiary companies could not be sold directly to the public unless their interest and principal were guaranteed by the parent company, and this the latter could not legally do because that would be placing at least a contingent fixed charge upon its own earnings.

This situation resulted in the Union Pacific 6 per cent. collateral trust bonds of 1879. Legally distinct companies were organized and chartered to build the desired branches. The Union Pacific advanced the funds with which to construct these lines out of its current earnings, and received in compensation the capital stock and first mortgage 7 per cent. bonds of the smaller companies, which thus became subsidiary. To reimburse its treasury for these advances, the Union Pacific mortgaged these first mortgage bonds, and issued and sold about $7,000,000 of collateral trust bonds against them. The interest on this collateral was more than sufficient to pay the interest on the 6 per cent. bonds, so that, as long as the subsidiary companies did not default in their interest payments, the charges against the revenues of the parent company were not increased, while at the same time it was getting the benefit of a profitable interchange of traffic with those companies. Thus did the Union Pacific accomplish the feat of constructing, eventually without cost to itself, branch lines which were directly under its control, and at the same time of living up to the letter of the national statute.

Three years later, when the Union Pacific created a second collateral trust issue for a similar purpose, suit was brought by a stockholder to prevent the issuance of the bonds, upon the ground that this really increased the funded burden of the Union Pacific property, and, therefore, was in violation of the national statute. It was shown, however, that the plaintiff although a stockholder at a time previous to the date of this bond issue, had sold his stock and had not again become a shareholder until after the new bond issue had been authorized. The court decided that he had no right of action, so that the real point of the case was never judicially considered.

The idea of the collateral trust mortgage was probably suc-

*From a paper by Thomas W. Mitchell in the Quarterly Journal of Economics.

gested by the practice, long current among stock brokers, business men generally, and railroad companies as well, of borrowing upon corporate securities as collateral. Such debts, in the form of ordinary promissory notes, ran for short periods of thirty or sixty days only. The question is naturally suggested, If such collateral is adequate security for ordinary commercial paper, why would it not also be adequate security for long-time loans?

The collateral trust mortgage soon became popular and was used for a variety of purposes. The most important of these have been to fund floating debts, acquire control of connecting railroad lines, and to finance new construction. Out of seventy collateral trust issues about which inquiry has been made for the present investigation, eleven have been made for the first of these purposes—funding troublesome floating debts. Some of these have been due to the misfortunes of the railroad company, some to new construction for which funded obligations had not yet been created, some to both. Thus poor crops in Kansas and Nebraska in 1886 and 1887, strikes and general labor agitation, caused the Atchison, Topeka & Santa Fe to incur a floating debt of $5,000,000 in 1888. A strike, a flood, assisted by a general business depression, caused the Baltimore & Ohio Southwestern a floating debt of over $1,000,000 in 1897. The Richmond & West Point Terminal Railway and Warehouse Company repeatedly piled up floating debts because of the general unprogressiveness and lack of efficiency in the management of the railways which it controlled. Illustrations of floating debts due to construction were those of the Central Railroad and Banking Company of Georgia in 1887, and of the Missouri Pacific prior to 1895. The former piled up a 6 per cent. floating debt of $1,050,000 in building roads in South Carolina, and funded this into a 5 per cent. collateral trust mortgage. The Missouri Pacific had been building railroads with materials bought on account or on commercial paper. All of the floating debt thus created had been bought up by Jay Gould, Russell Sage and other directors, and held by them subject to call. This debt resulted in the Gold Funding Notes of 1895.

The manner in which this method of funding floating debts becomes available may be illustrated by the case of the Richmond & West Point Terminal Company in 1883. That company had acquired control of a network of railroads in Virginia, Tennessee, Georgia and the Carolinas, by purchasing their capital stock and bonds. Almost invariably these had been obtained in exchange for its own capital stock, so that these securities of subsidiary companies lay in the Terminal Company's treasury, unencumbered by any mortgage. When the company found itself burdened with a large floating debt in 1883, it relieved itself by pledging a great mass of these shares and bonds as security for its 6 per cent. two-year collateral trust notes.

The old Wabash, St. Louis & Pacific funded a similar floating debt in 1883. That company had been seized with the mania for expansion. Organized in 1879, it had in three years' time increased its mileage from 1,578 to 3,518 miles, its debt from thirty-five to seventy millions, and had accomplished this partly by construction under subsidiary companies, mostly by annexing all the odds and ends of railroad lines lying loose in its vicinity. In the same process it had collected a large and miscellaneous mass of railroad securities in its treasury. Aided by destructive washouts, poor crops and the poor condition of the roads acquired, it had piled up a floating debt of over $5,000,000. About $18,000,000 worth of these stocks and bonds were bundled together under a collateral trust mortgage and $10,000,000 of 6 per cent. notes issued against them, part of which was to provide for this floating debt and part to pay off certain car trust certificates which were to mature during the ensuing nine years.

These bonds of the Wabash were to run thirty years. Usually, however, the securities issued to take up a floating debt have a period of only three or four years, and are called collateral trust notes. The Richmond & West Point Terminal notes of 1883 matured in 1885, and were converted into another collateral trust issue bearing 7 per cent., and maturing in 1887; the Atchison notes of 1888 were to run only three years; the Union Pacific Collateral Trust Notes of 1891, three years; those of the Northern Pacific of 1893, five years.

The reason for the temporary nature of these issues is apparent. They are created when the railroad company is in financial distress, when its credit is poorest. Consequently, these notes must either bear high interest rates or sell at a large discount, or both. The first collateral trust loan of the Richmond & West Point Terminal in 1883 bore 6 per cent., and was negotiated at 90, representing a cost of 11 per cent. per annum. Its successor in 1885 bore 7 per cent. The Atchison notes of 1888 bore 6 per cent., and netted the company 97½. The Union Pacific notes of 1891 bore 6 per cent., and were taken at 92½, representing a cost of 8 per cent. per annum. The railroad company feels that by tiding over the temporarily unfavorable condition of its finances it can place its long-time securities at lower interest rates. Hence these short-time notes.

So much for the floating debt as leading to this form of security. A more important purpose of the collateral trust mortgage is to serve as a means of acquiring control of connecting lines. There are three ways in which this may be accomplished, namely: (1) One railroad company may purchase a controlling interest in the securities of a second company, paying for them in cash, and reimburse itself by mortgaging the securities thus purchased and selling collateral trust bonds against them; (2) the purchasing company may exchange its collateral trust bonds directly for the desired securities of the second company, and deposit these securities obtained in the exchange under the collateral trust mortgage; (3) the trustee of the mortgage may sell the collateral trust bonds on the market, and with the proceeds purchase the desired securities of the connecting lines and deposit them under the mortgage.

The first method, the cash purchase, will usually be followed when there is reason for a quick purchase of the desired securities. Thus, during the panic of 1893, the preferred and common stock, the second mortgage and equipment trust bonds of the Chesapeake, Ohio & Southwestern took a sudden and large drop. The Illinois Central snatched them up at their low prices, at the same time buying that company's floating debt and overdue interest coupons, and thus obtaining control. This move gave the Illinois Central an outlet from Memphis toward the Northwest for the traffic coming up over its Yazoo & Mississippi Valley division, and also connected that division of its system with the main line at Fulton, Ky. The Illinois Central reimbursed itself for these cash appropriations by selling an issue of collateral trust bonds secured by a mortgage upon the Chesapeake, Ohio & Southwestern securities.

Again, in 1892, the Illinois Central purchased $35,236,000 of the mortgage and income bonds of the Louisville, New Orleans & Texas Railroad, which paralleled its Yazoo & Mississippi Valley division. By the terms of the agreement it was required to pay $5,000,000 of the purchase price in cash. To pay the remainder of the purchase price of $25,000,000 and to reimburse itself for this cash payment, the Illinois Central mortgaged the securities purchased, and issued $25,000,000 of collateral trust bonds against them.

In other cases the companies owning the desired connecting lines may have only a small amount of securities outstanding, so that these may be purchased for cash without inconveniently draining the purchasing company's treasury. The Reading Company in 1899 purchased most of the $1,500,000 capital stock of the Wilmington & Northern at from $40 to $50 per share ($50 par value), and reimbursed itself in the following year by an issue of $1,300,000 of 4 per cent. collateral trust bonds.

A more common practice in acquiring control of connecting lines is to exchange the collateral trust bonds directly for the stocks and bonds which are desired, and which become the security of the collateral trust bonds. This exchange is made at a fixed ratio stated in terms of the par value of the two sets of securities, usually offering the holders of the desired securities a little more than the market price of their holdings at the time. Thus, in 1902, the Chicago, Rock Island & Pacific Railroad Company, wishing to acquire the capital stock of the Chicago, Rock Island & Pacific Railway Company, offered the holders of that stock its collateral trust 4 per cent. bonds, together with the common and preferred stock of the Rock Island Company of New Jersey, in the ratio of $100 in bonds, $70 in preferred stock, and $100 in common stock for each $100 of capital stock of the railway company. The Railway company's stock, which had been paying 5 per cent. dividends, had risen in market price from 135 in July, 1901, to 170 in June, 1902, and thence to 200 later in the year. The securities for which these stocks were exchanged guaranteed their holders 4 per cent. on the par value of their investment in the form of interest on the collateral trust bonds, an additional 2.8 per cent. if earned as dividends on the preferred stock, in all a possibility of 6.8 per cent., and gave them a bonus of common stock. Rock Island Company's preferred stock commenced paying 4 per cent. dividends in 1903; but its ability to continue this is contingent upon the old Railway company's ability to continue paying more than 7 per cent. dividends on its stock, which, in view of the present inferior condition of its property, is improbable.[1]

Again, in 1902, to acquire the stock of the Choctaw, Oklahoma & Gulf Railroad, the Chicago, Rock Island & Pacific Railway Company offered the holders of that stock its 4 per cent. collateral trust bonds at the rate of $80 in bonds for each $50 share of Choctaw common, and $60 in bonds for each $50 share of Choctaw preferred. The preferred stock had been paying 5 per cent. dividends since 1898, and the common from 2 to 4 per cent. This was not in itself an attractive offer to the preferred shareholders; but they had either to accept this offer or furnish large amounts of funds for betterments and extensions, besides withstanding the competition of a parallel line which the Rock Island threatened to build if they refused this offer. They accepted.

The third method of purchasing the securities of another railway company is illustrated in the Richmond & West Point Terminal mortgage of 1887. The "Terminal Company," which had hitherto been subsidiary to the Richmond & Danville, wished to acquire the $6,000,000 of first preferred stock of the East Tennessee, Virginia

[1]Since the above was written, the Rock Island Company has been compelled to reduce the dividend on its preferred stock.

& Georgia and a controlling interest in the Richmond & Danville stock, and thus to become the parent company. For this purpose $4,400,000 in cash was required, in addition to 40,000 shares of the "Terminal Company's" stock. To obtain this cash and fund a floating debt, a mortgage for $8,500,000 was placed upon a list of stock and bonds, including the "East Tennessee" and the Richmond & Danville stock about to be purchased, the list amounting to $21,416,000. The collateral trust bonds thus secured were delivered to a syndicate in exchange for the necessary cash funds, the syndicate reimbursing itself from the sale of the bonds. In other cases the trustees of the mortgage sell the bonds, and from the cash proceeds purchase the desired railroad securities and hold them subject to the mortgage.

So much for the methods of purchasing the securities of connecting railroads. Twenty-nine out of about 70 collateral trust issues were created wholly or in part for this purpose. Other methods of acquiring control of connecting lines are through the lease of their roads, consolidation, and common personal ownership of the stock of the two companies. The lease is the most common. But if a fixed rental is paid for the leased line, this becomes burdensome to the lessee if the acquired line should prove unprofitable or during times of depression. If the rental be a fixed percentage of the gross or net earnings, thus fluctuating with the prosperity of the leased line, this in practice has been found to discourage improvements by the lessee upon the leased property, because the lessee will not get the whole benefit of such improvements. As a result, many companies are supplementing their leases by purchasing the stock of the leased lines, or are purchasing this stock and canceling or refusing to renew their leases. The Illinois Central adopted the latter course in dealing with its Iowa lines in 1887. The Mobile & Ohio, in 1900, supplemented its lease of the St. Louis & Cairo Railroad by purchasing that company's stock under a collateral trust mortgage. Very frequently a railway company, after obtaining a controlling interest in the stock of a connecting line, will also lease its road. This enables the parent company to operate the leased road as an integral part of its system.

In "consolidation," as the term is here used, one company loses its identity, its property being sold to the other company in consideration of the assumption of its debts by that company, or distributed to its stockholders, which consist of the parent company. The method of consolidation is rarely followed in practice. It has the advantage of simplifying accounts by avoiding the necessity of keeping a distinct set of accounts for each part of the system. But a connecting line may become a burden instead of a blessing to the system, and under consolidation there is no way in which to remove such a burden except insolvency and reorganization. whereas, if control is exercised through stock ownership, the burdensome line may be dropped off by redeeming the collateral trust mortgage and selling the underlying securities.[1] Further, consolidation may lead to legal complications. There is always that danger that the courts will declare the consolidation illegal; and, since a case testing its legality may not come up at once, but several years later, when everything has been adjusted to the new order, it is considered advisable not to resort to this method of control. Finally, in case a consolidation were declared illegal, there is still grave doubt as to the charter rights of the consolidated company. Thus the present Chicago, Rock Island & Pacific Railway Company was a consolidation of the former Chicago, Rock Island & Pacific Railroad Company, an Illinois company, and the Mississippi & Missouri River Railroad Company, an Iowa corporation. The laws of Illinois forbid a railroad company from purchasing and owning the stock of another corporation; the laws of Iowa permit it. What rights are possessed by the present Rock Island Railroad Company, which is a corporation under both sets of laws? Does it possess the most liberal provileges conferred by each charter or the least liberal? As a matter of practical policy, the solicitors of the company will claim all the privileges they ever enjoyed under either charter; but there are abundant opportunities for legal complications.

Control through common personal ownership in the stock of two or more railroad companies was, until recently, illustrated in the method by which the Vanderbilt system was held together. The parts of this system, including the New York Central, the Lake Shore & Michigan Southern and the Michigan Central, were operated in harmony because the Vanderbilt family held a controlling interest in the share capital of each company. This has its disadvantage in that the death of a single individual may cause the break-up of the whole railroad system. In 1898 and 1900 the New York Central purchased the Vanderbilt holdings in the stock of the other two companies, and as much of the remaining stock as was offered, paying for them in 3½ per cent. collateral trust bonds secured by the stock purchased.

This case illustrates a third purpose for which collateral trust bonds may be issued; namely, to more firmly cement the parts of a railroad system together. In this case common personal ownership was converted into corporate ownership. In other cases separate holding companies may be organized to acquire and hold the securities of connecting lines. The old Richmond & West Point Terminal Company, which was organized in the interests of the Richmond & Danville, was an instance of this kind. Or, as in the case of the Erie Railroad's purchase of the New York, Susquehanna & Western and several other companies in 1901, the collateral trust mortgage may be the means of converting close but informal working agreements with connecting lines into actual control.

We come now to the most important purpose for which bonds in general have been issued, and the purpose second in importance for which collateral trust bonds have been issued. That purpose is the financing of new construction. The general practice in building extensions and branch lines nowadays is to construct these under separate charters. But, instead of selling the securities of the new railway company upon the market, these securities are issued to the parent company, and the latter places upon the market its own collateral trust bonds secured by a mortgage upon these stocks and bonds of the subsidiary company. This course secures the necessary construction funds as readily and insures to the parent company the control of the new lines.

In practice this method works itself out in two variations. The parent company either advances the necessary construction funds out of its own treasury in exchange for the securities of the subsidiary company, and later reimburses itself by the sale of collateral trust bonds, or, in advance of construction, it gives its collateral trust bonds to the subsidiary company in exchange for the latter's stock and bonds; and the subsidiary company then obtains the needed construction funds by selling the collateral trust bonds thus received.

The collateral trust mortgage issued by the Union Pacific in 1879, already referred to as probably the earliest issue of the kind, was an instance of the first variation. The $14,376,000 of trust 5 per cetn. bonds of the Missouri Pacific Railway in 1887 was another instance, and were secured by the first mortgage bonds of seven subsidiary companies. A similar collateral trust mortgage of 1890 was secured by the bonds of 19 subsidiary companies which were built in this way. The Illinois Central and the Louisville & Nashville are also among railroad companies which have financed new construction in this way.

The variation has the disadvantage of entailing a considerable drain upon the earnings and working capital of the parent company, perhaps impairing its working efficiency, and especially diverting funds which might have been paid out in dividends to other purposes. And in practice it seems to be less favored than the second variation, namely, the exchange of securities with the subsidiary companies and the sale of the collateral trust bonds in advance of the construction work.

The latter has been a favorite method with the St. Louis & San Francisco, that company having put out four issues of collateral trust bonds in this way. Other railroad companies which have followed this method are the Burlington (1881), the Rock Island (1884), Illinois Central (1886), the Atchison, and the Union Pacific. This method was also followed by the Pennsylvania Company in putting out its guaranteed trust certificates in 1897 and following years. By following this method the drain on the parent company's treasury was reduced to a minimum, namely, the interest upon the bonds issued.

The reasons for financing new construction by means of collateral trust issues are various. To construct new lines under the parent company's charter would often mean that they would automatically become subject to old mortgages. This means that new bonds issued would have a junior lien, and, as the *Commercial and Financial Chronicle* puts it, an investor prefers a first lien upon a specific piece of property to a tenth or twelfth mortgage upon a whole system. If subsidiary companies are organized, these must be controlled either through the lease of their lines or through stock ownership. The first mortgage bonds of the subsidiary companies might be offered directly to the public; but the investor prefers a bond which, in addition to being a first lien upon a specific piece of property, is a direct obligation of the parent company. The collateral trust bond has both of these desirable qualities, and gains additional strength from the fact that frequently the same bond is thus indirectly a first lien, not upon one branch road only, but upon several, thus widening the security. As in insurance, there is safety in numbers.

Again, as already intimated, the control of connecting lines through stock ownership is a possible advantage in that it may enable the latter to rid itself of such lines if they prove unprofitable. Sometimes a subsidiary company can obtain valuable charter privileges. The Rock Island built the road of the Wisconsin, Minnesota & Pacific under an old charter which exempted its stockholders from the liabilities imposed by the states through which its lines passed.

But the most important reason for constructing additional mileage in this manner consists of the limitations of the parent company's charter privileges. In the first place a railway company's charter will pretty definitely fix the location and length of the road which may be constructed by it. Thus the Illinois Central's charter empowered it to construct a railroad from Cairo, Ill., through the

[1] This is not true, however, if the interest on the subsidiary company's bonds or dividends on its stock be guaranteed by the parent company.

central part of the state to the northwest angle via Galena, and a branch from Centralia to Chicago. If that company wished to construct other mileage within the state, it might be enabled to do this through an amendment to its charter; but in these days of hostility toward corporations it might have to surrender some other valuable charter privilege in exchange for the desired amendment. Further, the powers granted to a railroad company in its charter hold only within the boundaries of its birth state; and, if it wishes to push its lines into other states, as all great railroad systems do, these lines must be built under separate charters obtained under the laws of the states in which they lie. Hence a great railroad system must consist of the lines of a number of smaller or of larger companies, all of which are controlled in some way by one great "parent" company. As shown before, where these subsidiary companies sell bonds and they usually do these bonds will command better prices if they are represented in the market by the parent company's collateral trust bonds.

The foregoing three purposes, namely, funding floating debts, purchasing control over connecting lines and financing new construction—are the principal purposes for which collateral trust mortgages have been created. Of these, the last two, which together represent the building and development of railway systems, are *par excellence* the purposes of the collateral trust mortgage. Fifty out of about 70 such mortgages have been created, wholly or in part, for one of these two purposes. The funding of floating debts comes next with 11 such issues to its credit. A few of the more important minor purposes are illustrated in the following paragraphs.

One such purpose of the collateral trust mortgage is to market the companies' securities on more favorable terms than could be obtained otherwise, either by postponing the sale of long-term bonds until market conditions become more favorable or by combining a number of different bond issues and strengthening their security, to give strength to the combination. In the first case the new issue usually takes the form of collateral trust notes which bear a higher rate of interest than the underlying securities, and are exceeded by them in par value. Thus the Baltimore & Ohio Southwestern had sustained during 1896-97 a series of disasters which impaired its earnings, so that its first consolidated 4½ per cent. bonds had declined from 79 to 60. Being in need of funds with which to repair the damages to its track, that company deposited a number of these 4½ per cent. bonds as security for $675,000 of notes, which were turned over to a syndicate in exchange for the needed funds.

On the border between this and the next case are the several collateral trust issues put out by the Seaboard Air Line Railway Company between 1900 and 1903. The Seaboard Air Line Railway Company had authorized in 1900 a $75,000,000 issue of 4 per cent. bonds, which were a first lien on 350 miles of railway, and a direct mortgage on 1,010 miles of other road, subject to outstanding prior lien bonds amounting to $12,748,000, and was a consolidated lien on the remaining mileage of the Seaboard system. The security was not strong enough to sell the bonds. Consequently, as funds were needed, three successive collateral trust issues were substituted. In each of these there was deposited an amount of the unsalable "first fours," just double the amount of the collateral trust notes or bonds authorized. Two of these collateral trust issues bore 5 per cent. and one 6 per cent., as compared with the rate of 4 per cent. on the underlying bonds. The collateral trust bonds sold at from 100 to 105 as compared with a price of 82 to 90 on the underlying bonds. The Chicago & Alton Railway Company did a similar thing in 1902, issuing $5,000,000 of 4 per cent. notes against $7,000,000 of 3 per cent. refunding bonds of the Chicago & Alton Railroad Company.

In 1898 the Louisville & Nashville's unified 4 per cent. bonds were selling at from 80 to 90. Wishing to pay off over $7,000,000 of first consolidated mortgage bonds which matured that year, the Louisville & Nashville placed a 20-year mortgage upon $14,000,000 of these unified fours and $4,000,000 of Paducah & Memphis division bonds, and issued 4 per cent. collateral trust bonds against them. These bonds sold around par. The Louisville & Nashville collateral trust bonds of 1882 were issued for a similar purpose. In this case $10,000,000 of 6 per cent. bonds were issued against $28,163,000 par value of a varied list of bonds, and sold at 90.

Still another purpose of collateral trust bond issues is the reduction of fixed charges. This may be done by converting flexible rentals into fixed interest rates. Thus, in 1900, the Mobile & Ohio purchased the stock of the St. Louis & Cairo, whose line it had leased at a rental amounting to 25 per cent. of $^{150}/_{640}$ of its gross earnings, thus substituting a fixed interest charge for this flexible rental. Or bonds with a low rate of interest may be substituted for preferred stocks with fixed dividend rates. Thus the 3½ per cent. guaranteed trust certificates of the Pennsylvania Company take the place of the 7 per cent. special stock of the Pittsburg, Ft. Wayne & Chicago, which dividend is guaranteed by the Pennsylvania Railroad.

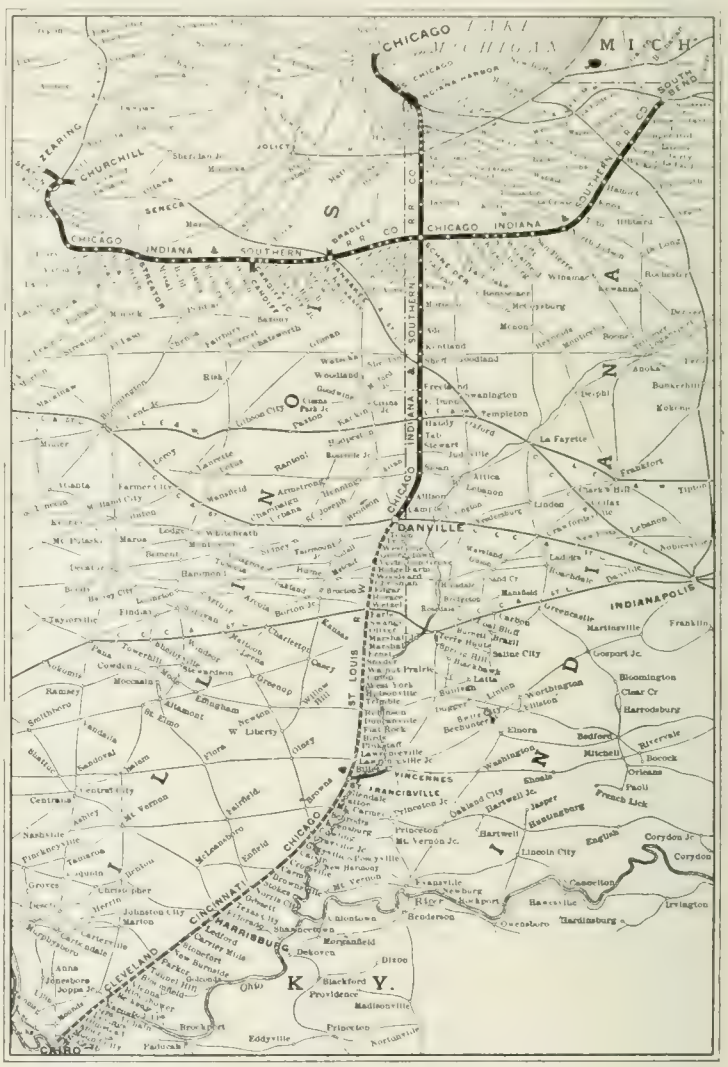
Three other purposes of collateral trust issues need only be mentioned. These are: (1) To refund previous issues of bonds, (2) to convert a previous bond issue for the purpose of increasing its authorized amount, and (3) to consolidate and unify the mortgages of railroad companies which enter into consolidation. The usual method of accomplishing each of these purposes is by means of a consolidated or general mortgage. The use of the collateral trust mortgage in this way is very exceptional.

Chicago, Indiana & Southern.

The accompanying is an official map of the Chicago, Indiana & Southern, the New York Central line formed by consolidation of the Indiana, Illinois & Iowa, or, as it was familiarly known, the "Triple Optic," running from Zearing, Ill., east to South Bend, Ind., 200 miles, and the Indiana Harbor Railroad, which in January of this year was extended southward 109 miles from Indiana Harbor, Ind., on the lake shore, 19 miles from Chicago, to Danville, Ill., the northern terminus of the Cairo division of the Big Four.

The two roads were in April consolidated into the new company, the name Indiana Harbor Railroad now covering only the Indiana Harbor Belt, not shown on the map, which, having on Feb. 1, 1905, taken over the rights of the Michigan Central in the tracks of the Chicago Junction Railway and two short belt lines, operates 70 miles of belt line from Indiana Harbor, Ind., to Franklin Park, Ill.

The advantages of the new Indiana Harbor-Danville line to the New York Central system are three-fold. It reaches valuable coal fields which are expected to furnish a large part of the coal supply of the lines east from Chicago. As shown on the map, it gives



Chicago, Indiana & Southern.

a direct connection over Vanderbilt rails to Cairo, at the junction of the Mississippi and Ohio rivers, which is expected to compete effectively for traffic to and from the Gulf. To carry out this plan, large improvements have been made on the Cairo division of the Big Four, and the North & South Despatch Line has been organized to run over this line, the Mobile & Ohio and the New Orleans & Northeastern to New Orleans. It is 389 miles, Chicago to Cairo, by this line against 365 miles by the Illinois Central and 942 miles, Chicago to New Orleans, against 923 by the Illinois Central. By running over the new line into Chicago from Sheff, Ind., where it crosses, the Big Four would, instead of as at present using Illinois Central trackage from Kankakee into Chicago, for 56 miles, and the Illinois Central station in that city, be able to enter the city over Vanderbilt rails and run into the La Salle Street station now used by the Lake Shore and the Nickel Plate. The Chicago, Indiana & Southern is an unusual railroad in being made up of two lines running practically at right angles to each other.

How to Get Your Percentage of Competitive Business.*

When up town, visit your merchants. There is always liable to be something somewhat wrong, and if it is with the other line, they will tell you about it, advise you what they have ordered and where from, and will let you have their business for the asking. If it is something wrong with your line, you should look after it at once and make every effort to adjust it. Many times a small claim promptly adjusted has a most beneficial effect.

Make a practice of watching all teamsters. The carload shipments are hauled by certain teamsters; be accommodating to them, having a kind word, placing cars where they can get to them handy, let them know that you appreciate the fact that they are trying to load and unload cars promptly and they will help you out in getting the cars, and will also prove a valuable source of information concerning shipments they have handled or that are expected.

The merchandise is also handled by certain teamsters daily. Keep yourself informed regarding their loads, and you will be able to arrive at pretty clear conclusions as to tonnage and shipments.

It is also a good plan to watch the other road's side tracks. Many times you will see loads that you have not been able to learn of from the teamsters or in any other way.

The mail order shipments are also easily watched and may also be secured. The farmers frequently ask for rates and other information on the street or over the telephone. Then is the time to give them all the information they wish and at the same time solicit the business for your line. Tell them all that they are able to ask, and even more. It places them in a position to favor your line with the business. When the shipment arrives, notify them promptly, and when they call for it go to the wagon with them, and if overweighed or in bad order, fix it up the best way possible. In doing these things, they frequently tell you of shipments they or their neighbors have received via your line and other lines, whether the service was satisfactory and what future shipments they are expecting and via what line.

The traveling salesman is also a man that can give you a great deal of information. Accommodate him, and when possible he will reciprocate. A visit with him will be of benefit to you. Get acquainted with him and he will give you many shipments which, not being routed by the buyer, he is in a position to control for you. He can also give you information concerning sales and tell you of merchants from whom you may secure future shipments.

*From an address to station agents, by M. A. Winkel, Agent of the Chicago & North Western at Algona, Iowa, delivered before the Agents' Association at Fox Lake, and published in the *North-Western Bulletin*, No. 3.

New Railroad Law in Ohio.

In establishing a Railroad Commission of three members, in place of the single officer now performing the functions of that office, the Legislature of Ohio passed an elaborate law to regulate the conduct of railroads and the charges which they shall make for transportation. This law has 38 sections and an abstract of its provisions follows.

Sec. 1. A Railroad Commission is created, to be composed of three commissioners; each commissioner's term is for six years from the first Monday in February, one to be elected every two years. One commissioner shall have a general knowledge of railroad law, and each of the others a general understanding of matters relating to railroad transportation. Not more than two can be of the same political party. No commissioner nor the secretary shall do any other business or serve on or under any committee of any political party. Salary of commissioners, $5,000 each; salary of secretary, $2,500; two clerks, $1,000 each, and one expert stenographer, $1,200. The commission may appoint necessary experts and inspectors. Inspectors shall have the right to inspect freight in cars or in freight houses; and to inspect waybills and other papers. All hearings shall be open to the public. The commission may attend conventions with the commissioners of other states.

Sec. 2. The term "railroad" shall embrace all railroads, receivers, etc., and express companies, but not companies engaged exclusively in the sleeping car business. The act does not apply to street and electric railroads engaged solely in the transportation of passengers within the limits of cities, nor "other private railroads" not doing business as common carriers.

Sec. 3. Every railroad is required to furnish adequate facilities and its charges must be just.

Sec. 4 requires tariffs to be filed with the commission and kept in stations accessible to the public. Tariffs, both local and joint, may be changed only on ten days' notice to the commission unless the commission allows a less time, and whenever a change is made a notice shall be posted in a conspicuous place in every station showing what the changes are and when they take effect. Charges greater or less than specified in the tariff are unlawful. The commission may prescribe the forms of tariffs, which must, as far as practicable, conform to the forms prescribed by the Interstate Commerce Commission.

Sec. 5. Joint rates must be just and reasonable, but each road may charge less than its local rate to or from the junction.

Sec. 6 allows commodity, concentration and other special contract rates, but these must be open to all shippers alike, and the rates are subject to the regulation of the commission.

Sec. 7. The classification of freight in the state shall be uniform on all railroads.

Sec. 8 provides for free transportation in certain cases and allows mileage and party tickets. Men in charge of livestock may be carried free both ways, subject to regulations made by the commission.

Sec. 9. Every railroad must maintain adequate depots and side tracks.

Sec. 10. Every railroad shall, when within its power, furnish suitable cars for carload lots on reasonable notice. In case of insufficiency of cars, distribution must be made to applicants in proportion to their respective immediate requirements, but preference may be given to livestock and perishable property. The commission may enforce regulations for furnishing cars, for switching, for loading and unloading, and for weighing.

Sec. 11. All steam railroads, as between themselves, and all interurban and electric railroads, as between themselves, shall afford reasonable facilities for interchange of traffic; precedence may be given to livestock and perishable freight. The commission controls private tracks in so far as used by common carriers.

Sec. 12.—Upon complaint of any person, firm, association, etc., of unreasonable rates, the commission may notify the road and, after ten days, proceed to investigate. It may enforce the attendance of witnesses. If, on investigation, a rate or practice is found unreasonable, or the service inadequate, the commission may order such rates or practices as it shall have determined to be just and reasonable; and what the commission prescribes the roads must do.

The commission may investigate on its own motion rates or practices believed unreasonable.

Sec. 13 empowers the commission to compel the attendance of witnesses and to call on the court of common pleas for aid where necessary. Witnesses shall receive fees for attendance and mileage, but witnesses subpoenaed at the request of others shall not be paid by the state except on approval of the commission. A full and complete record shall be kept of all proceedings and all testimony shall be taken down by the stenographer. A copy of the record of an investigation shall be furnished free to any party to the investigation and to other persons on payment of a reasonable amount.

Sec. 14. Whenever, on investigation, a rate is found unreasonable, or unjustly discriminatory, the commission shall issue its order fixing a reasonable rate or regulation, etc., and all railroads affected shall conform.

Sec. 15. Rates, etc., fixed by the commission are *prima facie* lawful for one year, unless modified by the commission or by the procedure of Section 16.

Sec. 16. Any railroad or other party aggrieved by an order may within 60 days proceed against the Commission in the Court of Common Pleas. The court may admit other interested parties within ten days after the service of the complaint. Actions under this section have precedence over any civil cause of a different nature pending in the court. If on trial new evidence is presented, the court shall send the evidence to the commission and postpone action for 15 days. Either party to an action may within 60 days appeal from the judgment of the court. In all cases under this section the burden of proof shall be on the plaintiff.

Sec. 17. No person shall be excused from testifying or from producing papers on the ground that his testimony would incriminate him, but he shall not be prosecuted on account of his testimony.

Sec. 18. The commission may inquire into the management of the business of all railroads and shall keep itself informed as to their methods. The commission shall prepare suitable blanks for the purposes designated in this act, which blanks shall conform, as nearly as practicable, to the forms prescribed by the Interstate Commerce Commission.

The Commission or its agents may inspect the books of any railroad on demand and examine under oath any employee. The commission may require a railroad to produce books and records kept by it outside of Ohio, or verified copies thereof. Penalty for refusal, $100 to $1,000.

Sec. 19. Every railroad shall send to the commission copies of all contracts relating to transportation or any service in connection therewith.

On the first Monday in February every railroad must file a verified list of all passes and reduced rate tickets issued, with names of recipients, the amount received for reduced rate tickets and the reason for issuing.

Sec. 20. Every railroad shall, before September 15 each year, send in a true statement of its affairs relative to the State of Ohio, similar to that which it sends to the Interstate Commerce Commission.

Sec. 21. The Commission shall, on complaint, investigate rates

on interstate traffic and, if necessary, petition the Interstate Commerce Commission for relief.

Sec. 22. If any railroad or agent demands or accepts a greater or less compensation [illegible] prescribed by the tariff, the railroad shall be liable to a fine of $1,000 to $5,000 and the agent to a fine of $50 to $1,000. It shall be unlawful for a railroad to make a discount in consideration of the shipper furnishing part of the facilities of transportation.

Sec. 23 forbids discrimination between persons or localities or kinds of traffic.

Sec. 24 forbids any person or firm to accept a rebate or to give false weights, etc.; penalty $50 to $1,000.

Sec. 25. If any railroad shall do or omit anything contrary to this law it shall be liable to the party injured in treble the amount of damages sustained.

Sec. 26. Any railroad employee refusing to fill out and return blanks, or giving a false answer, is guilty of a misdemeanor; fine $100 to $1,000; also, a fine against the railroad of $500 to $1,000, if the employee acted in obedience to the direction of a general officer.

Sec. 27. Any railroad violating any provision or failing to put in operation a joint rate, or do anything wrong for which a penalty has not been provided, shall forfeit $100 to $10,000.

Sec. 28. Whenever the commission, after hearing, finds any charge, regulation or practice unreasonable, it may regulate the same, though the thing done be not specifically mentioned in this law.

Sec. 29 requires immediate notice to the commission of accidents attended with loss of human life, and the commission may investigate the accident, if the public interest requires it.

Sec. 30. The commission shall inquire into any neglect of the laws of the state; shall enforce this act, and all other laws relating to railroads, and report to the Attorney-General, and he must prosecute. He also must be counsel in any proceeding prosecuted or defended by the commission.

Sec. 31. If a railroad does not accept a claim for loss, damage or overcharge, within 90 days, the commission may investigate and make the facts public.

Sec. 32. Acts of the commission shall not be held illegal by reason of technical omissions.

Sec. 33. This act does not release any right of action under other laws.

Sec. 34. The commission may compel compliance by proceedings in mandamus, injunction or other appropriate remedy.

Sec. 35 requires tariffs to be filed within 30 days.

Sec. 36 abolishes the present railroad commissionership.

Sec. 37 declares each section of this act independent, so that the holding of one section void shall not affect other sections.

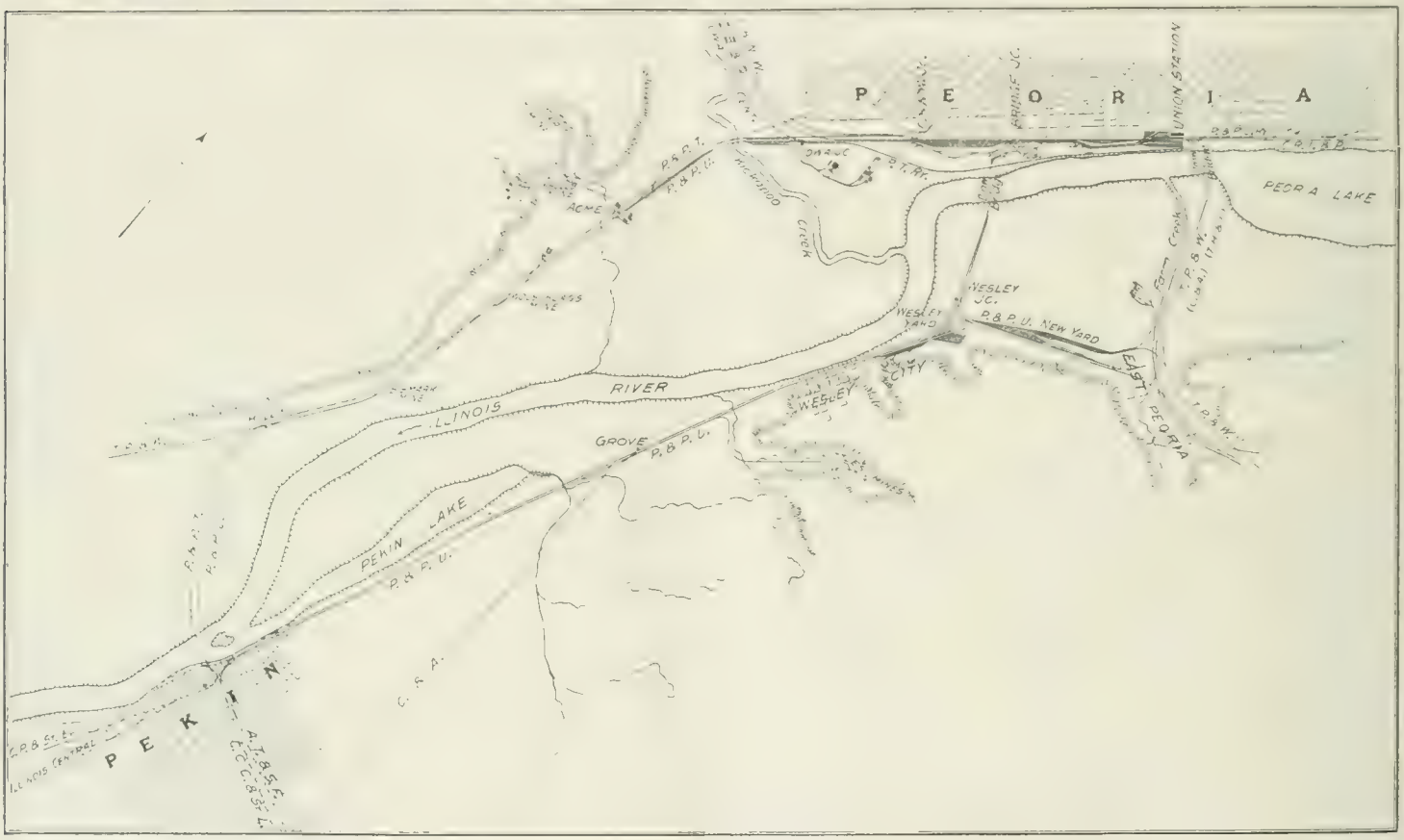
Sec. 38 repeals certain laws.

New Gravity Yard for the Peoria & Pekin Union.

The Peoria & Pekin Union Railway Company, owning a terminal property within and connecting the two cities of Peoria and Pekin, Illinois, is composed of six proprietary interests, namely, the Illinois Central, Chicago, Peoria & St. Louis, Big Four, Toledo, Peoria & Western, Lake Erie & Western and Chicago & North-Western railroads; and of the following tenant interests: Chicago & Alton, Vandalia, Iowa Central, Chicago, Burlington & Quincy and Chicago, Rock Island & Pacific (the two latter for passenger business only).

During the year 1905 there was a total in-and-out movement of cars over these terminals of 570,000, and the total cars handled and switched on orders, including the above, was 1,116,000 for the year. The total days engine service for the year was 8,900, making a total of 125 cars handled per engine per day. The present mileage of the Peoria & Pekin Union Railway is 93 miles, composed of 25 miles of main lines, 9 miles of side tracks on line, and 59 miles of yard tracks. There is a total of 560 switches, four interlocking plants and one drawbridge in connection with all tracks.

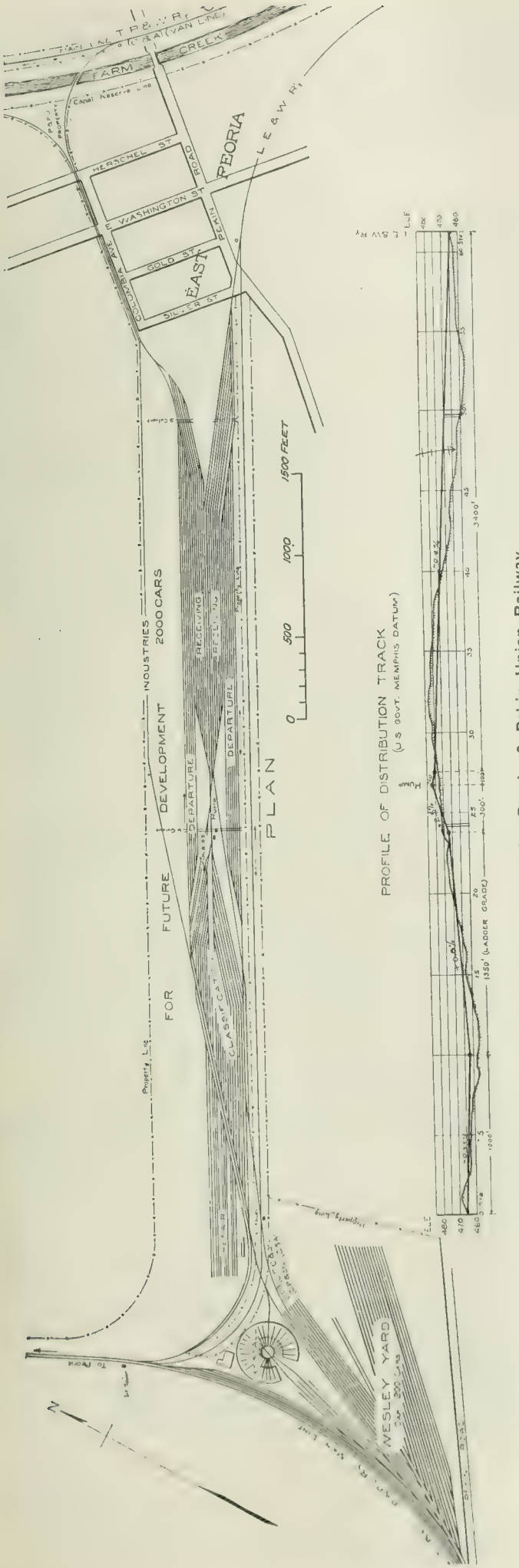
The records show that the business through the Peoria gateway has increased about 8 per cent. each year for past decade and that the present capacity of this property for economical handling of business should not exceed 2,000 cars a day. It therefore became necessary to increase the present capacity enough to take care of the natural increase of business for the next decade. A new yard was accordingly decided on, the plan for which is shown herewith. A map of the company's lines with railroad and industrial connections is also shown. By consulting the latter it will be seen that it is proposed to divert all freight traffic now entering Peoria from the east side of the Illinois river into the new yard, where all trains will be broken up and classified. The interchange of cars between any of the eight roads will be made at this point, and thus only straight Peoria business need be sent into that city.



Map of Peoria & Pekin Union Railway.

The portion of the yards north of the distribution or hump track consists of a receiving yard of six tracks with a capacity of 50 cars each and a departure yard of six tracks with a capacity of 60 cars each. These yards will accommodate the business of the Toledo, Peoria & Western's Eastern division, the Vandalia, and the Dwight division of the Chicago & Alton.

The portion of the yards south of the hump track consists of a receiving yard of seven tracks with a capacity of from 40 to 60 cars each, and a departure yard of seven tracks with a capacity of 50 cars each. These yards will be used to accommodate the business of the Lake Erie & Western from the east and the Chicago, Peoria and St. Louis, Big Four, Illinois Central and Chicago & Alton (Springfield division) from the south. A classification yard of 22 tracks with a capacity of 500 cars, lying immediately west



Plan of New Yard for Peoria & Pekin Union Railway.

or and connected by double ladder with the hump track, will serve to accommodate the classification of both inbound yards. A 150-ton railroad track scale fitted with automatic weighing device is conveniently located on the outside track of the classification yard. All cars to be weighed will pass over the scale, which is built on a 1 per cent. grade, and afterward pulled back on the distribution track and sent over the hump to their proper place in the classification yard. The bad order cars will be dropped into the north side of the classification yard and pushed through into the repair yard, which lies immediately west of the classification yard and is composed of 11 tracks with a total capacity of 200 cars.

The tracks in general are spaced 13 ft. centers with 15 ft. centers on ladders. The repair yard tracks are spaced in pairs of 16 ft. centers and 42 ft. center to center of pairs, thus allowing room for a material or supply track between each pair of working tracks.

The drainage is taken care of with two large concrete culverts of flat top design, the tops being of I beam and concrete construction. The location of the hump is such that it can be raised or lowered as the weather conditions demand.

The engine house and coaling plant shown at the west end of the plan will not be built at present, as the company has abundant facilities for caring for engines on the Peoria side of the Illinois river. The contractors having the work of grading and masonry expect to finish by August 1st and if there is no unforeseen delay in delivery of track material it is expected to have the yard in operation by November 1st.

For the foregoing information we are indebted to Mr. Curtis Millard, President, and Mr. Stanley Millard, Chief Engineer, of the Peoria & Pekin Union Railway.

Leaves from a Railroad Engineer's Note Book.

II.

[Mr. W. W. Hoy, of Johannesburg, South Africa, Chief Traffic Manager of the Central South African Railways, spent about half of the year 1905 inspecting American and European railroads. The appendix to his formal report to his company, consisting of "brief notes on various railway practices," has the freshness and charm which belongs to honest jottings of first impressions, although a trifle more care would have prevented his occasional errors.]

Illinois Central Railroad.

There are at Chicago 10 railroad tracks in actual daily operation, used as follows, and in the order given:

Two tracks—Slow suburban traffic.
Two tracks—Through main line traffic.
Two tracks—Goods traffic.
Two tracks—Express suburban traffic.
Two tracks—Engines working between running shed and station, about two miles.

The main line station at Chicago has no platforms, but has wooden floors raised a few inches above the rail level.

I inquired into the all-electric signal which is in operation here, and found that the motor situated at the points worked very well and gave every satisfaction.

On a line over which this company has running powers, a train on the 19th of May took 1 hour 47 minutes to cover 57 miles.

Each suburban station consists of a high wooden platform, level with the floor of the carriages.

The platform is divided into two sections; one end for express trains, and the other for slow trains.

There is no station master, the station being in the charge of a booking clerk (usually a lady). The average wage paid for booking services is from £7 to £10 per mensem.

The suburban trains are of one class only and are composed of from two to six coaches, six being the maximum. They are worked by small tender engines of four and six wheels coupled type and each carries from three to three and a half tons of coal. These engines are not turned, but run either head or tender first as occasion demands, without reduction of speed. They are not very high wheeled, but are quick starters.

The first carriages provided were furnished with wooden seats, but the later and standard pattern are fitted with cane seats.

The running times were not obtained, but ordinary trains ran eight miles in 28 minutes with 14 stops, and express trains the same distance in 11 minutes.

Smoking and non-smoking compartments are provided.

In trains of two coaches there are two conductors, one of whom acts as guard; in trains of five coaches there are three men provided, one of whom also acts as guard.

The suburban service consists of 243 trains per week day and 85 on Sundays.

The train brakes are the Westinghouse air type.

In some trains the small space at the rear is utilized for the conveyance of baggage, but baggage is not usually carried, and the space is not specially provided therefor.

Grand Central Station, New York.

The installation in the signal cabins is the low pressure power system. Each pair of points gives an indication when clear. Fly

shunting of trains and carriages is in daily operation at this station.

All passenger carriages are fitted with hand brakes in addition to the provision of the automatic air brake.

Every train is under the control of the brakesman who regulates the speed either by hand brake or by the Westinghouse air-brake.

All passenger rolling stock is cleaned at Mott Haven, a depot about six miles from the Grand Central Station.

The signalman indicates electrically to the gatesman the time when to close the gates—just before lowering the starting signal.

New York Interborough Rapid Transit.

The Interborough Rapid Transit (Subway division) is the latest attempt at solving the method of handling congested city and inter urban passenger traffic.

The subway is 21 miles in length, was built and is owned by the city and has been leased for 50 years to the railway company which works the elevated lines in and about the city.

The principal features of this system are:

1. Underground in the city.
2. Easy access by the public, as the roof of the subway usually forms part of the roadway.
3. The provision of local and express tracks in the center and busiest parts of the city.
4. Uniform fare for whatever distance traveled; tickets being placed in a collecting box before passengers are allowed on the platform.
5. Only one class of carriage.
6. Double tracks throughout with block signal sections so arranged that trains follow one another at intervals of two minutes for local and two and a half minutes for express trains.

One million three hundred thousand passengers are carried daily on the elevated railway and the subway.

The speed averages 30 miles an hour, stoppages included. I traveled on some trains which attained a speed approaching 50 miles an hour between stations, *e.g.*, from City Hall to 96th street, a distance of 6½ miles, was covered in 12 minutes. The average stoppages occupy from 9 to 14 seconds.

The length of rail is 60 ft. and the weight 75 lbs. per yard.

The power is electrically delivered to the train by means of a third rail.

Three-phase alternating current is conveyed from the main power house to sub-stations, where it is transformed into direct current.

Each motor car is fitted with two motors of 200 h.p. each, which are of the direct-current series type. The multiple unit system is in operation on all the trains.

Express trains are composed of five motor cars and three trailers; local trains of three motor cars and two trailers. In the eight-car train the first, third, fifth, sixth and eighth are motor cars.

By the system of motor control the electric power delivered to the various motors throughout the train is simultaneously controlled and regulated by the motorman at the head of each train.

The weight of the motor cars averages 88,000 lbs., and that of the trailers 66,000 lbs. All cars are heated and lighted by electricity. Each car is 51 ft. long, and has accommodation for 52 seated and 100 standing passengers. All stock is of the end door type, and is built to be anti-telescopic and fireproof.

The Westinghouse air-brake system is in use on all trains. An emergency air-brake valve has been provided on the truck of all motor cars; it is operated by a "track trip" which acts in case the motorman does not obey the signal and attempts to enter section which is blocked against him.

The subway is lighted throughout from sources quite independent of the train power supply.

The signals are electrically lighted by a system different to the power and general lighting circuits. An alternating current is employed in the signal track circuit which has characteristic differences from the direct current used to propel the trains.

The gage is standard 4 ft. 8½ in. For purposes of emergency a connection is made with the other railways which run through the city.

Northern Pacific.

On the railroad which runs through the forests alongside the Pacific Coast I noticed that spur sidings had been provided at frequent intervals of one or two miles for the purpose of loading timber. These sidings are only protected by disc signals situated at the points. No fixed signals appear to be in use on the railroads running along this coast. The stoppages on this line at intermediate stations do not usually exceed 15 seconds.

In traveling from Vancouver to San Francisco the time occupied in the journey worked out as follows:

Left 8.45 a.m. from Vancouver, and after 35¼ hours' journey reached San Francisco at 8 p.m.

This time shows at an average speed of 31 miles an hour.

A lunch basket was provided at a cost of 50 cents (2s. 1d.).

The cloak room charges are excessive, 2s. 1d. being charged for five small packages, or a cost of 5d. per package.

The carriages are lighted by electric light, which gives splendid results.

The Pennsylvania and the New York Central.

The two railroads which exert, by their rivalry, the strongest influence upon American railroad working are the Pennsylvania (8,556 miles) and the New York Central & Hudson River (7,703) railroad companies.

Both lines compete for the mineral traffic between the Lakes and the Pittsburg district.

One of the premier trains of America the "Twentieth Century Limited" is run by the New York Central between New York and Chicago; the time occupied in the journey being 19 hours. Whilst I was in America the speed of the train was increased to bring the "Flyer" to its destination within 18 hours, because the Pennsylvania Railroad had been enabled, by deviations and regrading in the district of Pittsburg, to shorten its schedule for the same journey to that amount of time. A regrettable accident, however, caused the company to revert to its previous schedule of 19 hours.

As regards the standard equipment of these lines, wherever possible, the tracks are brought up to meet the conditions of running; overhead bridges are being built in the vicinity of cities to eliminate the danger of level crossings so frequent in American towns; block signaling is also receiving considerable attention, and the Central Railroad of New Jersey (a subsidiary line of the P. R. R.) has recently been installed for a distance of 40 miles with the most modern type of block signals extant.

Additional interest is occasioned in this type of signaling in that the signal lamps are all of the seven-day burning type and require attention but once a week for trimming purposes. Signals are erected at distances varying from a quarter to one mile apart, according to the density of the main line traffic, goods and mineral traffic requiring to be forwarded along the four tracks.

New York affords additional interest on account of the enormous tunneling work which is being carried out by the Pennsylvania.

A two-tunnel, each single track, is being pushed through from Long Island, under the East river, through Manhattan Island, under the Hudson River, and up into the mainland, the state of New Jersey.

In the Pittsburg district this same company has spent over £3,000,000 in effecting improvements, especially with regard to the regrading of the line through the Allegheny Mountains and completing a deviation which entirely avoids Altoona and gives a better grade for express passenger trains.

The Pennsylvania Railroad Company arranges personally-conducted tours in addition to the usual facilities afforded to the tourist agencies.

Rock Island Railways.

A white pole is fixed some distance from a level crossing as an indication to the driver of an approaching train that he is nearing a crossing.

The saloons are fairly well cleaned, but the brass work suffers from want of attention.

Southern Pacific.

This railroad has no fixed signals in general operation. There are, however, disc signals situated at the points, and these are connected with the yellow distant signal, which works in conjunction with the points, showing "clear" when they are set for the main line.

Dining car No. 10,059 running over these lines is the most modern and up-to-date vehicle of its type I have yet seen. It is fitted with ice chambers and a chill chamber, and has very well arranged pantry and kitchen accommodation.

A large proportion of the engines on the Southern Pacific-Californian section are crude petroleum-burning locomotives.

The ferry boats belonging to this company have a carrying capacity equivalent to 48 bogie vehicles and two large locomotives. The boat engines are oil fuel burning, and have only recently been converted from coal consumers. They are, however, very satisfactory. The ferries are fitted with hydraulic lifts for adjusting the gangways at each side, and the locomotives are in motion one minute after arrival of the boat at the pier.

St. Louis Station.

At the station yards 2,500 trucks are handled per day of 24 hours.

The average coal truck carries a 35-ton load.

The system of signaling is electro-pneumatic, and all points operated from the signal towers are equipped with electric repeaters, to indicate that the points have been passed over and are clear.

The movement of all traffic in the yards is controlled from the signal boxes, with which there is telephonic communication from the various yard centers.

The telautograph instrument is operated at this station with great success.

The traffic in the various marshalling yards is broken up by means of "humps" or gravitation sidings. There is one brakeman to each vehicle as it travels down the hump. These men are collected and returned to the hump by a special train consisting of van and engine.

The classification yard consists of 25 tracks.

In loading coal for foreign stations, small carrying capacity

trucks are utilized for stations at comparatively short distances from the loading center, and the large capacity trucks are despatched to New York and other distant stations, the object being to get the greatest available paying haul.

Shunters work 12 hours per day, and are paid at 15 cents per hour. Signalmen in the principal cabins work eight hours per day.

Engines coal at St. Louis in two minutes; the larger engines take about seven tons of coal.

Rest rooms are provided. Engine-drivers have a minimum rest of from four to eight hours, according to the time they have been on duty.

Trains Running on Opposing Lines.

I was considerably impressed by the American method of running trains on opposing lines, *e.g.*, when two trains are running in the same direction, instead of detaining one at a station and allowing the faster train to proceed, arrangements are made for the latter to run on the opposing line of rails, passing the other train en route and getting into its proper position at a station ahead. From the inquiries which I made the system answers satisfactorily. The "Twentieth Century Limited" has actually passed an express train under these conditions, both trains traveling at very high rates of speed.

Railway Oil Contracts.

Whilst in America I took many opportunities of inquiring as to the working of the "oiling" contract system on the railroads and forwarded to the Chief Railway Storekeeper of this administration copies of some agreements entered into in Europe as well as in America.

The motive power officers with whom I discussed the matter speak highly as regards the economical advantages of the system, and although they admit they had considerable difficulty when introducing it, they say that the system is now no longer in the experimental stage, that it is a good one and one which saves the railroad administration money.

Contracts are entered into for periods of three, five and ten years duration.

It does not necessarily follow that the progress of the agreement leads to increased advantages for the oil company, as with the tendency to increase the size of the locomotives and freight rolling stock, the cost of oiling is added to on account of the larger consumption without a correspondingly increased payment being made to the oil company by the railway company.

Invariably also the railroads seek better terms with the termination of their contracts, and my information is that the oil companies have not acted unreasonably in meeting the representations of the railroads. Both parties to the agreement are of course thoroughly acquainted with all the facts.

Probably the best example I can give is the information given me by one of the chief motive power superintendents, who had just taken out some figures in oiling in anticipation of the renewal of the contract coming up for discussion. He informed me that, notwithstanding the increased number of vehicles employed, the larger dimensions of the rolling stock and consequently greater oil consumption per vehicle, the oil cost to his company has only slightly increased during the past 14 years.

I consulted various vice-presidents and general managers with regard to the system under discussion and although I expected considerable difference of view, I was very much impressed by the unanimity of opinion.

I also forwarded to the Chief Railway Storekeeper a list showing the names of the companies who have entered into contracts for the oiling of their rolling stock. It will be observed that in every instance the railroad companies in America pay on a car and engine mile basis, and not per train mile as is contemplated in the copies of contract sent me. The car mile is considered more equitable than any other form of calculation.

I was informed by one of the motive power superintendents of a railroad operating over 8,000 miles of track that he knew where the oil company lost on the contract but that compensation was derived from the sale of the oil.

In reporting on this matter I visited some of the oil centers in California for the purpose of studying the method of dealing with oil in bulky quantities and ascertaining what facilities were offered for oil transport.

In some instances the crude oil, utilized as fuel for furnaces and engines, is carried in pipe lines exceeding 110 miles in length from the oil wells to the coast and is run directly to the oil ships or steamers on the wharf or into the oil tanks for conveyance by rail.

The cost of the crude article is from 35 to 40 cents per barrel of 40 gallons, equal to about 1s. 6d. to 1s. 8d. per barrel, or ½d. per gallon.

Canadian Pacific Railway.

I left Montreal at 9.40 a.m. on Sunday and arrived at Vancouver at 12.30 p.m. the following Friday. The distance is 2,942 miles and the speed averaged 21⅘ miles per hour.

The passenger rolling stock in general use is the open sleeping car type, built to accommodate 16 passengers, with one state room which has accommodation for two passengers. Palace cars are now being run, but an extra charge of 36s. per passenger per night in addition to first class fare and sleeping fee is made for what in America is regarded as luxurious traveling.

Tourist or colonist cars have partial sleeping accommodation, bedding being supplied at one-half Pullman rates.

No privately owned Pullman cars are run on this line in general traffic. All cars are owned by the railroad.

Gas is the general illuminant on all cars.

Several passenger carriages are fitted with mosquito netting.

Books, periodicals, newspapers, post cards, illustrated playing cards, postage stamps, telegraph forms, guide books and time-tables, etc., are obtainable on all trains at various centers—one bulletin to each car.

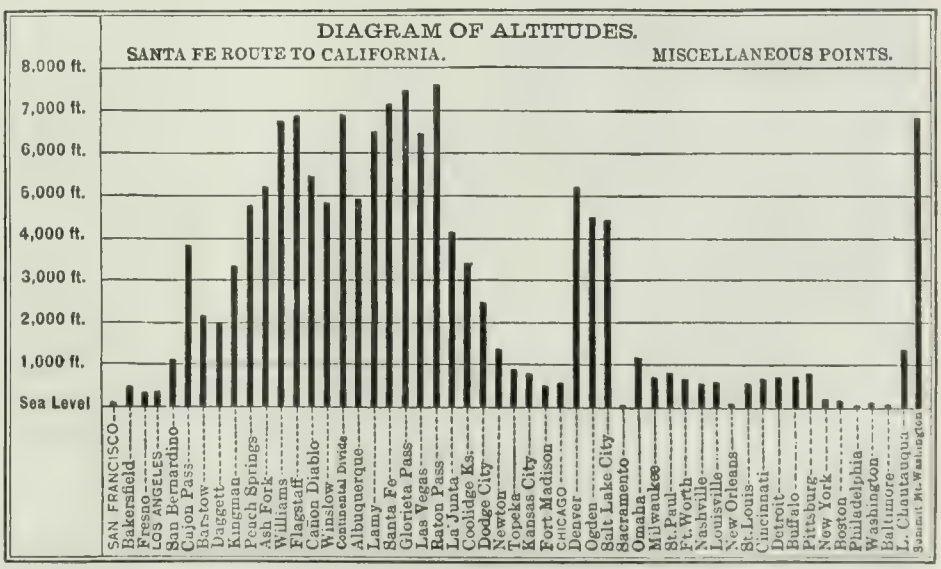
Compressed air is used in the saloons to force the water from tanks to wash basins, no pumping being necessary.

Each car is supplied with hair and clothes brushes.

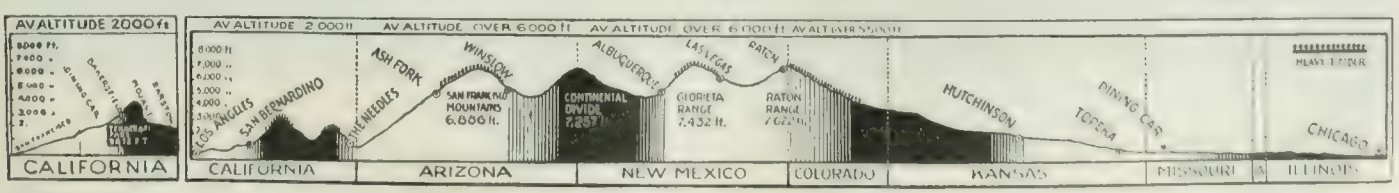
Iced spring water is supplied for all filters, which are attended to at appointed stations.

Graphics of a Transcontinental Line.

The passenger department of the Atchison, Topeka & Santa Fe has issued a clever folder which shows the altitudes traversed by this route to the coast, and makes capital out of them. Other altitudes are exhibited in comparison, so that we are able to appreciate



Altitudes Chicago to California over the Santa Fe Shown Graphically.



Chicago to California over the Santa Fe Showing Graphically, for Train Leaving Chicago at Night, the Parts of the Road Traversed at Night.

that the road crosses six Mt. Washingtons between Chicago and the coast, as per the accompanying drawing. The graphic division of the trip into night runs and day runs is another interesting and commendable feature of the folder.

Railroads and Transportation in Siam.

BY L. L. BENNETT.*

In 1891 an association of foreigners living in Bangkok, the capital of Siam, secured a franchise for a narrow gage railroad from Bangkok to Paknam, near the mouth of the Menam river. The length of this line is 16 miles, and the gage, one meter. This was the first Siamese railroad. The ties are of teak wood, worth at present about $1 a cubic foot. They were secured at that time cheaply, as teak is a native wood of Siam. The road was completed in about a year, and has been in operation since the latter part of 1892. It exists for its passenger traffic more than for any other purpose, and has paid interest on the investment from the start. At present the Paknam road pays annual dividends of 12 per cent. on the stock. The line is ballasted with broken bricks and has practically no grades or curves. The distance from Bangkok to Paknam is covered in one hour's run. The road comes in direct competition with water transportation on the river. It gets about all the passenger business but hauls a very small percentage of the freight tonnage, which still goes by water. The Paknam road was built cheaply by using an old roadbed made for carts and vehicles, and cost, fully equipped, only about $19,000 per mile.



Camp of the Construction Engineers.

In 1892 the government advertised for bids for the construction of about 160 miles of standard gage railroad from Bangkok north to the important interior town of Korat, the road to be known as the Korat Railroad. The principal bidders were Mr. George Murray Campbell, a Scotch contractor, who represented a syndicate headed and financed by the great China merchants, Messrs. Jardine, Matheson & Co., of London and China, and Herr Bethge, a German army engineer, who represented a syndicate of Germans backed by the Krupps of Germany. The competition became bitter and from the very first assumed the form of an international fight for commercial supremacy, since, directly behind the two bidders, stood the British and German consuls and all the influence of those two governments, backing the respective claims. The result was that the British drew first blood in a long commercial war, which has not yet ended, and secured the first contract. This contract was to build and equip about 160 miles of line for about $30,000 per mile, a wholly inadequate sum, considering the difficulties and expense of the work and the nature of the country.

The Germans thereupon insisted on the appointment of Herr Bethge as Director-General of the Royal Railroad Department of Siam, and he was appointed by the Siamese king in accordance with the wish of the German consul backed by his government. This appointment placed the Germans in the position of supervising engineers and inspectors over the work to be done by the British contractors. A bitter rivalry already existed between the two before any work was started and the consul for Germany succeeded in inducing the king to believe that it would be a clever move on the Siamese side to appoint German engineers to watch the British contractors in the interest of the government. The results will be foreseen by any practical railroad man in America. A long fight immediately started between the contractors and the Government which lasted for more than six years.



Building the Abutments and Piers of the Ban Po Bridge.

The government railroad department immediately organized a

*Mr. Bennett went to Siam as an engineer engaged in building the Korat Railroad in 1893, and remained with the contractors until 1897. He was later engaged by the Minister of Agriculture to estimate the cost of certain canal and irrigation work, and subsequently negotiated the franchise for a large electric light plant and operated the plant, lighting the streets and buildings of Bangkok, and the King's palace. He was appointed U. S. Vice-Consul General to Siam in 1899.

force directed by German ex-army engineers who introduced an elaborate organization with so much red tape and pomp and so many high-sounding titles for the officers, that, for a country like Siam, with only 160 miles of railroad under way, the whole thing was like one of Gilbert & Sullivan's comic opera productions. It was very expensive, but it served the real purpose for which it was created by the astute Asiatic government—that is, provided a fine array of uniformed foreign engineers and officials for exhibition on state occasions, which greatly impressed foreign newspaper correspondents and consuls with the large progress which was being made by Siam in civilization and railroad building.

The new Royal Railroad Department proceeded to make things warm for the British contractor who, on his part, was not at all slow to show that he was fully as good a lawyer as a contractor. Much time and money were spent in keeping detailed records of claims against the government, and had legitimate construction work been prosecuted with the same energy and perseverance as records were compiled for claims and arbitration court proceedings, the practical results would have been great speed in actual construction work. The fight went on merrily until the latter part of 1896, when the contract was cancelled and the whole dispute submitted to arbitration, which lasted until 1899, when it was decided in favor of the British contractor and the Siamese government was obliged to pay down a sum equal to about $800,000 and also the cost of the long drawn arbitration proceedings, which was several hundred thousand dollars more. This is the first and last important contract ever awarded by the Siamese government for public work. It caused inestimable injury to every one concerned, and has prejudiced the government against entering into any contracts with foreign firms of contractors for work in Siam.

The railroad was completed under the supervision of the government railroad department and the Germans drew second blood in the fight, which has been a very one-sided fight ever since. It has been easy for the Germans to place nearly all orders for railroad materials for Siam in Germany. This victory was promptly followed by the purchase by the large German main lines of nearly all the steamship lines trading into Siam. Thirty or more steamers were bought in two transactions and passed from the British to the German flag. The Germans followed up the two large purchases with several smaller ones of stray British and Danish ships until the whole of the shipping between Singapore and Bangkok, Hongkong and Bangkok, and Singapore and the Philippine Islands is to-day in the hands of the Germans.

Siam has at present over 400 miles of standard and narrow gage single track railroad, and the government builds slowly at the rate of about 30 miles a year of new extension. The work at present consists of an extension of the Korat Railroad north to Chiengmai, in the teak wood country, and northern extremity of the kingdom, where the government has had considerable trouble in the past with tribes called "Hawhs," who speak a dialect of their own, have their own recognized local chiefs, and are little in sympathy with the Siamese government.

The lines now built are:

	Miles.
The Paknam Railroad, narrow gage	16
The Pechaburi Railroad, narrow gage	95
The Korat Railroad, standard gage	160
The Chiengmai branch, standard gage, about	150
The Phrabad Railroad	12
Total	433

The government railroads pay about 3½ per cent. on the investment. They cost about $40,000 per mile to build and equip. In the hands of capable foreign railroad operators, and out of government control, they would easily earn 7 or 8 per cent. The grades are for the most part light and curvature easy. Buildings are of masonry and teak wood—good and substantial construction. The bridges are mostly steel with concrete foundations on piles and brick masonry abutments above ground level. Most of the bricks for the original work were imported from China. There are some teak wood trestles over canals. The rails are of 55-lb. section with hard wood ties 6 x 8 in. The wood is so hard that the ties sink in water, and had all to be cut in the forests, hauled to the rivers and canals by means of water buffaloes, and then floated over to the railroad on bamboo floats. The cost of ties is about 90 cents to $1 each. The track is ballasted with broken bricks in the low country, and stone and gravel in the hill country. Many of the bricks were excavated from the foundations of ancient temples and ruins at the site of the old ruined city of Ayuthia, which was the capital of Siam about 170 years ago before the Siamese were driven out and the ancient city destroyed by the Burmese.



Building the Pak Preo Bridge, Korat Railroad.

There was a great deal of difficulty experienced in building earth embankments in the low rice country owing to expansion and contraction of the banks. In the wet season the earth and clay soaked with water and expanded. In the dry season the banks shrunk and huge cracks opened up, swallowing large quantities of ballast from the jolting of the trains. In a year or two most of the ballast originally placed under the track had completely disappeared. Likewise the banks settled as much as 30 to 40 per cent. below the established grade, and had to be re-topped. The bridge foundations are what might be called floating foundations, being large at the base and resting on round piles driven from 20 to



Teak Wood Trestle Worth $120 per 1,000 ft. b. m., in the London Market.



Suam Pluk Bridge; Korat Railroad.

30 ft. in the ground, and about 10 to 15 ft. below ground level. The formation in the lowlands is compact silt uniform for hundreds of feet down.

Difficulty was also experienced with bridge foundations and abutments. When the abutments were built and the bank filled in behind, some of the abutments were pushed over several feet by the weight of the earth fill behind. The masonry, piles and all seem to have been sprung forward, moving from the top and apparently in a solid mass, without the slightest injury to the abutment. When the earth was removed from behind the abutments, they sprung back again, in some cases half way to their original position. As the whole of the low lands were subject to flood during the wet season, bricks, ties and other building materials were stored on top of the roadbed during certain seasons.

The embankment was the only dry land within some distance, a fact soon discovered by the snakes and reptiles, which took refuge in the buildings and the track material along the embankment, much to the dismay of the bare footed coolies who worked on the construction. It was necessary to furnish bamboos with hooks on the end so that the coolies could turn over the ties before taking hold of them; and at the bottom of the pile it was not unusual to find several cobras and centipedes.

About 100 miles north of Bangkok the nature of the country changes completely, and the line enters the mountains and jungle. One stretch of some 35 miles of this country was called the "Dong Phya Fai," land of an evil spirit, and was widely known by the natives as an unhealthy locality. Much difficulty was experienced in building this section of the railroad. Deadly malarial fever broke out and many of the white engineers and foremen died or had to be sent out of the country to save their lives. The coolie laborers died by the hundreds, and the balance of them stampeded and ran away. The contractor was obliged to import Chinese direct from China, place them in boats on arrival at Bangkok, and send them up country before they had time to communicate with friends and countrymen ashore, so that they would be ignorant of the bad reputation of the country where they were going to work. They also died like flies and ran away and it was several years before this portion of the railroad was finally built. One German engineer remained through the entire construction. He constantly drank bottled beer, which was enough to kill an average man in that climate. On this he nearly lived, beginning drinking before breakfast in the morning.

The labor used on construction was almost entirely Chinese. They worked by piece work or contract wherever it was possible. A good Chinese coolie would carry in two baskets balanced on a pole on the shoulder nearly 2 cu. ft of earth or clay and dump it into an earth embankment. Good men could carry as much as 5 cubic meters or 6½ cu. yds. per day, at a cost of about 9 cents a cu. yd.

Korat, the terminal point on this line, is a thickly settled district, the gateway to a large population. There exists an ancient silk industry, where the natives have for hundreds of years manufactured beautiful silks on crude hand looms, and in patterns and colors peculiar to the district. The product is very limited, and silks from this place, like fine oriental rugs in Persia, bring large prices.

Although railroads have done much to develop Siam and were necessary in order to reach such places in the interior as Korat, where there is no water communication. I believe the Siamese have overlooked and neglected water transportation facilities. Originally there were no roads in Siam other than waterways. Three large rivers running north and south for a hundred miles or more over a level plain are connected by a network of cross canals intersecting. These have always been the real roadways of Siam, and carry to-day 90 per cent. of the freight of the country. Where the railroads go they readily secure the passenger traffic, but where water transportation is possible, the canals and rivers still compete successfully.

A 20-ton boat starts up country for a cargo of rice, with three boatmen, each drawing $10 wages a month. A whole family lives on the end of the boat, and frequently the wife and children help to propel it. The boat may be operated entirely by a man and his family. Even if all three boatmen are hired at an average wage of $10 a month, the boat can make two trips 100 miles up the river or canal in a month at a cost of $30 for wages, and $10 for repairs and depreciation, bring down 40 tons of rice—20 tons to a trip—and deliver it at the door of the rice mill, which is always located on the water, at a maximum total cost of $1 per ton for the rice delivered at the mill. The railroads cannot do this at a profit, and have the disadvantage of not being able to discharge the rice direct from cars into the mill, which greatly adds to the total cost of transportation. Then, besides, the boatmen can quite likely get two or three tons of general cargo, such as petroleum or cotton goods, on the up-country trip, which pays several dollars for freight, and thus reduces the cost of transportation on the rice. It is safe to say that water transportation on unhulled rice in Siam, where that class of transportation is possible by boat, does not exceed in cost 5 mills per ton mile. Rice constitutes 85 per cent. of the movement of freight in Siam, teak wood about 10 per cent., and the balance of goods transported are included in the other 5 per cent. The export trade of Siam in 1904 amounted to about $22,000,000.

The Siamese have greatly neglected these useful waterways in the past. A German named Mueller secured a franchise some years ago to build a systm of canals and irrigation ditches over an area

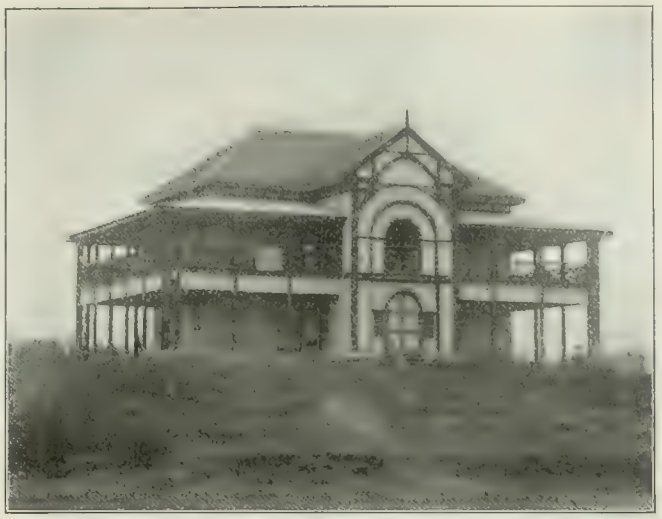


Combined Irrigation and Transportation Canal in Siam.

of uncultivated rice land. This land was wild only because of lack of transportation facilities. The canals were completed and the land opened to settlement, with the result that to-day at least 100,000 people live and cultivate the land along this canal where no one lived before, and the main canal is only about 35 miles long. No railroad ever built in Siam up to the present can make such a showing.

The Korat Railroad crosses this canal. The new canal was opened some years ago with considerable ceremony, the king being invited to ride over it. The foreign consuls and many prominent officials were invited to be present. His Majesty traveled up the railroad by special train to the point where it crosses the canal, and arrived about 10 o'clock in the morning on a scorching hot day. This function was a most curious sight. There was not a thing at the landing place but open rice fields, on which the sun beat down mercilessly. At the canal crossing, standing in the open fields under the bleating sun were the German officials of the canal and railroad, dressed in silk hats, spike-tailed dress coats, and tall, white collars, which had long since wilted and collapsed from perspiration. They were awaiting the arrival of His Majesty, who came late, as usual. It is to be hoped that the king enjoyed the sight as much as the spectators. He, himself, had the good taste to wear thin silk clothes suited to the temperature and place.

Materials for railroad construction were formerly purchased by private negotiation, through agents in Germany and England. Some years ago the United States minister, Hon. Hamilton King, began to agitate the purchase of all materials by competitive bid and advertisement in the leading commercial papers of the world. This proposal was opposed by certain officials at first, but not openly, for fear of the imputation of "graft." Finally Mr. King was entirely successful, and to-day all large orders for materials are purchased by advertisement and competitive bids are considered, which gives American manufacturers a chance to compete for Siamese railroad trade.



Station on the Korat Railroad.



Korat Railroad Passing Through the Jungle.

Thus far railroads and all public works have been built out of public revenue, and until a year ago Siam had no public debt. A loan of $5,000,000 was floated for carrying on public works, and was promptly underwritten in London and France on advantageous terms to the Siamese government.

Rolling stock and equipment of the Siamese railroads include three classes of cars for the passenger traffic. Passenger cars are built after the American type. First class cars are well furnished like a first class day coach in this country, with certain minor changes to suit the altered climatic conditions. Second class cars are somewhat more plainly finished, and third class cars have plain, curved wooden seats and plainly painted interiors, free from any elaborate fittings and finishing. Over 90 per cent. of the passenger traffic is third class. The first and second class do not earn expenses. Passenger fares are about the same as in the United States except first class, which is higher per mile than on the United States railroads.

Freight cars are of the two-axle type commonly used in Europe called "wagons," and carry from 10 to 12½ tons each. The locomotives and cars in use are of many types. Few supplied on the original contract were found suited to the requirements of the traffic which developed.

Bangkok, the principal seaport of Siam, is a large city of mixed population containing about 500,000 inhabitants. It is located on the Meinam river, about 30 miles from the sea. This river is navigable for large ships inside the bar. It is over 600 ft. wide, with a uniform depth of more than 30 ft. at low tide. There is, however, a very bad bar at the mouth of the river, which has only 7 to 10 ft. of water at low tide. This bar is composed entirely of silt and could easily be dredged. The trade of Siam is greatly handicapped by the existence of this obstruction to navigation. At all seasons of the year over half the cargo has to be lightered for over 30 miles from the bar to the city, and during five months of the monsoon, ships are forced



The King's Train.

to anchor 20 miles from the bar, and discharge and load from lighters 55 miles from Bangkok under the lee of an island. The total shipping of the port of Bangkok per annum is said to have been about as follows for 1904: Exports, 500,000 tons; imports, 200,000 tons; total, 700,000 tons.

On account of the bar only small ships ply between Bangkok and Singapore and Hongkong, where all cargo is transshipped to large European and American steamers. This transshipment costs fully $2 per ton extra freight. Also lighterage on one-half the total tonnage at the Bangkok bar costs another $1.50 per ton. The local ships are only able to cross the bar with something less than half a full cargo. It would therefore appear that the annual cost to Siamese trade on account of the existence of the bar at the mouth of the river is roughly as follows: Extra local freight and transhipment charges at Singapore and Hongkong on about 700,000 tons of cargo per annum at the rate of about $1.50 per ton, $1,050,000; extra cost of lighterage on one-half the total tonnage from the bar and island up to Bangkok at $1.50 per ton on 350,000 tons, $525,000; total cost per annum to Siamese shipping, $1,575,000. If the bar is removed, large ships direct from Europe and America can enter the Bangkok river, discharge and load direct from wharfs, and not charge more than 50 cents per ton extra freight rate from London or New York over the Singapore rate.

The cost of dredging the river bar and building stone jetties to create scour and maintain a depth of 30 ft. of water, might cost $6,000,000; certainly not more. This work would more than pay for itself by indirect returns to Siamese trade in four years. It has always seemed strange that the British government and shipping interests do not take up this matter and push the dredging of the bar. In this way British shipping interests could recoup their lost prestige and shipping trade at one stroke, as this would place them in the position of being able to enter the Bangkok trade with their large steamers from Europe, and compete on equal terms with the German steamers, and would, to a great extent, make the local German steamers unprofitable investments so far as the Bangkok shipping trade is concerned.

Railroad Officers' Stock in Coal Companies.

The investigation of the relations of the Pennsylvania Railroad and its officers to the companies shipping coal over its lines, which is being made by the Interstate Commerce Commission, was reported in part in our issue of May 25, page 527. The hearing was resumed the following week, and the first witness was W. A. Patton, Assistant to the President of the Pennsylvania. He presented a list of the companies in which he held stock, prominent among which were the Keystone Coal Company and the Atlantic Crushed Coke Company. Some of his stocks were acquired as a result of his participation in a company which bought the coal lands when the business was started. Replying to a question as to how he acquired large amounts of stock in certain companies, Mr. Patton said that he was born in western Pennsylvania, and had been a life-long friend of Colonel Huff, who had given him the stocks. Friendship, said Mr. Patton, goes a good ways. "These stocks were not given to me for favors that I might be able to render. The railroad company encouraged the development of the soft coal lands and at that time it was not considered a crime for a railroad man to hold stock in a coal company." Mr. Patton had never attempted to conceal his ownership of coal stocks and did not believe that his superior officers were ignorant of such ownership.

A. W. Gibbs, General Superintendent of Motive Power, said that he owned no stock and was in no way interested in any coal company.

Witnesses testifying in behalf of the Alexandria Coal Company asserted that the Alexandria mine had to be sold because of inability to get sufficient cars, and that other coal companies at the same time were receiving cars. One witness asserted that Michael Trump, General Superintendent of Transportation of the Pennsylvania, had said that the road intended to protect the Berwind-White Coal Company at all hazards.

Frederick Vrooman, Assistant Trainmaster, told of gifts of money received from coal companies for favors which he did not grant. "Then why did you take the money?" asked the lawyer. "Well," answered the witness, "if there was money to be given out I was there to take it."

The First National Bank at Altoona and the banking firm of Cassatt & Co., of the same city, are largely owned by relatives of the President of the Pennsylvania road, and inquiry was made to find out if President Cassatt had any interest in the coal business, but none was shown.

The Altoona Coal & Coke Company, hauling cars from the mine to the main track with its own engine, was allowed 18 cents a ton out of the rate ($1.30) to tidewater.

J. B. Hutchinson, former General Manager of the road, gave testimony concerning distribution of cars at times of great scarcity. Some shippers asked for more cars than they required, and then allowed them to stand loaded on the sidetrack.

J. Howard Patton, of Greensburg, Pa., brother of W. A. Patton, is Superintendent of the Claridge mine of the Keystone Coal & Coke Company, and is also station agent at Claridge, but without salary. Asked why he continued as agent without remuneration, he said because he belonged to the Veterans' Association of the Pittsburg division. He thought that his brother's connection with the railroad and the coal companies rather worked to the disadvantage of the coal companies.

Victor Wierman, Superintendent of the Pennsylvania at Camden, N. J., testified concerning privileges allowed to the Susquehanna Coal Company at South Amboy, N. J., and concerning stock in the Saltsburg Coal Company owned by him. He had bought this stock when assistant engineer on the Pittsburg division.

J. K. Johnston, Superintendent at Tyrone, testified that he owned no coal stocks. He had repeatedly been offered gifts by or in behalf of shippers, but always declined to receive them.

Albert Von Bergelberg, of the Reakirk Brothers Soft Coal Company, averred that the railroad had ruined him financially; he believed that they refused to give him cars because they held no stock in his company. The witness testified as to hundreds of letters written to the general manager and other officials urging them to allow him more cars. He said he had been forced out of the South Amboy trade by the Keystone Coal & Coke Co. The discriminations against him compelled him to run behind in expenses for the past two years.

R. H. Large, coal freight agent of the railroad, gave evidence showing that it was impossible for shippers other than the Berwind-White Coal Co. to send coal to Harsimus (Jersey City). Mr. Large also testified as to allowances made to several of the Lloyd companies on rates to tidewater points, and allowances made to the Latrobe Coal Co. for carrying coal from the mines to the main line of the Pennsylvania, while, as a matter of fact, the hauling was done by the railroad, as the Latrobe Co. at that time had no engines. There was a special allowance made to the Susquehanna Coal Co. which supplied bunker coal to the tugboats in New York. The Susquehanna enjoyed a monopoly on this class of business.

On May 23 the Board of Directors of the Pennsylvania Railroad appointed a committee of five directors to investigate the charges of wrong doing which have been brought against officers of the company during the hearing. The chairman of this committee is C. Stuart Patterson. The committee has engaged as special counsel Mr. Silas W. Pettit.

President Cassatt, who went to Europe about three weeks ago, has telegraphed that he is coming home at once, expecting to reach New York June 2.

The newspapers say that suits have been brought in the courts against the Pennsylvania Railroad on charges of discrimination in the distribution of cars by the Pennsylvania Coal & Coke Company for $2,500,000, and the Federal Coal Company, for $750,000; also that many other shippers will bring similar suits.

Seventieth Anniversary of an English Railroad.

BY W. B. PALEY.

The South-Eastern is now, with the exception of the Great Western, the only important railroad entering London that was authorized so long ago as the reign of King William IV., yet still exists under its original title. The South-Eastern Railway was incorporated in 1836. Several other metropolitan lines, some of greater importance, date from that period, but have changed their names. To some extent the identity of the South-Eastern has been lost since the working agreement formed in 1899 with the London, Chatham & Dover, but nevertheless each company retains its separate capital account and its own board of directors.

It will easily be recognized that so profitable a location as one to Dover, the key to the traffic to and from mid-Europe, would not be long in attracting the attention of capitalists when once railroads became a popular form of investment. The project was really mooted so long ago as the end of 1824, a period when a small railroad mania set in, the principal result of which was the Liverpool & Manchester line. Nothing then came of it, but the second mania, that of 1833-7, gave birth not only to the South-Eastern but to nearly all the original trunk lines of Great Britain as well. The first portion of the line to Tonbridge was opened in May, 1842.

As authorized by act of June 21, 1836, the South-Eastern was to commence at Croydon, some 10 miles from London, by a junction with the London & Croydon Railway near its terminus. This local line had received its charter the year before. The South-Eastern would have preferred to be independent of it, but the Government did not favor an additional cutting and carving of the crowded parts of South London, and as the Croydon company itself only got into London over the Greenwich line it was considered that the South-Eastern was not unfairly dealt with on similar terms. No running powers, however, were provided, nor authority to have a London station, either where these other lines terminated, near London Bridge, or elsewhere. The route to Dover was to be via Oxted, Edenbridge, Tonbridge, Ashford and Folkestone, the first portion

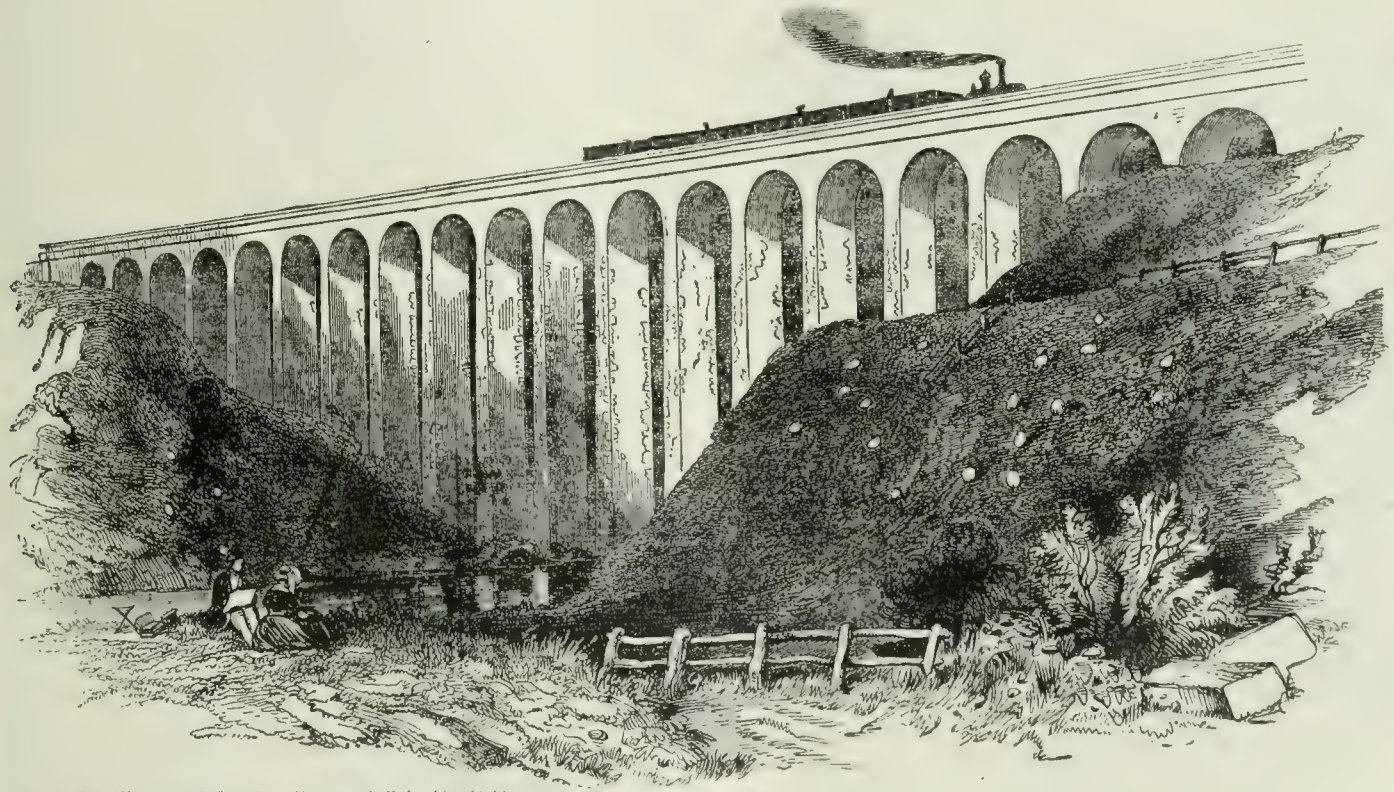
involving very long tunneling near Oxted. Work was begun on this section, but had not proceeded far when, in 1837, the London & Brighton Railway obtained a charter. This line also was compelled to make use of the little Croydon company's undertaking. As it would go for some miles to a certain extent in the direction of Dover, it was thought better to save the tunneling and use the Brighton line as far as Red Hill, near Reigate, about 21 miles from London. A short bit from there to Edenbridge brought the South-Eastern back to its original plan, as far as the line farther east was concerned, but at the expense of seven miles extra distance. Within recent years, however, the Oxted line has been built, although it is not used for London-Dover traffic, a still shorter cut having been previously opened. To prevent any more loss of distance, the South-Eastern Railway was laid out as straight as the crow flies between the Brighton junction at Red Hill and the town of Ashford, in Kent. This stretch of 45 miles is probably the longest straight piece of railroad in the Kingdom. As it goes through favorable country, if the South-Eastern in old days had been an enterprising company it might have made a great reputation on it for high speed.

The Brighton Company got to work in 1841, but it was May of the following year before the first section of the South-Eastern, between Red Hill—or Reigate, as it was called—was opened for traffic. Headcorn was reached in August, Ashford in December, and by June, 1843, the road was open to Folkestone. This, of course, was almost as good a point for Continental traffic as Dover, and soon proved that this branch of business would be extremely profitable. Before long the harbor was acquired from commissioners, and a short but very steep branch railroad made down to it, crossing the harbor by a turning bridge built of laminated wooden planks in the form of a double bow. This bridge, built about 1848, is still in use, and is decidedly a curiosity.

So far as Folkestone the construction of the line was easy enough. The Folkestone station, however, is approached by one of the highest viaducts in the country. This crosses the valley of the Foord, a small stream which comes down through a deep gully in the chalk. There are 19 arches, all of 30 ft. span and only 6 ft. thick, built in brick. At the highest point the rails are 105 ft. above the usual level of the stream. The central piers have inverted arches below them. All have stood extremely well, the structure being to-day in excellent order. The total length of the parapets is 758 ft. It was considered a marvel of lightness and compactness, from the fact that the pressure of the entire structure was not more than 1,200 lbs. to the square foot. The Folkestone viaduct is shown in the accompanying illustration, which is taken from a wood cut in the *Illustrated London News* of February 10, 1844, and is therefore contemporaneous with the opening throughout of the South-Eastern line.

The remaining six miles into Dover comprised works of a magnitude hitherto unknown. High chalk downs, rising to 350 or 400 ft. above the sea, extend to the water's edge; the coast line being, however, somewhat indented. Three tunnels, respectively 1,590, 5,799 and 4,176 ft. long, were built, named Martello, Abbot's Cliff and Shakespeare tunnels. In the two last, owing to the great depth below the surface, horizontal shafts were used, opening on to the sea, in addition to the usual vertical ones. The excavated material was simply tipped out and the galleries were closed up again, leaving the shafts open for ventilation. In the Shakespeare tunnel the chalk was so friable that two separate tunnels were made, each about 30 ft. high by 12 ft. wide, with a mass of chalk 10 ft. thick between them. It was intended to leave these tunnels unlined, but afterwards they had to be lined, an inconvenience considerably felt with modern rolling stock of maximum dimensions. Between Abbot's Cliff and Shakespeare tunnels a way was made by blasting down the side of the cliffs and building the line on the debris, a strong sea wall keeping this from being washed away for about a mile. This sea wall is 23 ft. thick at the base, 5½ ft. at the top, and about 60 ft. high. On this section was Round Down cliff, 375 ft. high, which was entirely removed on January 26, 1843, by the explosion of 18,000 lbs. of gunpowder.

From Shakespeare's Cliff tunnel to the Dover terminus (a site for which was obtained with difficulty) the line ran, and still runs, upon a wooden viaduct. At high tide, in rough weather, the sea drives up under the line. To prevent the shingle from being washed away a number of old Great Eastern Railway tenders were obtained from the Stratford works, filled up solid with concrete and pitched about on the beach. The timber viaduct or trestle had a counterpart at the London end at one time, though it has long been replaced with earth work. London Bridge station being, in spite of enlargements, too small for four companies, an obnoxious toll having to be paid to the Greenwich Railway for the use of 1¾ miles of that line, the South-Eastern and Croydon companies opened, on May 1, 1844, a large terminus in the Old Kent Road, termed Bricklayer's Arms, from a neighboring inn. This was used as a supplementary passenger station, third-class traffic being dealt with there. For upwards of 40 years it has been the chief London freight and cattle station. On the Bricklayer's Arms branch was a trestle or wooden viaduct about a mile long, described as "built in the American manner, in which a certain rude elegance is attained at small cost." The wood was subjected to Payne's anti-dry-rot process, which was also supposed to render it fireproof.



From the Illustrated London News, of Feb. 10, 1844.

Folkestone Viaduct; South-Eastern Railway.

The South-Eastern was a badly planned line. It not only took a course about 20 per cent. too long, but one which avoided all the important places in Kent. Its length from London Bridge to Dover was 88 miles. A direct line through Maidstone, the county town, need not have been more than 70 miles. However, in those early days everyone was not convinced of the need for railroads, and Maidstone would not have one. The route by Chatham and Canterbury was the proper one, and might have been got into 73 or 74 miles, but the passage of the river Medway and the heavy gradients

beyond were thought too formidable. Early in the sixties the London, Chatham & Dover company built its line this way, and proved a thorn in the South Eastern's side for many a year. Its coming rendered cutting off the right angle at Red Hill indispensable, and in 1868 a shorter route was opened between Tonbridge and New Cross, saving some 12 miles, though at the cost of heavy gradients. The extensions, in 1864-66, from London Bridge to Cannon street and Charing Cross were also undertaken with a view to meeting the new competition, now happily ended by a working agreement under the style of the South-Eastern & Chatham Railway.

The Dover line was originally laid with triangular sleepers, two being cut from a square balk. It was expected that they would bed themselves better in the very poor ballast the district affords. It was not a costly line, all things considered, the 67 miles from Red Hill to Dover being made for $14,250,000, or about $212,500 a mile. The railroad was opened throughout on February 7, 1844, and has paid an average dividend upon its ordinary stock of 4.29 per cent. a year for the 62 years.

The Gasolene Car for Interurban Service.*

In view of the present widespread interest in steam railroad circles in the self-power-contained car as a means of meeting the increasingly severe competition of the electric roads, it may not be amiss to consider this type of car from the viewpoint of the electric railway engineer. That the large roads have keenly felt this competition has long been known, and it is now particularly evidenced by the various methods under consideration for meeting it. Thus, the Union Pacific has built at its Omaha shops a straight gasolene car, wherein the power output of a gasolene engine is mechanically transmitted to the car wheels. The Burlington some months ago built at its Aurora shops and for a short time experimentally operated a gasolene-electric car, wherein the power output of the gasolene engine was transmitted electrically to the wheels. The Delaware & Hudson has placed in operation a gasolene-electric car. The Lake Shore is also trying such a type of car. The Ohio River & Columbus Railway, according to the technical press, is experimenting with a steam propelled car which is to be a modern edition of the old-time steam "dummy." The press very recently described the Strang car, a gasolene-electric car which ran with its own power from Philadelphia, where it was built, to Kansas City, where it is to go into service on an interurban road in that vicinity.

The writer has seen experimental outfits utilizing the automobile principle of carrying the motive power on the truck frame. In one case, it was a high-pressure superheated steam engine with direct chain transmission and with flash boiler, kerosene or gasolene-pan burner, radiating condenser, etc., all very much the same as the equipment of the well-known "White" steam automobile. In another case it was a four-cylinder gasolene engine with friction disc transmission, etc., similar to automobile equipment.

The independent motor car idea had its inception abroad and much more work has been done in this direction in France, Germany and Great Britain than in this country. The most conspicuous application of the idea is the steam motor cars of the Great Western Railway of Great Britain. This railway has in use a number of modernized steam dummy cars using coal as fuel for steam generation. The preference on the Continent seems to be for the internal combustion engine and several experimental gasolene engine cars are being tried. The Wurtemburg street railway is one of the most aggressive of foreign roads in trying the independent motor car. This railway has experimented with electric storage battery cars, with steam motor cars of the Serpollet type, and gasolene cars of the Daimler motor type. It is interesting to note that the Wurtemburg street railway put an independent gasolene motor car into service in December, 1893, something over 12 years ago.

There can be no doubt that most of the several types of self-power-contained cars will find useful fields of application and will become valuable auxiliaries to the standard forms of rail transportation; but also, in the judgment of the writer, there should be no doubt that these fields of application will be relatively restricted and do not include such as are now served by the standard electric system.

The factors which have made electric traction so brilliantly successful in city, urban and interurban service are many and varied, but those which enter into a discussion involving a consideration of other types of motor cars are: (a) reliability and simplicity; (b) high schedule speeds and high train frequency; (c) cleanly and noiseless operation; (d) low cost of operation and of maintenance.

On the other hand, the self-powered cars enjoy two advantages which are the sole reasons for the present interest in this type of car. They are: (e) absence of external power transmission circuits; (f) lesser initial investments.

*Extracts from a paper by F. W. Hild, Chief Engineer of the South Western Wisconsin Railway, read at the third annual convention of the Iowa Street and Interurban Railway Association, held at Des Moines, April 19 and 20.

Descriptive.—The straight electric system has been in use some 17 to 18 years, and its essential features of power station, substation, transmission line, overhead or third-rail conductor, track return circuit, trolley and car equipments, are well understood by all railway men. The several types of independent power-contained cars have been described at different times in the technical press. Nevertheless, a few notes descriptive of one of the earliest cars in successful operation in this country at the present time may be apropos, particularly since all this new type of cars have many things in common. [This is the St. Joseph Valley Traction Co. car described in the *Railroad Gazette* April 21, 1905.—Editor.] . . .

The entire space inside and under the car body is so completely taken up with the power equipment as to leave no room for passengers or merchandise, whence it follows that this car is a locomotive pure and simple, and is of use only with trailers. Its weight is approximately 37 tons, distributed about as follows:

Car body and trucks	15 tons.
Gasolene engine and generator	9 "
Storage battery	5 "
Motor equipment	5 "
Water cooling system, gasolene tank, air brake equipment and other accessories	3 "

All the apparatus in the equipment of this locomotive has demonstrated its utility in various fields of application, practically all of the electrical apparatus being standard for railway service, so it may well be said that there is nothing experimental about the outfit. In view of the highly developed standard steam locomotive, it is extremely doubtful, unless the fuel cost of gasolene engines be enormously reduced, that such locomotives as just described will become popular. It is proper to say here that the St. Joseph Valley locomotive, which in itself is a very successful machine, is the outcome of exigencies arising from certain franchise restrictions affecting motive power and time when the road had to be put in operation. The later equipment and the other self-contained cars in construction or in operation in all cases combine the motive power with the passenger or freight car on the same set of trucks.

Apparently the greatest difficulty encountered by the designers of the gasolene cars is the transmission of power from the engine to the driving wheels. This is not surprising in view of the fact that the internal combustion engine is essentially a constant-speed motor and that railway work demands wide ranges of variable speeds. At the present time the favorite means appears to be the use of electricity, indicating that the difficulties of direct mechanical transmission and variable speed operation are so great as to warrant the rather roundabout transmission involved by the addition of a generator, with or without batteries, and the standard railway type motors and control. Indeed, it is claimed by the promoters that the efficiency of the gasolene-electric outfits compares very favorably with any type of mechanical transmission, and, moreover, has the greater advantage of large variations of speed, flexible driving, ease of control and lesser wear and tear. The acceleration and changes of speed are smooth, and without the jar or shock which is ever present with any mechanical change-speed gear. This situation suggests to electrical engineers the early discussions of series vs. shunt motors for railway work. The designers of the gasolene-electric cars, while fully agreed as to the method of power application, nevertheless differ among themselves on the important question of power supply. Thus some insist that a storage battery is an indispensable adjunct, for the reason that gasolene engines have low efficiencies at fractional loads, and furthermore have practically no overload margin; the battery, therefore, is needed to take care of the recurring inevitable over-loads. Others, however, prefer to use a much larger generating unit, largely because of the saving in weight and space, and the avoidance of acids and fumes.

General Comparison.—It probably needs no argument to show that the straight electric car considered alone is far less complicated and hence far more reliable than any other form of motor car. The straight electric has the minimum of moving parts, all of which (excepting the brake mechanism, which is common to all cars) are non-reciprocating, while all other types of self-propelled cars have reciprocating mechanisms, which include a great number of moving parts, more or less complicated in adjustment. The greater simplicity and reliability of the standard electric car is perfectly obvious in the fact that, aside from the conductor or fare collector, but one attendant, the motorman, is necessary for the car operation, whereas, every type of independent railway motor car, so far as the writer knows, requires an additional skilled mechanic to look after the portable power plant. Of course, efforts are and will be made to render the equipment so thoroughly automatic as to permit of dispensing with this skilled mechanic. Far be it from the writer's wish to infer that American inventive ingenuity may not accomplish this, but a few healthy doubts as to its early attainment are permissible when one remembers the automobile enthusiast who stated that he owned a car for three years, of which he spent one year on it and the other two under it. The annoyances which may attend the use of a private vehicle may be tolerated by the owner, but such annoyances would be prohibitive in a public utility like a transportation system; therefore the need

of minimizing interruptions and delays will undoubtedly compel the retention of the extra attendant.

But the question of reliability of the straight-electric goes beyond the car itself and involves a consideration of power generation and transmission. Power generating machinery, both steam and electric, has been brought to a very high order of development, and in the hands of thoroughly competent operators the probability of interruption of power service through failure of this machinery is extremely remote, particularly if the plant be provided with a judicious yet reasonable reserve. There are plants in this country which have operated for years without failing to deliver power, and it has come to be understood that the engineer who fails to "keep the busses hot" must have an exceptionally good excuse in order to retain his job. . . .

Schedule Speeds and Train Frequency.—It is a peculiar fact that no other form of machinery, whether used for power generation, power translation, or power utilization has such high efficiency, such capacity for overload and such flexibility of control as has electrical apparatus. The remarkable speed and torque characteristics of the series-wound motor permit of a smooth and rapid rate of acceleration, absolutely under the control of the operator. This rate of acceleration may be practically anything desired and is accomplished without resorting to excessive power demand or abnormally large motors. The maximum acceleration is usually determined by the comfort of the passengers, and by the slipping of the wheels, and is not limited by energy consumption. Indeed, it has been shown that for a given schedule the equipment having the highest rate of acceleration will perform the service with the least energy consumption. The facility for maximum acceleration, the great capacity for overload, and the high ratio of power to weight, enable the straight electric car to handle more successfully and economically high or schedule speeds than any other type of car, no matter how equipped. The steam-engine operated car, because of the overload power of the steam engine, would probably come next, while the gasolene car, with direct mechanical transmission, would, because of the absence of starting torque and of overload capacity of the gasolene engine, fall well below them all.

High accelerating power becomes more important as the number of stops in a given distance increases, and it is this fact, as well as the difficulty of mechanically transmitting power from the gasolene engine to the drivers, which renders combination gasolene electric cars at present the most promising of the self-contained cars.

That system of transportation operating the most frequent trains will obviously best serve the traveling public. The experience with the standard electric cars has demonstrated the public's appreciation of this in the new business which the electrics have built up for themselves. Such frequent train service of the standard electric system is made possible by the fact that practically no power is wasted. The motorman by the simple manipulation of his controller utilizes the power only as it is needed, and does not waste energy—that is, fuel—when the train is coasting or standing still. Experience of electric roads is such that the starting and stopping of the different train units so dovetail into one another that the load on the central power house is proportional to the *average* energy consumption per train.

Any system of transportation employing self-contained motive power units must be obviously at a disadvantage in this respect, since fuel consumption must go on all the time the train is in service, whether it is coasting or standing at a station.

Operating and Maintenance Costs.—The absence of actual operating data of self-contained cars does not permit at the present time of a comparison of actual maintenance and operating charges between such cars and the straight electric. It is perfectly logical, however, to expect, in view of the complicated mechanism of the former and extreme simplicity of the latter, that the maintenance charges for the self-contained car system will be greater than for the straight electric. The maintenance cost may reasonably be expected to be about midway between the electric car and the steam locomotive.

The operating cost of the several types of self-contained cars will naturally vary among themselves, but in all instances such costs, exclusive of interest on the investments, will be materially higher than the straight electric, and in most cases the costs, including interest charges, will favor the straight electric. This reasonably follows in view of the high efficiency of the modern power station and transmission systems of electric traction, and also because of the high weight efficiency of electric cars. The independent motor car must not only drag along its own power plant but it must sacrifice valuable remunerative space in order to carry it. For the same remunerative capacity, the self-contained car will weigh from 50 to 100 per cent. more than the standard electric car. Under the same conditions of track, speed and distance the energy consumption required to move cars of any sort will vary as their weight, whence it follows that the energy consumption of the self-contained car will be from 50 to 100 per cent. greater than the electric car.

The labor expense of practically all types of self-contained cars will be 50 per cent. and upwards—greater than the straight electric for the reason that in addition to motorman and the conductor, a skilled mechanic is necessary for the operation of the power generating apparatus in each of the self-contained cars. This attendant is usually paid 30 to 40 cents per hour, or from 50 to 100 per cent. higher wages than the ordinary platform man receives.

All self-contained cars, excepting those equipped with storage batteries, must have prime movers of sufficient capacity to suitably accelerate the cars, and since the power required for accelerating is from two to four times that for full-speed running and also because of the intermittent power demand in railroad service, it follows that the average load on the prime mover will be but a fraction of its rated power, hence the efficiency of engine operation whether steam or gasolene, must be low. This condition is worse with gasolene engines, which have no overload margin, and in many cases the average load will probably not exceed 40 per cent. Where a floating storage battery is carried on the car, it is, of course, possible to use a smaller engine and to work it at close to its rating most of the time, and the fuel cost per ton-mile of such a car would be somewhat less than of one without battery.

The St. Joseph Valley locomotives with single trailer, during the early days of its operation averaging 66 miles per day, consumed 50 gals. of gasolene per day. This worked out per train mile as follows:

Fuel, at 16 cts. per gal	12.0 cts.
Labor, 75 cts. per hour	3.4 "
Acid, water, waste, sundries	0.6 "
	16.0 cts.

Mr. H. M. Beardsley published in the *Street Railway Journal*, July 15, 1905, a very complete table of operating statistics of electric roads in New York state. A study of this shows that straight electric operation per car-mile is much less than the above figures, and if the comparison be made on the basis of cost per car seat or unit of remunerative space the showing will be still more in favor of the straight electric cars. The averages of ten roads in the table work out as follows:

Operation.

Power	2.629 cts.
Wages of conductor, motorman	4.146 "
Car service supplies	.109 "
Miscellaneous	.16 "
	7.044 cts.

Comparison between a single concrete case and an average of a lot of widely varying cases, while giving an indication, is not convincing, therefore it may be of more interest to compare briefly the requirements and performance of a gasolene-electric car and a straight electric car for transporting a given number of passengers, under the same conditions of distance, time, stops and roadway. Assume a line 25 miles long, standard steam railroad construction, stops of 15 seconds duration each, to average one every three miles. It is desired to operate a car seating 48 passengers, making the run one way in one hour.

Let us take the Delaware & Hudson car previously mentioned. [*Railroad Gazette*, Feb. 9.] It has been recently described in the technical press but nothing regarding its detailed performance published, so we must rely upon calculated performance. This car weighs about 125,000 lbs. and the car body, 65 ft. over all, is of the combination type; that is, with passenger and smoker compartments seating a total of 40 passengers, and with baggage-express compartment. The engine is at one end, and the motorman's compartments with controlling apparatus at each end for operation of the car in both directions. Power is supplied by a 160 h.p. gasolene engine, direct-connected to a 120-k.w. separately excited generator. A small 5 k.w. generator furnishes the excitation. Motor equipment consists of two 200 h.p. standard railway motors, with two series-parallel controllers. The generator output is limited by the capacity of the gasolene engine. The controllers, besides the usual connections for changing motors from series to parallel, also have connections for changing the voltage of the generator through its excitation. The acceleration and speed regulation of the car is then governed by the voltage of the generator and not by the usual method of resistance in series with the motors.

A standard interurban car, about 45 ft. long, will seat comfortably 48 passengers, and will weigh fully equipped 24 to 28 tons. With four 50 h.p. motors geared to about 35 to 38 miles per hour maximum speed, and with normal trolley voltage, such a car will perform very satisfactorily the service outlined.

In Fig. 1 are two curves showing the schedule performance which might be expected of the two cars, B referring to the gasolene-electric car and A to the standard interurban car. Incidentally, it is interesting to observe that as the frequency of stops increases the self-contained car falls much more rapidly away from the schedule than the straight electric. Thus, at one stop per mile, it can do 18¾ miles per hour schedule, while the straight electric can do 21¾ m.p.h.

Under the conditions assumed, the rate of energy consumption of the straight electric car will be about 60 watt-hours per ton-mile at the motors, and this value will be used as applying to the combination, self-powered car, although as a matter of fact, the input to the latter will be somewhat higher owing to its slower

rate of acceleration and would more than offset the elimination of rheostatic losses in the motor control.

Manufacturers of gasolene engines of the size under consideration generally claim 10 horse-power-hours output per gallon of gasolene at full load, but will guarantee only 8 horse-power-hours per gallon of this fuel. In the calculations which follow, no account will be taken of the rapid falling off in fuel economy at fractional loads, so in using the 8 horse-power-hour-per-gal. value, the error, if any, is in favor of the gasolene outfit.

Electric power station performance is well-known from numerous published or otherwise available records. The following is typical of a 4,000 k.w. turbine, water-tube boiler plant with coal at $1.60 to $1.80 per ton.

Coal	$0.0034
Labor	.0016
Maintenance	.0007
Supplies	.0003
Cost per kw. hr. at switchboard	$0.006

A well operated plant with fairly good load factor should encounter little difficulty in producing power at this figure; indeed, many show much better results. For the purposes of this discussion, however, a higher figure, $.0085, will be taken. This value is easily attained by most of the interurban power plants in the Middle West.

Transmission efficiencies to the motors will be taken to average as follows:

	A. C. system.	D. C. system.
Step-up transformers	96 per cent.	96 per cent
Line	97 "	97 "
Step-down transmission	96 "	96 "
Rotary	..	88 "
Car transformer	96 "	..
Feeder and trolley, net work	93½ "	89 "
Net efficiency	80 per cent.	70 per cent.

Gasolene Electric Car, 62½ tons.

62½ x 60 = 3.75 k.w.-hrs., per c. m.
3.75 x 25 = 94 k. w. average per trip.
94 k. w. = 78 per cent. of 120 k. w. the rating of the generator, and at this average load, generator efficiency equals 90 per cent. approximately.

Then

$$\frac{3.75}{.746 \times .90} = 5.6 \text{ h. p. hrs. p. c. m.}$$

The engine will develop at full load about 8 h. p. hrs. per gal. of gasolene.

With fuel at 10 cts. per gal.

$$\text{Power } \frac{10 \times 5.6}{8} = 7 \text{ cts. pr c.m.}$$

Car crew:	Per hr.
Motorman	21 cts.
Conductor	21 "
Mechanic	33 "
	75 cts.

$$\frac{75}{25} = 3 \text{ cts. per car-mile.}$$

Waste, oil, small supplies.... 60 cts.

Straight Electric Car, 30 tons.

30 x 60 = 1.80 k. w. per c. m.
1.80 x 25 = 45 k. w. avg. per trip.

Power at interurban generating station costs $0.0085 per k. w. hr. at the busses; taking transmission efficiency to the motors at 80 per cent. (A. C. system).

Then

$$\frac{1.80 \times .0085}{80} = 1.91 \text{ per c. m.}$$

Car crew:	Per hr.
Motorman	21 cts.
Conductor	21 "
	42 cts.

$$\frac{42}{25} = 1.68$$

Allow for substation attendance	.01 p. c. m.
	1.69 p. c. m.
Waste, oil, small supplies	55 cts.

Summary.

7.00 cts.	Power	1.91 cts.
3.0 "	Labor	1.69 "
0.6 "	Supplies	0.55 "
10.60 cts.	Per car-mile	4.15 cts.

These are comparative costs per car-mile, exclusive of maintenance and of general expense, and are subject to considerable variation under varying conditions. The Union Pacific car, which weighs about 29 tons, has unofficially been stated to consume ½ gal. gasolene per car-mile in service involving much fewer stops. The Strang gasolene storage battery car weighing approximately 37 tons consumes, according to official statements of the builders, .45 gal. gasolene per car-mile. No statement of service conditions is given, but it is inferentially taken from the run from Philadelphia to Kansas City, where the stops were very infrequent, probably less than 1 in 20 miles.

As a check on the above calculations these data are interesting. The gasolene consumption per ton-mile works about as follows:

D. & H. car	0.0112 gal.
U. P. car	.0168 "
Strang car	.0118 "

It is not intended to compare these three types of independent motor cars, for such comparison would be manifestly unfair unless one took into account all the factors entering into the construction and operation of each of the cars. It is intended to show, however, that the calculated performance of the D. & H. car includes a margin favoring the independent motor car as compared with the standard electric.

Initial Investments.—To get down to the gist of the whole problem and to see the influence of the initial investments on a given proposition, two cases will be investigated: the first between the gasolene-electric and the standard electric, and the second between these and steam railroad service.

The first proposition contemplates the average interurban condition and may represent the competition between two paralleling roads for the local passenger and light traffic business, which is assumed to demand cars at one hour headway from 6 a.m. until 12 p.m., or 18 hours service. The items of cost and maintenance common to both roads will not enter into the present consideration, and we will assume that the general expense of administration, engineering, taxes, insurance, etc., will be the same in both. We will take the same service conditions as before, i.e., 25 miles of road, stops every three miles, and one hour for the run.

The single-phase system is well adapted to such service and will be considered in the following. It would be entirely feasible to operate with a generating plant in the center of the line feeding 6,600 volts directly into the trolley, eliminating high tension transmission and sub-station, and thereby effect a saving in the assumed case of approximately $18,000. But it might be necessary because of water supply, coal, etc., to build the power house at one end of the line and thus necessitate a sub-station. In order to be entirely fair to the gasolene car, let us assume this extreme condition.

Two cars will normally handle the service, but for special days requiring half-hour headway and for reserve, four motor cars and two trailers will be purchased. The normal daily mileage will be 900.

Estimated Cost of Straight Electric System.

Power plant	$45,000
One sub-station	2,000
Distribution system	48,000
4 motor cars, 2 trailers	36,000
Rail bonding	6,250
	$137,250
Interest and depreciation at 10 per cent.	$13,725
Or, $37.60 per day.	

Estimated Cost of Gasolene-Electric System.

4 motor cars at $17,000	$68,000
2 trailers at $3,000	6,000
	$74,000
Interest and depreciation at 10 per cent	$7,400
Or, $20.30 per day.	

The maintenance of electric cars and plants per car-mile can be gotten fairly well from the many published records, but that of the self-powered cars is at present a matter of guess. It will be taken at 4 cents per car mile, which is roughly one-half the average maintenance charges of steam locomotives per mile.

	Gasolene-electric.	Standard-electric.
Power	$7.00	$1.91
Car crews	3.00	1.68
Supplies	.60	.55
Maintenance of equipment and cars	4.00	1.50
Maint. plant and distribution system	....	.50
Operating cost per car-mile	$14.60	$6.05
Daily Cost.		
Operation	$131.40	$54.45
Interest and depreciation	20.30	37.60
	$151.70	$92.05

Thus, the difference in favor of the straight electric under the conditions assumed would be $59.65 per day, or approximately $22,000 per year.

Consider now an existing branch of a steam road where the passenger traffic is light. Service must be given even if without profit; indeed, many such branch lines are now operated at a loss so far as the passenger and light traffic is concerned. The problem then is to find the cheapest means of handling the business.

Let us take the same length of line, frequency of stops, etc., as before, but that four trains each way per day will handle the business. We will assume that the train crews when not on the passenger runs are kept employed elsewhere on the system. The steam service would call for two light locomotives and four passenger combination cars. The self-powered and the straight electric would each require two motor cars and two trailers. The trailers would not be used during the normal service, but would have to be purchased and kept to meet the demands of Sundays and special days.

It is assumed that the roundhouse, repair shop and water tanks would about balance the cost of electric car-barn and repair shop. Omitting, then, as before, all factors of cost and operation common to all three systems, we will have:

Estimated Investment for Steam Service.

2 45-ton locomotives, with tenders	$16,000
4 passenger coaches	16,000
	$32,000
Interest and depreciation at 10 per cent	$3,200
Or, $8.78 per day.	

Estimated Investment for Straight Electric Service.

Power plant	$27,000
Sub-station	1,500
Distribution system	48,000
2 motor cars and 2 trailers	21,000
Rail bonding	6,250
	$103,750
Interest and depreciation at 10 per cent	10,375
Or, $28.50 per day.	

A plant of this size would not produce power so cheaply as the

larger ones previously considered. The cost per kilowatt-hour is taken at 1½ cents, whence we have:

	Per car-mile.
Power	3.38 cts.
Labor, as before	1.69 "
Supplies, as before	.55 "
Maintenance, as before	2.00 "
	7.62 cts.

Estimated Investment Gasolene-Electric Service.

2 gasolene-electric cars	$34,000
2 trailers	6,000
	$40,000
Interest and depreciation at 10 per cent.	4,000

Or, $10.90 per day.

The steam train will consist of the locomotive, tender and two cars, giving a train weight of approximately 110 tons. Under the assumed conditions of schedule, stops, weight, etc., such trains will require 35 watt-hours per ton-mile; i.e., .0745 h.p. per ton-mile. In such service the locomotive would burn about 7 lbs. of coal per horse-power-hour, and if this coal cost $2.25 per ton, the train-mile cost would be approximately:

Train Crew.

	Per hour.
Engineer	$0.35
Fireman	.21
Conductor	.30
Brakeman	.17½
	$1.03½

	Per train-mile.
Power	6.35 cts.
Maintenance locomotive and cars	8.0 "
Supplies	2.0 "
Roundhouse expense	1.0 "
Train crew	4.15 "
	21.5 cts.

The daily operating costs, exclusive of those items which are common to all the systems, would then be:

	Steam.	Electric.	Gasolene.
Operation	$43.00	$15.34	$29.20
Interest and depreciation	8.78	28.50	10.90
Total	$51.78	$43.74	$40.10

As the same equipment and therefore the same investment would be needed for a few trips more or less, and applying the same unit operating costs per car-mile and the same fixed charges, we get the following:

	Mileage.	Steam.	Electric.	Gasolene.
6 round trips, daily	300	$73.29	$51.36	$54.70
5 " "	250	62.53	47.55	47.40
4 " "	200	51.78	43.74	40.10
3 " "	150	41.03	39.93	32.80
2 " "	100	30.28	36.12	25.50
1 round trip, daily	50	19.53	32.31	18.20

This brings out clearly that in the assumed case the gasolene car is cheapest under six round trips per day, while the electric system is the cheapest at six trips or more per day. (See Fig. 2.)

Generally speaking, the gasolene car will show a saving over the steam train in light, infrequent service, but when the frequency begins to approximate 2½ hours headway between trains, the electric car is undoubtedly the cheapest and becomes increasingly so with increase of traffic frequency.

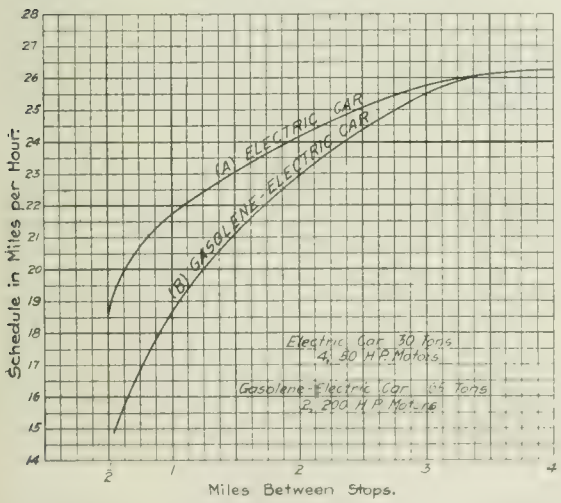
External Transmission Circuits.—We come now to what, probably more than any other factor, including even higher initial investment, has been the greatest stumbling block to the electrification of steam railroads. All other details of electric railroading have easily surmounted the objection of the steam railroad men. It is not the purpose to discuss the important subject of external transmission circuits within the limits of this paper, but it is well to point out that the progressive men in heavy railroad work no longer look upon the electrical power conductor with the doubt and misgiving, not to say scorn, with which they regarded it a few years ago. The overhead trolley has demonstrated its reliability and sturdiness on thousands of miles of electric roads from Maine to California, from the Lakes to the Gulf, in all conditions of weather and seasons. But until very recently low trolley voltage limited its use to light interurban service. The writer is quite in sympathy with the railroad men's objections to the third-rail, which, while it has splendidly performed its functions of showing the possibilities of heavy traction, is for many reasons inadvisable for surface work, although well adapted for subway or elevated roads. The advent of the single-phase system, permitting the use of high trolley voltages and hence moderate power conductors and bow trolleys, has brought the overhead trolley conductor into the field of heavy railroading and with the large eastern roads setting the pace, the early electrification of the present steam lines will inevitably come.

Conclusion.—Managers of steam railroads entrusted with the direction of large vested interests are naturally very conservative and therefore slow to make what would appear to be radical changes in their equipment. Therefore, while they realize the limitations of the steam locomotive in suburban and interurban service, they will, before stringing the trolley wire over their tracks, try out pretty thoroughly the independent motor car, which holds out alluringly the suggestion of interurban service without the power house, without the track bonding and without the external transmission circuit. This try-out will definitely establish the true field of the self-contained car, and, in the writer's judgment, this field will be the very short spurs of existing steam railroads serving sparse populations and making infrequent trips principally to connect with main line trains. Take one road, the Burlington, for example. The Galena Junction shuttle train operating on a five-mile spur, and meeting the more important trains of the main line; and the Dubuque shuttle train, which operates on the mile-and-a-quarter spur from East Dubuque over the Mississippi river bridge—these could well use such independent motor cars; unless, indeed, electric power at satisfactory rates can be purchased of the neighboring electric companies.

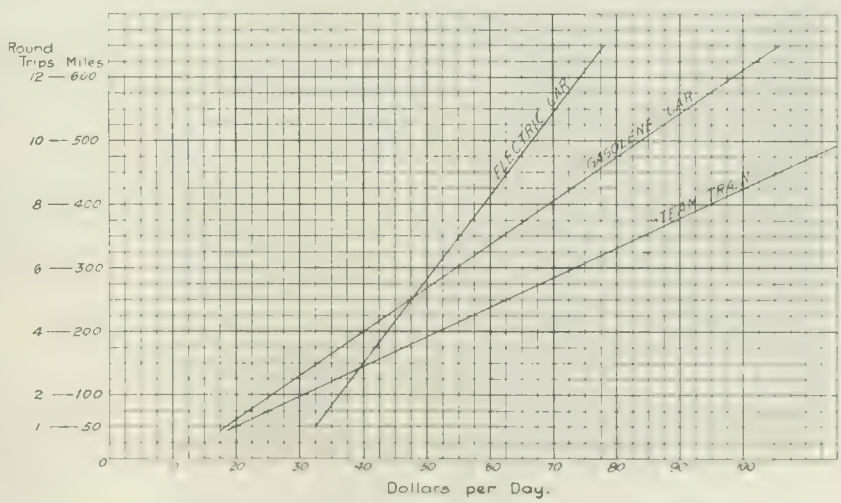
There is another field, not very wide it is true, but a profitable field which the independent motor car may enjoy with freedom from competition. The writer expects to see the present private cars of our millionaires displaced by the independent motor car, which can be made as comfortable and luxurious as any of the Pullmans now in service. Their owners may go anywhere that standard-gage tracks lead to, regardless of limitations to locomotives or to electric cars.

As to prospective interurban roads which are promoted with the view to using the gasolene or other types of independent motor, it is highly desirable to go slow and investigate. Broadly speaking, if a prospective road is to depend for revenue only on its passenger and light express traffic, and the business only warrants 1½ or more hours headway between cars, it becomes very much of a question whether or not the road will pay or ought to be built at all. But this brings us into the realm of interurban railway economics, concerning which much less even than with railway engineering it is not well to generalize. Each individual proposition should be independently examined and passed upon by a competent engineer, who should determine the equipment best fitted for it.

In city service the independent gasolene car will find only the remotest application. Under certain conditions of power plant arrangement and operation there may be isolated instances where the independent car might be called upon to handle the "owl" serv-



Schedule Performances of Electric and Gasolene-Electric Cars.



Comparative Costs of Operating Different Types of Cars.

ice in the small hours of the morning. It may also be used on such streets on which the municipality prohibits the laying of tracks. Indeed, such cars are already in operation on Fifth avenue, New York. In such service, the independent car will probably displace the so called "trackless" trolley cars, which are in use in some of the European cities.

In conclusion, the writer believes that the independent motor car will prove a useful transportation medium. Its field will be distinct from that served by the standard electric system. The likelihood of the independent motor cars becoming serious competitors of the electric cars is quite remote. Reduction in operating cost of the independent car must come about through cheaper fuel and smaller labor expense. As we all know, the price of gasolene is constantly increasing, due to the diminishing supply of the crude oil from which it is made. Kerosene engines and alcohol engines are frequently spoken of, but as yet cannot compete with the gasolene engines. The reduction in labor expense is not very promising. Advances and improvement in the art of the independent motor car will undoubtedly be made, but at the same time it must be borne in mind that the electric system will by no means stand still, and if its future progress be judged by that of the past, it will undoubtedly become the pre-eminent transportation medium.

Canadian Railroad Notes.

OTTAWA, May 28.—The Government has made an important concession to the Grand Trunk Pacific. The agreement embodied in the National Transcontinental Railway Act provides that the Dominion shall give the company free all the crown lands required on the western division, between Winnipeg and the coast, for right of way and station purposes. An order-in-council recently passed gives the company the mining rights in all such lands in Manitoba and the Northwest provinces.

J. J. Hill's project for a transcontinental railroad through Western Canada has spurred the Canadian Pacific to revive its long-existing plan to build a grain elevator on the Pacific coast.

Progress of the Electrification of the West Jersey & Seashore.

The construction of the electrified section of the West Jersey & Seashore between Camden and Atlantic City is progressing rapidly. The contract for the equipment and construction of this road was let to the General Electric Company last December, the equipment to be in operation by July 1, 1906.

The work has had to be done so as not to interfere with the regular operating schedule of the present steam trains. As a consequence much track work has been done during certain hours at night. In addition to track work, bonding and pole line construction, an 8,000 kilowatt generating station and seven sub-stations are being erected and equipped. Progress on some of the sub-stations has been phenomenal. At South Camden, Glasboro, Newfield and Reega, the sub-stations are well under way, each containing two 750 kilowatt rotary converters with auxiliary apparatus with arrangements for a third complete set. At Mizpah and Clayville the equipment consists of two 500 kilowatt rotary converters with room for a third, while at Atlantic City two 750 kilowatt machines are being installed with an ultimate equipment to consist of two additional 1,000 kilowatt units. The eighth sub-station is at the main generating plant and contains two 750 kilowatt rotary converters.

The progress of the work will be clearly evident to visitors during the Atlantic City conventions. Leaving the Camden terminal on the West Jersey and Seashore Branch, those stations most advanced in construction are at South Camden, Glasboro and Newfield. The third rail construction has progressed rapidly, the over-running type of rail being mounted on reconstructed granite insulators. At crossings special jumper cable construction is employed. The cable is laid in bitumenized conduit, itself imbedded in cement. The cable ends in a bonding terminal by which it is connected to the third rail. A terra cotta cap completely protects the cable entrance of the conduit from the weather.

The bonding on the 140 miles of track is well in hand. More than two-thirds is completed, this part of the work being done under the handicap of the present operation of steam trains. In conjunction with the third rail and track bonding, a double transmission line is being run on a single set of poles. The conductors are arranged on two cross-arms with the three respective three-phase wires on each side of the pole in the usual triangle. A ground wire extends along the top of the pole line.

Current for the transmission circuits will be generated by three 2,000 kilowatt Curtis steam turbines at 6,600 volts, and stepped up to 33,000 volts for transmission. At the sub-stations the rotary converters will deliver direct current to the third rail at 650 volts. With few exceptions the over running third rail will be used throughout. In the city of Camden and between Newfield and Millville the overhead trolley will be installed.

The turbines are now in process of erection at the main station and a month from now they will probably be operating the cars over the new line—the longest section of trunk line steam road up to the present electrified.

The Inter-Pole Railway Motor.

A number of tests of the Inter-pole Railway Motor have recently been made, according to the *Street Railway Journal*, in which the most encouraging results have been obtained. From these it appears that the motor is sparkless under all conditions of operation, even though the voltage may be as high as 2,000; that it is capable of great flexibility in the matter of speed regulation; that the torque is much higher than that usually obtained with the same amount of material, so that, for a given service, it can be made smaller than others. It is argued that with these advantages a higher voltage than that usually allowable can be used.

From the diagrams published of the speed curves, that have been obtained, it appears that the average attainable is high. The line rises rapidly from the start, and swings off easily into the line of maximum speed. In these diagrams the results obtained with the inter-pole motor are superimposed upon those obtained with one of the ordinary type, and in every case those of the inter-pole are the higher. That is to say, with the more rapid acceleration possible and the higher speeds attainable it naturally follows that a given distance can be covered in a shorter time, without discomfort to passengers, than can be done with motors of the ordinary type.

There are also some other operating advantages set forth in the article referred to. In a specific case for which the calculations were made for a double equipment of 40-h.p. motors on a 17-ton car it was found that a saving of 25 per cent. of the energy could be made on a one-mile run, while the same schedule as with the ordinary motors was retained. "The possibility of operating the motors with weakened fields allows a saving of energy, from the fact that very much less resistance in the parallel positions will be used in getting the motors up to full parallel running position. This is an advantage that will appear more particularly in short runs, or where the controller is thrown on and off at frequent intervals."

In the matter of efficiency, it appears that, with 100 per cent. of field efficiency, there is a total efficiency of 85 per cent. for the motor at about 58 per cent. of load.

Foreign Railroad Notes.

Immense quantities of game birds are shipped from the forests of northern Russia to Moscow, St. Petersburg and other cities, nearly all in winter. Over a certain route the charge for such shipments by sleighs is one-third or more higher than by rail; yet the dealers in game are said to prefer the sleighs, because the carriers are responsible, and deliver at destination whatever they receive; while out of every barrel shipped by rail five to ten pairs of birds are missing when delivered.

The head of the Hungarian State Railroads since the change in the ministry is Francis Kossuth, son of the Louis Kossuth whose visit to America in 1850 was one of the great events of the time. Francis Kossuth is an engineer by profession, long connected with the Mont Cenis Tunnel and Italian railroads, and not till after his father's death in 1894 did he return to Hungary from Italy. In Hungary he has been leader of what is known as the independence party.

Indian Engineering reports successful trials of a steam rail motor car at Lahore. The car is somewhat similar in general type to those used on the Great Western Railway, England, and was imported, presumably, from that country. It is 5 ft. 3 in. gage, 64 ft. 2 in. long over buffers, and is, in effect, a small locomotive at the end of a special coach, so constructed that the locomotive can readily be detached from the coach. The latter seats three first-class, three second-class and 78 third-class passengers, as compared with about 54 on the British cars. The wheels of the locomotive are not coupled; they are 3 ft. 7 in. in diameter. The cylinders, 9 x 14 in., are outside the frame.

The General Manager of the Natal Government Railways in his report for the year 1905 makes the following comment on American cars ordered for trial: "The 10 American wagons ordered for experimental purposes were erected and brought into traffic use on the 27th of July, 1905. Thus far the wagons have done good work, but time alone will determine their efficiency in comparison with the British product. It is very apparent that the work put into the wagons has not the 'finish' of British construction, but this is a point, granting that an equally long life is obtainable from the trucks, that is not of great moment, and possibly indicates the lines upon which British builders may yet be able to supply wagons at a cheaper cost than hitherto."

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS WESTMINSTER LONDON

ANNUAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

The Rock Island-Frisco Standard Box Car 561
Good Wheels and Bad Ones 561
Railroad Officers' Investments 561
The Burlington Assn. of Operating Officers 562
The Passing(?) of the Steam Locomotive 563
Report on Nova Scotia Railroads 564
Long Island Railroad 564

ILLUSTRATED:

Baltimore & Ohio Refrigerator Car 565
Standard 80,000-lb. Box Car for the Rock Island-Frisco System 568
Power Transmission Line and Third-Rail System of the Long Island 570
All-Electric Interlocking at Council Bluffs 574
Phosphate Cars for Atlantic Coast Line. 577
Cardwell Friction Draft-Gear and Rocker Side Bearing 581
New Shops of the Canada Car Co., Ltd., Montreal 584
McElroy Automatic Electric Car-Lighting. 590
Car Ferry Lines of American Railroads 593
A New Steam Rail Motor Car 598
Steel Castings in Cars and Trucks 600
Denver & Rio Grande Observation Cars 601
Malleable Cast Iron 602
The Sault Ste. Marie Canals 604
Rifle Pipe for Pumping Heavy Crude Fuel Oil 606

MISCELLANEOUS:

The 50 Ton Box Car as a Standard 572
Russian Car Capacity (Note) 577
New Railroad Laws in New York 579
The Chilled Car Wheel from a Manufacturer's Standpoint 580
The Motive Power Officer 581
The Art of Water Softening 589
Programme of M. C. B. Convention at Atlantic City, N. J. 592
The Boundless West 592
Hermann von Budde (Note) 598
Cast-Iron Wheels 600
Comparative Cost of Repairing Steel and Wooden Cars on the Harriman Lines 604
Gasolene Motor Cars for Railroad Use 605
The Coal Traffic Inquiry 606
Canadian Railroad Notes 608
Higher Technical Education in Germany 608

GENERAL NEWS SECTION:

Obituary 163
Meetings and Announcements 164
Elections and Appointments 164
Locomotive Building 165
Car Building 165
Bridge Building 166
Railroad Construction 166
Railroad Corporation News 168

VOL. XL., No. 23. FRIDAY, JUNE 8, 1906.

What an efficient standardization committee can accomplish in the car department of a large railroad system is well shown by the work of such a committee on the Rock Island and Frisco systems in designing a standard 40-ton box car, illustrated on another page in this issue. It is difficult to find a weak spot in the fundamental reasons underlying the general features of the design, or in the details as they have been worked out in the complete car. The value of team-work is apparent. Strength has not been sacrificed for low tare weight, due attention has been given to ease of repairs at isolated points where special material is not available and special tools are not at hand, and the needs of the traffic which will be handled by such cars have been met. We understand that the committee is at work on other standard designs of freight equipment along much the same lines.

One feature of the Rock Island-Frisco car is the use of steel members in the body framing. Aside from the draft attachments, the weakest points of a box car are the roof and the ends. With the ordinary wood framing it is almost impossible to keep all the members of the side truss rigidly in place and prevent twisting and distortion of the whole body. It is this twisting and swaying that destroys the effectiveness of car roofs much quicker than exposure, walking on them, or damage from other causes. The green wood put in cars warps and shrinks in seasoning and tightening the brace rods or plate rods has little effect. With a fairly strong and rigid steel side and end frame the body is made an integral part of the underframe. The value of the side trussing in carrying part of the load is almost negligible with wooden construction, except under excessive deflections of the sills. By the introduction of deep cross-bearers under each door post in this car, however, the steel side frame serves a useful purpose in carrying part of the load between the bolsters and the blank door panel. The end framing is substantial enough to withstand any ordinary shifting of the load without breaking or bulging.

When a railroad wreck occurs as a result of a broken or defective wheel, who is responsible for the loss of life and property? Is it the purchasing agent who bargains like a Shylock for the cheapest wheels he can get, regardless of their quality and ability to stand the strains to which they are subjected in service? Is it the mechanical officer who knows, or at least should know, good wheels from bad wheels, and who still allows cheap and inferior wheels, utterly unfit for the service they are to perform, to be put under the cars in his charge? Is it the wheelmaker who makes bad wheels that will stand acceptance tests but that he knows will not stand service strains, justifying himself on the theory that he has given the railroads all the quality he has been paid for? This is the real cast-iron wheel question, stripped bare of all side issues and looked squarely in the face. Wheel failures under high capacity cars are becoming more and more frequent, and, with increasing density of traffic, more dangerous. If cast-iron wheels of the best quality are not safe to run under high capacity cars, it is little less than criminal to go on putting them under such cars. If defective and inferior wheels are bought because they are cheap, it is more than criminal on the part of the man who makes such wheels and the man who knowingly buys them. Discussions over specifications and tests and guarantees only serve to divert attention from the real trouble, which is trying to make wheels for less than the cost of raw material. It would be a great good if more effort was made by all concerned to see how good a wheel can be made in cast iron instead of how good a wheel can be made for $6.89.

RAILROAD OFFICERS' INVESTMENTS.

"Have you a ruffian that will commit
The oldest sins the newest kind of ways
Shakespeare, King Henry IV

Forty years ago, soon after Dr. E. H. Williams became general superintendent of the road then generally known as the "Pennsylvania Central," the good doctor made to a friend a statement in substance as follows: "These people are going to make me rich. Before I fairly got settled in my new office a certificate for shares of express company stock, made out in my name came to me, but I sent it back, explaining that I could not afford to pay for it. Then a fast freight line certificate came, and I treated the matter in the same way. Then others came and I concluded to report the whole matter to the President, J. Edgar Thomson. He told me that it was the policy of the company to have its responsible officers relieved of private cares and anxiety. They should have a good salary and be in a position to give their best energies to the company's service

He further said that it was good policy for the general officers to be interested in the great industries which made business for the road. I was advised to accept the certificates which I had refused, but in all cases in future to report to him whatever ownerships I might acquire in companies doing business with the Pennsylvania."

This is recalled, not for the purpose of preaching, which does no good, or for "searching out the hearts of men before the judgment seat," where we have no jurisdiction. It is, rather, to show that to observers of the methods of individuals and corporations controlling large undertakings nothing new has been developed by the testimony to the Interstate Commerce Commission of the relations between the Pennsylvania officers and the coal companies, except that some coal companies have bribed employees, and that one of them has paid cash to a high officer. This vulgar incident has the slight merit of making vice unattractive.

Mr. Thomson's policy was sound, not only in relieving his officers from private cares and getting for the company all the initiative and power of minds unharrassed, but also in making incentive for able men. The result is fine—a staff of educated, able, honorable men, unsurpassed perhaps in these respects by that of any large corporation or club or church; for the coefficient of human error is large and variable, and sinning is as old as Adam. But while this policy aided probably in producing this result during the earlier period when car shortages were little known, and when there was no concealment by the railroad officer of his money interest in corporations which were customers of the road, nevertheless it is a dangerous policy. There is another obvious criticism: If it is desirable for the railroad service to have the general officers well-to-do the money should come from the company's treasury, and not be taken as tribute from the customers. It is not a sufficient answer to this to say that public sentiment compels the railroads to contribute to the spread of the Gospel by giving half fare to preachers, or that state governments compel railroads to pay the salaries of railroad commissions, or that the price of decent treatment by public officers and newspapers has been free transportation.

Opportunities to make money come to men who have power. It is not necessarily wrong to sell influence, to receive free stock for help or for the use of a name, but it is dangerous. Most good things are dangerous. Not long ago an important railroad officer became convinced by his own investigations that an extension of his company's line would make possible a great industry whose business would be highly profitable to his road. He advocated and secured the building of the extension. It was immediately profitable, and the industrial undertaking was profitable, and he was offered a substantial amount of its stock. But his president, whom he consulted, advised him to refuse it. Upon this statement of facts some persons will judge this president harshly and regret his subordinate's earned and lost opportunity. Others will believe that the president properly stopped the transaction, not because it was wrong or harmful, but for fear of a precedent for less justifiable or more dangerous ones.

It is the rule, not the exception, that railroad officers are imbued with a high sense of duty and a readiness for self-sacrifice far beyond that which prevails in other commercial undertakings. This is a condition naturally and necessarily developed in a service where carelessness or any slight relaxation of attention to duty may make a loss of life and property. The responsibility is such that hours of work or intensity of work are limited only by physical possibilities. Successful administration is that which keeps the company out of trouble and somewhat diminishes public complaint. Those who fail in ceaseless vigilance drop by the wayside, but beyond this negative result there is the hope for promotion to a position of power. And here there are not only legitimate chances, but also insidious temptations which test not only the man's basic principles of morality but also his judgment on questions new to him—like those which Dr. Williams described to his friend.

It is not difficult to see that there is a primary wrongdoing in the organization of industrial and other companies in such a way that "full paid" shares are in the treasury, ready to be given away without recording in the books of the company the money or other value received for them. The common way of doing this is to record the purchase of patents or good will or property at a price which will equal all, or nearly all, the capital stock to be issued. The seller then returns to the company such an amount of stock as represents the over valuation of what he has sold. Over valuation is wrong, and the full paid stock in the treasury is the result of it. Perhaps, therefore, this stock is "tainted," and one should neither buy it nor receive it. Honest folks differ in opinion of the use of tainted money as well as tainted stock.

It is a time for corporate house cleaning, and it is to be hoped that it may be thorough. That the clamor for it is insensate makes no difference. It should be done, although the demand for purity is too apt to be a passing fever of that great body of people with fragmentary morals picked up casually and adapted to criticism of incidents made public day by day; glib folks with capacity to "form and express a great variety of opinions on a great variety of subjects."

THE BURLINGTON ASSOCIATION OF OPERATING OFFICERS.

The Burlington Association of Operating Officers, organized for the purpose of promoting co-operation between these officers and of advancing the standards of practice of the road, which originated in a very modest way a good many years ago, has been in existence in its present form for a little more than three years. The good results which may be attributed directly to the existence of this association make an account of its organization, history, method of operation and something of what it has accomplished of very great interest. For the information contained in the following we are indebted to Mr. S. D. Brown, Secretary of the association.

The Burlington Association of Operating Officers as at present organized on the Chicago, Burlington & Quincy Railway is the outgrowth of a very small beginning. On March 10, 1886, in response to a call previously sent out, the master mechanics of the Chicago, Burlington & Quincy and system lines, met at Aurora, Ill., and organized a Master Mechanics' Association with a membership of 15 or 20 officers representing the mechanical department. Mr. G. W. Rhodes, then Superintendent of Motive Power, was elected Chairman and served in that capacity until 1903. Meetings were held semi-annually until 1898; since then sessions have convened annually. One of the objects in forming this organization was the discussion of questions of mechanical details, and the establishing of standards and practices in the motive power department for the government of all concerned. Interest in the meetings was manifested from the very first, not only by the members themselves, but by other officers of the road. In November, 1896, the superintendents first met in joint session with the master mechanics and also organized a Superintendents' Association. From that time until 1902 meetings were held both jointly and separately by these associations. In March, 1903, these meetings were consolidated and the Burlington Association of Operating Officers organized with a constitution and by-laws.

The officers of the association consist of a chairman, a first and second vice-chairman, and a secretary, who perform the duties usually devolving upon such officials. The executive committee is composed of the chairman and vice-chairman of the association, together with the general managers of the Lines West and East of the Missouri River, or a representative appointed annually by them. This committee selects from among the subjects which the members have been invited to hand in, those which appear to be of general interest, and the members are notified through printed programmes of all new subjects introduced for discussion at least three weeks prior to the meeting at which such subjects are presented. They decide on the time and place of all meetings of the association and in other ways have general charge of its affairs. Altogether 38 meetings have been held and 16 different points on the line have been visited. These latter included Chicago, Aurora, Omaha, Kansas City, St. Louis, Denver and St. Paul. A regular order of business is followed, and the meetings are conducted somewhat in the same way as those of the Master Car Builders' and American Railway Master Mechanics' associations. Fifteen members, including the chairman, constitute a quorum for the transaction of business. The membership of the association consists of the general officers of the system and the following representatives from the Lines East and Lines West: General managers, general superintendents, assistant general superintendents, superintendents of divisions and terminals, assistant superintendents of divisions and terminals, chief engineers, engineers of Lines East and of Lines West, engineers of maintenance of way, superintendents of motive power, mechanical engineers, engineers of tests, superintendents of shops, master mechanics of divisions and terminals, assistant master mechanics of divisions and terminals, general piecework inspectors, mechanical inspectors, inspectors of transportation, supply agents, and auditors. Officers of the various departments not eligible for membership may be present at any meeting of the association upon invitation of the heads of their respective departments of the executive committee, but do not take part in the proceedings unless invited by the chairman. The present active membership of the association is about 90.

Committees for the investigation of special subjects ordered by

the meetings are appointed by the chairman and serve until discharged by action of the meeting. There are also several standing committees, such as Motive Power Statistics, Motive Power Standards, Train Rules, Permanent Way, Blanks, etc. Since the organization of the association in 1886 something over 1,000 subjects have been considered. Nearly 60 per cent. of these have been submitted to the management, approved and made the standard practice of the road.

From a mechanical department standpoint the association has been instrumental in bringing about a great many standards relating to rolling stock and other equipment of the road. It has tended to diffuse much information concerning new practices and ways of doing work between the different shops which otherwise would have remained as purely local matters, thereby reducing the cost. It has created a lively interest and rivalry between different divisions in the matter of economy and workmanship. One of the particular aims of the association has been the co-operation of the different departments, the bringing together of superintendents, master mechanics and others, and interesting them in each others' work through the discussion of subjects of mutual interest, such as maintenance of permanent way, structures of all kinds, operation of trains, handling of freight, etc., which are of interest to master mechanics and superintendents alike.

A concluding thought may well be expressed in the words of a former member, who said, "I have very great faith in the efficiency of the workings of this joint association. I believe that in years to come the progress of the Burlington road will be written in the minutes of this association; the progress in economies, progress in improved methods, progress in all material things will be written in the minutes of these meetings."

THE PASSING (?) OF THE STEAM LOCOMOTIVE.

Not many months ago it was stated in Congress (jocularly, let us hope) that in 10 years the steam locomotive would exist only in museums, as a relic of bygone methods of transportation, but there is certainly no evidence to warrant such an assertion. In some particular localities, the electric locomotive will soon displace those operated by steam, the transposition being made on an elaborate scale, but it must not be argued from this that any such movement will become universal. Very good reasons exist in these special cases for the change to electric power, and in each case an extremely great density of traffic obtains in the territory undergoing the transposition.

Motor cars are also making their appearance in limited numbers where certain exigencies in the traffic create a seeming demand for this type of vehicle. Some economy of operation is claimed for the motor car, but where the electric locomotives are being installed, the question is one of greater importance than bare economy—enlargement of the traffic and the proper facilities for handling the same. A year ago, Mr. Wilgus, vice-president of the New York Central, made this very clear by some pertinent remarks in discussing a paper presented by Mr. W. B. Potter, before the New York Railroad Club, and we do not know that his statements have since been controverted. He demonstrated that the contingent expenses were enormous (in the New York Central's scheme at least), and that the actual expense of electrifying suburban service would be only about 25 per cent. of the amount spent to secure the full value and benefits of such electrification. He further stated that the question had not been looked upon as decreasing the cost of operation, but rather from the standpoint of being able to build up an increase of business, not only from the more attractive and smokeless locomotives for the Park avenue tunnel, but also by the increase in capacity of terminal facilities which electric traction offered.

The locomotive tests of the Louisiana Purchase Exposition demonstrated the economical efficiency of the ordinary steam locomotive in a way that admits of no dispute, the committee which conducted the experiments testifying that "it is a fact of more than ordinary significance that a steam locomotive is capable of delivering a horse-power at the drawbar upon the consumption of but a trifle more than 2 lbs. of coal per hour. This fact gives the locomotive high rank as a steam power plant." Modern gas engines and producers will do little better than a horse-power hour per pound of coal, and with 30 per cent. loss in generation, transmission and conversion, we have a fuel consumption at the electric locomotive of 1.4 lbs. of coal per horse-power hour as compared with 2 lbs. for the steam locomotive. There will likely be reductions in the cost of repairs, as there will be no boilers to maintain (except at the power stations), but of course, the maintenance of the electrical apparatus is in some respects an unknown factor.

The capital expenditure necessary to perform the same work is very much greater with electric traction: a modern steam locomotive, capable of exerting 15,000 h.p., can be purchased or built for about $15,000, or approximately $10 per horse-power. The investment for a horse-power in electrical equipment will be something as follows:

Gas producers	$20.00
Gas engines	45.00
Housing	10.00
Generators and switchboard	15.00
Electric locomotives	15.00
Total	$105.00

By the time our transmission lines were in we should probably have a first cost not far from $120 per horse-power developed on the rails, although the distance of transmission and the density of traffic would affect very greatly the cost of distribution.

A locomotive exerts its full power but for a small fraction of the time that it is running, and it often runs much less than one-half of the time, due to road and terminal delays. Three thousand miles a month is a fair average for freight locomotives, which means 100 miles per day. At 10 miles an hour average speed, less than half of the time would be spent in performing useful work. This is not all due to terminal delays, as the lay-overs, while on the road, are likely to be as great as those at division points. If we consider that it exerts its full power for one-half of the time that it is running, we will not be understating the "work performed." The balance of the time, perhaps half of its maximum power is developed, which would give us an average of three-eighths of the full capacity of the engine, but one-third would no doubt be closer to actual conditions as they exist on railroads in this country. We can check this roughly by remembering that while 200 lbs. of coal *can* be burned per square foot of grate surface per hour, less than 100 lbs. will be the average consumption for a trip. The fuel saving (as demonstrated above) may be $2 - 1\frac{4}{10} = .6$ pound per horse-power hour, and at one-third of the time for full capacity, we should have an actual saving of $.6 \div 3 = .2$, or one-fifth pound of coal per hour. These figures are, of course, only roughly approximate, and would vary greatly with individual cases, but we believe that they do not err sensibly on the side of the steam locomotive. As there are 8,760 hours in a year, we should save (on the above basis) 1,752 lbs. of coal, or say, 1 ton in round numbers for each horse-power of locomotive in service, figuring the horse-power by the size of the boiler and cylinders. With coal at $1.50 per ton, we should save in fuel about ½ per cent. on the extra capital investment.

Steam locomotives lose much time in the round house on account of frequent boiler washings and repairs, and these necessitate cooling the boiler and firing it up again. Including the work, this may require from 5 to 8 hours, depending upon the kind of fuel used and the facilities at the point where the work is done. If we concede that the electric locomotive can make double the mileage, we might double this saving, but still not have an attractive financial proposition. As stated previously, there will no doubt be reduction in the cost of repairs to the locomotives, and if we assume that it will be cut in half per horse-power, the figures will appear somewhat as follows:

Value of locomotive	$15,000
Cost of repairs, per year	3,000
Reduction of one half	1,500
Horsepower of locomotive	1,500
Repairs per year per horse power	1

This added to double the fuel saving estimated above makes a total of $4.00 per year on an extra investment of at least $100. There are other expenses which might be reduced, but on the other hand, there are power house maintenance and repairs, and as a general proposition, it is evident that the electric locomotive will not be universally adopted on the basis of economy, unless in some particular localities, where coal is dear and water power abundant; where the density of traffic is great and the facilities for rapid train movement may demonstrate a paying investment; or where there are tunnels that cause difficulty in ventilation, or particular grades that could be more efficiently handled by electric than by steam locomotives.

If electric power is advocated for density of traffic, motor cars are introduced where the converse is true; where traffic is light and not thought sufficient to pay for ordinary train expenses. Here the principal saving is in train crew wages. We have seen that the gas engine costs two or three times as much as a locomotive of equal power, and gasolene at 10 cents a gallon is three times as

expensive as coal at $1.50 per ton. The clutches for speed variation are not very desirable attachments to rolling stock, as is evident by gasoline-electric combinations, which double the first cost and increase operating charges at least 25 per cent.

It is true that we can use steam engines and boilers, but the washouts and other performances to which steam boilers are periodically subject, are not conducive to the satisfactory maintenance of the passenger end of the vehicle. While the "repair track" is certainly not the place to make repairs to machinery and boilers, neither is the round house the proper locality to protect a car. If repairs are needed to one or the other, it practically ties up a train, and the difficulty of turning at the ends of short branch runs may be quite a serious consideration, where a light locomotive can simply uncouple and pass around a siding. If the particular service requiring motor cars should diminish, either periodically or permanently, little use would be found for such equipment, where a separate locomotive and car could readily be used to advantage.

The wages of the train crew are the principal items of saving expected, but it is uncertain how long such economies may be enjoyed, in the light of recent legislation and the efforts of labor organizations.

The general availability of railroad equipment for various uses is an important consideration in purchasing cars and locomotives and the motor car is not likely to share in these advantages with a light locomotive or are discarded from main line usage (of which most roads have more than they know what to do with) and a combination car. The difficulty of maintaining special equipment at out-of-the-way points is another thing to be considered. There is little data on the cost of construction and operation of these combination types, but it is extremely doubtful if they will ever be used in large numbers or in fact as generally as enthusiasts now claim to foresee.

Upon considering the above facts, it appears that there is no reason why the improvement and perfecting of the steam locomotive should not be pushed with vigor. There is much room for improvement, and the Pennsylvania Railroad tests will throw light upon the direction to turn for promising results. Superheating is in its infancy in this country and promises to do much in saving fuel and reducing boiler repairs. The recent interest in treating water, and the improvements (sadly needed) in terminal facilities will materially benefit the service performed by the steam locomotive, and much real progress is looked for in these directions.

We do not by any means wish to impede the introduction of electric traction; on the contrary, we believe that too much attention and thought cannot be given to it, but the proper limitations must be studied and observed. The New York Central terminal and the Atlantic City line are admirably adopted to the substitution of electric power for steam, and we believe will give good financial returns, but the general equipment of trunk lines which is advocated by some experts must be considered with caution and study. The steam locomotive is bound to reach further development and motive power officials should bend their energies in this direction as the "iron horse" will be with us for many years to come, and will not be merely on exhibition as a "relic of barbaric ages."

Report on Nova Scotia Railroads.

The report of the Provincial Government Engineer of the province of Nova Scotia for the year ended Sept. 30, 1905, has recently been issued. It deals, not with railroads owned by the general government of Canada which come under the direct control of the Minister of Railways, such as the Intercolonial (467 miles in Nova Scotia), or with privately owned roads declared by Parliament to be for the general benefit of Canada which come under the jurisdiction of the Railway Commission, such as the Dominion Atlantic (231 miles), but with all railroads in the province not falling under one of these two classes. These amount to a total of 490 miles, the longest being the Halifax & South-Western, with 244 miles of line.

At the close of the fiscal year 1904 this road had only 96 miles of line. The increase in its lines has for the first time raised the mileage which falls under the jurisdiction of the province above the mileage of either of the other two classes of roads.

The Halifax & South-Western is the Mackenzie-Mann line. It is still being extended, and when completed as now planned will have about 450 miles of line. At present it connects Halifax and Liverpool, 110.5 miles; Barrington Passage and Yarmouth, 50 miles, and Bridgewater and Middleton, 55 miles, with two branches 7 and 22 miles long respectively.

Work is now nearly finished on a connecting line between Liverpool and Barrington, with track laid part of the way. The Halifax & South-Western during the year under consideration acquired the Halifax & Yarmouth, running from Barrington Passage to Yarmouth, so that on completion of the Liverpool-Barrington section the Mackenzie-Mann interests will have a line from Halifax on the eastern side of the southern part of the Nova Scotia peninsula southwest along the shore to Yarmouth, a short distance northwest of the southern extremity of the peninsula. This, it is expected, will be put in operation late this year. The Mackenzie-Mann system also includes the Inverness Railway, 66 miles.

The Engineer speaks of a new departure in the province, namely, the building of a standard-gage railroad for lumbering purposes by the Springfield Railway Company of Bridgewater. Previously lumber in Nova Scotia has been carried almost altogether by water. When carried by land it was either by teams or for a short distance by a tramway generally with wooden rails. As the value of lumber increases and the business falls into the hands of larger operators it is quite possible that the system which has been initiated by the Davison Lumber Company may be used quite extensively. This company has purchased large tracts of timber land in Lunenburg, Queens and Annapolis counties, and has decided that for the proper operation of their lumber lands a railroad was necessary. In September, 1904, they submitted plans and profiles of a line 4½ miles long, and in November of the same year an extension of 3¼ miles. In August, 1905, they applied for permission to open the road for traffic. The line, while having rather heavier gradients than is desirable on a railroad to carry on a general passenger and freight traffic, is well adapted for the present traffic, and the location is such that these gradients can be improved with small expenditure at any time it is proposed to take up passenger traffic or extend the line. In other respects the railroad is practically up to the standard suitable for carrying on general passenger and freight traffic and reflects the greatest credit on this enterprising company.

The only important survey appears to be that of the Cape Breton Iron, Coal & Railway Company, which has had final surveys under way for a line from Sydney to Louisburg, which is to handle the output from new mining areas to be developed in Cape Breton county.

The table of accidents shows that no passengers were killed during the year, and only one injured, which duplicates the showing of the previous year. Seven employees were killed and 13 injured, against two killed and nine injured the year preceding.

Long Island Railroad.

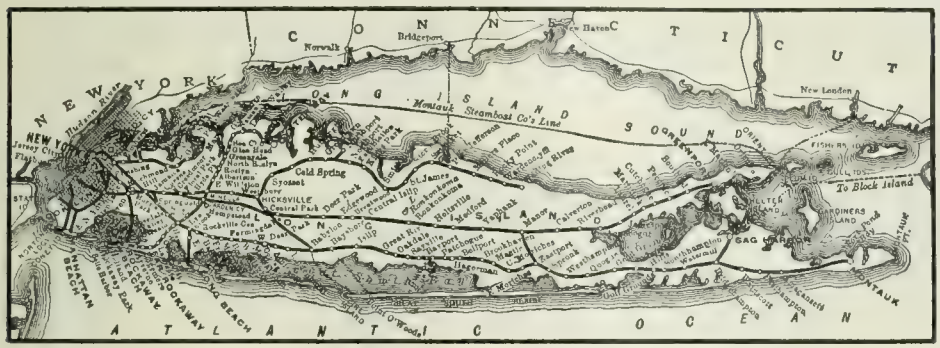
The unusual situation and great potential strength of the Long Island, a railroad confined to an island with connection only at one terminus, and that by car ferries, with other railroads, but with a practical monopoly of a suburban territory of tremendous promise when once made accessible to New York City, has often been commented upon in these columns. In the review of the road's annual report for the year ended June 30, 1904 (*Railroad Gazette*, Dec. 9, 1904), it was shown that while gross earnings had recently largely increased, net earnings from operation had steadily decreased, and instead of a net income profit of over $500,000 in 1902 there was a deficit after charges of over $250,000 two years later. There were pointed out three significant items which helped to bring about the great increase in expenses. These were increased fuel cost, increased car service charges and increased fixed charges due to new securities issued. In considering results for the year at present under review, ended Dec. 31, 1905 (the date of the fiscal year having been changed), it will be interesting to observe the present status of these sources of expense.

So far as gross earnings are concerned, 1905 was by a considerable amount the most prosperous year in the history of the road. They amounted to over $7,800,000, a gain of more than $800,000 over the record figure of the preceding year. Operating expenses, however, showed a gain almost as great, so that net earnings for the year ($1,460,000) were larger by only $81,000 than those of 1904. In fact, the net earnings figure for last year is slightly less than in 1893, when there were 29 miles less operated. As passenger traffic is by far the largest part of the road's business, so the greatest gain in earnings last year came from this source. Freight earnings, however, showed a proportionate increase. Both increases were evidently due to the general prosperity rather than to any particular set of conditions.

Under operating expenses, conducting transportation shows the largest increase. This account includes two of the items already alluded to—fuel and car service. In 1901, with a passenger and freight train mileage of 3,456,305, fuel cost was slightly over $400,000. In 1905, with train mileage (4,284,266) not greatly increased, fuel expense had risen to over $880,000. As explained in 1904, this great increase is due to the necessity which the road is under of using anthracite instead of bituminous coal on most of its locomotives, owing to the fact that so many of its lines enter the limits of Greater New York where the use of hard coal is required. With electrification this condition will be immediately obviated. Again the situation of the Long Island has made operation expensive by

greatly increasing car service charges under the present per diem system. With no connection whatever with other lines at any of its eastern termini, no track connection anywhere with any other railroad, and a heavy passenger service, it is easy to see that the difficulties of promptly getting freight cars off the road are very great. So recently as 1902 the Long Island paid less than $18,000 for car mileage. Last year, car service cost $227,846, a gain of $13,000 over the previous year. Efforts have been made to have the road considered as a switching line, and a schedule of car service charges put in force on that basis, but so far this has not been brought about. For a road situated on an island, with its longest through line only 115 miles long, it would seem only fair that some such arrangement should be made. As it is, the Long Island, with 392 miles of line, has an unfavorable car service balance entirely out of proportion to its size and its freight equipment.

In the third expense mentioned, interest on bonded debt, last year's increase, due to additional bonds issued, was only $86,631, following $169,700 in the six months preceding and $201,200 in the 12 months ended June 30, 1904. The net increase during the year in funded debt was $3,878,000, which is the amount of new capitalization involved in the sale of $6,000,000 4 per cent. refunding mortgage bonds. As the terminal improvements for which these bonds were issued necessitate capital expenditures extending



Long Island Railroad.

through several years from which no revenue can be derived until completion of the improvements, a proportion of the interest has been charged into cost of their construction.

The year's principal charges to capital account were as follows: Atlantic avenue improvement, $780,735; Bay Ridge improvement and elimination of grade crossing in Brooklyn, $67,115; electrification, $3,545,583. There were also charges to capital account for current improvements amounting to $1,104,141 for general maintenance of way betterments, including second, third and fourth tracks, and to $135,856 covering cost of 50 ballast cars, three shifting engines and the steamer "Wyandotte."

The Atlantic avenue improvement in Brooklyn, with the exception of the Flatbush avenue freight and passenger terminals, is finished, and passenger service over the Atlantic division is now operated entirely by electricity. Electrification of the lines in and adjacent to Brooklyn and Queens boroughs is largely finished and electric train service, with 172 regular trains daily, has been in operation since the close of last year between Flatbush avenue, Belmont Park, Woodhaven Junction, Rockaway Park, Hammels, Valley Stream and Far Rockaway and Jamaica and Springfield Junction. The running time between Jamaica and Flatbush avenue has been reduced 7 minutes on express trains and 14 minutes on local trains, and between Flatbush avenue and Rockaway Beach 14 minutes. President Peters reports, however, that electric operation is not as yet on an economical basis. The third rail system in use on the road is described in another column.

The new 1,600 car freight yard one mile east of Jamaica is practically completed. Three other yards, with individual capacities of from 50 to 180 cars were also put in service last year. The rebuilding of the 34th Street ferry terminal on both sides of the East river has steadily progressed. When finished, there will be four new standard slips on the Manhattan side, with a new ferry shed and waiting room. The cost of this improvement will be about $275,000. The new interlocking plant controlling the Long Island City terminal yard is now in service. A new and complete shop for repairing all floating equipment is being built at a cost of $75,000. In addition to these improvements, 11 miles of second track between Babylon and Oakdale are under construction. In order to acquire additional equipment an equipment trust is to be created covering 25 locomotives, 65 standard vestibule passenger cars, 100 gondolas, 100 box cars, two ferry boats, two car floats, one tug boat and 139 steel passenger motor cars and trailers to be used in electric service.

On Nov. 11, 1905, the Glen Cove Railroad, a single phase electric line 3.28 miles long, was put in service by the Long Island Railroad, power for its operation being transmitted from the power house at Long Island City of the Pennsylvania, New York & Long Island Railroad, the company which is building the Pennsylvania's East river tunnel. Another step in acquiring electric properties was taken during the year in the organization of the Long Island Consolidated Electrical Companies as a holding company for securities owned in electric lines promoted or acquired in the interest of the Long Island Railroad. Among the securities which this corporation is to hold are the interests recently acquired in the New York & Long Island Traction Company and in the Long Island Electric Railway. The new company will issue its own obligations against the securities deposited and funds will thus be provided for building additional electric roads to serve as feeders and to protect the revenues of existing steam lines.

As will be recalled, the Long Island Railroad during the year 1905 was signally unfortunate in the loss of two of its Presidents, Mr. W. H. Baldwin, Jr., who died on January 3, and Mr. W. F. Potter, who, having succeeded Mr. Baldwin on January 13, held the position until his death on April 2. To succeed Mr. Potter, Mr. Ralph Peters, previously General Superintendent of the Southwest System of the Pennsylvania Lines West was elected President. The new General Superintendent also came from the Pennsylvania Lines West, so that Pennsylvania methods are now dominant. With less than a full year's term of office, the new management is hardly to be judged by the results presented in the present report, but apparently it is successfully carrying on the work of Mr. Baldwin and Mr. Potter along the lines laid down by them. In spite of a large increase in expenses and a loss of $45,590 from operation of the Montauk Steamboat Co., a charge which did not have to be faced in 1904, the year shows a small net income credit instead of a deficit more than twice as great in the preceding year. Already, in expectation of the completion of the various Long Island tunnels, there is a tremendous real estate boom in that territory, and once the tunnels are completed and close connection made with Manhattan, the Long Island will have a chance to show what may not improbably be remarkable capacities as an earner.

The following statistics show the principal results of the year's operations:

	1905.	1904.
Mileage worked	392	392
Freight earnings	$2,322,344	$2,050,456
Passenger earnings	4,399,624	3,928,427
Express earnings	1,022,036	959,519
Gross earnings	7,824,987	7,021,378
Maint. way and structures	804,738	789,383
Maint. of equipment	957,958	712,994
Conducting transportation	4,407,560	3,929,270
Operating expenses	6,364,636	5,642,261
Net earnings	1,460,351	1,379,116
Net income	22,529	*54,390

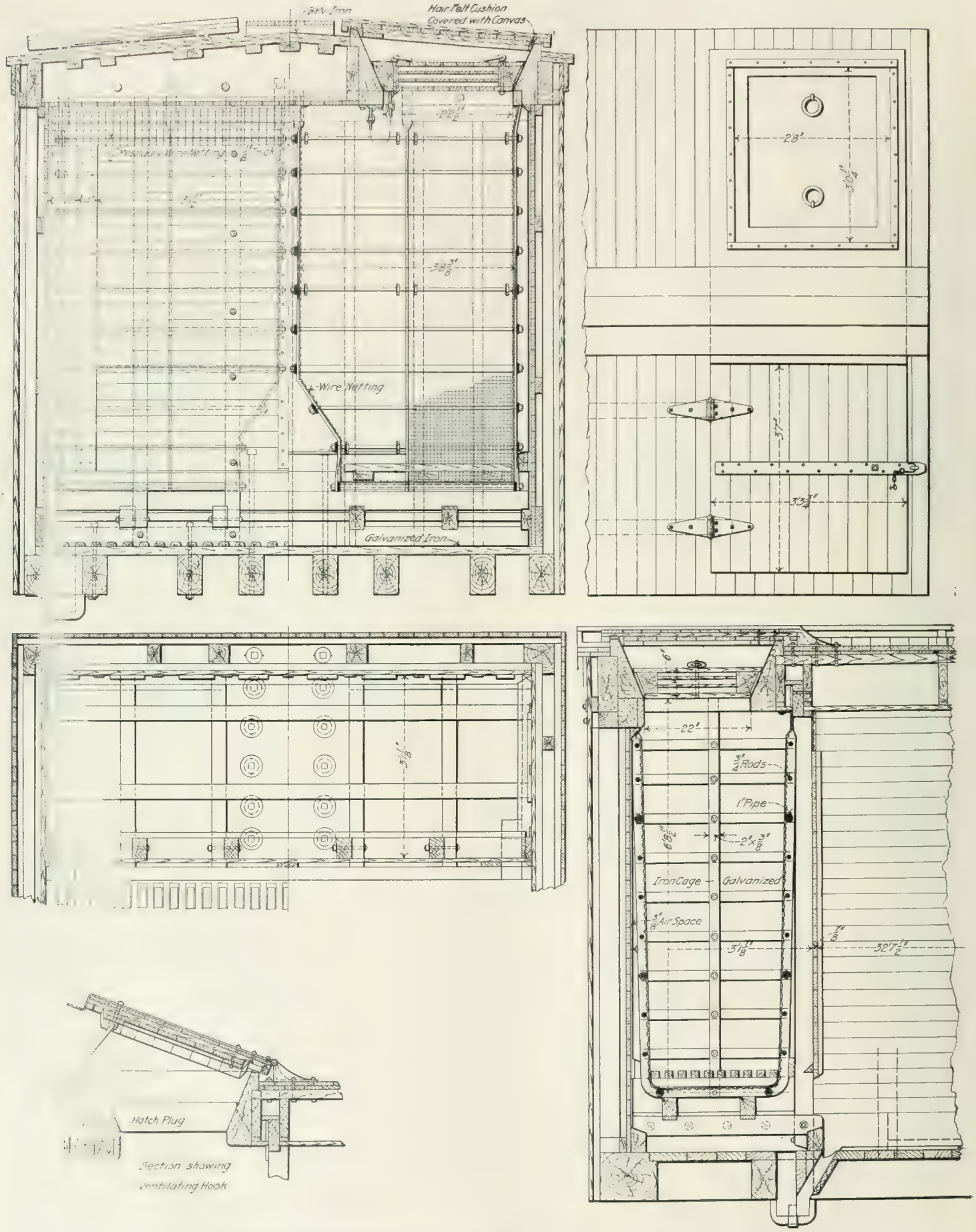
*Deficit.

Baltimore & Ohio Refrigerator Car.

The Baltimore & Ohio class R-4 refrigerator car, of which over 400 are in service, represents the latest development in this class of freight equipment. These cars are 32 ft. 7 in. long, 8 ft. 3 in. wide, and 7 ft. 6 in. high in the clear inside, with a total cubic capacity of 2,015 cu. ft. and a marked capacity of 70,000 lbs., with a weight of 53,300 lbs. They are fitted with steam and air signal pipes so that they may be run in refrigerator express service in passenger trains. The principal features of interest are, of course, the methods of insulation and ventilation and the ice boxes. These are shown in the accompanying drawings.

The insulation under the floor consists of five layers of $\frac{7}{8}$ in pine, bass wood or cypress fitted in between the sills and separated by 1-in. air spaces. On top of each layer of boards is a sheet of insulating paper or deadening felt. Above the sills is a layer of half ply Paroid and one of three-ply Neponset insulating paper, over which the $1\frac{3}{4}$-in. floor boards, tongued and grooved and white leaded are laid. In the sides the insulation consists of the outside sheathing $\frac{1}{2}$ in. thick, a layer of deadening felt, a layer of half-ply Paroid, $\frac{3}{4}$-in. air space, layer of Hercules paper, $\frac{1}{2}$ in white pine lining, $2\frac{1}{4}$ in. air space, layer of three-ply Neponset paper, $\frac{1}{2}$ in. pine lining, layer of Hercules paper, $\frac{3}{4}$ in air space, layer of half ply Paroid, layer of deadening felt and the inside lining of $\frac{7}{16}$-in. matched bass wood. In the roof is the inside ceiling of $\frac{7}{16}$-in. matched bass wood, layer of three-ply Neponset insulating paper, $\frac{3}{4}$-in. air space, layer of paper, $1\frac{1}{2}$ in air space, $\frac{7}{8}$ in bass wood blind ceiling, layer of paper, $1\frac{1}{2}$ in air space, $\frac{7}{8}$ in bass wood lining, layer of paper and the air space under the double board roof.

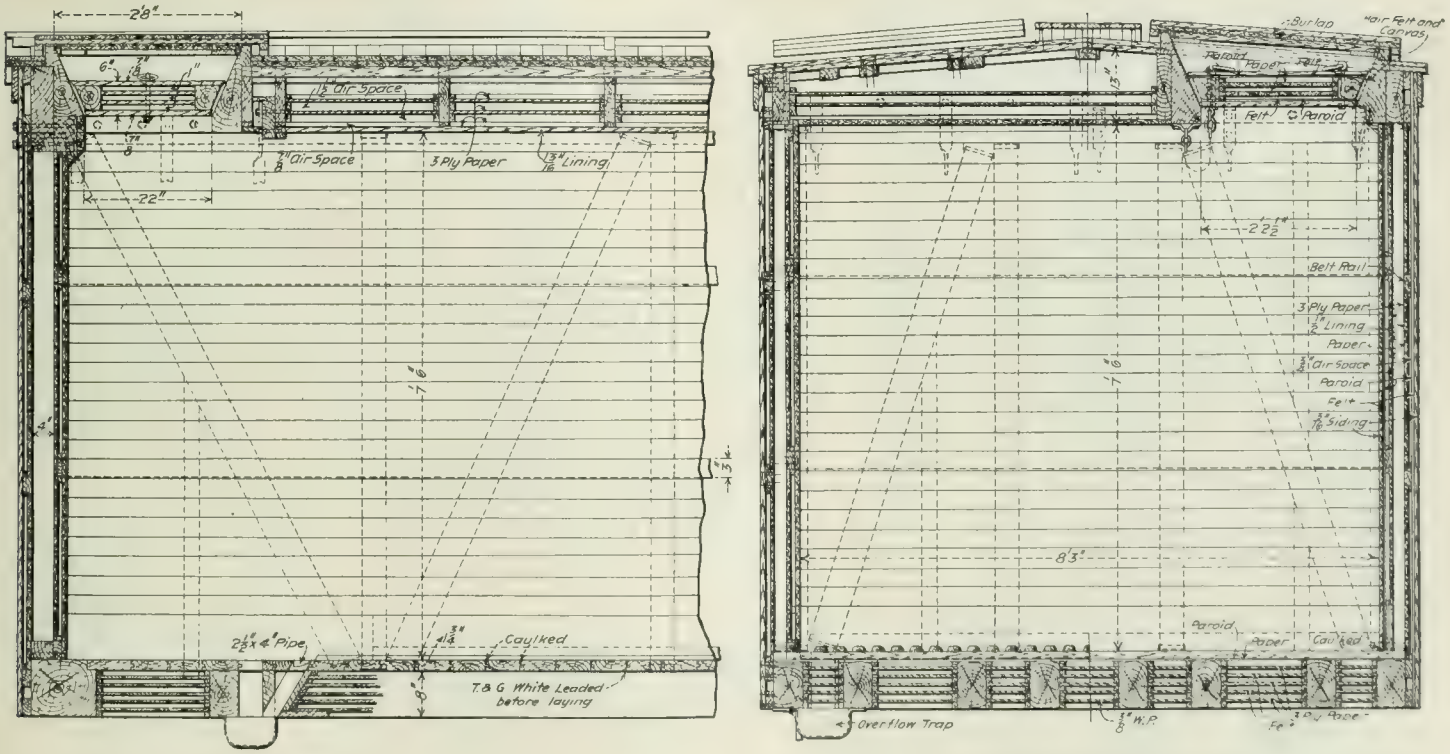
The ice boxes are arranged in pairs at each end behind a $\frac{7}{8}$ in wood bulkhead. They are each 3 ft. $8\frac{5}{8}$ in. wide by 2 ft. $7\frac{1}{4}$ in.



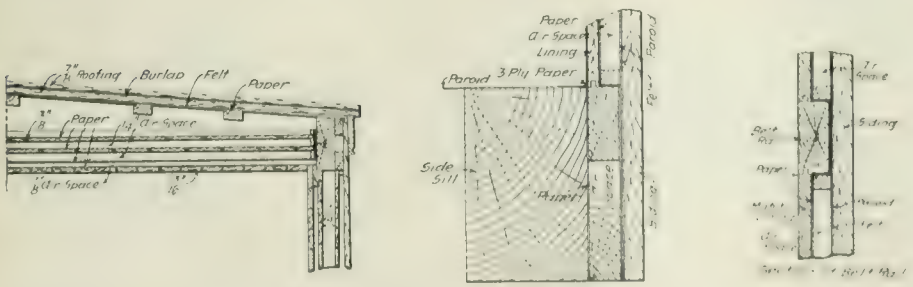
Details of Ice Boxes and Roof Hatches, B. & O. Refrigerator Car.



70,000-lbs. Capacity Refrigerator Car—Baltimore & Ohio.



Longitudinal and Cross-Sections of B. & O. Refrigerator Car, Showing Insulation.



Details of Insulation; B. & O. Refrigerator Car.

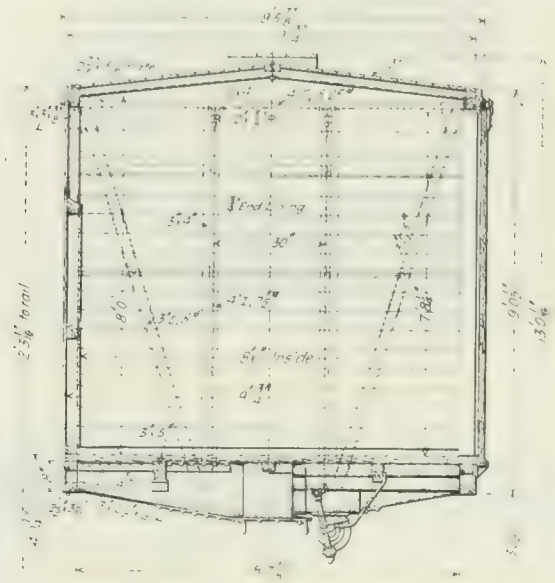
at the top sloping to 2 ft. 1½ in. at the bottom. The baskets are made of ½-in. mesh galvanized iron wire on a frame or cage of ½-in. x 2-in. galvanized iron bars, and rest on two 3-in. x 3¾ in. blocks in the drip pans. One trap of malleable iron is used for the two boxes in each end of the car, the trap being located under the bulkhead just inside the side sill. Drainage from the floor of the car is carried off through the same trap. The entire space inclosing the ice boxes is lined with galvanized sheet iron.

Air enters the boxes through the 7-in. opening above the bulkhead, falls as it cools and leaves through the 10-in. opening below. The upper opening is covered with a screen of ⅛ in galvanized wire with 1½-in. meshes. When it is desired to use the car, a ventilator car, the hatch plugs are dropped into the ice boxes and hung from a ⅜-in. chain attached to the hatch frame. The roof doors are hinged at the back edge and can be secured in a raised position by a ventilating hook, as shown on the drawings. A circulation of air is thus obtained down through the forward ice box into the car and out through the rear ice box.

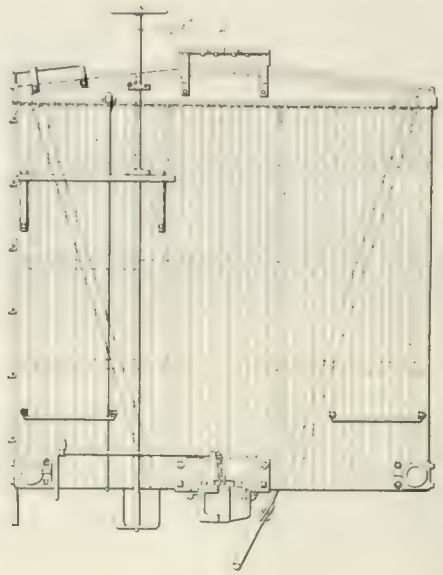
Particular attention has been paid to designing all the parts so that they are accessible and easily removed and replaced in case repairs are needed. The ice boxes, it will be seen, are made with an offset in the center to permit the removal of the draft bolts without taking down the boxes. The cages attached to the car with bolts and the framing for the drip pan supports and bulkhead is entirely separate from the floor or sides so that the boxes may be removed by taking out a small number of bolts and lag screws. We are indebted to Mr. J. E. Muhlfeld, General Superintendent of Motive Power, for the drawings.

Standard 80,000-lb. Box Car for the Rock Island-Frisco System.

At the time that the motive power committee of the Rock Island-Frisco System made its investigations which led to suggestions for standard locomotive equipment (*Railroad Gazette*, Dec. 30, 1904), another committee was engaged in similar work regarding the car equipment. Following the completion of its duties by this latter committee, a standardization committee was formed which is at present engaged in standardizing both passenger and freight car equipment. The standard design for box car has lately been completed, and the drawings are shown herewith. In its report the first committee recommended a capacity of 60,000 lbs. for box, furniture, refrigerator, fruit and stock cars, on the ground that the conditions of traffic did not justify the use of a higher capacity. The committee further recommended the use of steel underframe and steel skeleton superstructure in these cars made of commercial sizes of rolled plates and shapes only, such as can be bought in open market. When the standardization committee came to work up the design for a standard box car it was decided to make it of 40 tons capacity instead of 30 tons, as in the meantime it had been deemed inadvisable to build cars of 30 tons capacity of steel.



Cross-Section of Standard 80,000-lb. Box Car.



End Elevation of Standard 80,000-lb. Box Car.

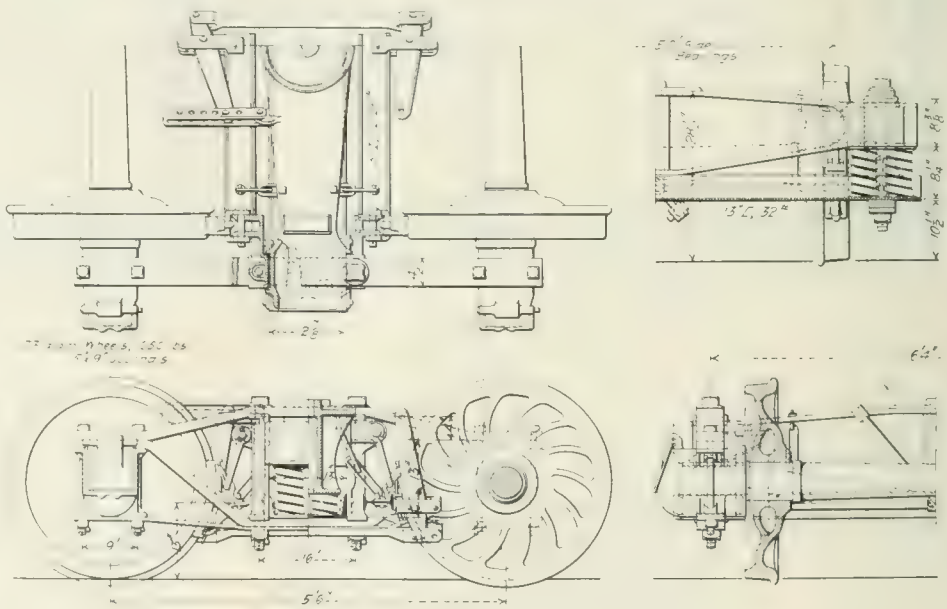
The first committee recommended the working out of the designs with a view to using these steel shapes in such a manner that they would require only punching and shearing without the necessity for heating and working in forms and dies. Also that the center sills and draft rigging be made of uniform strength for all classes, designed on the basis of the stresses imposed in service, without regard to the carrying capacity of the car, since high and low capacity cars are coupled together indiscriminately in making up trains. The steel skeleton superstructure was to be rigidly secured to the underframe and braced in such a manner as to retain its normal shape under all ordinary conditions. The use of a wooden superstructure with steel underframe was disapproved of because of the shrinkage of the former, without accompanying change in the latter; the rods and bolts therefore become loose and the entire superstructure becomes shaky and deformed.

The standard box car is 40 ft. long, 8 ft. 6 in. wide and 8 ft. high to carline inside. It is 44 ft. ⅛ in. face to face of couplers, 9 ft. 3⅜ in. wide over sheathing and 13 ft. 1/16 in. high from rail to top of running board. The center sills are 15-in., 33-lb. channels, 12⅞ in. back to back. The side sills are 8-in., 11¼-lb. channels, flanges in. Under the door posts, 3 ft. 3 in. each side of the transverse center line, is a transverse member built up of plates and angles and similar in form to the body bolster. The web of this member is ¼-in. plate, the upper and lower edges are stiffened by 3-in. x 2½-in. x ¼-in. angles, and riveted to the latter end and to the lower flanges of the center sills is a ¼-in. plate 5 ft. 1⅛ in. long and 9 in. wide at its widest part.

The body bolster construction is shown in detail. The webs and upper plate are ½ in. and the lower reinforcing plate ⅜ in. The angles are 3 in. x 3 in. x ⅜ in., except the vertical reinforcing angles over the side bearings, which are 2½ in. x 2½ in. x ¼ in. The connecting plates to center and side sills are ⅜ in. Between center sills is a suitable steel body center-plate casting.

The 4 in. x 8 in. wooden end sill is bolted to a 2⅜-in. plate stiffened top and bottom by 3-in. x 2½-in. x ¼-in. angles. Additional stiffness is given the underframing by 6 in. x 3½ in. x ⅜ in. angles extending from the ends of the body bolsters to near the ends of the center sills.

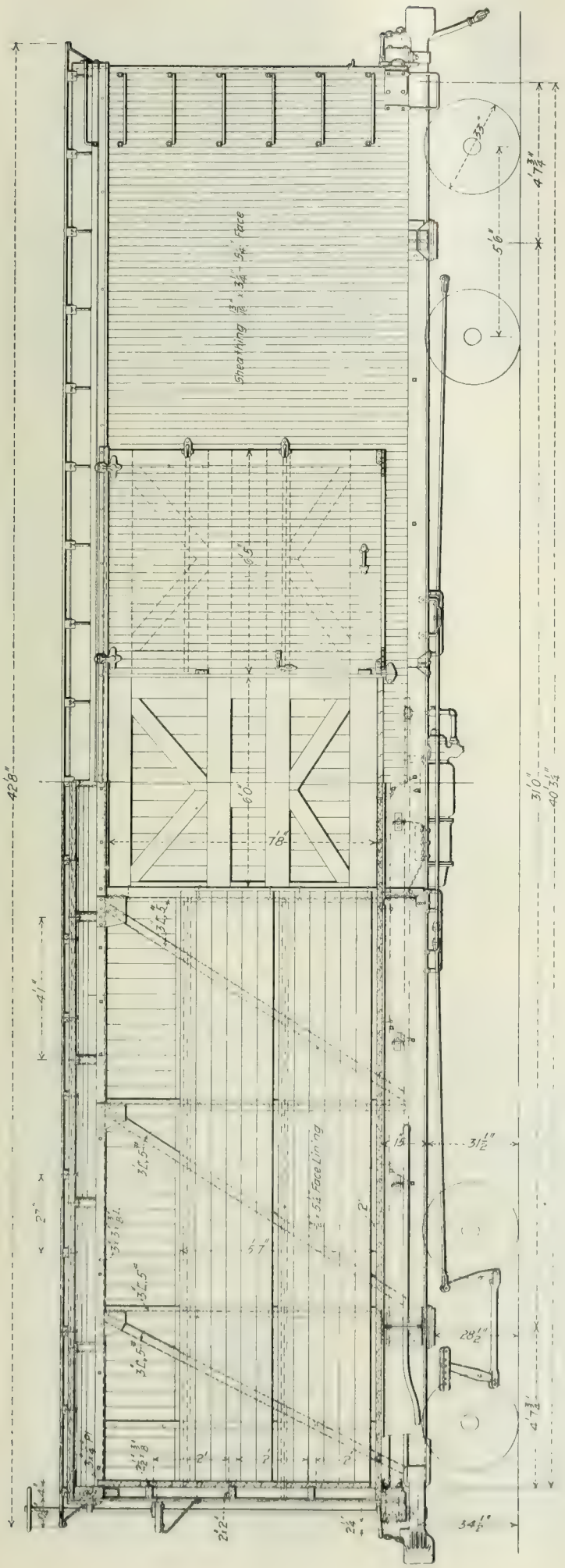
The superstructure is made up of channels, angles and I-beams. The end posts are 4-in., 7½-lb. I-beams, and the corner posts 4-in. x 3-in. x 5/16-in. angles. The side and door posts, the braces and purlins are 3-in., 5-lb. channels. The top members are 3-in. x 3-in. x ⅜-in. angles on the sides and 4-in., 5¼-lb. channels on the ends. The belt rails are 2½-i. x ⅜-in. flat iron. Longitudinal floor nailing sills, 3 in. x 5 in., midway between center and side sills, rest on 4-in., 5¼-lb. channels secured to the sill webs by angles. There is also a 3½-in. x 2¼-in. center nailing strip between center sills.

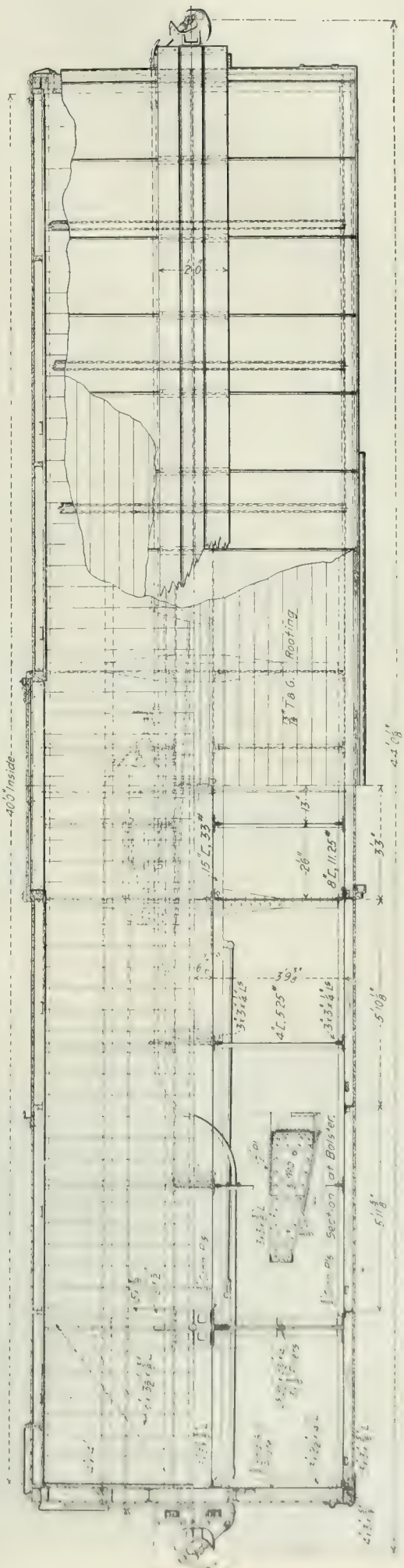


Standard 80,000-lb. Arch Bar Truck.

Further details of the wooden construction may be obtained readily by reference to the drawings. The car has but one door in conformity with the committee's recommendation on this point.

The arch-bar type of truck was chosen and is designed to have as few parts as possible. The details of the 40-ton truck are shown. The committee called attention to the fact that many bolsters are fitted with pressed steel or malleable iron center plates having too small bearing surface, which either fail under load or the unit pressure is so great as to cause excessive friction and consequently excessive flange wear on wheels and rails, and derailment on curves. It was recommended that in such cases the center plates be replaced





Plan and Side Elevation of 80,000-lb. Steel Frame Standard Box Car, C., R. I. & P. and St. L. & S. F.

by cast steel center plates having sufficient bearing area to bring the friction under load within allowable limits. It will be noted that the cast-steel truck bolster has a center bearing of generous proportions. The estimated weight of the car is approximately 40,000 lbs. No cars have been built from the design as yet.

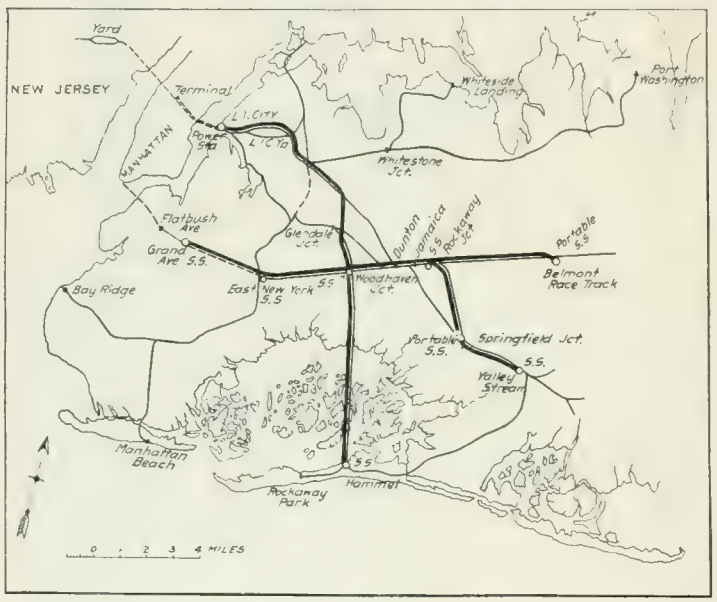
The committee report mentioned the portions of higher capacity cars found to be liable to failure, which for box cars are: Body bolster, truck bolster, draft rigging, door fixtures, brake beams, end framing, end lining and roofs. These features on the accompanying design will therefore be studied with special interest.

We are indebted to Mr. W. A. Nettleton, General Superintendent of Motive Power of the Frisco, for the drawings.

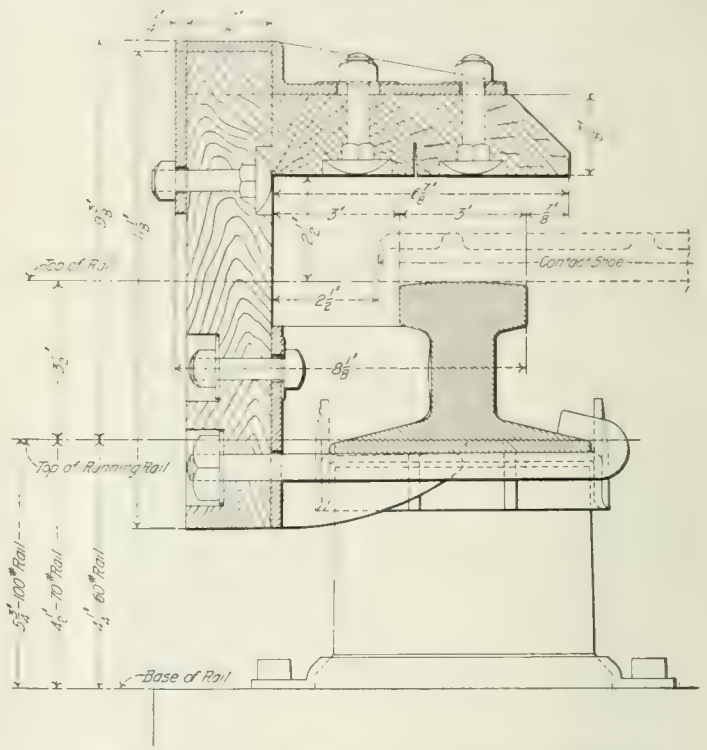
Power Transmission Line and Third Rail System of the Long Island Railroad.

In our issue of November 3, 1905, we published a general description of the electrification of the Long Island Railroad, and in our issues of April 6 and 13, 1906, we printed a full detailed description of the main power station. We are now enabled to show a few illustrations of some of the more important details of the power transmission and third rail systems. Overhead construction for the power transmission line was adopted wherever it was usable, although the impracticability of constructing high-tension overhead transmission lines in thickly populated sections of Brooklyn and Queens required recourse to underground construction in several places. The lengths of the various sections of the transmission lines are as follows: Conduit section of trunk line, power station to Dutchkills street, 1.12 miles; overhead trunk lines, Dutchkills street to Woodhaven Junction, 7.85 miles; conduit section from Woodhaven to East New York, 3.23 miles, and from East New York to Grand avenue, 3.04 miles; Woodhaven to Dunton, 1.7 miles; overhead from Dunton to Rockaway Junction, 1.73 miles; Rockaway Junction to Belmont Park, 3.71 miles; Rockaway Junction to Springfield Junction, 3.35 miles; Springfield Junction to Valley Stream, 2.57 miles; Woodhaven Junction to Hammel, 6.98 miles. The total mileage of conduit lines now in use is 9.09 miles, and that of pole lines 26.19 miles.

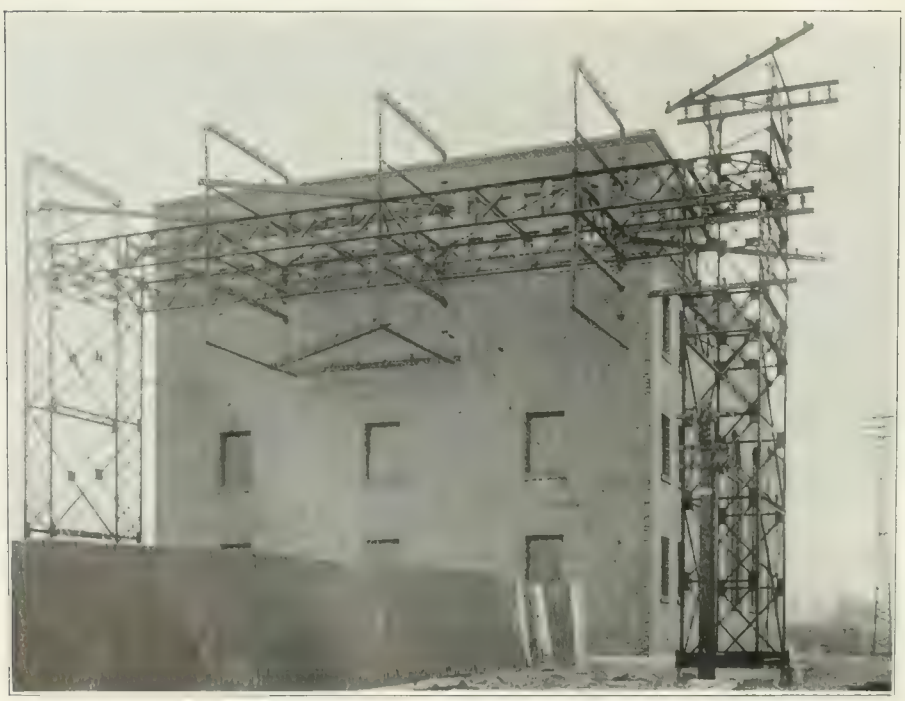
Certain portions of the conduit were especially difficult of construction because of its being situated below the level of the ground water, and special provision had to be made for the drainage of the ducts. The ducts are pitched so as to bring all the drainage into three sumps, from which it is pumped by means of electrically driven submerged centrifugal pumps automatically controlled and discharging into the city sewer system. A cross section of the ducts and manholes on Atlantic avenue is given in the accompanying illustration. The underground high-tension cables are of the three-conductor type, each conductor having a cross section of 250,000 c.m.



Map of Transmission Lines—Long Island Railroad.



Details of Third Rail Guard—Long Island Railroad.



Cable Rack at Rockaway Junction Substation.



Lightning Arrester House at Dunton.



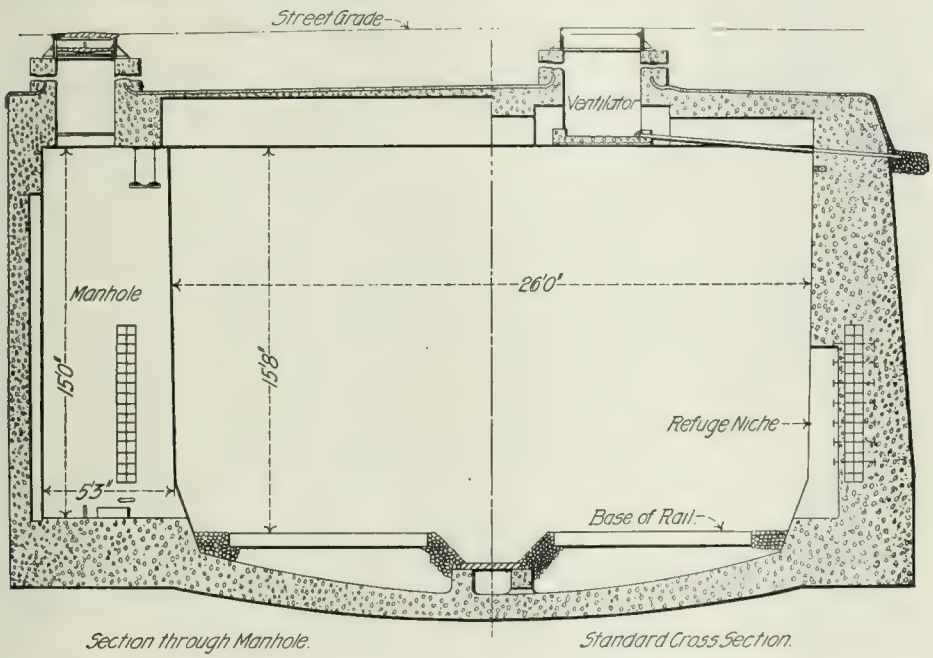
View of Third Rail East of Jamaica.

and being composed of 37 copper wires. The completed cables, including insulation, measure 2⅞ in. outside diameter. There is in all about 25 miles of high-tension underground cable installed, besides .418 miles of armored submarine cable. Wherever the underground cable section of the transmission line is joined up with the overhead system, lightning arresters and choke coils are installed, suitable houses being provided to shelter this apparatus, there being one on the main transmission line at Dutchkills street, Long Island City, and another at Dunton, on the branch line running east of Woodhaven. Smaller houses were also provided for the same purpose at the two drawbridges.

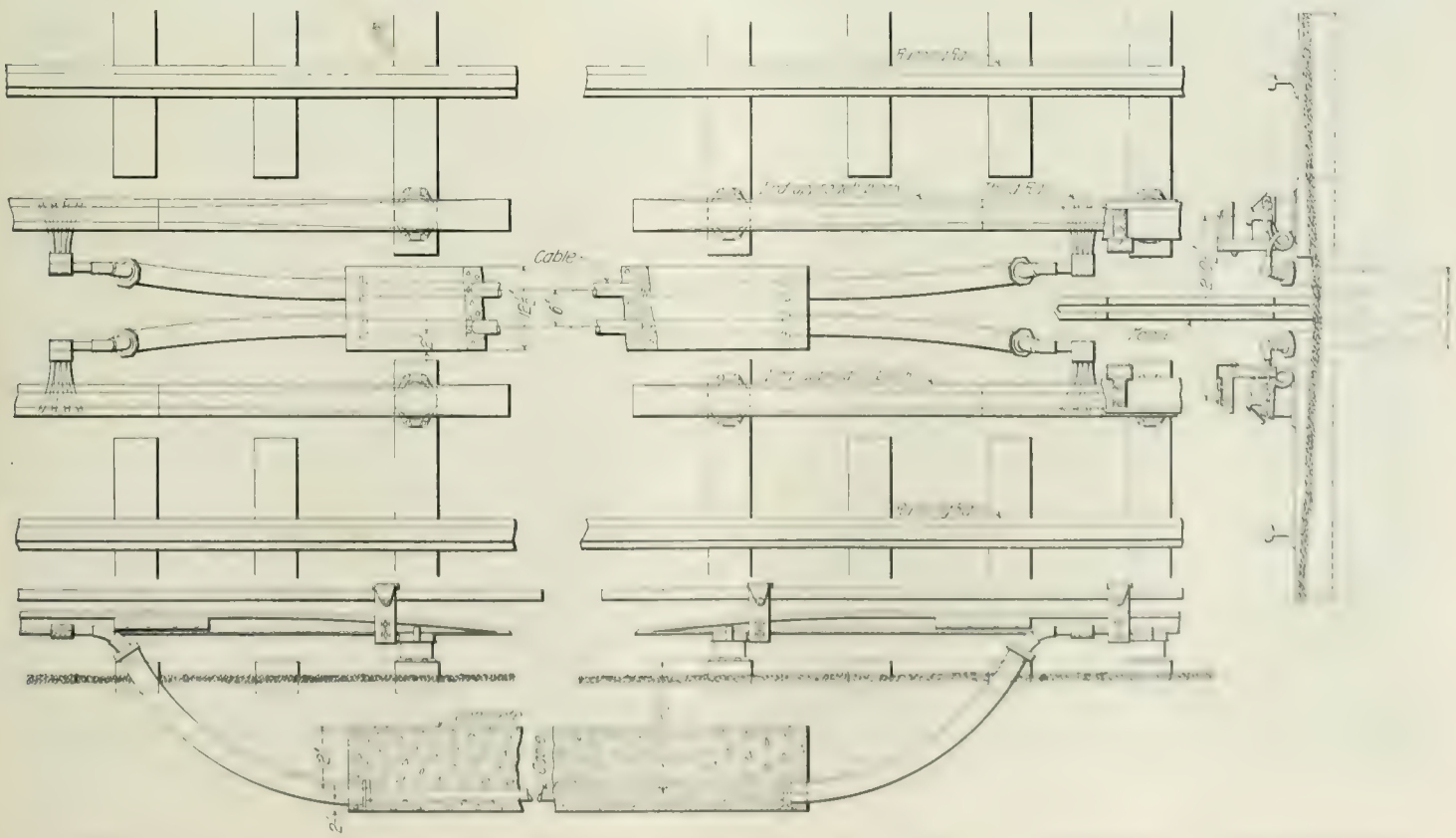
There are two general divisions of the overhead construction—the trunk line between Dutchkills street and Woodhaven Junction and the branch lines between that point and the other outlying sub-stations. The trunk line as well as the more important branch lines are built of steel poles, while the less important branch lines are of wood poles. The ability of the steel pole to act as a lightning rod is turned to advantage, and each pole is thoroughly grounded to a copper plate buried beneath the foundation and connected to one of the anchor bolts by a copper wire.

The wooden poles are of two kinds—chestnut, which is the standard for ordinary work, and creosoted yellow pine, which is used only along the trestle over Jamaica Bay. The creosoted poles are treated with 15 lbs. of dead oil of coal tar per cubic foot of timber. Creosoted poles are all set 15 ft. into the bottom of the bay by means of a water jet. At the Woodhaven and Rockaway Junction sub-stations, special terminal poles or racks are provided to distribute the overhead circuits along the face of the building parallel to the high-tension switching galleries in such a manner that the disposition of the cables after entering the building will be most convenient. The terminal racks at both stations consist, as shown in the illustration, of steel truss bridges supported on lattice steel columns carried on concrete foundations.

The rail used for most of the construction is a modified tee shape weighing 100 lbs. to the yard in 33-ft. lengths. The section is 4 in. high, with a head 3 in. wide, bottom flange 6 in. wide, and web 1½ in. thick. This particular shape was selected because of the limited vertical distance between contact and running rail tops requiring that the upper rail be of as low section as possible to provide maximum insulation distance to tie. In some cases running rails were only 60-lb. section, reducing the available distance from the top of the tie to the top of the third rail to only 7½ in. The



Standard Details of Subway Construction—Atlantic Avenue Improvement.



Standard Arrangement of Third Rail Connecting Cables at Crossings; General Design and Arrangement of Approach Blocks.

section, therefore, is that of heavy rail squeezed out horizontally, with a broad base adapted to reduce overturning. The section, together with the guard, is shown in the accompanying illustration.

The rail is of extra soft steel, as will be seen by the following analysis:

Carbon	0.08	Sulphur	.029
Silicon	.074	Manganese	.022
Phosphorus	.074		

The resistance of the sample in the above analysis is by measurement for a 100-lb. section, equivalent to 1,650,000 c.m. of copper.

All of the main line tracks on the elevated line are provided with this 100-lb. third rail excepting about 7½ miles, which are fitted with 70-lb. standard relaying T-rails. For sidetracking and unimportant spur work, 60-lb. relaying rails are used.

The end approach blocks and incline for lifting the third rail shoes are of cast iron. Two lengths are used—one being 5½ ft. long and used on main line tracks where the shoes must be raised and lowered at high speed, while the other, which is 2½ ft. in length, is used only on spur track and sidings. The approach blocks are attached to the end of the rails by the regular splice plates, and are supported on standard third rail insulators at their outer ends. The general design and arrangement of the approach blocks in position is shown in the illustration. The third rail joints are bonded by laminated copper foot bonds with plug terminals. The third rail is frequently interrupted by highway crossings and switches, and at such places underground cables or jumper cables are used. The accompanying illustration shows the standard method of running and connecting up such cables. They are buried not less than 2 ft. below the surface of the ground, and except where run under public highway crossings a 2-in. plank laid on top constitutes the only protection. At highway crossings, however, a concrete matrix about a foot thick is substituted for the plank in order to insure protection against injury in case the streets are opened by gas or water pipe workmen.

Practically all the line is double-tracked, excepting two stretches which are four-tracked—one on Atlantic avenue between Chestnut street and Woodhaven Junction, and the other running south from Woodhaven Junction as far as the north end of the trestle. About 20 miles of track on Atlantic avenue is laid with 100-lb. T-rails. The remaining portion of the electrified system is laid with various weights of rail, running from 60 to 80 lbs. per yard. The completed overhead line was first put in service on April 27, 1905, and the third rail was first put in service about May 13, 1905. Regular operations began July 26, 1905. The operation of the transmission line and the third rail have been remarkably free from interruptions of whatever nature, and have demonstrated their efficiency as a substantial and reliable transmission system for a suburban railroad on whose regularity of operation thousands of people are daily dependent.

The design and construction of the foregoing transmission system was carried out by Westinghouse, Church, Kerr & Co., engineers for the Long Island Railroad Company, and the entire work was under the direction of Mr. George Gibbs, Chief Engineer of Electric Traction of the Long Island Railroad, subject to the approval of an electrical committee consisting of the chief operating officials of the road, with the President as chairman.

The 50-Ton Box Car as a Standard in Railroad Equipment.

BY W. E. SYMONS.

Two years ago an editorial in the *Railroad Gazette* on the economy of the 50-ton box car contained this statement: "The fact that the Pennsylvania Railroad made this car a standard two years ago is a strong argument in its favor as having an earning capacity greater than the 30 or 40-ton car." An analysis of the real value of 50-ton box cars must take into consideration two important points: Can the greater loads they will carry be obtained? If so, what is the greater carrying capacity during a given period over and above the additional first cost, and the extra cost of hauling the extra dead load due to their weight? In the same article attention was also directed to the fact that "on the Missouri Pacific, after four years of educating the shippers and agents in loading cars to the fullest capacity, the average shipment of general freight per car from 23 of the largest stations on their lines was 11,688 lbs."

In view of the fact that many thousand 50-ton capacity cars have been added to the equipment of our railroads in recent years and many thousands are now under contract or construction for future delivery, it sems not inappropriate to raise the question at this particular time as to whether the results obtained from the use of the 50-ton car in actual service will justify its extended use in all localities as a standard car, in place of the 40 or 30-ton car, or whether these results, when properly analyzed, will not show that the 50-ton car, from a practical or commercial standpoint, can only be regarded as a specialty and confined to a particular class of traffic in a territory where the limits of its usefulness are governed by well determined lines of demarcation.

A proper and intelligent analysis of this subject necessarily involves the collection or compilation of itemized data on the essential factors that have a bearing upon or controlling effect on the relative value of this car as compared to the others above mentioned. Among these most important factors are the following:

(1) First cost of car.
(2) Capacity of car, cubic contents and weight.
(3) Weight of car.
(4) Average load carried in tons.
(5) Conditions which militate against full load.
(6) Cost of maintenance.
(7) Extra cost of hauling extra dead weight when moved with less than full capacity.
(8) Extra cost for maintenance of permanent way, bridges, etc.

The most important items above enumerated, and which are essential to the fair comparison with cars of 30 or 40-ton capacity, can only be obtained by actual experience with the large car under operating conditions and it should be borne in mind that such only tend to show the value of the car in the particular territory where it is in service and the comparisons are being made. Therefore, it would be highly interesting and very valuable to the railroad world, also to the operating officers at this particular time, if they could be favored with a very thorough and complete report of the results obtained by the use of a given number of these cars in comparison with others covering a period of two or three years, furnishing the exact figures and facts, that others who may contemplate the addition of new and heavier equipment may be better able to reach a correct conclusion in the premises, as to the type of car best adapted for the locality through which their lines may run.

Some observations of a general character may serve to emphasize certain points of more or less interest. One of the most prominent railway systems in the West have at present in service over 5,000 50-ton box cars, with steel underframing, 40 ft. long and weighing over 41,000 lbs. These cars, as a rule, are loaded to a point reasonably near their capacity in both directions between Missouri river points and the Pacific Coast, a distance of 1,780 miles, and not infrequently from Chicago or points East, giving a through haul in the latter case of 2,280 miles. This, of course, is what might be termed an unusually favorable condition of service for the 50-ton cars and gives them a place at once among the improved facilities that count for increased net earnings. The average tons per loaded car on this line is 20.18, while the average tons per revenue car is 19.38. The average tons for all cars, loaded and empty, including cabooses, is 14.05. From these figures it can be readily seen that the very creditable tonnage per loaded car of 20.18 is doubtless largely influenced by the use of the 50-ton car in this particular territory. As further evidence of this, let us enumerate some of the various commodities handled at different points on the line and the quantities in percentage of the car capacities which enter into the general average above given. A few of the most commonly known commodities, which form the greater portion or bulk of freight shipments and the percentage of the car capacity utilized in their movement, are as follows:

Brick	95.6	Mill stuff	61.4
Coal	92.7	Oil	97.0
Corn	93.5	Ore, lead, and bullion	102.5
Hay	38.3	Sugar and molasses	80.9
Lumber, ties, etc.	70.4	Wheat	93.1
Merchandise	26.5	Miscellaneous	63.3

From this it is apparent that with the low average per cent. of loading in cars handling hay, merchandise, mill stuff and miscellaneous, the 50-ton box cars have undoubtedly contributed much to the high general average of revenue tons per car. Inversely, it affords excellent proof to the contention made by many, and in which the writer concurs, that there is a special field for the 30-ton car of the American Railway Association dimensions, which the 40 and 50-ton car cannot invade without a positive loss, either direct or indirect to the operating companies; and that field is the one where the last-mentioned commodities predominate and where conditions necessitate their movement in a manner to suit the shipper, regardless of the wish of the carrier. In further support of this view or theory, let us again refer to the results obtained on the Missoui Pacific road, and in commenting on the same it is suggested that, as a general proposition, it is not within the range of possibilities for the carriers to educate the shippers so as to secure the delivery of their traffic for shipment at a time and in a manner that will permit of a prompt and full-carload movement at a specified time of commodities of this character which will compare with the handling of ore, coal, bullion and similar commodities, which are regulated by the train load rather than by the car load and which are offered for shipment at a time and in such quantities as do not require movements of less than the maximum train load. It would seem to the writer not inappropriate to suggest that this is an era of the shipper educating the carrier rather than the carrier educating the shipper and he is inclined to think that the results shown by operating statistics would prove this to be correct. A casual glance at the condition of our equipment in recent years and operating statistics will suggest, he is quite sure, some inquiry as to the cause of certain apparent deficiencies.

In 1903 we had a total of 43,871 locomotives; in 1904 a total of

46,743, an increase of 2,872 engines; 1,585 of these were freight engines, the majority of them consolidation heavy freight engines, in many instances almost twice the tractive power of the freight engines of a few years ago. During the same period we also had added to our freight equipment 38,412 cars, most all of which were above the 60,000 lb. capacity. It is a significant fact, however, that during the year 1904 the average tons per freight engine were only 48,463 as against 51,265 for 1903 and 50,874 for 1902. The ton miles per freight engine showed a corresponding decrease, there being 6,456,846 in 1904 and 6,807,942 in 1903, proving conclusively that notwithstanding the very unusual addition in number and corresponding capacity of freight engines, that less work was performed both by engines and cars. This would seem to warrant the conclusion that a portion at least of this deficiency or very unfortunate waste of tractive power was absorbed in hauling the dead weight of the very heavy cars added to our equipment. These variations or changes in operating results are due, of course, to a combination of many causes, some of which pertain to railroad operation or administration and some of which are commercial and social in their character.

During the past few months the writer has had occasion to analyze certain items entering into general operating results or expenses on several lines and on some of these the 50-ton box car has played quite a prominent part, particularly in localities and under conditions especially adapted for the use of the 30-ton car, weighing from 34,000 to 35,000 lbs. The net revenue tons per train mile hauled on a small road or on a certain division of a large road, where they have quite a large volume of coal, ore, bullion and other heavy commodities suitable for movement in the 50-ton car and also a heavy local freight and merchandise business suitable for a 30-ton car, can be and frequently is reduced to a figure which, in the absence of a thorough analysis of the conditions, would indicate a lack of proper supervision by the adverse effect of the heavy local freight and merchandise trains being largely made up of 50-ton box cars weighing from 40,000 to 46,000 lbs. each, and in many cases having only 10 to 12 tons lading. Such conditions will make a very bad showing for any operating officer, and if viewed on a net ton mile basis only would destroy his reputation, and materially affect the net earnings. Under such a condition there is certainly a special field for the 30-ton car for local and merchandise service and the 50-ton car for the heavier and less bulky commodities of a different character, and any attempt to use the 50-ton car as a common standard under these conditions would be as impractical and expensive as to adopt a heavy consolidation freight engine of 45,000 lbs. tractive power as the standard engine for all kinds of freight service, without exception and with a view of eliminating all other types of engines from the road except the passenger engine.

In England the small car or "goods wagon" has been and is a success, and in such matters as are of purely a commercial or social character and go to influence or govern the size of cars in England, we are, as a nation, following closely in the footsteps of our English brethren, not because it is English, but for the simple reason that we cannot do otherwise. In order that this may be made a little clearer to any who may not be familiar with the conditions, let us briefly analyze the conditions that govern this phase of transportation.

The merchandise, freight or goods traffic out of London or any other commercial center includes quite a volume of business commonly called emergency or rush orders of merchandise of a general character held in stock in large quantities by the wholesale house or jobber, but not carried in sufficient quantities by the local or retail dealer in the smaller cities and country towns to supply the trade between their regular shipments of spring, summer, fall and winter goods or commodities. There are also financial reasons frequently which prevent the small dealer ordering all he might fairly anticipate as his legitimate needs for a certain period; therefore, from many causes unknown to the carrier, shipments of this kind in great numbers are delivered to the freight houses late in the afternoon, frequently with the distinct understanding and pledge on the part of the traffic department that they will be delivered at the home town, possibly 10; 20, 50 or 100 miles distant, at the time of opening of the business houses the next morning. Frequently the shipment only consists of a few hundred pounds. It is placed in the car and when its destination is reached the car is switched or shunted out of the train, which then proceeds, possibly repeating this operation at numerous towns along the line of the road. This, not because the railroad prefers these small hand-basket shipments, but because the shipper requires it and demands it and it must be provided in that manner.

In America such practices were little known years ago, most freight being ordered by mail; and in the sparsely settled districts two weeks to 30 days was considered a very prompt delivery, on the frontier two or three months. But things have changed. The small jobber in the outlying cities and towns, also the country merchant, calls up the wholesale house by long distance telephone without leaving his own office and places his order with the understanding that it is to be delivered at his town during the night or early the next morning. Thousands of such orders are coming in daily to all of the large commercial centers and the different railroads are vying with each other to see which can best serve patrons of this character. These shipments, although insignificant in bulk or revenue to the carrier, are frequently made by patrons whose shipments of a different character amount to a great deal during the year, and in order that they may be moved with promptness and despatch and at an expense that will bear some reasonable ratio to the revenue derived therefrom it is absolutely essential that equipment suitable should be provided. If the 50-ton box car is made a standard by any considerable number of lines these cars will, of necessity, be used in traffic of this character with the result that the net revenue tons per train will be largely reduced without a sufficient corresponding increase in earning capacity of these cars when handling a commodity for which they are especially adapted.

The freight car mileage for 1904 was 14,353,650,056; 31 per cent. of this was empty car mileage, which would indicate that there were many lines operated under a condition where it was almost impossible to secure loading in both directions for their cars. While this is doubtless largely the case in roads that are essentially coal or ore lines, yet much of it is in the agricultural districts where the empty mileage is box car equipment, handling an average of about 15 to 18 tons per revenue car. This would seem to warrant the suggestion, if not the conclusion, that a general utility car substantially built to meet all the physical conditions resulting from interchange service, with minimum dimensions of the American Railway Association's standard box car, of a capacity not exceeding 80,000 lbs. and with the probability that 70,000 lbs. would be more desirable, is not only the more typical, but more desirable commercially, physically and financially, as a common standard for American railroads, than the 50-ton car, although the latter has been made standard on some of the most important trunk lines, and by virtue of the interchange arrangements between American roads is not only in evidence on, but in some localities forms a no small part of the equipment used by, lines which have openly declared in favor of the 60,000 capacity and against the 100,000 capacity car.

It seems rather inconsistent, from a business and commercial standpoint, that large trunk lines should spend enormous sums of money in perfecting their permanent way, shops, yards and other facilities for handling their business, also equally large sums in the purchase of expensive motive power and equipment which is peculiarly adapted to their line and meets with the views of their officers, and then that a large portion of this equipment should be diverted into a class of traffic and on to lines where the conditions are directly opposite to those which prompted its purchase and where the officers in charge hold directly opposite views as to its commercial value as an operating unit and as to the practicability of its use. And while much of this modern heavy equipment is to be found on roads whose officers question its adaptability to the conditions which they have to meet, at the same time a no less conspicuous feature of what might be termed unbusinesslike conditions that result from the interchange of cars is the presence on the large trunk lines which have adopted the modern heavy car of a great number of the small antiquated cars belonging to the lines which do not favor the use of the big car. Many of these small cars were built years ago when the tractive power of our freight engines averaged about 25,000 lbs. The original construction being light, this, together with their age, renders their physical condition such that in some cases they are scarcely safe for service in light trains in local service, and are absolutely dangerous when placed in modern heavy trains handled by modern types of heavy freight engines; dangerous not only to the cars themselves, but in case of accident as a rule they are not only badly damaged, but are the direct or indirect cause of damage to the modern heavier cars with which they are intermixed in train service. The high cost of freight car repairs on some lines can be traced to the retention in service in some cases of light antiquated equipment that should have been retired from service immediately following the advent of the large steel car.

One of the most prominent systems in the country, which has adopted the 50-ton car with steel under-framing as a standard, is to retire this year from service 16,000 of the small antiquated freight cars. Aside from the reduced capacity, together with the increased cost of maintenance of the individual cars which are to be thus retired, it is not unreasonable to suppose that the question of safety in connection with their use along with the large car may have had some bearing in reaching a conclusion in reference to their retirement. It would not seem unreasonable that the Master Car Builders' Association should seriously consider some amendment to, or modification of, the present rules of interchange which, while not restricting any railroad company as to what it should use on its own lines, would establish some reasonable line of demarcation as between what might be considered antiquated and unsafe equipment and what is of such physical condition and character as to meet any and all conditions, and this without in any manner abridging the rights of the owners or without any resulting inconvenience to the shipper, and which would at the same time harmonize with

the spirit which has prompted many of the more progressive roads into making unusual strides in the matter of improved equipment.

All-Electric Interlocking at Council Bluffs.

The Union Pacific has now in course of construction at Council Bluffs a Taylor all-electric interlocking plant, made by the General Railway Signal Company, of Buffalo, with which there will be controlled from a single tower all the switches and signals from the east end of the Missouri river bridge eastward to the Union Pacific Transfer Station. There will be 65 working levers in a 72-lever frame. The average number of daily train movements at the junction is 240, and five switching engines are constantly employed in moving cars from one railroad to another and to and from numerous private sidings.

Fig. 1 shows the arrangement of the tracks, switches, derails and signals, and the wiring, outside of the cabin, for electric locks. The wires for other purposes are carried on the same poles, but are not shown here. Fig. 1 is not drawn to scale, but is approximately correct as to longitudinal proportions except where pieces are cut out, as between signals D 08 and 08. The approximate distances are, beginning at the left or west end of the plan: From D 02 to 02, 2,500 ft.; from 02 to 72, 2,500 ft.; from 72 to 70, 3,000 ft.; from 70 to 23 (dwarf), 775 ft.; from 23 to 69, 750 ft.; from 69 to the cabin, 450 ft. From the cabin to the farthermost switch (58) near signal 70, the distance is 1,865 ft.

The lines north of the cabin constitute two double-track railroads, one of which is used by the Union Pacific and the Chicago & North-Western, and the other by the Rock Island, the Milwaukee and the Wabash, as shown on the drawing. The tracks south of the cabin extending directly east lead to private industries, and those to the southeast to distributing yards and engine houses, and to the main line of the Burlington.

The home signals are all fitted with electric slots, so as to be thrown to the stop position by the action of the track circuit relay as soon as the engine of a train passes the signal. The distant signals are controlled by their home signals and also by circuit breakers which are opened by the home signal on the same post, except No. 72, at which point there is no home semaphore signal. There is a disk, but this is not depended on to operate a circuit breaker. This distant signal has a slot of its own.

In all high-speed tracks the switch levers will be locked by track circuit locking, and mechanical detector bars are to be used only on the yard tracks used for low speeds. In consequence of disturbance in the track from currents leaking from power and street railroad circuits, amounting to as much as five amperes, it was found necessary to use alternating currents for the track circuits. These are used throughout the plant, and for the block signals as far as the Missouri river bridge. The current for the track circuits is delivered from transformers, made by the Union Switch & Signal Company, which take 400 volts from the line, and the relays will be of the type used in the New York subway, made by the same manufacturers.

In Fig. 1 secondaries of transformers are shown connected to track in place of the usual track battery. On the Missouri river bridge an ordinary track battery is used. This is necessary on account of the difficulty of running high-tension wires over the bridge.

The power for this plant is to be supplied by the Omaha Electric Light & Power Company, at 400 volts 60 cycle alternating current, but there will be an emergency a.c. generator in the signal cabin for use in case the power company's line should fail. This will be driven by a gasolene engine.

The main battery for moving the switches and interlocking signals will consist of 55 cells of Electric Storage Battery Company's type E, of 120 ampere hour capacity. This will be charged by a Crocker-Wheeler 125-volt 2-k.w. generator. To charge the storage batteries that are to operate the automatic block signals and the annunciators there will be one Crocker-Wheeler type L 250-volt 2-k.w. generator. These block signal and annunciator batteries will be the Electric Storage Battery Company's type ET, with cells of 36 ampere hour capacity. Of this type there will be double sets, making 252 cells in all. For the track circuits there will be a Fort Wayne 400-volt, 60-cycle, 2-k.w., single-phase, alternating-current generator. This generator will be used only in emergencies, should the power company's line go down or the main transformer burn out. All the generators will be driven by a Westinghouse three-phase, 60-cycle, 5-h.p. motor, type CCL; and the emergency gasolene engine referred to will be a Fairbanks-Morse of 6 h.p.

The resistances in the line circuits for the block signals and annunciators are so arranged that they are all multiples of 1,016 ohms. This was necessary in order to have all the batteries exhaust at the same time. In this way complications in the charging circuit are avoided, as all the batteries can be charged at once. The result is that the batteries consist of from one to four sets of seven cells in series.

Consequently, to provide for a charge and discharge of the line storage battery it was necessary in one place to provide for throwing four sets of cells from series to parallel and from parallel to series, with charge and discharge. The wiring for one of these switchboards is shown in Fig. 3. This switch is used at the signal bridge on which signals 1, 2, 3 and 4 are situated. It has three sets of five-pole, double-throw knife switches, of 15-ampere capacity, mounted on a slate base. These three switches are connected together, and as one lever will throw them all at once, no mistake can be made. This switchboard throws a set of four batteries from parallel discharge to series charge, at the same time that it throws another set of four from series charge to parallel discharge.

The power switchboard consists of three main units—one for the 250-volt line circuit, one for the 125-volt main battery charge circuit, and one for the 400-volt a.c. generator.

The equipment of the switchboard will consist of two d.c. volt meters, two d.c. ammeters, one a.c. volt meter and one a.c. ammeter, all Weston instruments. There will be two sets of ground lamps, one for each d.c. circuit. There will be two no-load cut-outs, one for each d.c. circuit; three rheostats; one three-pole, single-throw knife switch to control the induction motor; one two-pole, single-throw knife switch to control the tower lights; one double-pole, double-throw knife switch to throw the alternating line from the

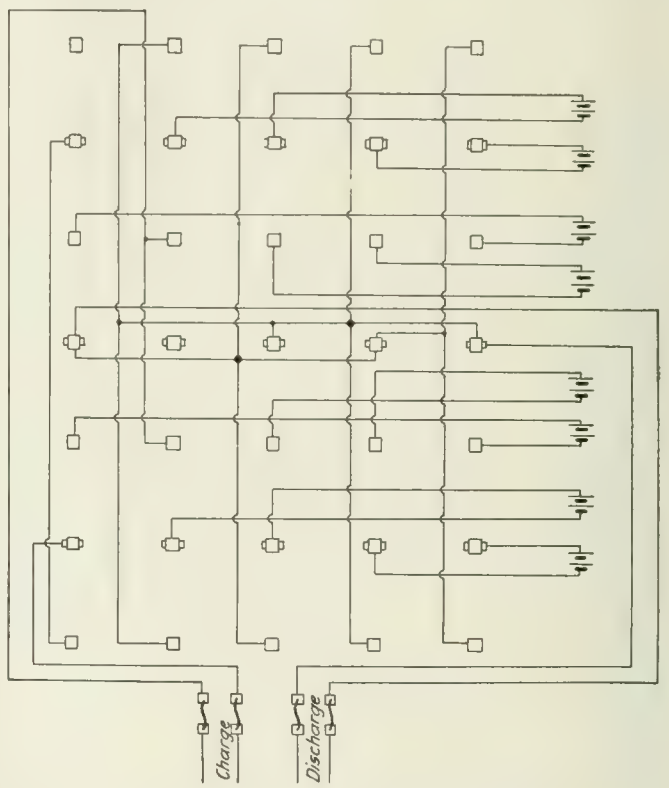


Fig. 3—Wiring of Switch.

power company's transformer to the 400-volt generator; one double-pole, double-throw knife switch so arranged that the main battery can be charged either separately or in series with the local lock battery of six cells.

This switchboard will be made by the General Railway Signal Company. The distributing switchboard will be of the General Railway Signal Company's three cut-out type. Cut-out A, Fig. 2, controls signals 1, 2, 3, 4, 16, 17 and 69, and switches 28, 29, 30, 31, 46, 47, 48 and 49. Cut-out B controls all switches and signals west of and including signals 19 and 20. Cut-out C controls all the rest.

The electric locking may be understood by reference to the wiring on Fig. 1, and to Fig. 2, which shows the wiring in the cabin. As there are home and distant signals on the same posts, the approach locking of one section overlaps the detector locking of the next one. The working of the electric locking may be understood from a description of one circuit. For instance, the eastbound approach locking at the extreme west end operates as follows: Suppose a train to enter the section of track marked A, the armature of relay No. 6 would drop, and thereby open the circuit through its points so as to de-energize annunciator No. 6 in the tower (Fig. 2). Annunciator No. 6 controls high-tension relay No. 7 through its front point and wire a, b, c, d. The circuit for high-tension relay No. 7 also goes through the front point of annunciator No. 7. These two front points are bridged by a circuit breaker on the lever of distant signal No. 72, so that, although the points of either of these annunciators may be open, high-tension relay No. 7 is not affected

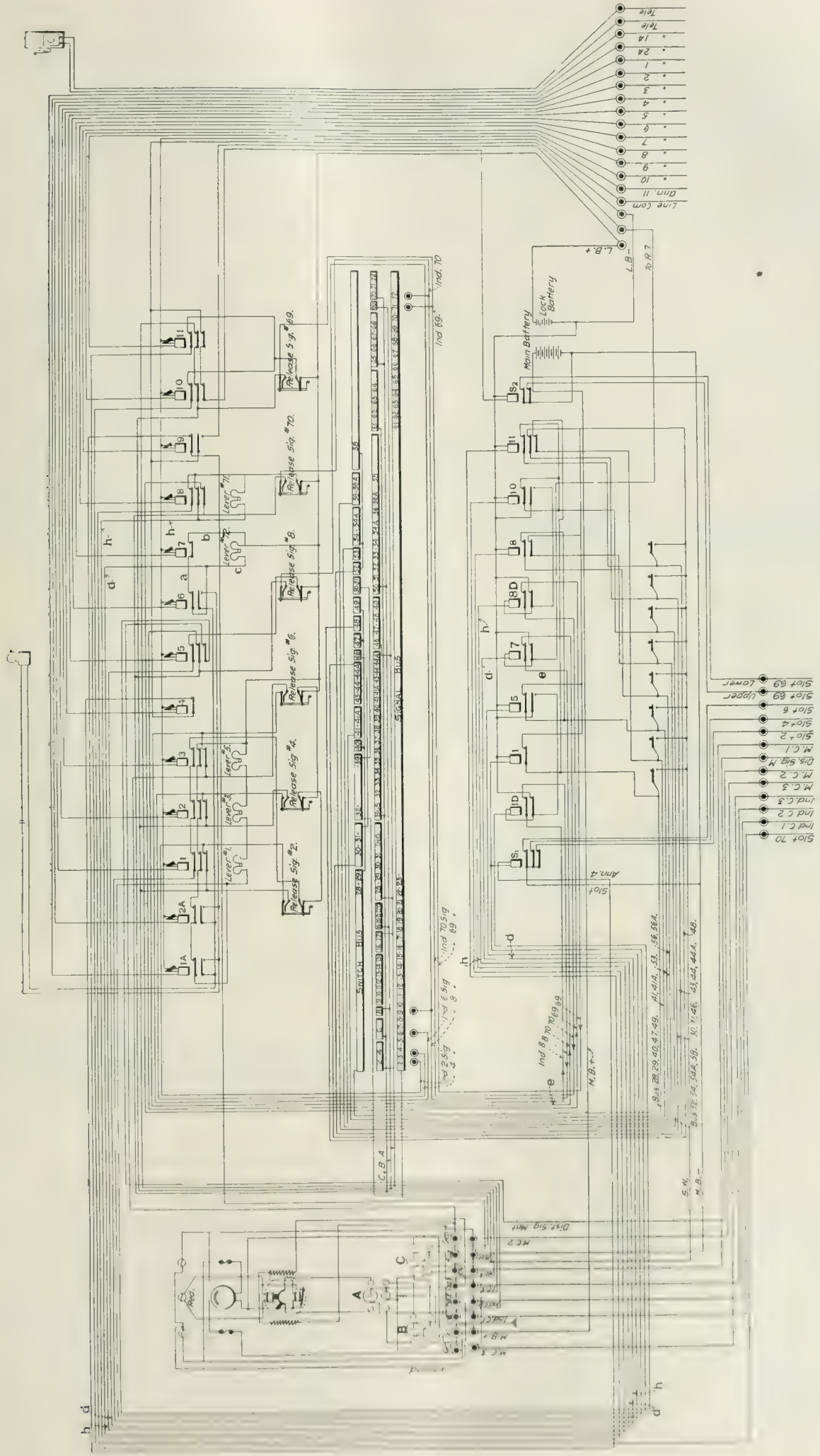
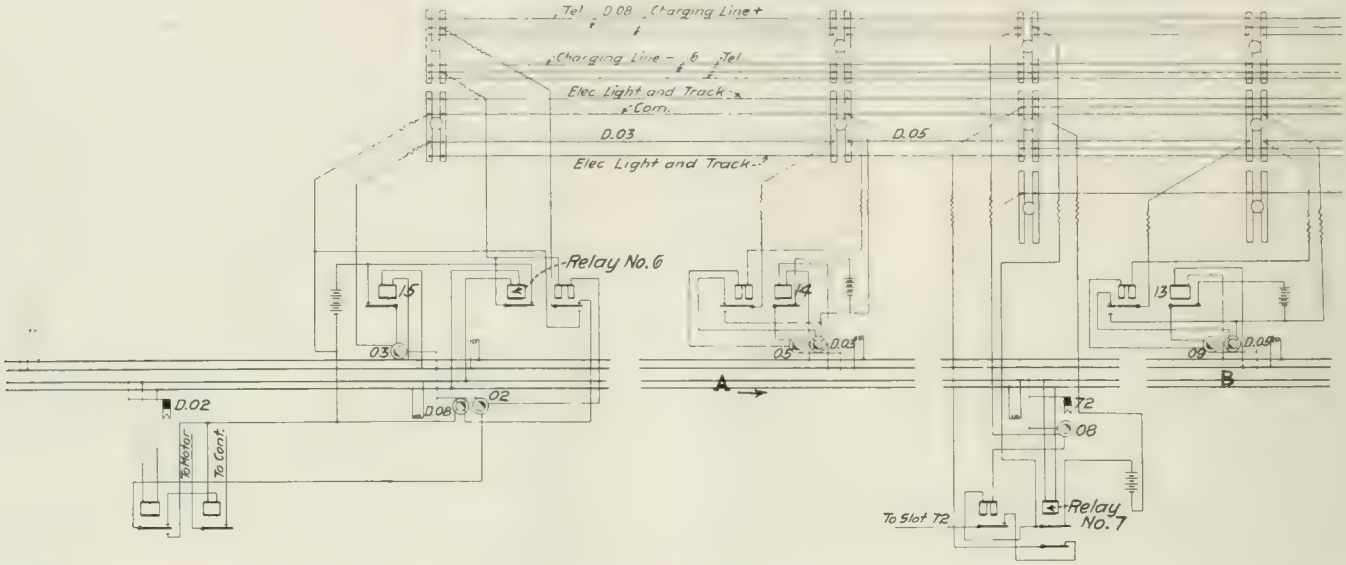


Fig. 2—All-Electric Interlocking at Council Bluffs, Iowa, Union Pacific Railroad—Wiring in Cabin for Electric Locking.

The arms in this drawing referred to in the description are those connecting annunciators 7 and 8 in the upper part of the drawing with electro magnets 7 and 8D in the lower part. The first mentioned may be called the "A" arm and the latter the "D" arm. An A train passing 1 eastward opens annunciator 6; and high-tension relay 7 (wire a, b, c, d). This circuit is effective only when lever 72 is reversed; Relay 7, open, breaks the indication circuit for this lever while 72 is off.

unless lever 72 is reversed. But, supposing lever 72 reversed (signal 72 cleared), a train entering section A will drop the armature of high-tension relay No. 7, which will break the indication circuit of signal No. 70. As signal No. 70 must have been cleared before signal 72 could be cleared, it is readily seen that, under the above conditions, it will be impossible to restore lever 70 to the normal position while a train is in section A B—that is, between the distant and the home signal—for the indication cannot be received. When a train has passed signal 70, track relay No. 8 drops its armature, thereby de-energizing annunciator No. 8 in the tower. Annunciator No. 8 controls high-tension relay No. 8 directly through a front point. High-tension relay No. 8 controls through its front point the control or operating circuits of switches Nos. 58, 56, 56A, 54, 54A and 52; so that when a train is on the rails forming the circuit between signal No. 70 and the back-up dwarf signal No. 23, the restored on section No. 10, which is shown on the plan by letter D, so that when a train has passed signal No. 69 it is possible to make reverse movements. But while a train is in section No. 9 (C) it is impossible to clear signal No. 70, as the slot circuit for this signal runs through the points of the relays of sections B and C.

The screw hand releases operate as follows: The circuit for each high-tension relay controlled by an annunciator in a home signal track circuit is taken through a normally closed contact on a hand release. Each hand release has also a normally open contact so connected as to cut out all breaks in the indication circuit of its home signal should the contact be closed. Therefore, the first turn of a hand release will break the circuit of a high-tension relay controlling the switches in the route so that they cannot be moved; and the last turn will shunt out all breaks in the home signal indication circuit so that the return current can operate the indica-



Wires with numbers only are for control of corresponding annunciators or block signals.
Ch + — Positive charging line.
Ch — — Negative charging line.
Com. — Line common.
Tel. — Telephone.
Cont. Sig. 72 — Control circuit for signal 72.
Elec. — 400 v. electric light and track circuit primary feed wires.

Dis. Sig. Motor — Positive wire to operate motor of distant signal No. D 09 controlled by the signal man.

M. C. — Main power common. That is, the 110 v. common for the interlocking functions.

Slot 69 up — Slot of upper arm of signal 69

Slot 69 low — Slot of lower arm of signal 69.

Ch. feed = Feeder for charging circuit. This circuit charges the block signal and annunciator storage batteries.

Signal D 02 is controlled from station A in the Omaha passenger yard.

Though only one battery is shown at each location, there are two sets, one on charge and the other on discharge.

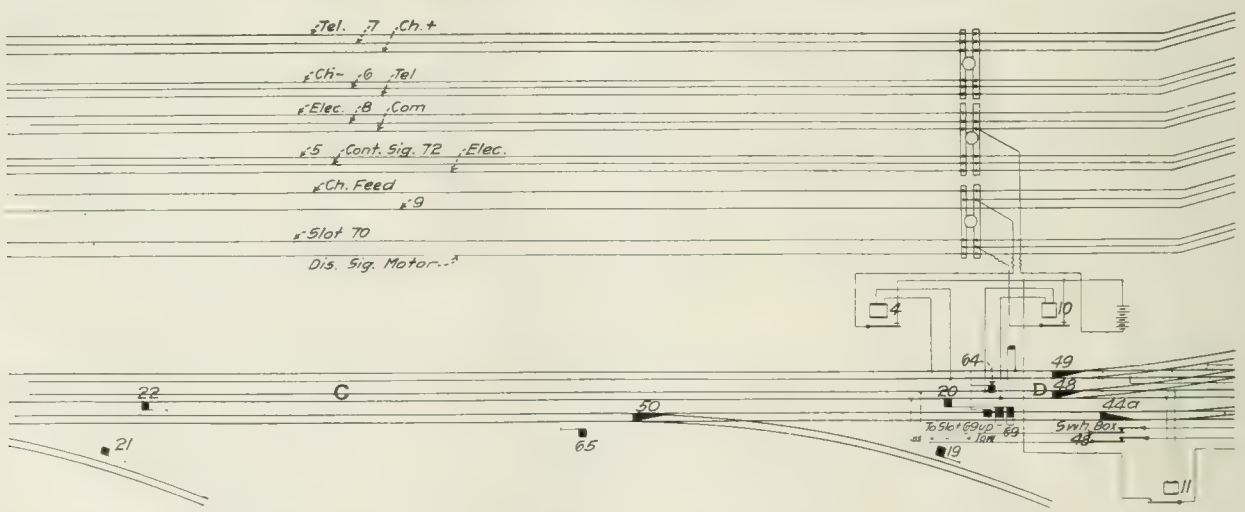


Fig. 1—Electric Locking Circuits of Interlocked Switches and Signals on the Union Pacific at Council Bluffs, Iowa.—Continued on opposite page.

The four parts of this diagram are to be read from left to right across both pages, the western end of the yard being at the top of this page.

power is shut off from all switches and derails in this circuit, and they cannot be moved until the train has passed out. Also, annunciator No. 8 controls through a front point, parallel with the circuit breaker on lever 71, high-tension relay No. 8D (through wire h). No. 8D controls, through its front point, indication circuit of signal No. 69; so that, when a train passes signal No. 70 with distant signal No. 71 clear, it is impossible to restore signal No. 69 to the normal position while the train is in this circuit. High-tension relays No. 7 and No. 8D are stick relays; that is to say, they break their own circuit through a front point. The restoring point for No. 7 is track section No. 9, which is shown on the plan by the letter C. Consequently, when a train enters section No. 9, high-tension relay No. 7 is restored, and it is possible to return signal No. 70 to the normal position, thereby allowing reverse (westbound) movements to be made on this track past signal No. 23. No. 8D is tion magnets. Now, as the switches in the route cannot be moved with the screw hand release in this position, the signalman is obliged to restore it.

All the rest of the electric locking in this plant works in the same manner. That is to say, the approach locking does not operate unless the train approaches the distant signal with the distant signal clear. If it is clear, it is impossible to restore the home signal lever to the full normal position until the train has passed the home signal itself or the first back-up dwarf signal in the route. It will be seen by reference to the plan that the approach section for the double signals 3 and 4 on the North-Western and signals 1 and 2 on the Rock Island extend out beyond the interlocking limits to points E and F, which are approximately 1,000 ft. back of the signals. All slot circuits are taken through switch-boxes on all facing point switches in the route, and where there are two arms

the signals are selected by means of the slots. The signal common wire is not broken through the switch-boxes.

The double-arm signals, where they have a home and a distant blade, are a combination type. The home arm is the new General Railway Signal Company's enclosed mechanism signal, using the vertical motor (described in the *Railroad Gazette* July 14, 1905, page 42). The distant arm is operated by one of the old-style Taylor motors clamped on the post, with a rod outside the post.

The disk signals shown on the drawing are Hall automatic block signals, which have been in service at this point for a number of years.

For the foregoing information we are indebted to Signal Engineer J. C. Young and to W. H. Arkenburg, who until recently was chief draftsman and who designed the electrical features of the plant. Mr. Arkenburg's arangement of electric locking was described in a recent letter to the *Railroad Gazette*, and also in a paper which was read before the Railway Signal Association at its meeting in New York City last month.

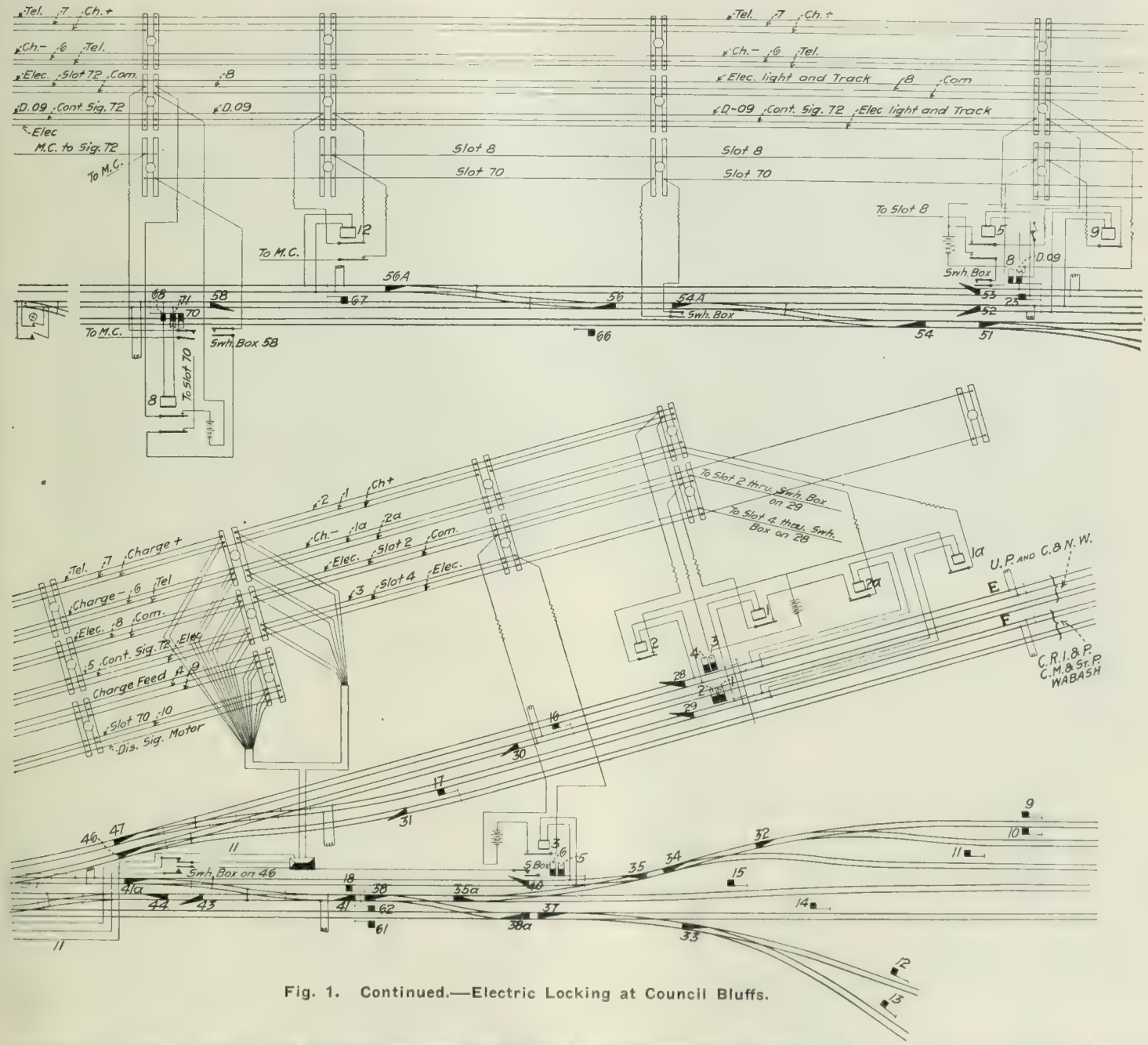


Fig. 1. Continued.—Electric Locking at Council Bluffs.

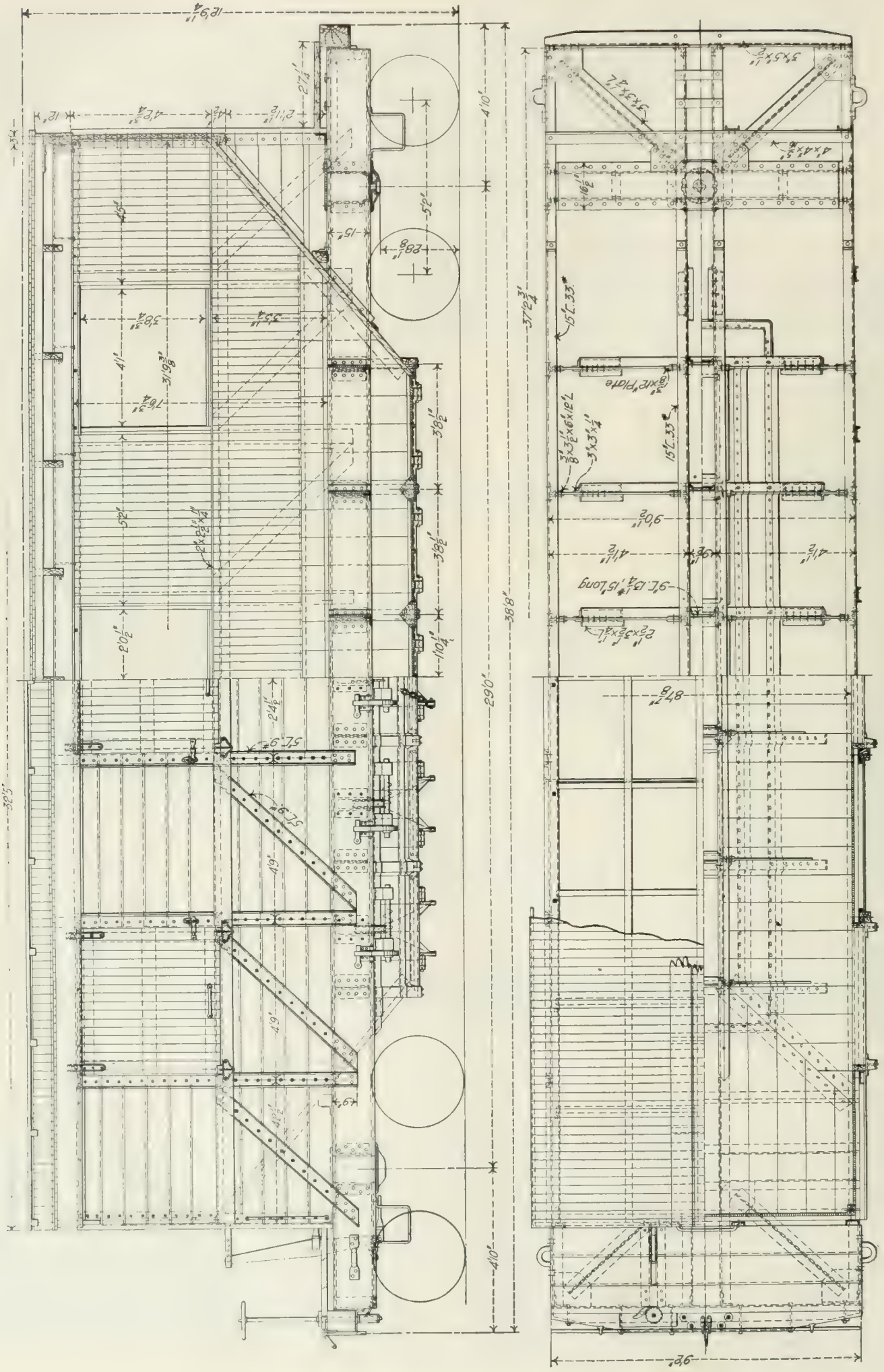
The capacity of Russian freight cars has been increased 20 per cent. without the intervention of any new construction, but simply by the order of the Ministry of Transportation that the standard freight car, heretofore limited to a load of 750 poods, hereafter may carry 900 poods. This short and easy method is not altogether unfamiliar in this country; where in the early days of increasing car capacity it was known as the "paint brush method," and consisted in changing the figures after "capacity" on the sides of a car. It is not many years ago that the permissible carload in Russia was increased from 600 to 750 poods; but then some strengthening of the springs was required.

Phosphate Cars for the Atlantic Coast Line.

The Atlantic Coast Line has recently received from the Middletown Car Works 75 phosphate cars built from the designs of Mr. R. E. Smith, General Superintendent of Motive Power. The phosphate rock which occurs in large beds in South Carolina is an excellent natural fertilizer and the Atlantic Coast Line handles a large tonnage over its lines. The cars used in this traffic are a combination of a box car and a center dump hopper car. They are 38 ft. 8 in. long over end sills and 31 ft. 9⅜ in. long inside of body, and have a capacity of 80,000 lbs.

The underframe is made up of four longitudinal sills, each 15-in., 33-lb. channels, with wooden end sills supported on a ½-in. x 3-in. x 5-in. bracket angle riveted to the ends of the longitudinals. The center sills are spaced 9½ in. apart back to back, and are separated by short pieces of 9 in. channel put in at each hopper support. A simple design of body bolster is used consisting of two 15 in., 33 lb. channels with flanges out, spaced 10 in. apart. A ½-in. top cover plate is riveted to the top flanges and the bottom of the box section is formed by a 10 in., 15 lb. channel riveted in between the two heavy channels. The bolster is built up around the center sills, which are continuous from end sill to end sill, by cutting away the flanges of the bolster channels and fitting up the webs tight against the sill webs.

The hopper floor slopes from the ends and sides to the five long and narrow hopper doors under the center sills. The floor is made up of 13/64-in. planks and has a slope of about 48 deg. from the horizontal. The sides are supported at the top by the wooden sill on top of the channel side sill and at the bottom by two ¼ in. x 3 in. x 3 in. angles parallel to the door openings. At the junction of the drop doors plate cross bearers or hopper supports ⅜ in. x 12 in. are



Plan and Side Elevation of 80,000-lb. Phosphate Car, Atlantic Coast Line.

riveted across between the side and center sills. These support 3-in. x ¾-in. iron straps which pass under the center sills and support the floor angles as well as the hopper door frames.

There are five hopper doors having openings 3 ft. x 11 in. These openings are closed by iron doors hinged to the door frame along one side. Two deep lugs are cast on the doors opposite to the hinges to which the winding chains are attached. Two chains are used to each door, fastened to a ring to which the single winding chain is also attached. This single chain passes over a large sheave carried in a bracket riveted to the inside of the side sill and down to the winding shaft mounted on the bottom flange of the side sill. The center sills and door frame castings are capped with triangular blocks so that none of the load will lodge on them.

Above the side sills and below the belt rail the body is built like a gondola with longitudinal side planks bolted to a trussed side frame of 5-in. 9-lb. channels. The posts in this frame are carried up to the plate, but the braces extend up only to the ¼-in. x 2-in. x 2½-in. angle girth. In the middle panel the brace is omitted.

Above the belt rail are three door openings 3 ft. 8¾ in. x 4 ft. 1 in., closed by overhung sliding doors fitted with seal locks as in an ordinary box car. These doors are used for loading the cars from platforms. The roof is made of two layers of boards with a layer of Armitage three-ply plastic roofing paper between layers. Inside lining, $^{13}/_{16}$-in. thick, is put on the sides and ends from the floor to the plate.

The brake cylinder, triple valve and detached auxiliary reservoir are mounted above the sills under the end slope at one end of the car. The cylinder lever is vertical and works in a fulcrum attached to the end girth.

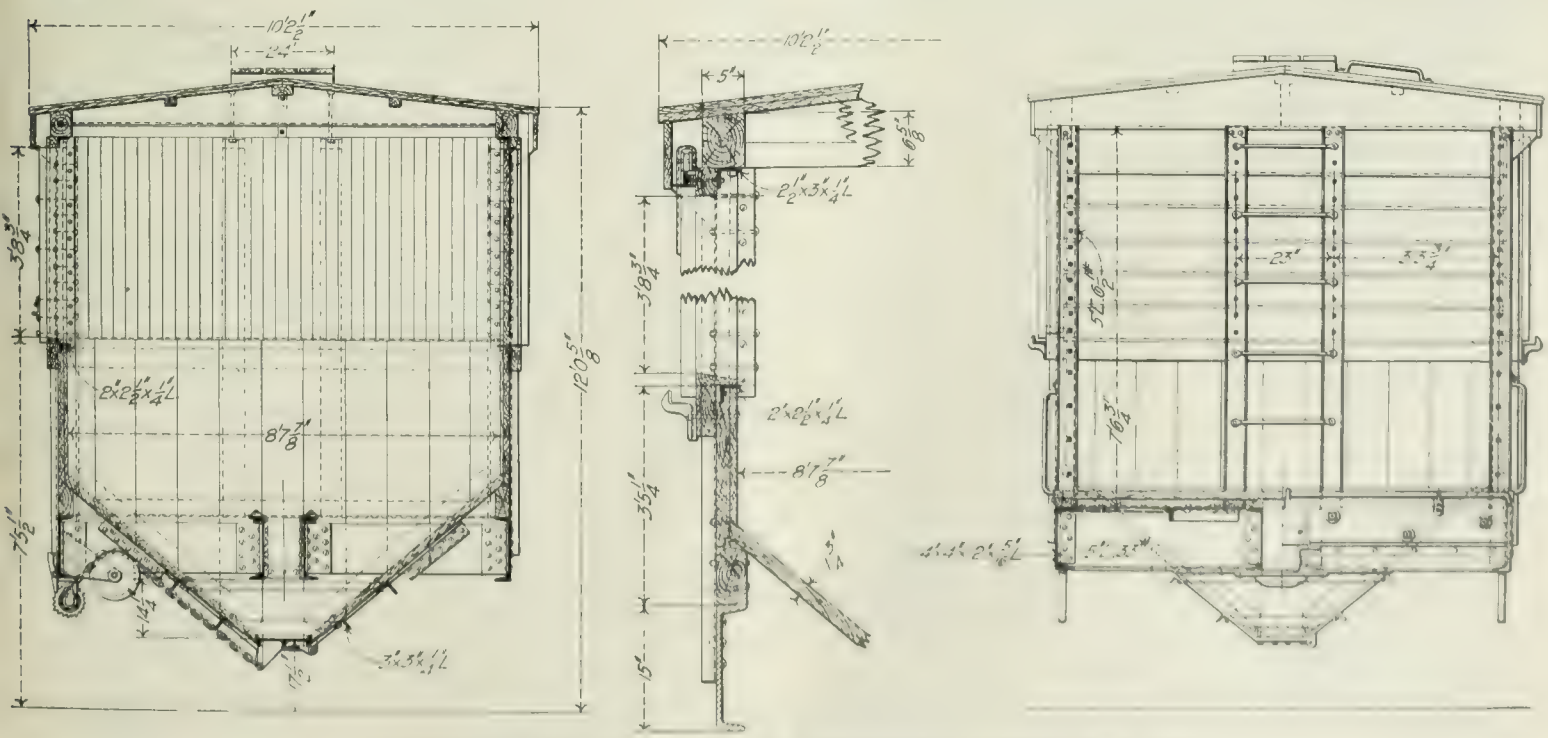
We are indebted to Mr. George I. King, Vice-President and General Manager, Middletown Car Works, for the illustrations.



40-ton Phosphate Car, Atlantic Coast Line.

New Railroad Laws in New York.

The Legislature of New York has passed this year two general laws affecting railroads, in addition to the Elsberg bill and two others having to do mainly with rapid transit in New York city. The most important general law is that which was introduced by Senator Barnes, extending the liability of railroads for injuries to employees. By this law any employee suing a railroad or a receiver for personal injury arising from the negligence of the corporation, the receiver, or any officer or employee, shall have the same rights and remedies as are now allowed, and, in addition, it shall be held that other employees entrusted with authority of superintendence, control or command, or with authority to direct another employee



Cross-Section and End Elevation of Phosphate Car, Atlantic Coast Line.

in the performance of duty or having physical control or direction of the movements of a signal, switch, engine, car, train or telegraph office, shall be deemed vice-principals and not fellow servants. If an employee is injured by a defect in machinery, cars, engines, attachments, etc., when such defect could have been discovered by the employer by reasonable care, tests or inspections, the employer shall be deemed to have had knowledge of such defect; and proof of the defect shall be prima facie evidence of negligence of the employer. This law runs in favor of executors and administrators in case of a deceased employee; it does not affect actions now existing; and no contract between the employer and employee shall limit liability.

The other law is Chapter 380, amending the railroad police law so that the Governor may appoint special railroad policemen for service at any place (limitation to stations and steamers abolished).

An act regulating demurrage and requiring reciprocal demurrage was passed but was vetoed by the Governor as unconstitutional.

The Chilled Car Wheel from a Manufacturer's Standpoint.

BY P. H. GRIFFIN,
New York Car Wheel Co.

The chilled car wheel situation at the present time is not encouraging. Prices paid for wheels are lower in proportion to the cost of material and labor than they were last year, and present conditions of guarantee are likely to be made more, instead of less exacting. The wheel makers presented the question of guarantee at the Manhattan Beach Convention of the Master Car Builders' Association last June and made clear the impossible nature of present practice. A committee of the Association was appointed to consider the subject and no doubt a report will be made at the convention next week.

The wheel makers' report of last year was the result of careful investigation of the whole subject, and was made after conferences extending over a period of six months, at which every wheel foundry in the country was represented. As any change in present conditions of guarantee must be accepted by the railroads the wheel makers themselves can accomplish nothing beyond presenting for the consideration by the railroads, recommendations which from the standpoint of the makers would improve the wheel situation. Railroad officers, however, generally look upon the solution of the chilled wheel problem as one for which the wheel makers are responsible. The fact is, however, that the railroads themselves are the sole parties to determine the price paid for wheels, and therefore the quality of wheel which is furnished. The conditions attending the manufacture and use of chilled wheels have changed radically during the last eight years, and prices and guarantees which may have been reasonable a few years ago are most unreasonable now. The severity of wheel service has more than doubled in the past five years on account of the increase in loads carried. The net price per pound paid, however, is lower now than then, and the length of service for which guarantees are demanded has been increased instead of being decreased. The conditions under which guarantees are now enforced make the cost per wheel to the manufacturer greater than ever before. Some years ago a mileage guarantee of three or four years' service was considered ample, and the wheel maker was allowed to examine wheels removed from service on account of defects due to manufacture to ascertain the justice of claims for replacement. Now many railroad companies retain possession of wheels on which replacement is demanded and a bill is rendered against the wheel maker of $2 per wheel for the cost of such replacement. In some cases, wheel makers are not allowed to inspect such wheels and have no knowledge of the cause of failure. This practice may be convenient for the railroads and may avoid discussions as to whether failures are due to conditions of manufacture or not, but the injustice of it is apparent.

A few years ago, certain tests to determine the strength of wheels and depth of chill were imposed by one or two railroads using large numbers of wheels, and these tests were gradually adopted from time to time by others. It was the intention of these tests to determine the quality of wheels offered, and by testing representative wheels. To accept or reject certain lots of wheels. Service guarantees were not demanded; the wheels having been accepted as suitable for service under the tests, it was considered fair for the wheel maker to be relieved from further responsibility. Some railroads soon began to adopt the practice of imposing the tests referred to and also requiring a service guarantee. As the demands of service became more severe the severity of these tests was increased from time to time, until now it is difficult to make wheels which will stand both the tests and the service imposed. Wheels can be made which will do one thing or the other, but, at some prices paid, wheels cannot be made which will properly do both. The tests require wheels to resist extreme strains never developed in service, and the wheel maker must make a constant effort to turn out wheels to stand the test in order that any may be sold, regardless of whether they will stand the service or not.

It is of vital importance to the railroads themselves that wheel makers should be allowed to examine wheels for which claims are made under the guarantee of failure in service. The increasing load carried by the wheels and the increase in speed of trains are developing new causes of failure and intensifying others that were not so important a few years ago. If wheel makers have no opportunity to investigate failures and, through the knowledge gained by such investigations, of providing the means of overcoming the particular causes of failure, it is evident that the railroads will be the great sufferers. When a wheel fails in service, whether from defects due to manufacture or from those that arise from some condition of service, the wheel maker may be called upon to stand a charge of $2, or to replace the wheel which failed; but there is no such limit for the railroad company, a broken wheel may involve the loss of life and property. For this reason alone the railroads should invite every means of providing against such a contingency, even if it does involve some trouble in the matter of wheel inspections and adjustments of claims.

It has been asserted by some that the chilled car wheel has reached the limit of its capacity and that something must be found to take its place. No doubt some railroads that are getting just the cheap wheels that they pay for may believe that it will be necessary to find something better, but it is doubtful if the great majority of railroads will abandon the most economical and serviceable article of railroad equipment because it cannot be made cheaper and cheaper from year to year. The difference between the cost of good and poor wheels is so little that the remedy for the trouble now existing would be quickly found if the railroads would abandon the idea that it is of vital importance to save a little money in the purchase of car wheels at the cost of losing large sums in service results. Until the railroads are ready to meet this additional expense in the beginning and to abandon the idea that guarantee requirements should be increased from year to year, instead of being decreased in proportion to the increase in load and speed, the necessary improvement cannot be obtained. The chilled cast-iron car wheel, properly made, is fully equal to any present service requirements. The railroads that have not been carried away with the idea of buying wheels regardless of cost and have conscientiously encouraged the improvement of the chilled wheel to withstand the service under 50-ton cars have demonstrated the capacity of such wheels. There are many thousands of wheels in service under such cars which have been in use quite long enough to conclusively prove their suitability and safety. They were made under conditions of price and guarantee, however, that enabled the wheel makers to turn out a really good wheel. To sum the whole matter up, either the most important thing is to save every possible penny in the purchase of chilled wheels regardless of service results, or to obtain wheels that are equal to the demands made on them at a reasonable price that would enable the successful manufacture of such wheels.

It serves no purpose to equip passenger trains with every device and improvement that can add to comfort and safety and to run them closely following freight trains on the same track, or on adjacent tracks used by freight trains, when the latter are equipped with appliances that are unsafe. The constant effort to reduce the time interval between trains and to increase the speed makes the danger of accidents from wrecks caused by wheel failures more and more imminent; yet to-day the railroads are buying and putting under freight cars chilled wheels which are not strong enough to stand the service. Wheel makers, no matter how inexperienced in the making of good chilled wheels, can secure orders from the railroads by quoting lower prices or giving longer guarantees. A low price paid by one railroad soon becomes the established price for other roads. It is a fact that for several years some of the most important railroads have placed orders for wheels under such conditions of price and guarantee as to make their orders absolutely undesirable to responsible wheel makers, because wheels of good quality cannot be made at the prices paid except at an actual loss. Some railroad officers seem to think that it is the duty of wheel makers to refuse to accept orders under such conditions, but it is not always expedient or possible to do so. No doubt the competition between individual wheel makers has led them in the past and will probably lead them in the future to accept orders on whatever terms are offered and to cut down as much as possible the cost of manufacture and, consequently, the quality of wheel supplied. The railroads, however, eventually get the quality of wheel they pay for.

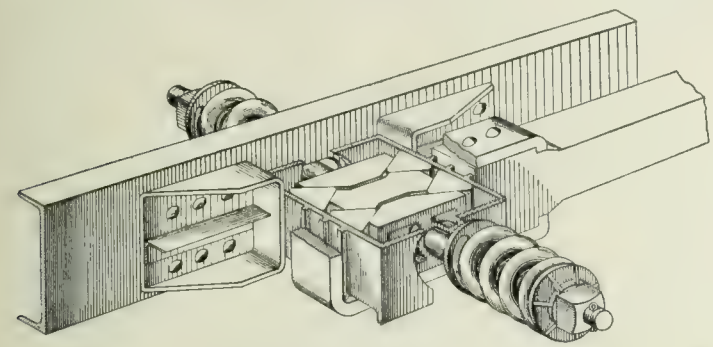
The bargaining for low prices has resulted, in the case of large contracts for some of the important railroads, in placing or withholding orders for wheels on account of a difference in price that would not amount to more than five or ten cents a wheel. This is economy gone mad. Such a small difference in the price would seem to make no particular difference to buyer or seller, or to necessarily involve any falling off in the quality of wheels obtained. But such bargaining has gone on year after year, and the point was reached some time ago where wheels capable of standing up under the increasingly severe conditions of service, on account of greater speed and higher loads, could not be made for the price paid.

One of the unfortunate phases of the situation is that a large part of the wheel renewals under cars are made on foreign cars, and if one or more railroads are buying wheels of inferior quality such wheels are distributed all over the country. A road that insists on buying good wheels and is willing to pay a fair price for

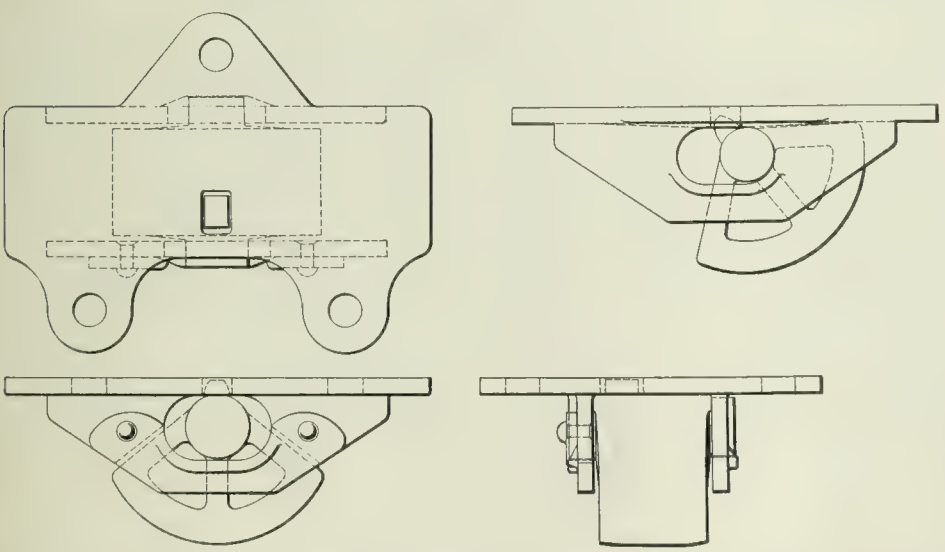
them, may thus be subjected to serious accidents from the failure of inferior wheels under foreign cars, or even under its own cars which have had wheels renewed on some foreign road. Until a price is paid that will enable the use of proper material and conditions of manufacture the railroads collectively and individually must accept the consequences sure to result from the use of cheap wheels. It is the misfortune of the chilled wheel that it is so cheap. Scrap value considered, the cost of eight wheels for one car is less than $40. The addition of $10 to the cost of wheels per car would solve the difficulty. It would seem to be worth this to achieve the desired results in view of the fact that many times this amount is certain to be quickly expended in meeting the cost of failures due to present conditions.

The Cardwell Friction Draft Gear and Rocker Side Bearing.

The Cardwell friction draft gear, illustrated herewith, has over 200 sq. in. of friction surface in contact in its normal state. This increases as the gear comes into action to a maximum of 252 sq. in., the increasing surface contact being coincident with increasing pressure from the springs. The peculiar feature of the gear is the location of the springs outside the center sills, with provision for the bodily movement of same with the central portion of the gear, the travel of which approximates one-half the total travel of the coupler.



Cardwell Friction Draft Gear.



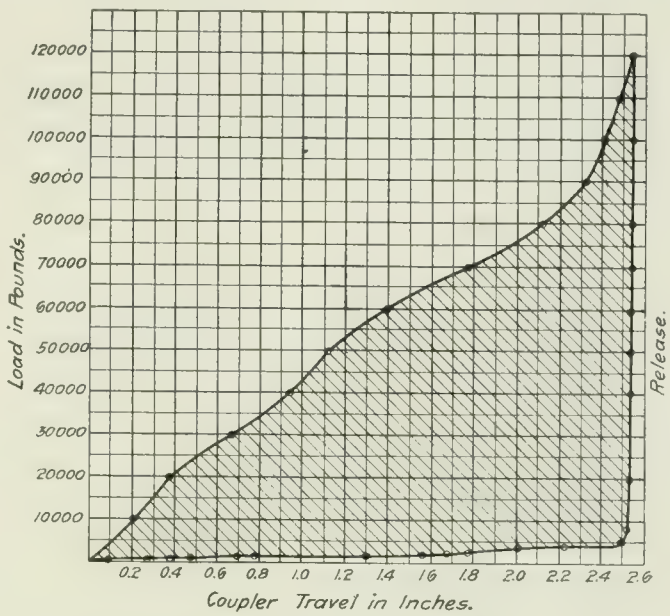
Cardwell Rocker Side Bearing.

The special advantages claimed for this disposition of parts is the availability of the entire space between center sills and within coupler yoke for friction parts; and accessibility of the springs for ready inspection and repair. A broken spring can be replaced without otherwise disturbing the gear, and without having to take the car to the repair track. Ease of adjustability in case of lost motion either from wear of the friction parts or set in the springs is another important advantage, the tightening of the nuts on the spring rod being all that is necessary. The relation and interaction of the friction parts is such that acute wedge angles are maintained throughout the range of action of gear, making it sensitive to the action of the coupler whether the blows be light or heavy.

The friction casings or pocket follower plates surrounding the wedges are malleable iron. The upper portion is cut away in the illustration so that the heavy transverse striking edges of the two, which limit the travel of the gear, are not seen. The springs are M. C. B. standard.

The ultimate capacity of the gear is 160,000 lbs. The accompanying diagram of compression test by R. W. Hunt & Co., Chicago, was made primarily to determine the character of the release curve and was not carried up to the capacity of the gear. This line is practically vertical from the maximum, 120,000 lbs., down to 5,000 lbs. The gear tested had been in active service for eight months on the car from which it was taken. In service tests of the gear, loaded cars have been run together with relative velocities beginning with two miles per hour and increasing to 18 m.p.h. without damage to cars or gear. The most practical test, however, is the results yielded from its use on a thousand cars in service for more than a year without repairs to the gears.

Four classes are made. Class A is for wooden cars. In the aplication to same, ½ in. metallic draft plates, extending from end sill over body bolster and bolted to end and center sills and bolster, are used. Class B is for interchange with twin-spring gears. It is



Compression Test of Cardwell Friction Draft Gear.

the type shown in the illustration. Class C takes the standard spacing recommended by the M. C. B. Association for friction gears. It has longer pocket follower plates than class B. Class U is a special design for application to Union Tank Line cars, taking a draft lug spacing of 23½ in.

The Cardwell rocker side bearing, one style of which is illustrated herewith, is quite simple, being made in three parts, namely, the rocker and the carrier for same, the latter having a detachable side to permit insertion and removal of rocker. It will be observed that the rocker has a rolling bearing with the carrier plate, giving rolling contact top and bottom and thus minimizing friction. Also the rolling top bearing materially increases the travel of the rocker. In the style illustrated there is a top centering lug and the action is such that when the rocker is released from contact with the truck bearing, its own weight brings it back to the center of the slotted openings in which it rolls. All of the parts are strong and its action is positive. The top portion or carrier is made of malleable iron and the rocker of cast-iron. It weighs about 12 lbs. It is in service on a considerable number of cars and is understood to be giving entire satisfaction.

Both of the devices described in the foregoing are made by the Cardwell Manufacturing Company, Chicago.

The Motive Power Officer.*

BY C. M. BASFORD,
American Locomotive Company.

There is a remarkable fascination about a big powerful locomotive. When it stands at the head of a train ready to depart or when a magnificent train passes at high speed or even when the locomotive stands at the gloomy roundhouse waiting its turn for the service necessary to put it in condition for another run we stop for an interested admiring look.

The locomotive is worthy of the admiration and the respect of all, for it represents a development which has changed the form of human life, and it is one of the greatest influences for good that the

*An address delivered before the Mechanical Engineering Society of Purdue University.

world has ever known. The thought of what the locomotive has done is an inspiring one, and yet there is more to come.

Those who are interested without understanding are fascinated by the power and majesty of the machine. They see only the surface and are mystified, but those who understand the difficulties and appreciate the possibilities are inspired, because they see that the present is but a beginning with a wealth of opportunity for the future.

In the belief that there may be one or more present to-day who will act a leading part in the future, an attempt will be made to indicate some of the principles which may become important.

Our railroads are established and the country depends upon them for its very existence. They were built to meet existing needs and were extended to create new ones, until transportation now becomes our most vital necessity. The struggling enterprises of early days have given place to great and powerful combinations, and the crudities and expedients of the past must give place to the perfection of construction and methods which congestion of traffic necessitates. The traffic of a single district—Pittsburg—to-day would have swamped all the railroads east of the Mississippi river at the time of the Civil War, but congestion is not the only factor to be dealt with. Wages are advancing and rates dwindling as a natural result of irresistible forces.

American railroads are usually built along the lines of least financial resistance and improvement problems in grade reduction and curve specification were handed down to the present generation of managements. Improvements in yards, at terminals and at points in transit simplify the handling of freight, and soon the locomotive will receive its share of development. Heretofore it has grown chiefly in size, weight and power, but there remains another development in the direction of crowding the greatest possible capacity for power within the possible limits of weight and size. Economy of operation, while important, is less important to-day than the provision of the utmost possible capacity of the machine. Perhaps this may be more clearly stated by saying that the greatest need is for that which wil extend to the utmost the capacity of the fireman and render the limited physical strength of a man capable of supplying the requisite power.

This is the locomotive problem for the immediate future—to provide more power without greatly increasing existing weights. A secondary, but scarcely less important field for effort, is the improvement of design and method of operation which will reduce road service failures.

Another opportunity for the greatest abilities lies in revolutionizing methods of motive power management to bring them into parallel with those methods which have brought the greatest successes in the management of vast industrial establishments. Altogether the motive power problem presents possibilities as great as those of any field of mechanical activity and these are worthy of the efforts of the best of men.

Thirty years ago the head of the mechanical department led a comfortable life. He could safely follow precedent and the strenuous life had not been invented. Labor wars had not begun and the stirring emergencies of the present were unknown. It was easy to select shop machinery. There was no shop problem, no pooling of locomotives, no piece work price, no heavy locomotive or large capacity car and no train four-fifths of a mile long. No one cared much about the records of performance or cost of work. Workmen were better trained and good apprentice systems were in force. There was no tendency to go outside of a railroad organization to secure any official, and railroad ways and methods were those of smaller days. There were emergencies, of course, but not the emergencies of to-day. Thirty years ago the railroad official was a good man and as efficient for the time as the official of to-day, but he was a very different kind of official. His facilities were crude and his responsibilities not so great. Locomotives did not weigh 50 tons and other factors were in proportion. The superintendent was his own general manager and he knew every man in the train service. The master mechanic knew all his shop men and the engineers and firemen. He knew their history and he knew all about them and their affairs. Each locomotive had a name and an engineer and fireman were assigned to it. They went into the shop with their engine or they were laid off while it was repaired.

We have no desire to return to the old methods, but those methods are now worthy of thought because while all conditions of service have greatly changed, we have not changed enough in our views as to the proper management and organization of the motive power departments. The past has left us a somewhat unfortunate legacy, of which the result only needs attention on this occasion. The result referred to is seen in the tendency for young men to be easily enticed away from railroad service after they have spent years in preparation for it and are fairly on the road to win success. As a legacy of the earlier days of railroads in this country motive power positions are not, as a general rule, made sufficiently attractive. This, however, is to be changed and the power to bring the change lies in the young men who now hold responsible motive power positions and in those who are to hold them in the near future. As motive power problems and possibilities become better appreciated and better understood, the railroads will surround motive power positions with greater attractions which will eventually render it thoroughly worth while for the very best mechanical talent to prepare for work which, because of its attractions, will preserve this talent to the railroads. There are signs on the horizon to-day that this happy state is coming soon.

As to the locomotive problems of the present we have a few like these: Shall the next lot of passenger locomotives be single or double expansion? Shall we experiment to-day with superheating? Shall we order balanced compounds? Shall we not adopt improved valve gear? For the next very heavy freight locomotives shall we order articulated compounds? Shall we brave the criticisms of those who worship simplicity and order really better locomotives, even if a few complications are involved? In the shop problem, shall we or shall we not organize and operate large plants upon the well understood principles which have made large manufacturing enterprises successful? In the next order for 10,000 cars shall we use all wood, all steel or composite constructions?

These are live questions and those who are to decide them need to understand the reasons why they are presented and why they are pressing.

Shall the next lot of passenger locomotives be single or double expansion? Compounds, because of their favorable use of steam by dividing the range of expansion and the range of temperature changed in the cylinders, are more economical in the use of steam than are simple engines. This improves the efficiency of the locomotive as an operating unit, which is more important than economy. There is less cylinder condensation in a compound because the division of the expansion between the two cylinders reduces the range of temperature and therefore reduces the amount of moisture condensed from the incoming steam for the next stroke. A further advantage in the use of compound cylinders which applies to the three and four cylinder types lies in the fact that the steam is divided into smaller installments and not so much steam is required to pass through a given number of steam ports and passages. This renders a three and four cylinder compound "quicker on its feet" than single expansion locomotives of the same capacity, and, as a matter of fact, the highest speeds in regular train service in the world are made with compound locomotives.

It may seem strange, in view of the superior economy of compound locomotives, that they have not been adopted generally in place of single expansion locomotives. Compounds are apparently increasing in favor at the present time, and this is to be explained rather on the ground of the increased capacity which they render available rather than because of their superior economy. It is claimed by those who have used compounds and discarded them that the additional cost of maintenance, because of the somewhat increased complication, more than offsets the advantage gained by saving a little fuel. While this may have been true some years ago, it is not believed to apply to the more recent types of compounds and it may even be claimed at the present time that the feature of economy may be disregarded. This is because of the very much more important attribute of the compound in applying increased capacity. At the present time railroad men are so anxious to secure the utmost possible capacity that they are willing to accept some additional trouble and expense in maintenance in order to secure the additional power which every railroad now requires in order to deal with trains of increasing weights and speeds. Reliability of service in summer and winter is now becoming very important in competitive passenger service. For this reserve capacity is necessary.

When a railroad official faces the increasing weight of trains and increasing severity of schedules, he is ready to grasp at anything which will help him out of the difficulty. Because compounds do increase capacity, young men who are now preparing to enter motive power service will find it advantageous to have well defined opinions as to the possibilities of the compound to meet future requirements which are going to be more difficult than those of the past or present. When the question of locomotive design is raised on a railroad where an additional car must be hauled and the time must be somewhat shortened, the compound locomotive lies ready at hand to meet this need. Those who are most competent to judge, believe that the locomotive of the future is sure to be a compound.

Shall we experiment to-day with superheating? Superheated steam offers a very attractive field in connection with locomotive development. In German practice it has been remarkably successful and the Canadian Pacific Railway has practically duplicated the stisfactory results obtained in Germany. A number of experiments are now being made in this country, promising very satisfactory results. In short, superheating is one of the fundamental questions in locomotive practice which is worthy of most careful attention at this time.

Superheating does not seem to be antagonistic to compounding, but it serves in the same general direction to reduce heat losses in the cylinders. Condensation of steam in locomotive cylinders and

passages robs the locomotive of a great deal of its power and, in cold climates, this becomes a serious matter. It will always be difficult to thoroughly protect the cylinders and steam passages from radiation and therefore other precautions may be necessary to prevent the loss of heat from lessening the power of the locomotive. Superheated steam, coming into the cylinders at high temperature as it does, permits of a larger loss of heat before producing condensation than is possible with saturated steam where the margin for loss without condensation is very small. Superheated steam may lose to the cylinders and passages a much larger proportion of its heat before condensing, and in this lies the chief advantage of its employment. Superheated steam is also quicker than saturated steam in its movements through passages and ports as is proven by the fact that in Germany seven-inch piston valves suffice for ordinary passenger locomotives.

Such a principle as this cannot be applied to a locomotive without incurring some trouble and expense. While the improvement in the efficiency and economy of the locomotive is very readily attained, it is quite possible that it may be attained at too great an expense of restricted mileage and cost of maintenance, and it is always necessary to nurse a new development in order to make it practically successful. The question at the head of this paragraph should be answered in the affirmative because the possibilties of superheated steam at the present time seem to be exceedingly important and it is perfectly safe to spend the time and money necessary for experimenting because of the practical certainty of the results.

Shall we order balanced compounds? The subject of balanced compounds really requires a paper by itself. Locomotives have become too large to permit of continuing indefinitely the mere increase of size and weight. More scientific development is needed. The usual methods of counterbalancing answer very well for comparatively light locomotives, but as locomotives become larger and the parts become heavier the internal stresses upon the engine itself, due to the inertia of the parts, and the effect upon the track of the unbalanced counterweights renders it necessary to devise a better scheme of balancing. In ordinary practice counterweights are added to the driving wheels for the purpose of balancing the reciprocating parts, but the revolving weights themselves need balancing when near the top and bottom of their paths. When in these positions the counterbalance weights tend to change the weight on the driving wheels, due to their centrifugal action, acting vertically upward when the weights are near the top of their path, and acting vertically downward when they are near the bottom. The counterweights, therefore, tend to lift the locomotive in the one case, and tend to increase the weight on the rails in the other case. This causes the so-called "hammer blow" upon the rail, and because this so-called "hammer blow" sometimes amounts to 25 per cent. of the static weight on the rails, it becomes exceedingly important in limiting the weight allowed upon driving wheels. By using four cylinders and balancing reciprocating parts with other reciprocating parts, and revolving weights with revolving weights, a practically constant pressure on the rail is secured which renders it permissible to increase the weight on the driving wheels without increasing the destructiveness upon the track. By this permissible increase of driving wheel load a larger boiler may be carried, which is greatly to be desired in locomotive practice to-day.

On the Pennsylvania testing plant at St. Louis the Cole four-cylinder balanced compound operated for a full hour at a speed of 75 miles per hour, thus indicating a remarkable capacity. Incidentally, economy of fuel and water constitute attributes of this type of locomotives, and in the constructive features it is found to be possible to materially lighten the parts because the work is divided among a larger number of them. The subdivision of the power reduced the fiber stresses on each of these parts and the disturbing influences of very heavy rods and reciprocating parts are avoided. The effect of reciprocating parts upon the structure of the engine as the movements of these parts rapidly change in direction, has probably never had the attention which its importance merits. For high speed passenger service, and also for freight service the four-cylinder balanced locomotive presents advantages which should be tested to the utmost.

Shall we adopt improved valve gear? Many efforts have been made to improve locomotive valve gear. These have been directed toward an improvement in the distribution of steam, and also to improvements in mechanical construction. Entirely aside from possible improvements in the distribution of steam, the valve gear of American locomotives of very large size present an opportunity for structural improvement which, at the present time, is extremely important. The present tendency toward the use of Walschaert valve gear is due chiefly to the desire to improve structurally rather than to improve the use of steam. It is considered advisable to remove the valve gear from a confined space under the locomotive and also, if possible, to lighten the parts and arrange them in direct lines. The Walschaert valve gear does this, and more. It substitutes easily maintained joints and pin connections for the very large and inaccessible eccentrics and it provides an arrangement which is not as liable to derangement as is the Stephenson motion.

For the next heavy freight locomotive shall we order articulated compounds? Heretofore the locomotive has grown generally in size and weight, without radical change in principle to meet conditions of growth which cannot properly be made through the application of the brute strength idea in design. Large freight locomotives of ordinary types now involve single parts so large as to be difficult to handle in the shop. Their very size gives evidence of the stresses to which they are subjected, and it is believed that the time has arrived for dividing the power and work of the freight locomotive into a larger number of parts as is done in the case of the Mallet articulated compound which has now been successfully running for over a year on the Baltimore & Ohio Railroad. This locomotive weighs 477,500 lbs., including tender, and is the heaviest and most powerful ever built. A glance at this enormous machine immediately indicates the absurdity of designing it upon the basis of two cylinders. This locomotive has operated so successfully as to practically establish the principle of the articulated compound for locomotives which are not nearly so heavy. This general subject of the large freight locomotive is one which now needs, and will continue to need the attention of those who are preparing to deal with the problems of the next few years.

These questions are not to-day always placed before motive power men for final decision, but these are some of the real mechanical department questions which motive power men should be permitted to decide, and if they are decided by the right men many factors of railroad operation will be revolutionized. To the future other questions may be left, but the answers must not be long delayed.

It is necessary to decide upon suitable recruiting methods upon improvements in organization and methods of dealing with the rank and file as well as with the officers and subordinates, to produce a stream of developed talent toward the shop, where it is soon to be more greatly needed than ever before.

What is the locomotive of the future to be? It will be a steam locomotive for a time and then electric. In many places traffic is now sufficiently congested to render electric locomotives attractive, but before the steam locomotive becomes a mere curiosity there remains much for it to do, and its development and its improvement are by no means ended. The electric locomotive, however, is an entirely new problem.

As yet, comparatively little has been done in the improvement of the locomotive in this country in the direction of superior economy and efficiency. In Europe the high price of coal has led to care in design and in operation of locomotives which is unknown here. The French are a generation in advance of us in locomotive operation. In France, locomotive engineers use devices such as double valve gears and variable exhaust nozzles, which we do not intrust to our engineers and firemen. In England, the small number of locomotive failures on the road are a revelation to any one who studies them from our standpoint. In England, the locomotive is given a fair chance by receiving fair treatment, yet it probably does not cost more in the end. We certainly have much to learn from across the water, and while what we may learn is not so much in practice as in method, it is none the less important. That which we most need to learn from England is the value of appreciation of the locomotive and locomotive men. This will be learned and well learned—probably in the near future—of this we may feel sure. We may safely count that when those who are now students are ready to be leaders of mechanical departments of our railroads, the position of the department head will have become an enviable one. There is no field of mechanical work so full of opportunity as this and much depends upon those who are now fitting themselves for the leadership of to-morrow. These leaders may now be in the ranks; they may be in the colleges, but wherever they are their preparation must be thorough, for their work is to be great and it will grow to be still greater.

The idea of the importance of the mechanical problem when demonstrated on a large scale is suggested by the fact that January 1, 1906, a combination of 54 railroads controlled by the Vanderbilt interests became known as "The New York Central Lines." All cars, stations, locomotives and all the office stationery used in transacting the business of these 54 roads will bear this name. This enormous combination of responsibilities is not as impressive in any other of its phases as it is in the matter of the motive power responsibilities. The question of design, of construction, of locomotives, of shops and many other questions which are comparatively small on the individual roads of this combination now become great because of the effect of the practice in one portion of the system upon that in another. It is easily understood that such an aggregation of interests renders it necessary to prepare, through careful study, for every change in practice. The design of shops cannot be made without most thorough and careful consideration of practice in other parts of the system, made with the view of adopting the best in every detail, and the same applies with even more force in the case of locomotives. All this points to the necessity

for very high authority to properly administrate these responsibilities. In this discussion, only the high points are touched upon, many others being unmentioned because of the lack of time.

There seems to be no need of arguing at this time in favor of placing full and complete authority for such important problems in the hands of an official who stands immediately next to the throne. This, when done, will mean much to American railroads.

During the last ten years, motive power progress has been rapid because of the change in operating methods brought about by the large train unit. This has brought advances in weight and power which are startling, and the roads are not too well equipped with either physical facilities or men. Some radical changes are necessary

The "roundhouse foreman" as a designation of position has become outgrown, and the men required for the responsibilities of large and busy rounhouses cannot much longer be called foremen. They must be master mechanics, or the equivalent, because these positions have become more vitally important in the conduct of the railroad. The time has come for entirely separating shop and road responsibilities of subordinate officials. The larger shops require shop superintendents, and the conditions requiring master mechanics to properly look after enginemen, firemen, roundhouse forces and the shops as a combination passed away some years ago. Motive power work is divided into three distinct fields. First, the shop problem. Second, the locomotive operation problem, including roundhouse service. Third, mechanical engineering.

To be successful in either of these, wide experience is necessary. It is into the enginering branch that technical school graduates are most likely to drift, the work being agreeable and being very closely allied to the student's work at school.

Without in any way reflecting upon the opportunities offered in the line of mechanical engineering work, it should be said that experience either in the shops or in the roundhouse is important for a young man who is to succeed. It seems desirable to positively recommend young men to delay entering the engineering work until they have had experience in one or both of the other branches. If they are by temperament and ability qualified for either shop or road administration, they will learn this fact most easily and quickly in connection with the actual work, and if they are better fitted for engineering problems, they will be better able to handle them later on because of the road or shop experience. It seems, in general, desirable for most young men to avoid the drafting room immediately on completion of their college work, and it is believed that in this the most railroad officials will agree.

A word seems to be needed as to progress. In studying the careers of successful men, a prominent fact is developed which seems specially applicable to a successful railroad man. Those who have really advanced most rapidly and have risen highest have usually advanced slowly during the first dozen years. It is believed that an attractive future has been pictured for those who prepare and equip themselves in the right way to carry the mechanical railroad burden of the future. It most assuredly will pay to prepare thoroughly and well, for those who do this are sure to be greeted with most brilliant opportunities. In order to prepare thoroughly and well, however, years of experience are required.

The railroads themselves have not done as much as they might to provide the leadership talent which is so well known to be required for the future. It is in fact on many roads left for the young men who now enter the service to correct this, and they can do so by thoroughly preparing for their work.

No future is brighter than that which is offered in this part of the field of transportation, and it is hoped that some may be present who are to win in this great game. Nothing that is easy brings satisfaction in the doing, and if difficulties are a measure of satisfaction, there is an abundance of satisfaction in this work.

For young men to succeed, it is merely necessary to "make good." Every railroad official is looking for young men who may be trusted to do things. The official does not need to be told who can do them. A young man makes his record by his work itself. He should seek opportunities to do things that somebody wants done and in this way will become sufficiently conspicuous to attract attention. Of these opportunities, motive power work is full to overflowing.

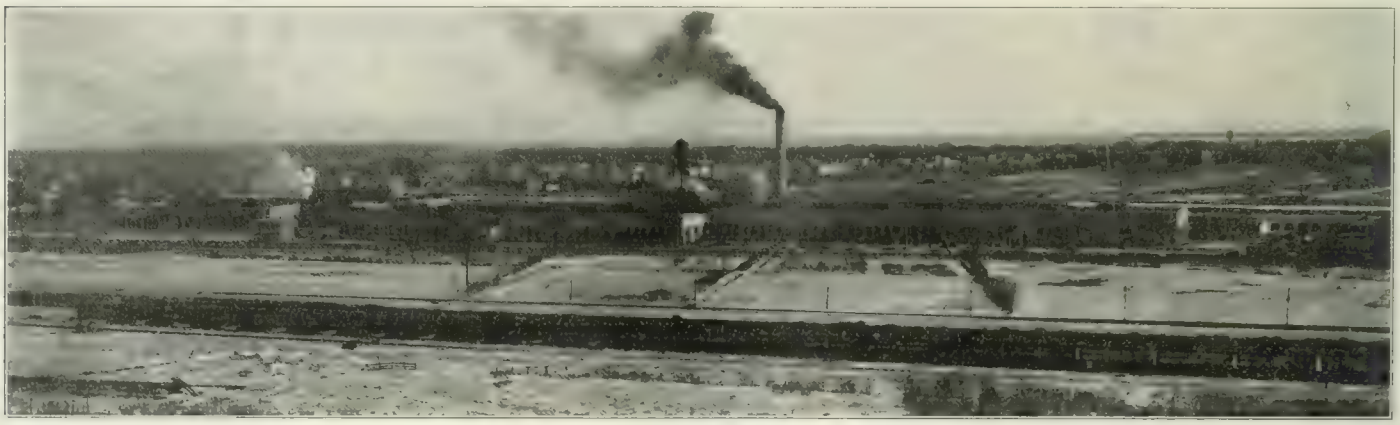
I believe in the motive power officer, in his opportunities, his possibilities and his ultimate success in becoming an executive and administrative official instead of remaining as a chief of a department.

"It is the ship with its bunkers full, its engines tested, its captain forewarned, its straight line voyage charted, that breaks the record into port."

"And it is the minute of talk after the hour of thought, the ounce of effort after the ton of preparation, that steers a business project into the harbor of success."

The New Shops of the Canada Car Company, Ltd., at Montreal.

The new plant which the Canada Car Company, Ltd., has lately completed is considered one of the best examples of a plant of this kind on the Continent; it therefore presents some very interesting features of design and construction. The location on the Lachine canal and Government railroad siding, just west of Montreal, affords the very best facilities for receiving the raw material and shipping the finished cars. The product of the company now consists of complete wooden cars, both for passenger and freight service, but provision was made in laying out the shops for the addition of a steel car plant. The present capacity of the shops, working day turn only, is 20 freight cars a day and 10 passenger cars a month. All forgings and castings entering into car construction are made in this plant. It is not the purpose of this article to describe in detail the various shops and their construction but rather to outline briefly the particular features that contribute to making the plant remarkable for its completeness and general economy of operation. The generation, distribution and application of the power in its several forms constitutes the principal item as affecting the cost of operation. This phase of the subject will therefore be presented in some detail.



View of New Works of the Canada Car Co. Ltd., Looking South Toward Lachine Canal.

The shops are located on a tract of 50 acres, the buildings occupying a little over seven acres. A record for rapid construction in Canada was established, as less than a year elapsed between the breaking of the ground and the opening of the shops. There are two main groups of buildings. The first contains the planing mill, matching room, cabinet shop, trimming and upholstering shop, passenger and freight erection shop, truck shop and passenger and freight paint shops. The other group embraces the wheel, gray iron and brass foundries, the forge shop, machine shop and pattern shop. The general arrangement of the various departments affords a steady progress of the material through the plant with the minimum amount of handling. The storehouse, paint house, dry kiln, dry lumber shed and office building are under separate roofs in the most convenient places, while the power house is as near central as possible when considering the advantage of its being close to the canal. The shop buildings are all one-story, with comparatively low roofs. The roofs are flat with monitor skylights. The walls are all reinforced concrete, 9 in. thick, which embraces the steel structural framework, and expansion joints are located regularly to localize any cracking of the walls. The roofs are drained towards the center and all drain pipes run down inside the buildings in order that the melting snow can be drained off during the coldest weather. On account of the very heavy snows common to this section, the roof construction was made unusually heavy, and the waterproof covering is of special roofing compound,.

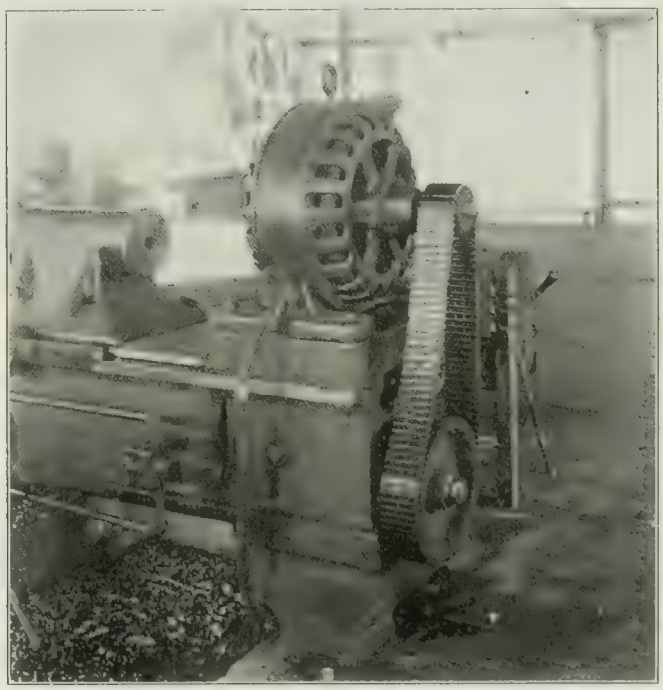
laid over heavy sheeting. The walls and monitors are well provided with windows, making the natural lighting very good. These shops are among the largest ever built of all-concrete, and against all precedent and advice, most of it was put in between October and May, during the worst of the winter weather. So far, no serious cracks have developed.

The first or largest group of buildings has a floor area of 183,060 sq. ft., while the smaller group has a floor area of 90,596 sq. ft. All the different shops in each group are similar in design and any particular department can be enlarged without any change in design, simply by additional buildings, and at the same time retain the general arrangement for handling the material and finished product. For instance, the wheel foundry can add moulding floors in the adjoining portion of the gray iron foundry, and increased area in the latter can be obtained by extending the building indefinitely. The roofs are high enough to permit the use of overhead traveling cranes, and those shops not at present equipped with crane service can be so provided by merely adding the runway girders. The shops and yards are equipped with complete fire and drainage systems. The various departments in the large group are separated by fireproof partitions which are provided with Kinnear rolling steel doors.

The power station is worthy of a somewhat detailed description, not because of its size, but on account of the complete equipment, showing the attention given to details. The building is reinforced concrete, 150 ft. long by 85 ft. wide, divided longitudinally by a concrete wall into the boiler room and engine room. It is



Automatic Dump Car Charging Cupola.



Chain Drive on Axle Lathe in Truck Shop.

one story high, and the engine room floor is 8 ft. higher than the boiler room floor, the latter being on the ground level. This gives a spacious basement beneath the engine room for auxiliary apparatus. The boiler room equipment consists of 1,800 h.p. of Babcock & Wilcox water-tube boilers, divided into three batteries of 600 h.p. each. The boilers are designed for 200 lbs. steam pressure and 150 deg. superheat, and are arranged with extension furnaces for the complete burning of all shavings from the mill. They are connected by means of an overhead steel breeching with a Custodis brick stack, 10 ft. in diameter by 150 ft. high. In laying out the power house, it was estimated that the shavings would constitute about 80 per cent. of the fuel required, and on this account it was decided not to install a coal or ash handling system at that time, although provisions were made for overhead coal hoppers and for an underground ash conveyor. Since the plant has been in full operation it has been shown that the estimate was very close as the shavings constitute all the fuel required to operate the power plant during the day. At night the shops are shut down and it is necessary to burn coal to furnish a small amount of power for lighting and some small auxiliaries, and in winter for the heating system. At the present time the coal used is unloaded by hand from cars right in front of the boilers, while the ashes are removed by small cars running close to the ash pits.

The engine room equipment is somewhat unusual in that it contains much of the piping and auxiliary apparatus usually placed in the boiler room. The steam header is carried by brackets on the engine room side of the dividing wall, and all valves are operated from the floor. The steam piping throughout is extra heavy, provided with Van Stone improved flanged joints, being designed for 200 lbs. pressure. The power house piping was installed by the M. W. Kellogg Company of New York. The equipment includes two 500-k.w. Curtis steam turbine units, two exciter sets, switchboard, condenser, air and circulating pumps, air compressor, boiler feed pumps, pumps for water supply, fire protection, heating and oiling systems. The turbines, exciters, switchboard, condenser and air compressor are located on the engine room floor, while the various pumps are all assembled in one section of the basement where they are under the care of one man. The engine room floor is of steel and concrete arch construction, and is of skeleton type, thus giving good light and ventilation in the basement. The layout of the entire power house is such that the capacity can be doubled without changing the general design. A 10-ton crane is provided in the engine room for handling all machines and for use when making repairs.

The electrical equipment is 600-volt, three-phase, 60-cycle, alternating current throughout. No direct current is used in the plant except for exciting the generator fields. One turbo-exciter set of 25 k.w. capacity is used for starting up and a motor-generator set of 30 k.w. capacity is used for regular service. Each shop is controlled direct from the switchboard. The electric power cables are carried to the two main building groups through underground tunnels which are 6 ft. wide by 6 in. high. The steam, water and air pipes are also carried through these tunnels, being supported by brackets on the wall. The tunnels are made of two separate thicknesses of concrete, separated by a double lining of waterproof material. They are well drained and a small pump is provided for removing any condensation. Both the tunnels are practically water tight. Where railroad tracks cross the tunnels, the latter are heavily reinforced.

The condensing apparatus was installed by the Alberger Condenser Company, and consists of one counter-current surface condenser, having a surface of 3,600 sq. ft.; one 8 in. x 16 in. x 16 in. x 12 in. horizontal two-stage rotative dry vacuum pump; one 6 in. x 6 in. x 6 in. horizontal duplex water pump; one 30 in. close automatic hot well, and one 8 in. x 16 in. x 18 in. horizontal single piston steam valve independent jet condenser. The condenser system is arranged for independent connection to all the engine room machines, thus permitting any portion to operate condensing while the other is running non-condensing for use with the heating system. The condensed steam is all returned to the boilers.

The air compressor is of 2,100 cu. ft. capacity and designed to run condensing at 200 lbs. steam pressure and 150 deg. superheat. The steam end is an Allis-Chalmers Corliss engine, and the compressor is the Ingersoll-Rand type; both the steam and the air ends are compound. The compressor is said to be the most economical machine of its kind ever built. The air receiver used with the compressed air system is 66 in. in diameter by 18 ft. long, and is located in the basement of the engine room. The compressed air is used for pneumatic hammers, riveters and drills, for a number of air lifts and bending tables, and in the spraying machines used in painting the freight cars.

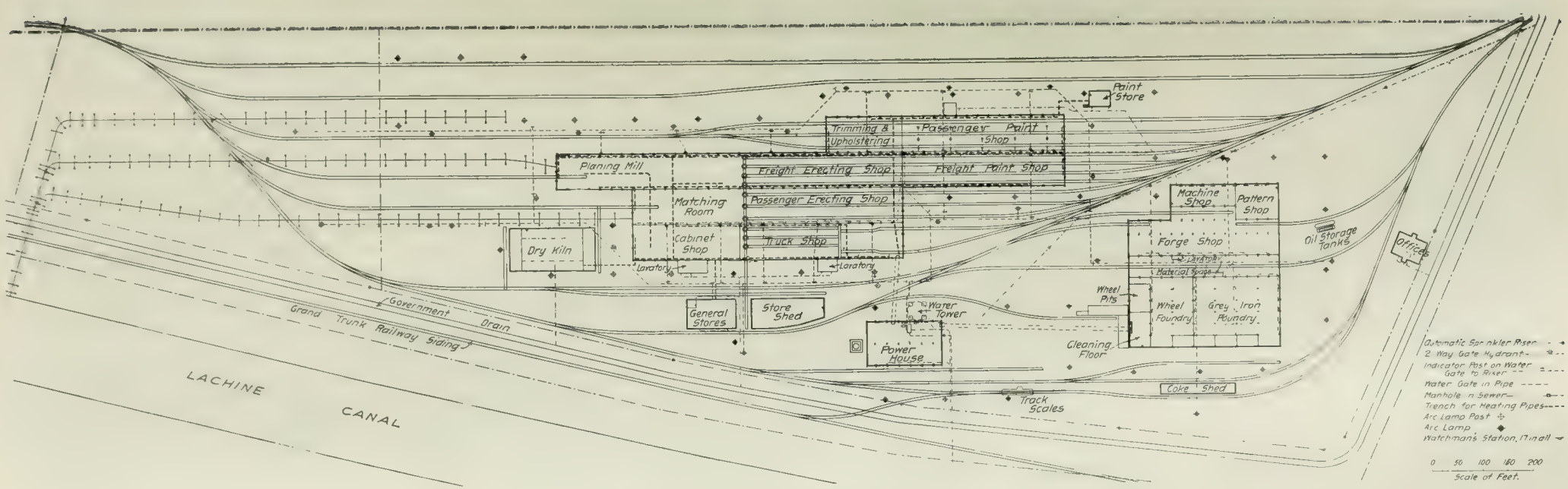
The heating system is another feature worthy of mention. The rigorous climate made it necessary to go into this question thor-



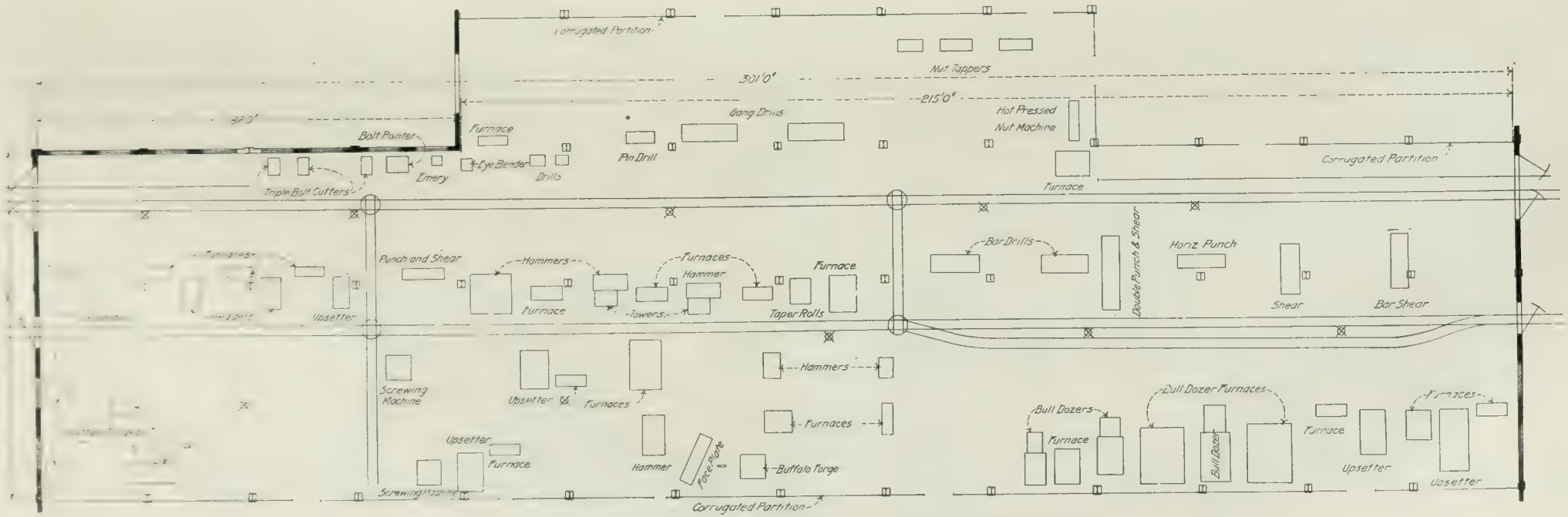
Interior View of Engine Room—Canada Car Co., Ltd.



Interior of Planing Mill—Canada Car Co., Ltd.



Plan of New Shops of the Canada Car Co. Ltd.



Plan of Forge Shop Showing Tool Arrangement—Canada Car Co., Ltd.

oughly and all systems were fully investigated. It was finally decided to heat the shops by the direct radiation method, using the exhaust steam from the power house. The return system is equipped with vacuum pumps which return all condensed steam to the feed-water heater, and which also reduce the back pressure on the turbines to a minimum. 85,072 sq. ft. of radiation surface was installed, and during the past winter the system proved most satisfactory in every way. The shops were always comfortable and the cost of maintenance exceedingly low. The heating system was installed by the W. H. Miller Heating Company, Chicago.

One of the illustrations shows a typical tool arrangement, and the two tables give the sizes of motors and methods of driving used on the wood-working machines in the planing mill, matching room and cabinet shop, and on the machines in the forge shop. In these shops individual motor drives are used almost exclusively and the motors were all selected after very careful and thorough tests of the power required by the various machines. The motors were selected with a view of having them all operate at as near full load as possible when the machines are in normal operation, thus insuring a good power-factor at the switchboard. By the close selection of motors it was shown that the individual motor equipment cost about 90 per cent. of the amount estimated for group drives, and at the same time the capacity of the tools was greatly increased. The shop wiring was installed all overhead in a very substantial manner and all service lines to motors were run in iron conduit pipe.

After the power was carried to the various shops, the motors were divided into 100-h.p. groups, and each group was controlled by an automatic circuit-breaker. This method was employed to prevent any trouble on the lines from shutting down the entire shop at once. These circuit-breakers act very quickly and the breakers on the switchboard controlling the entire shop were provided with time limit relays which would not open the circuit unless the shop breaker refused to act. In this way the shop was protected against a complete shut-down and also the whole circuit was protected at the switchboard in case the protective devices in the shop failed. The circuit-breakers in the shops were designed to prevent their being closed on short circuits. All the motors are General Electric and Westinghouse make, 550-volt, three-phase, 60-cycle. There are four 7½-ton electric traveling cranes: one each in the planing mill and matching room, and two in the forge shop. There is also a two-ton crane in the wheel foundry. All the cranes are equipped with three-phase alternating current motors, specially designed for the crane service. The cranes were built by the Niles-Bement-Pond Company and have proven very satisfactory. The shops are equipped with enclosed alternating current 110-volt arc lamps throughout.

The foundries have several features that are deserving of mention. The wheel foundry has a daily capacity of 300 wheels and has two cupolas each of 21 tons capacity per hour. The gray iron foundry also has two cupolas of nine and 12 tons capacity per hour, respectively. The blast is furnished by two Root positive blowers, direct-driven by two induction motors. The blast piping is so arranged and the gates are so placed that either blower may furnish blast for any one or any combination of cupolas. This gives protection against loss of a heat in either foundry from any possible difficulty with blowers or motors driving them. Two similar pneumatic elevators, each of three-tons capacity, one for each foundry, are used for lifting charges from the ground to the charging floor. The tracks on the charging floor are so arranged that either elevator may be used for raising the charges for both foundries. The charges are loaded on cars, weighed and taken by the elevators to the charging floor. The cars are then run onto a charging machine as needed, and the cars are dumped automatically. The reservoir ladles are tipped by small motors, and are operated, together with the ladle train, from one point by a boy who is able without assistance to distribute hot metal for the entire output of the wheel foundry. The wheel floors are 12 in number, arranged in straight lines. A system of hoists and conveyors runs the length of each floor, extending over the ladle train on one side and over the transfer train for hot wheels on the opposite side. The hoisting and traveling movements are operated by independent mechanisms and controlled by the workmen from any point on the floor. Thus the hot metal is brought from the ladle train and the wheels removed to the transfer train with a great saving in time and labor. The two foundries are considered the most modern in Canada and were equipped throughout by the Whiting Foundry Equipment Company, Chicago.

The larger part of the lumber is received by boat and an overhead telpher system carries the lumber from the canal to all parts of the lumber yard or into the west end of the planing mill. This telpher is also equipped with alternating current induction motors, and is a great factor in the economic operation of the plant. The shavings are removed from the machines in the planing mill and matching room by two fans direct-driven by a 50-h.p. and 75-h.p. motor respectively. The shavings, as already mentioned, are delivered to the boiler house. In the forge shop, oil is used for fuel in all the furnaces, thus doing away with the handling of coke and ashes. The oil furnaces are of the Ferguson type supplied by the Railway Materials Company, Chicago.

The layout of the entire plant is the result of careful study and design and the uninterrupted manner in which the material passes through the various shops has met with general approval. The results obtained in economy have been entirely satisfactory and in many cases beyond expectations. Mr. W. P. Coleman is President and General Manager of the company, and Mr. C. H. Russell, Secretary. Mr. N. S. Reeder, Jr., formerly Assistant General Manager, but now of the Pressed Steel Car Company, New York, had general charge of the construction of the plant, and Mr. E. G. M. Cape was his assistant. Mr. F. E. McKee, Electrical Engineer, Pressed Steel Car Company, Pittsburg, was Consulting Engineer.

Forge Shop Motor Equipment.

Item No.	Machine.	Make	Method of driving.	H. P. of motors
32	Bar shear, No. 11, 10x1½ in., or 1¾ in.	Williams & White...	S. G.	15
34	Single punch and shear, No. 11, 2½ in. in 1⅜ in.	Williams & White...	S. G.	10
35	Double punch and shear, No. 12, 2 in. in 1¼ in.	Williams & White...	S. G.	10
38	Double punch and shear, No 14½, 1 in. in ⅞ in.	Williams & White...	S. G.	5
39	Horizontal Punch, No. 3, 1¼ in in 1 in.	Williams & White...	S. G.	5
41	Bolt header and forging machine, 1½ in.	Acme Mach'y Co	B.	5
42	Do., 2½ in.	Acme Mach'y Co....	B.	7½
42A	Do., 3 in.	Acme Mach'y Co....	B.	10
42B	Do., 2½ in.	Acme Mach'y Co....	B.	7½
43	Do., 4 in.	Acme Mach'y Co....	B.	15
44	Do., 1½ in.	Acme Mach'y Co	B.	5
44A	Do., 1½ in.	Acme Mach'y Co	B.	5
44B	Do., 1½ in.	Acme Mach'y Co	B.	5
45	Forging rolls, No. 1	Williams & White...	S. G.	15
46	Bulldozer, No 8	Williams & White...	S. G.	20
47	Bulldozer, No. 4	Williams & White...	S. G.	7½
47A	Bulldozer, No. 5	Williams & White...	S. G.	7½
30	100-lb. cushion helve hammer	Bradley & Sons.....	B	5
31	100-lb. champion power hammer, No. 4	Beaudry & Sons.....	B.	3
31A	100-lb. champion power hammer, No. 4	Beaudry & Sons.....	B.	3
16	6-spindle independent gang drill.	Bertram & Sons.....	B.	7½
16A	6-spindle independent gang drill..	Bertram & Sons.....	B.	7½
17	6-spindle arch bar drill.....	Foote, Burt & Co....	B.	10
17A	6-spindle arch-bar drill.....	Foote, Burt & Co....	B.	10
18	10-spindle brake pin drill	Ajax Mfg. Co	B.	7½
22	2-in. triple-head bolt cutter....	Acme Mach'y Co.....	B.	5
22A	2-in. triple-head bolt cutter.....	Acme Mach'y Co.....	B.	5
106D	1½ hot pressed nut machine...	Ajax Mfg. Co.	B.	5
14	1-in. 6-spdle nut tapping machine	Ajax Mfg. Co.....	Group	15
15	2-in. do.,	Ajax Mfg. Co.....		
15A	2-in. do.	Ajax Mfg. Co.....		
13C	24-in vertical drilling machine...	Niles-Bement-Pond		
13A	32 in. vertical drilling machine..	Niles Bement Pond		
23	1½-in. triple-head bolt cutter ..	Acme Mach'y Co...		
23A	1½-in. triple-head bolt cutter..	Acme Mach'y Co....		
24	1-in. triple-head bolt cutter.....	Acme Mach'y Co...		
48	Eye bender, No. 2	Williams & White..		
49	2-in. bolt pointer	Acme Mach'y Co...		
52B	Grading machine No. C, 16x3 in. wheels.	Diamond M'ch'y Co.		

NOTE. In column headed "Method of driving," D. C. stands for direct coupled; C. D., chain drive; S. G., spur geared; B., belted.

Planing Mill Motor Equipment.

57	Timber planer, 24x14 in., No. 41.	Berlin Mach. Co.	D. C.	75
57A	Timber planer, 24x14 in., No. 41.	Berlin Mach. Co.	D. C.	75
80	End tenoning machine, No. 4...	Greenlee Bros.	B.	15
92	Band rip saw, 14x28 in., No. 109	Fay & Egan	S. G.	30
65	Planer, 15x6 in.	MacGregor & Gourlay	D. C.	40
65A	Planer, 15x16 in	MacGregor & Gourlay	D. C.	30
75	6-spdle boring mach., 40-ft. table.	Greenlee Bros.	B.	10
75A	6-spdle boring mach., 40-ft. table.	Greenlee Bros.	B.	10
75B	6-spdle boring mach., 40 ft. table.	Greenlee Bros.	B.	10
83	Double end tenoner, 12 in.....	Greenlee Bros	B.	30
84	Heavy horizontal mortising machine, No. 6C.	Greenlee Bros.	B.	7½
96	Vert. cut-off saw and grainer, No. 3, 16x10½ in.	Greenlee Bros	B.	10
99	Automatic cut-off saw, No. 3, 18 x12 in.	Fay & Egan.....	S. G.	15
98	Brace cutting mach., 24 in. saws.	Greenlee Bros.	B.	10
115	5-spindle vertical boring machine, No. 321	S. A. Woods	B.	7½
79	Heavy gaining machine, 40-ft. table, No. 3.	Greenlee Bros.	B.	10
77	3-spindle vertical boring machine, No 350	Greenlee Bros.	S. G.	7½
77A	3-spindle vertical boring machine, No. 350	Greenlee Bros.	S. G.	5
74	4-spindle horizontal boring machine, No 325.....	S. A. Woods.	B.	7½
91	Self-feed rip saw, No. 2.....	A. W. W. Mchy Co..	B.	10
91A	Self feed rip saw, No. 2.....	A. W. W. Mchy Co..	B.	10
61	Dimension planer, No 32, 24x24 in. x 18 ft.....	Fay & Egan.....	B.	15
78	Vertical mortising machine, No. 4, 40 ft table.....	Fay & Egan.....	B.	7½
62	Lightning flooring machine, No. 107, 6x15 in.	Fay & Egan..... ..	D. C.	30
62A	Lightning flooring machines, No. 107, 6x15 in	Fay & Egan.....	D. C.	30
99A	Self feed cut off saw, No. 2....	Fay & Egan.....	S. G.	3
99B	Self-feed cut off saw, No 2.....	Fay & Egan.....	S. G.	3
99C	Self-feed cut off saw, No. 2.....	Fay & Egan.....	S. G.	3
73	Universal boring machine, No. 52	Fay & Egan.....	B.	5
106A	Self feed band rip saw, No. 1, 24x9 in.	Fay & Egan.....	S G	15
106B	Band, rip and resawing machine, No. 146, 24x18 in	Fay & Egan..... ...	S. G.	20
106C	Vertical mortiser and boring machine, No. 302	S. A. Woods	B.	7½
64	Universal wood-worker, No. 4...	Fay & Egan.....	B.	7½
58	Finishing planer, No 153, 36x6 in.	Berlin Machine Co..	B.	10
66	Moulding mach., 12x5 in., No 842	A. W. W. Mch'y Co.	B.	20
103	Sanding machine, 42-in., 3-drum.	Berlin Machine Co	B.	20
106	Scraping machine, 42 in.....	Whitney Mfg. Co ..	B.	7½
59	Smoothing planer, Clement, No 1	A. W. W. Mch'y Co.	B.	7½
	Block and chip grinder.	Mitts & Merrill ..	B.	50
71	Double-head tenoning machine...	MacGregor & Gourlay	Group	15
81	Tenoning machine, No. 1	Fay & Egan		
94	Swing cut-off saw, 18-in.....	MacGregor & Gourlay		

Item No.	Machine.	Make.	Method of driving.	H. P. of motors.
65	Sash mortiser & relisher, No. 93.	Fay & Egan.		
65A	Sash mortiser & relisher, No. 604	Greenlee Bros.		
64A	Variety wood-worker, No. 4.	Fay & Egan		
67	4-side moulding machine, No. 3.	Fay & Egan		
69	Heavy double shaper	Berlin Machine Co.		
84A	Hor. mortising mach., No. 9011.	A. W. W. Mch'y Co		
86A	Band saw, 36 in. wheels, 18 in. under guide.	M'Gregor & Gourlay	Group	20
50	Grindstone, No. 3, 48x6 in.	Hamilton M. T. Co.		
70	Panel carver and friezer.	Fay & Egan		
85	Scroll saw, 36x39 in. table.	A. W. W. Mch'y Co		
94A	Swing saw, 18 in.	M'Gregor & Gourlay		
100	Double rip cross-cut saw, 16 in. saws	M'Gregor & Gourlay		
101	Single end wood lathe, 20-in. swing, No. 3.	M'Gregor & Gourlay		
76	Vertical boring machine, No. 2.	A. W. W. Mch'y Co		
107	Automatic circular saw sharpener	Baldwin-Tuthill & Bolton Co.	Group	5
108	Automatic band saw filer, No. 49B	Do.		
110	Automatic knife grinder, No. 221.	S. A. Woods		

NOTE.—In column headed "Method of driving," D. C. stands for direct coupled; C. D., chain drive; S. G., spur geared; B., belted.

The Art of Water Softening.

BY C. HERSCHEL KOYL.

It should never be forgotten by American railroad men, and it cannot be too often preached to this and succeeding generations, that the vast benefits now accruing and to accrue to American railroad service through the softening and purification of locomotive water, are due principally to the impetus given to investigators by the classic examination of the subject begun in 1871 by a Committee of the American Railway Master Mechanics Association.

This committee collected statistics from all parts of the country concerning the effects on boilers of different kinds of water, and from these statistics they learned the average cost of the additional cleaning, boiler repairs and fuel made necessary by using hard or muddy water. They found that the average cost in railroad work was aproximately $750 per locomotive per year, and that therefore the total cost to the locomotive service of the country was in the millions annually; and they laid down two fundamental rules which are as valuable to-day as they were in the '70s, and doubtless will be standard for all time:

First.—"Get, if you can, clean, soft, natural water."

Second.—"If you cannot get this, then soften and purify the water before it goes to the boiler."

I repeat these maxims in this place because I think they should be committed to memory by every railroad man interested in the locomotive service.

In those days practical water-softening was unknown; but since the time of the first meeting of this committee, and due largely to the continued wisdom of the Master Mechanics' Association, the various chemical difficulties have been overcome, the necessary mechanical appliances for work on a large scale have been perfected, the interest and confidence of railroad officers have been won, and water softening is now a business of established reputation and of great benefit in reducing boiler expense and increasing the continuity of locomotive service.

But just as there were, before the days of real water softening, a hundred quack remedies, all useless and mostly harmful so that James Boon, of the Pittsburg, Fort Wayne & Chicago, had to thunder forth in protest at a meeting of the Master Mechanics' Association, "the only compound fit for a boiler is pure water"—so now there are quacks in the field, men who know nothing of the chemistry or the mechanics of the art, men who by useless and silly operations on water, some of which is better before they touch it than after, are doing much to discredit a valuable business and betray the confidence of the railroad world. It therefore appears to me wise to state a few of the principles of the art, so that those who wish good water-softening service may discriminate between useful and useless processes, and save the railroads money and themselves many heart-burnings.

There are no mysteries in the art of water-softening. The present nearly perfect state of the art has ben attained by years of continued study by scientific men, and to understand it there are necessary only a reasonable knowledge of chemistry and mechanics, and a little common sense.

The whole process consists of two parts only: First, getting the dissolved calcium, magnesium, etc., out of solution and into suspension in the water; and, second, getting this precipitate out of suspension and settled in the bottom of the tank.

Any water can be prepared for boiler use, and water from a softening machine should never contain more than four grains per gallon of the salts of calcium and magnesium. I hear frequently of waters which are said to be so hard that they cannot be softened, but I have yet to find one. I hear of waters which contain so much sulphate of calcium that the softened water will contain too much sulphate of sodium to be usable; but this, too, is stuff and nonsense, for if the water is free from precipitate it may contain 500 grains per gallon of sodium sulphate, without a sign of foaming in a clean boiler.

Softened water should be perfectly clear, that is, it should be free from mud and from the precipitated calcium carbonate, for if there are present either fine particles of mud or fine particles of unsettled precipitate, the boiler will surely foam.

The finished water should contain about one-half grain per gallon of sodium carbonate. Good softened water contains between two and three grains per gallon of calcium carbonate which will be precipitated in the boiler, and therefore the water should contain about one-half grain per gallon of sodium carbonate to keep the calcium carbonate soft, that it may be blown out of the boiler easily and daily.

These are the guarantees which should be required when the contract is made. These are the fruits of the water-softening process, and by their fruits ye shall know them.

Fortunately there are some principles of chemical manipulation and mechanical operation necessary to the successful practice of the art, now so well established that no plant may hope to be in the highest class which has not incorporated them in its practice.

For any ordinary hard water, the reagents to be used are fresh lime for the extraction of the free and loosely combined carbonic acid gas, and sodium carbonate to change the sulphate and chloride of calcium and magnesium into sulphate and chloride of sodium. For clearing the water from matter in suspension, such as mud, it is necessary sometimes to add some two reagents, for instance, caustic soda and sulphate of iron, which will combine to produce a flocculent precipitate—in this case hydrate of iron—which will carry down with it all the suspended matter. These are the only chemical reagents necessary for any ordinary water; and, as they are thoroughly efficient and the cheapest in the market, they cannot be displaced to advantage by other more fanciful substances.

The Lime Treatment.

With water of a given hardness and lime of known purity, it is a simple matter to calculate and supply the exact amount of lime necessary. But commercial limes are of varying degrees of purity, containing from 2 to 40 per cent. of magnesia, and the burning to which the limestone is subjected varies in thoroughness, so that in a ton of purchased lime there may be 2,000 lbs. of pure lime, or there may be 800 lbs. of magnesia and perhaps 100 lbs. of unburned limestone, leaving only 1,100 lbs. of pure lime available for water-softening purposes. It is therefore useless to say "put in 100 lbs. of lime" unless we know its character. Of course the lime must be slaked before use, and this eliminates the unburned stones, but it does not eliminate the magnesia which goes with the slaked lime and is indistinguishable from it. A mixture of slaked lime with enough water to make it flow is called milk-of-lime, whether the lime is pure or whether it is half magnesia; but to this day there are men calling themselves "water-softeners," and accepted as such by some confiding customers, who advocate the use of milk-of-lime by measure for water softening. It is necessary to be very exact in providing just the proper amount of CaO for the extraction of carbonic acid gas from water; but there is only one method by which an absolutely definite amount of CaO can be supplied by weight or measure, and that is by its *solution* in water. A pound of water at a certain temperature will dissolve a certain number of grains of CaO and no more, and it will not dissolve magnesia; from which it follows that if lime is supplied in the form of saturated lime-water, its amount can be definitely calculated and controlled; but to endeavor to calculate the amount of CaO in a pound or a quart of milk-of-lime is pure guesswork, and to endeavor to soften hard water by supplying to it measured quantities of milk-of-lime is also pure guesswork.

A water-softening machine, therefore, to have any rank or standing, must supply its lime in measured amounts of lime water, and in no other way.

The Soda Treatment.

Sodium carbonate, and the other chemicals sometimes necessary, can be supplied only when in solution in water; and if the water-softening apparatus is fitted with the necessary small vats at the top, the supply of these chemicals can be conformed to and regulated by the amount of incoming raw matter if the vats are fitted with valves which themselves are controlled by the incoming stream. But there is a constant tendency to clogging of these small valves by the solid chemicals, due to the continuous evaporation of the water at these points; and for this, as well as for chemical reasons, it is wise to make these solutions as dilute as possible, and any effort to save expense by making these vats small or by feeding concentrated solutions of these chemicals, is misdirected and to the detriment of good operation.

The Mechanical Treatment.

It must be constantly borne in mind that if the water is to be thoroughly softened, every drop of it must get its little proportion of chemical; and since these solutions do not mix readily with hard water, it is absolutely necessary to perform long and continued stirring.

Since the introduction of the "continuous" water-softening machine, no necessary part of the operation has been so constantly overlooked as the very important subject of thorough stirring. All the European machines rely for their mixing on running the com-

bined streams of hard water, sodium carbonate and lime water, around a few baffle plates; but while the mixture thus effected is sufficient to make a decided improvement in the water, still the mixing is not thorough. I have seen many such machines in which the chemical reaction was not complete after two hours' standing, and I have seen water from machines in this country still in process of forming precipitate after the water had been turned into the storage tank. I have found not less than 20 minutes in summer and 30 minutes in winter of determined stirring is necessary to complete the mixing, and therefore the reactions, within the precipitation tank; and if this work is not properly done, precipitation will go on for hours in the settling and storage tanks, with the almost certain result of delivering to the boiler water containing fine particles of precipitate; and the certain result of this is foaming in the boiler.

Summary.

The necessary characteristics of any good water-softening machine are:

First.—That the lime shall be supplied and measured in the form of lime water.

Second.—That the other chemical solutions shall be very dilute.

Third.—That there shall be thorough stirring and mixing of the chemicals with the water, continued for at least a half hour.

The result will be: Water in the storage tank soft and free from particles of precipitate; and properly treated water when used in a boiler will *never scale, corrode nor foam.*

McElroy Automatic Car-Lighting System.

The service conditions on American railroads make the problem of electric train lighting an intricate one. The cars are large, require many lights and a corresponding high capacity of the generator and a wide range of automatic regulation. The service is constant and severe with long runs at steady high speed. Inspection points are far apart. Any system, therefore, which is to be successful under these conditions must be so constructed mechanically and electrically that it will stand severe service without requiring close inspection; must be thoroughly reliable and automatic in its regulation, obviating the necessity of an auxiliary light equipment and must show economy in repairs and in battery maintenance.

The McElroy automatic electric car lighting system shown in the accompanying illustrations is made by the Consolidated Car Heating Co. In the construction and development of this system the aim has been to provide a strong, compact, powerful generator; a thoroughly automatic, reliable and positive means of regulation for current flow to lamps and for battery charging; to reduce to a minimum the cost of inspection, and the necessity for repairs; and to give a convenient, agreeable and efficient light to passengers. The equipment comprises an axle driven dynamo; an automatic regulator for generator output, lamp voltage and battery charging, and a storage battery.

The dynamo is hung between the car axle and the end sill of the truck by the suspension known as the "goose neck cradle type" in accordance with standard practice with street railway motors. The weight is evenly distributed and all shock and vibration on the dynamo is absorbed by the two heavy coil springs which support the shell. The generator is direct driven through a steel cut gear attached to the car axle and a rawhide pinion on the end of the armature shaft. This method of driving is positive and the results obtained have been most satisfactory. All troubles due to breaking, slipping, or adjustment of belts or chains are eliminated. The action of the rawhide pinion and steel cut gear is accompanied by no noise, no lubrication is required and the amount of wear is small. The gear and pinion are enclosed in a pressed steel case to protect them against flying particles from the roadbed and are readily accessible through large inspection doors in the case.

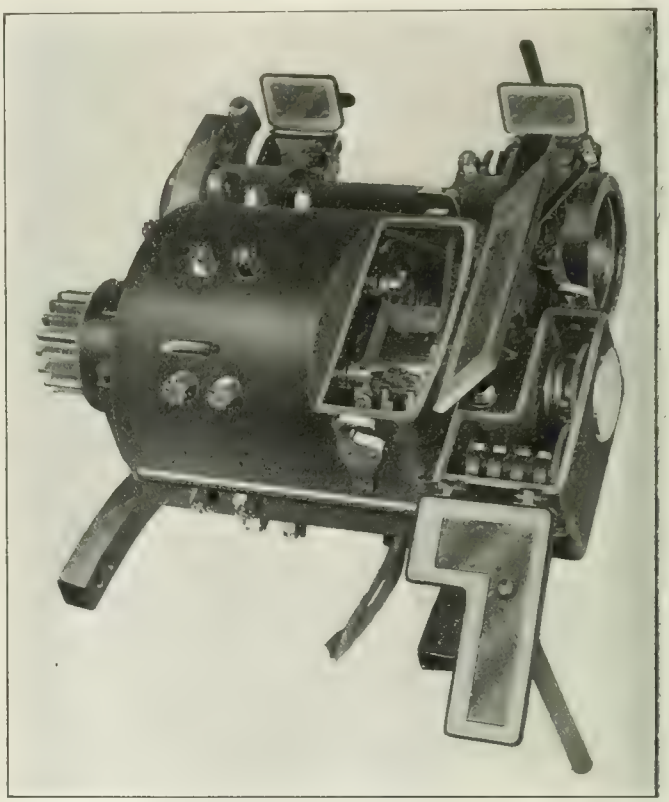
The dynamo is a shunt-wound, four-pole machine and is of sufficient capacity to charge a storage battery of 32 cells with a discharge rating of 40 amperes for six hours and at the same time supply 110, 60-volt, 8 candle power incandescent lights.

Special design is employed for obtaining thorough ventilation for the armature, and perfect commutation at the brushes. The use of band wires for the armature is done away with, thus obviating the danger of stripping the coils. The coils are held in position in the slots by means of fibre strips inserted in triangular notches on the circumference of the discs. Interpolated winding for the fields is made use of in order to obtain sparkless commutation during the variation of field strength necessary in so wide a range of train speed. The construction is simple and does not introduce any complications. Under this arrangement for regulation the brushes will carry a 50 per cent. overload without sparking and with no damaging effect on the machine for two hours. The two brushes are carried on the top of the commutator and are readily accessible for inspection through a large hinged inspection door.

Ball bearings of special foreign design are used on the armature shaft, reducing the frictional load to a minimum. Oiling or inspection of the bearings is only required once in six months.

The reversing switch is carried in a compartment on the commutator end of the shell. It is operated by the armature shaft and reverses the connections of the armature to the mains when the direction of the car is changed, thus keeping the same relations of positive and negative polarity in the external circuit. The construction of the switch is similar to that of a reversing drum switch of a street car controller. Its action is positive and sure when a change is required and after the change is accomplished there is no wear on the end switch mechanism.

The method of regulation will be best understood by referring to the diagram of wiring. The voltage of the dynamo is controlled by a field rheostat operated by a small series, double-field, reverse-wound motor in the regulator case. The rotation of the motor is governed by the combined action of two solenoids which act against the tension of a spring. One solenoid is a shunt wound coil connected across the dynamo mains and the other is a series wound coil in the dynamo battery circuit. When the dynamo is supplying current these two coils act in conjunction. So long as the pull of the solenoids just balances the tension of the spring the arm of the automatic switch is in mid position where the motor circuit is broken and the rheostat arm remains stationary until change in the voltage of the dynamo destroys the equilibrium between the pull of the spring and that of the solenoid when the motor will



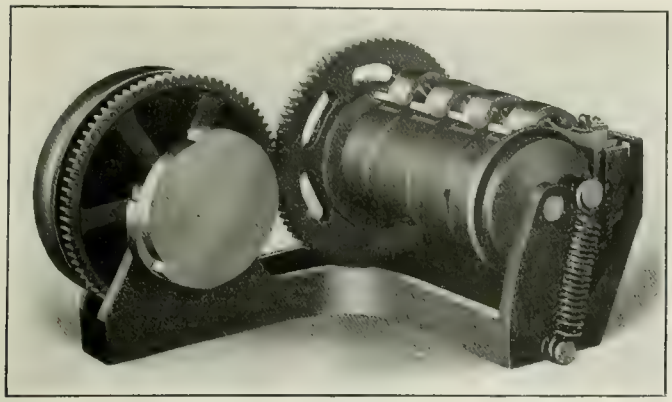
Dynamo for McElroy Automatic Car Lighting System.

again receive current and the rheostat be so adjusted as to bring the voltage of the dynamo to the correct value.

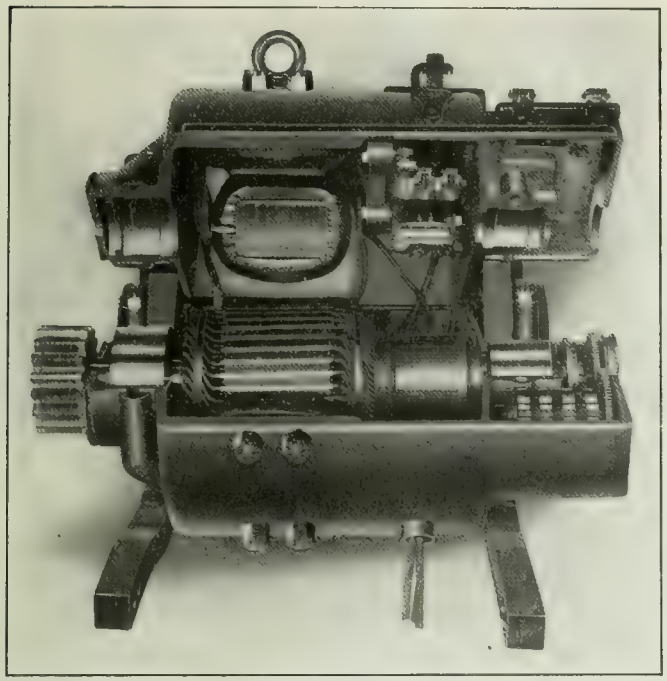
The switch connecting the dynamo and battery is automatically opened when the voltage of the dynamo equals the voltage of the battery. This operation is positive and takes place at zero difference of potential, so that no arcing occurs when the circuit is opened. In reversing the operation when connection is made to the battery, there is also zero difference of potential at the terminals which are connected, and the dynamo picks up the lamp load without fluctuation of the lights.

It will be noted that all current passing to the battery is taken through the heavy series coil of the solenoid, which coil, as above stated, acts in conjunction with the shunt-wound solenoid in controlling the dynamo potential. In case a heavy current passes through the series coil to a depleted battery, the increased pull on the plunger will operate the motor switch and cut resistance into the dynamo field; thereby reducing the voltage and preventing the battery from receiving an excessive charging current. As the charge to the battery nears completion the potential coil assumes nearly the entire control of the solenoid, only a very small current passing through the series coil. The series and potential coils are proportioned so that the proper amount of current is supplied to the battery at all times, this amount varying according to the condition of the battery. This feature is of importance in the effect on both the life and efficiency of the storage battery.

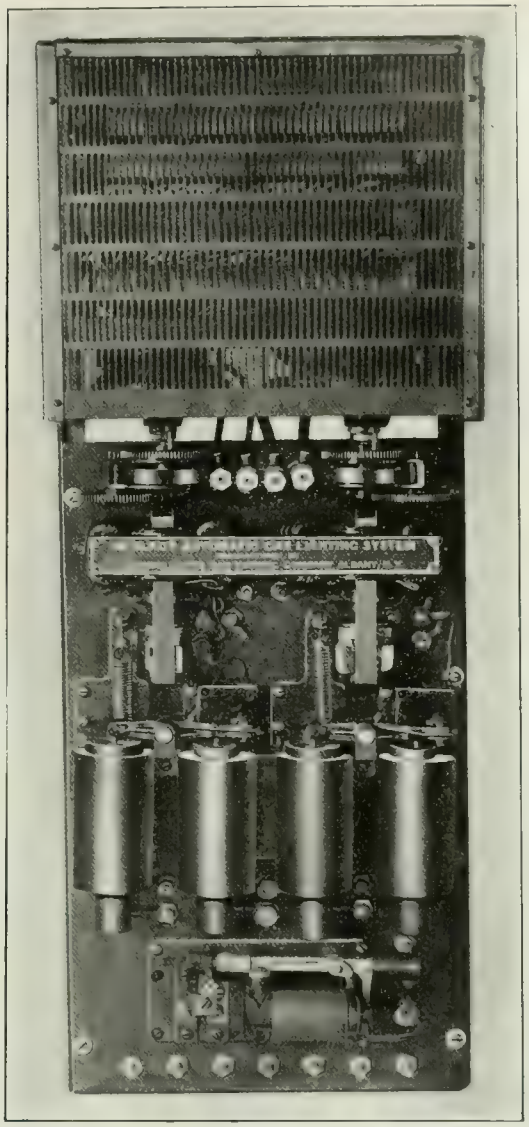
The lamp voltage is controlled through an independent rheostat



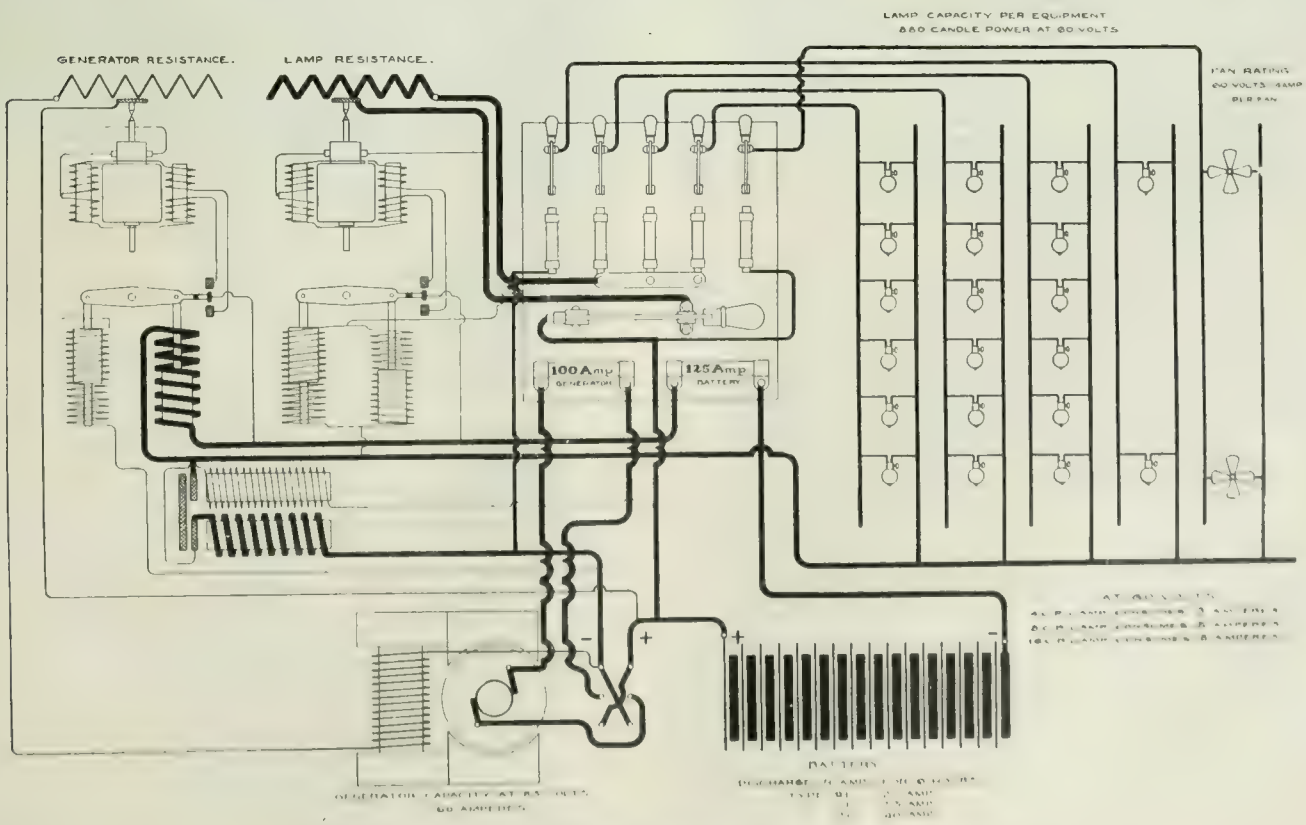
Reversing Switch.



Dynamo and Reversing Switch, Case Open.



Regulator.



Wiring Diagram for McElroy Automatic Car Lighting System.

operated by another motor which is controlled by a solenoid connected across the lamp mains and is independent of whether the current is supplied from the generator when the car is in motion or from the battery when it is standing still. The lamps can be turned on or off at will, either singly or in groups, without affecting the remaining lights, as the regulator immediately adjusts the resistance to maintain the fixed voltage across the lamp terminals. Regulation of the lamp voltage is constantly maintained within 1 per cent. of the mean value.

A 30-cell battery is used with this equipment, the size varying according to the number of lamps in the car. Owing to the fact that the capacity of the dynamo is such that the battery can be charged at the same time that the lamps are being run direct from the machine, it is not necessary to provide large storage capacity and a battery capable of carrying the lamp load for five or six hours is deemed entirely sufficient for all purposes.

A practical demonstration of the advantages claimed for the above system can be seen at the Atlantic City conventions at the booth of the Consolidated Car Heating Co., where the apparatus is to be in operation.

The Boundless West.*

From 1870 to 1900 the far western states and territories multiplied their population from two to 24 times. In the same period the increase for the United States as a whole was but 50 per cent. The best blood and brawn of the nation and of foreign countries was found in the comers to this new land. The percentage of illiteracy in these far western states and territories is lower than in the older states. With the exception of Utah, Arizona and New Mexico—where nearly every inhabitant is a member of the Mormon or the Roman church—the percentage of church members is considerably lower. Yet who can doubt that upon the lower steppes of the Rocky Mountains—in the Garden of the Gods—where the atmosphere is so clear that Pike's Peak seems but a step from the sugar fields of Greeley and Longmont, or in the Humboldt valley—only 4,000 ft. nearer the sky than we are here—where the blueness of the skies and the brightness of the stars would pale the bluest and brightest of famed Italia—that man loves nature and nature's God and worships him with eye and mind and heart?

The development of the resources of the wonderful Far West cannot be described within the limits of my time. Within the experience of active men adobe villages like Las Vegas, Tucson and Los Angeles; Indian rancheries like Phœnix; mining shacks like Helena, Butte and Boise; a mere prospect upon the banks of a wild and uncontrollable stream, like Spokane—have grown to be cities whose productiveness and attractiveness rival the progress of more than a century in the older states. The prune product of the Pacific Coast states has shut out the importations from Europe, and San Buena Ventura has beans for Boston, and to spare. The raising of Smyrna have been superseded by those of California. The oranges of the Mediterranean now find no market here—we have a surplus for export. Europe flavors its beer with hops from Oregon and Washington. Cattle produced on these far western ranges are marketed—on hoof and in carcass—in London. China and Japan and the South American states take flour in large volume from Washington and Oregon. California's output of gold is greater than ever and Colorado's exceeds it. The products of soil and of mine have been adequate to every enterprise; to all the needs of all industrial pursuits.

Seven distinct lines of railroad now span the continent from the Missouri river to the Pacific ocean. Inclusive of Texas the total length of main line is over 66,000 miles. The wonder they have worked in one generation is but an earnest of what they, unaided, shall accomplish in the generation beginning with the current year. But there are 5,900 miles of additional main line of railroad, the projection of which, within this territory, is not only acknowledged, but much of the work has been contracted and is now largely in course of construction. To these confessed projections it will be safe to add from 1,000 to 1,500 miles which are unavowed. Much of this new construction will develop and serve virgin territory.

Governmental and private irrigation projects within the expectation of men who have crossed the meridian of life will bring under the fructifying influence of never-failing streams approximately 10,000,000 acres of land so fertile as to make the valley of the Nile appear by comparison like the edge of Sahara. These lands are taken up greedily at $25 an acre.

The virgin forests of California, Oregon and Washington, Idaho and Montana are conservatively estimated to contain more than 732,000,000,000 ft. of uncut timber. The human mind cannot apprehend so vast a measure. It would make approximately 75,000,000 carloads of merchantable lumber, each of 10,000 ft.—and such timber! It would be worth a journey to Portland to see the forestry building of the Lewis and Clark Fair, still standing. It is built of fir logs that would make the lumber men of Wisconsin and Louisiana rub their eyes and wonder if they could distinguish a pine tree from the pillars of Hercules.

Eight states in this region produced last year, from beets, over 400,000 tons of sugar. Every year new factories are being constructed and more land is seeded to the sugar beet. . . . There has lately been uncovered in Nevada a deposit of copper ore to reach which over 100 miles of standard gage road is building by the owners of the mine. Indeed one might discourse all night of the abundant promise of this western half of our part of the continent.

* Logan or address before the Pittsburg Traffic Club. By J. C. Stubbs, Traffic Director of the Harriman lines.

Program of the Master Car Builders' Convention, Atlantic City, June 13 to 15.

The sessions of the convention will be held in the sun parlor, near the ocean end of the pier. There will be no hotel headquarters. The office of the President, Executive Committee and Secretary will be in the sun parlor. The Secretary will also have a desk in the office of the Enrollment Committee in the entrance to the pier. Immediately upon arrival, each member of the Association should report to the Secretary, register and receive his membership button, if he has none, and be furnished a properly numbered celluloid disc showing his registration. The members of the Association will also be furnished with badges for the members of their families. Cards for registration will be furnished at the Secretary's desk in the entrance to the pier. Those members who will attend only the M. C. B. convention need register but once during the convention, and it should be done immediately upon arrival. Those who stay for the Master Mechanics' convention are requested to register for that convention, after the adjournment of the M. C. B. convention.

OPENING SESSION, WEDNESDAY, JUNE 13, 10:00 A.M. TO 1:30 P.M.

Prayer	10:00 A.M. to 10:05 A.M.
President's Address	10:05 A.M. to 10:25 A.M.
Intermission (to allow visitors to retire should they wish to do so, although all are requested to remain)	10:25 A.M. to 10:30 A.M.
Report of Secretary and Treasurer	10:30 A.M. to 10:40 A.M.
Assessment and announcement of annual dues, appointment of Committees on Correspondence, Resolutions, Nominations, Obituaries, etc.	10:40 A.M. to 10:50 A.M.
Election of Auditing Committee	10:50 A.M. to 10:55 A.M.
Unfinished Business	10:55 A.M. to 11:00 A.M.
New Business	11:00 A.M. to 11:15 A.M.
Discussion of Reports on:	
Revision of Standards and Recommended Practice	11:15 A.M. to 11:30 A.M.
Composite Design of Coupler	11:30 A.M. to 12:00 M.
Tests of M. C. B. Couplers	
Topical Discussions.	
1. Circumferential variation allowable in mating wheels. To be opened by Mr. Geo. L. Fowler	12:00 M. to 12:20 P.M.
2. Piece work on Freight Car Repairs. To be opened by Mr. L. G. and Parish	12:20 P.M. to 12:40 P.M.
3. Should not the practice of hinging the running boards at the ends, to uncover ice hatches on refrigerator cars, be abandoned? To be opened by Mr. J. S. Leatz	12:40 P.M. to 1:00 P.M.
Discussion of Reports on:	
Cast Iron Wheels	1:00 P.M. to 1:15 P.M.
Triple Valve Tests	1:15 P.M. to 1:30 P.M.

Adjournment.

MIDDLE SESSION, THURSDAY, JUNE 14, 9:00 A.M. TO 1:30 P.M.

Discussion of Reports on:	
Brake Shoe Tests	9:00 A.M. to 9:30 A.M.
Air-Hose Specifications	9:30 A.M. to 10:15 A.M.
Brake Beam Specifications	10:15 A.M. to 10:45 A.M.
Axle Limits	10:45 A.M. to 11:00 A.M.
Rule of Interchange, including Report of Arbitration Committee, Revision of Passenger Car Rules, Prices for Repairs of Steel Cars	11:00 A.M. to 12:00 M.
Topical Discussions:	
1. Should not the uncoupling chains of passenger equipment be so arranged as to guard against the uncoupling of cars in transit by passengers who may be on the platforms. To be opened by Mr. F. W. Chaffee	12:00 M. to 12:30 P.M.
2. Advisability of splicing center sills on cars of 50,000 lbs. or less capacity, in order to perpetuate the cars for two or three years longer, with the least possible expense. To be opened by Mr. F. H. Stark	12:30 P.M. to 1:00 P.M.
Discussion of Report on:	
Revision of Rules for Loading Long materials	1:00 P.M. to 1:30 P.M.

Adjournment.

CLOSING SESSION, FRIDAY, JUNE 15, 9:00 A.M. TO 1:30 P.M.

Discussion of Reports on:	
High Speed Brakes	9:00 A.M. to 9:30 A.M.
Height of Brake Staff	9:30 A.M. to 9:45 A.M.
Combination Automatic Couplings for Steam Heat, Air Brake and Air Signals	9:45 A.M. to 10:15 A.M.
Location of Ladders	10:15 A.M. to 10:45 A.M.
Tank cars	10:45 A.M. to 11:15 A.M.
Subjects	11:15 A.M. to 11:30 A.M.
Unfinished Business:	
Reports of Committee on Resolutions, Correspondence, etc.	11:30 A.M. to 12:00 M.
Topical Discussions	
1. Methods of handling car scrap and usable material. To be opened by Mr. R. P. McKenna	12:00 M. to 12:20 P.M.
2. Desirability of adjusting brake pressure to light and loaded cars. To be opened by Mr. Geo. W. West	12:20 P.M. to 12:40 P.M.
3. Better fitting up of couplers, even to the point of machining, or at least drafting the pivot pin hole through coupler lugs and knuckle, with knuckle in place and tail of knuckle forced against lock and proper contour preserved under this condition. To be opened by Mr. F. W. Brazier	12:40 P.M. to 1:00 P.M.
Election of Officers	1:00 P.M. to 1:30 P.M.

Adjournment.

Car Ferry Lines of American Railroads.

BY R. C. DAVISON AND BRADFORD BOARDMAN.

We have collected figures concerning 1,360 miles of car ferry lines operated by 35 companies. The car ferry equipment has nearly trebled since 1897, when the *Railroad Gazette* printed a table giving figures similar to those published in this present one. Nine years ago there were 197 vessels in service, with an aggregate capacity of 2,069 cars. There are now 562 boats, carrying 5,615 cars. The size of the vessels has been much increased, though the average capacity in freight cars remains about 10, freight cars now being about 20 per cent. longer than previously. The average speed of floats towed by steamers is seven miles per hour; steamers carrying cars average about 10 miles per hour. The average number of cars carried daily by all lines is 11,476.

With some small modifications, nearly all companies use the same methods for transferring the cars to the boats and securing them during transit. A counterweighted bridge is hinged at the shore end and usually supported at the outer end on a pontoon. It is raised or lowered to the level of the float by pulleys, hand power being applied directly on a winch or through a hydraulic ram. The Long Island adjusts the height of the bridge by a screw mechanism, operated by an electric motor. The Wiggins Ferry transfers the cars by wooden cradles on iron wheels and steel swing beams. If the route of the boat is in comparatively quiet waters, it is very simple to fasten the cars to the float sufficiently firm so that there is no danger of their breaking loose. There are three common methods, and most companies use at least two of them. They are: setting up the brakes on each car, chocking the wheels, and making the car fast by chains fastened to eyebolts in the deck of the float and passed around either the axle, truck, bolster or the knuckle of the coupler. At the Lehigh Valley terminals, as a rule, only the hand-brakes are set up; if the cars happen to be all connected as they come in from the road, so that the air-brakes may be set, this is done from the switching locomotive after the cars are on the float; that is to say, the air-brakes are only set when it is convenient to do so. It is not considered sufficiently necessary to take any trouble about it. The chocks are sometimes made more effective by using "chock beds," i. e., timbers parallel to the track bolted to the deck on each side of the rails and having squared notches in them to receive the beams of soft wood used as chocks. Instead of ordinary chocks, the Grand Trunk uses rail clamps which stand 12 in. above the rail in front of the wheels, while on the Northern Pacific they fasten eccentric iron blocks to the rails. The Pere Marquette places jacks at an angle under the ends of the body of the car, set so as to take the weight slightly off the bearings.

On the Mississippi and other rivers in the middle west, where boats are often operated in shallow water, side paddle steamers are used to carry cars, or when floats are used they are towed by stern paddle wheel tugs. Such boats can be made with lighter draft than those using screw propellers. They also handle better when there is thin ice on the river.



Steamer Ukiah—California Northwestern.

Companies which operate ferry lines in tidewater harbors use two kinds of car floats. For through car service the floats have three or four tracks, usually three, which take up the entire available deck room, but for pier service, that is, when the cars are run from the railroad terminal to alongside an ocean steamer, a platform is put in the middle between the tracks for convenience in unloading the cars.

The Southern Pacific has six steamers varying in length from 265 ft. to 420 ft. The best known is the "Solano," which is 420 ft. long over all and 116 ft. 8 in. wide. When loaded she draws 10 ft. 8 in. of water. Her gross tonnage is 3,549 tons, and net 3,057 tons. She was built in 1879 by the Central Pacific and is made of Oregon pine. "The Solano" carries the main line trains between Port Costa and Venicia, Cal., a little less than a mile, and the average time including the transfer of the cars from the land to the steamer, is one hour and fifty minutes for freight trains and thirty-two minutes for passenger trains. She has two beam engines operating the paddle wheels independently, one wheel being set about 20 ft. ahead of the other. The cylinders are 60 in. in diameter, with 11 ft. stroke. The engines are rated at 2,250 horse-power. Oil fuel is used, the "Solano" being the first steamer on the Pacific Coast to do so. This boat has been in service for 25 years, and has been laid up for repairs for only 124 days during that time, 90 days of this having been due to the breaking of a piston rod in 1895.

The Pere Marquette steamers are particularly well known because of the great distance they travel, which necessitates an almost seagoing boat. The company has six steel steamers of 30 cars capacity and three of less, the larger capacity boats being used on Lake Michigan. "Pere Marquette 17," of which we reproduce photographs, is one of the latest of these; she was built in 1901, has twin screws, and is 350 ft. long over all, with 56 ft. beam. She has four tracks on the main deck, and above the spar deck are staterooms for passengers and crews. One of the most important problems these ferries have to contend with is ice. These boats are built with a special view to protection against this; the bow plate being double for 60 ft. and the hulls being built out aft to enclose the propeller shafts. Two triple expansion engines are operated independently. The cylinders are 19 in., 31 in. and 52 in. in diameter, with 36-in. stroke. The maximum indicated horse-power developed is 3,500, giving the vessel a maximum of 15 miles per hour, though the average is 12½. The boats ply between Ludington and Manitowoc, 56 miles, and are in service all the year round.

The Michigan Central steamer 'Detroit" illustrated herewith, was built in 1904 for use between Detroit, Mich., and Windsor, Ont., one mile. Her capacity is 21 freight cars; her registered tonnage is 1,307 tons, and gross tonnage 3,089 tons. The hull is of steel and is 308 ft. long, over all, and 77 ft. wide, over all. She draws 10 ft. of water when unloaded. She has four 10-ft. 6-in. propellors, two in front and two behind, driven by four engines developing 3,600 h. p. The high-pressure cylinders are 24 in. by 33 in., and the low-pressure 48 in. by 33 in. The "Transfer," also operated over this route, is unique in having side wheel as well as one propellor.

The California Northwestern steamer "Ukiah" is a wooden side-wheel boat 290 ft. long over all and 41½ ft. broad. Her gross tonnage is 2,564 tons, and net 2,019 tons. Her draft unloaded is 6 ft. The side wheels are driven by one engine, with cylinders 65 in. in diameter and 12 ft. stroke, developing 2,000 h.p. Oil fuel is used. This boat carries 16 freight cars and is fitted for passenger use when not transferring cars. She can make the six-mile trip from Tiburon to San Francisco in less than 40 minutes, with between 2,000 and 3,000 passengers.

The New York, Philadelphia & Norfolk uses one wooden float and five steel floats; the latter are all built alike, being 340 ft. long and 19 ft. wide over all, with 3½ ft. draft light, and 6½ ft. when loaded. The hull is divided in 17 watertight compartments, each of which is reached from the deck by means of a manhole. There are four tracks on the deck, the two inside tracks carry eight cars each and the outside ones seven each. The rails are carried on steel chairs, one pair being fastened to each deck beam. These boats were built to cross the rough waters of Chesapeake Bay daily all the year round in any weather, and excellent results have been obtained. On several occasions two compartments have been flooded in collisions, but each time the trip was completed and transferred, the cars unloaded and the barge repaired and put into service again in a short time. Automatic steam towing machines are used and the power for these and for the steam



Steamer Solano—Southern Pacific.



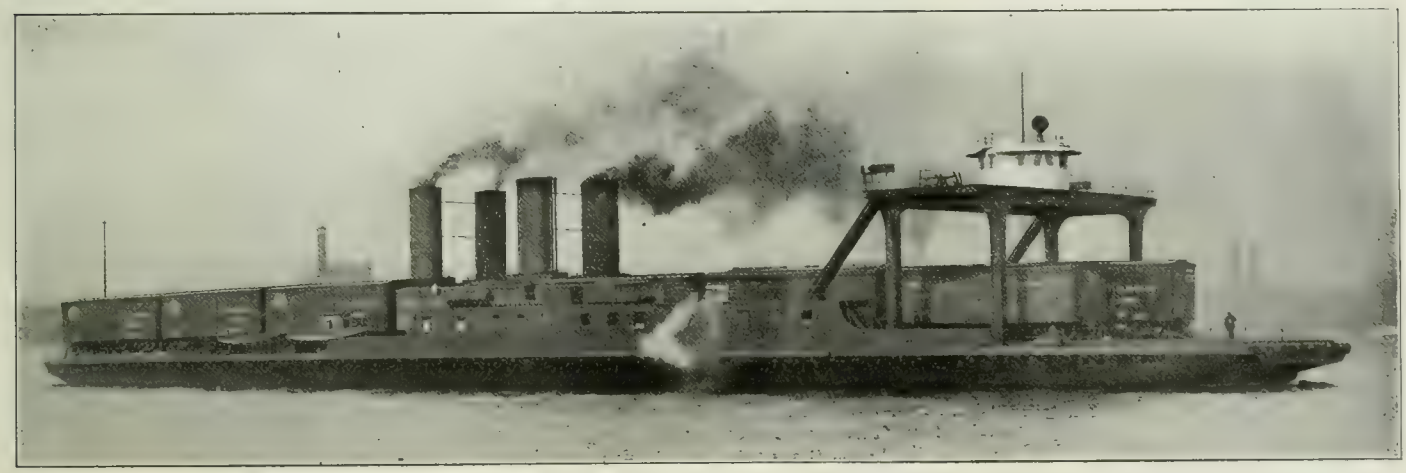
Steamer Pere Marquette 17—Pere Marquette.



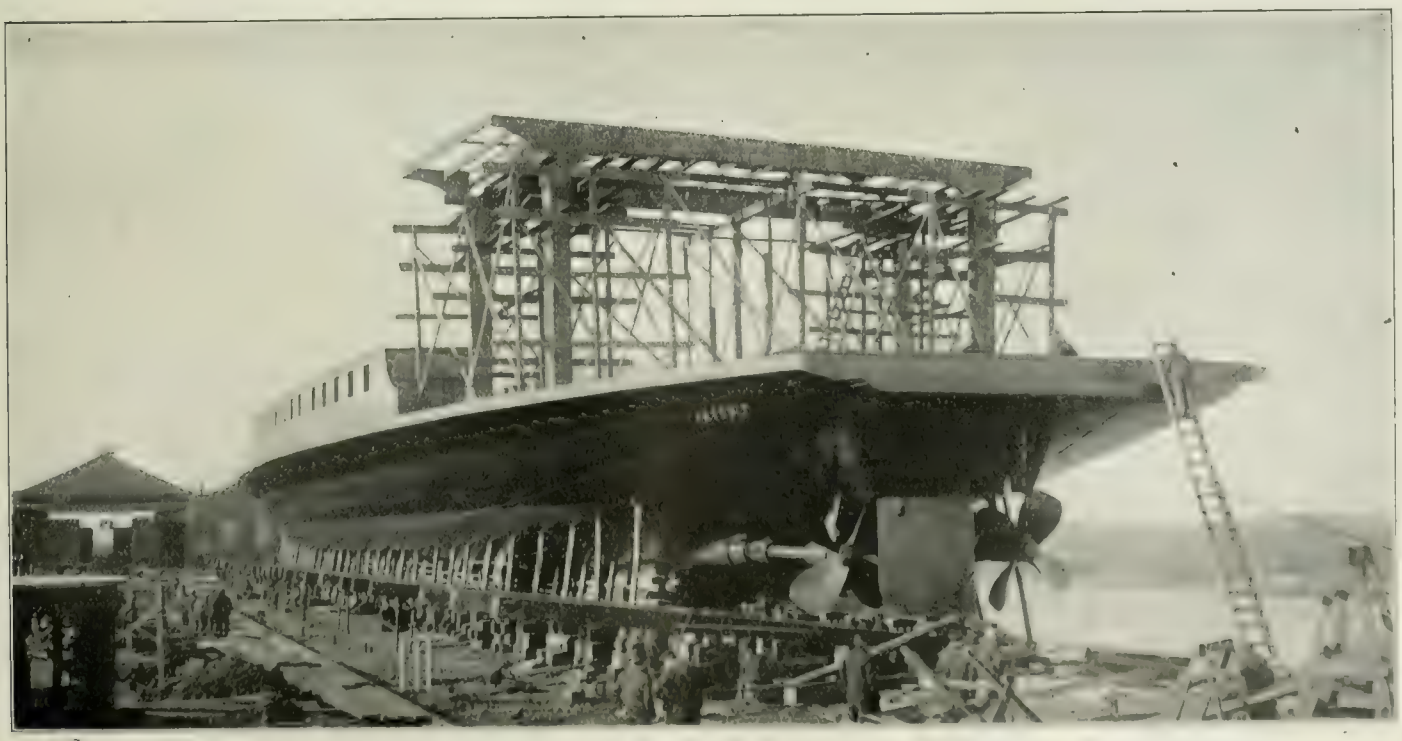
Steamer Pere Marquette 17—Pere Marquette.



Car Float No. 10—Erie.



Steamer Detroit—Michigan Central.

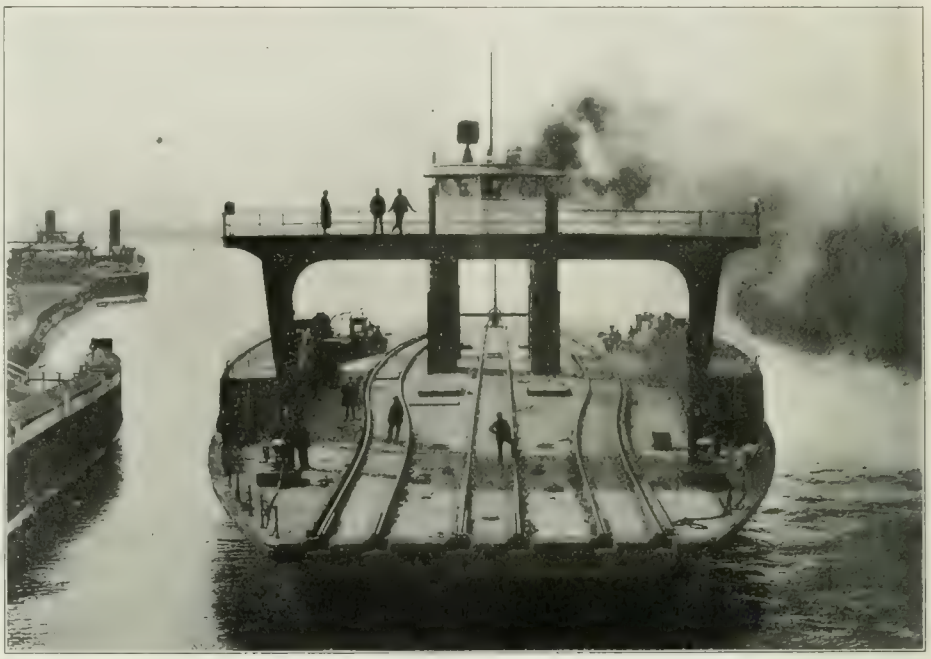


Steamer Detroit, Bow Quarter—Michigan Central.

steering gear, capstan engines, pumps and for heating purposes is furnished from a Scotch marine boiler 5 ft. 6 in. in diameter and 8 ft. long. The towing machine takes up quickly any slack on the tow line and pays it out when a heavier strain is put on it, so that in a heavy sea the pull on the towing bitts is kept constant. The machines are also useful in shortening up the towing line and rapidly taking it inboard when the barge is about to be docked. Since it takes these barges normally about six hours to make each trip, and often longer in rough weather, sleeping quarters for the crew of six are provided amidships on a steel structure about 20 ft. above the main deck.

The handling of a float at a terminal is usually as follows: The float is brought up to the transfer bridge and made fast by ropes drawn taut by winches. There being one of these ropes at each side, this process draws the float up snug and so that the tracks on the float and on the transfer bridge are in approximate horizontal alinement. The final adjustment is made by a ratchet working a screw by which the tracks on the bridge can be slid over a few inches. The bridge is raised or lowered before the float comes in until the tracks are in approximate vertical alinement with the tracks on the float. If, after the float is made fast, the alinement is not accurate enough to slide the toggle bars on the bridge into the toggle caps on the float, time can be saved in adjustment by running the switch engine onto one of the bridge tracks until its weight tilts that side far enough to let one toggle bar engage the cap. The locomotive is then switched over to the other track and another toggle bar is made fast. A difference in height of several inches can be adjusted by this means in quicker time than if the float were lowered in the ordinary way. When the bridge has been used for some time, the toggle bars have a good deal of play, so that the difference in the height of the rails on the bridge and on the float may be as much as two inches. This being too much of a drop for the trucks of the tender to safely take, a flat car is coupled to the locomotive and backed up to the end of the string of cars on the float. Transfer bridges are usually double-tracked. When the float has three or more tracks, the tracks bend together with a crossing frog a few feet from the bow of the boat. The switch points are on the bridge.

It is comparatively rare for cars to be lost from the floats while in transit; most of the accidents occur while at the dock. The engineman of the switching locomotive sometimes fails to obey the trainman's stop signal and backs a string of cars up against the bumper. If the bumper holds, the force is usually enough to break the ropes which make the float fast, in which case the float is driven out from the dock and the cars spilled out between the bridge and the boat. An advantage of having low bumpers, rather than high ones which reach to the drawheads, is that the trucks of the last car of the string will go over a low bumper, and the car will come down on its body on the end of the boat. This makes the trouble evident at once to the engineman, who then stops the train; in such a case the fastening ropes do not break and no car is lost. Steel floats are flat on top, while wooden floats are usually humpbacked to give them greater strength. For this reason, in case the float breaks loose from the dock while the cars are unsecured and the brakes unset, the cars are more liable to slide down grade from the middle of a wooden float than from a steel float. Another advantage of the steel float is that the bow is not so bluff as a wooden boat; it has a long overhang, and when there is ice at the pier it rides over it, instead of packing it up in front. The pontoon is weighted with rocks inside and kept as free from water as possible, so that its lifting power may be near the maximum, it being, of course, easier to let the float down than to raise it up. When the pontoon is damaged a rope is passed under the bridge at high tide and made fast to a gallows overhead; when the tide falls the pontoon drops with it and can be floated out from under the bridge and the necessary repairs made. The bridges have to be made very strong. They are hinged at the shore end so rigidly as to allow no torsion at that point. When heavy cars are run on



Steamer Detroit—Michigan Central.

CAR FERRY LINES OF AMERICAN RAILROADS.

Railroad.	Car Ferry Lines. FROM	TO	Length in miles.	Passenger or Freight Cars.	Equipment. Floats. Number	Floats. Total capacity, Cars	Steamers. Number	Steamers. Total capacity, Cars.	Total vessels	Total capacity, Cars.	Capacity of largest floats or steamers.	Average daily number of cars ferried.	Average length of time cars are on the floats or steamers.	Average speed in miles per hour.
A., T. & S. F., Coast Lines	Pt. Richmond, Cal.	Various points, San Francisco.	7 to 9	F.	4	56	2 tugs.	..	6	56	14	133	1½ hrs.	8
A. C. L.	Pinner's Pt., Va.	Portsmouth, Va. / Norfolk, Va.	2 / 1½	F. & P.	4	16	1 tug.	..	5	16	6	8	10 hrs.	4
Balt. & Ohio.	St. George, S. I.	Various points, New York harbor	3 to 10	F.	43	448	13 tugs.	..	56	448	14	598	3 to 12 hrs.	8 to 10
	Philadelphia	Camden, N. J.; various points in Philadelphia harbor ..	1½ to 3½	F.										
	Balt. Harbor	Locust Point, Canton and Colgate Creek.	1½ to 3	F.										
	Shepards, D. C.	Alexandria, Va., connecting with So. Railway	1	F.										
‡Bessemer & L. E.	Conneaut, Ohio..	Port Stanley, Ont...	58	F.	..	..	1	30	1	30	30	80	5 hrs.	12
Cal. No.-West.	Tiburon, Cal.	San Francisco	6	F.	..	..	1	14	1	14	14	..	....	16
Can. Pacific.	Windsor, Ont.	Detroit, Mich.	1	F. & P.	..	..	2	32	2	32	16	200	30 min.	9
	Proctor, B. C.	Kootenay L'd'g.	30	F.	6	86	3 tugs.	..	9	86	15	120	3 to 5 hrs.	7
		Lardo.	63	F.	..	..	..	..	..	..	..	..	....	..
	Slocan City, B. C.	Rosebery.	25	F.	2	16	1 tug.	..	3	16	8	32	3½ hrs.	7
	Nakusp, B. C.	Arrowhead.	36	F.	2	16	1 tug.	..	3	16	8	32	5 hrs.	7

Railroad.	Car Ferry Lines. FROM	TO	Length in miles.	Passenger or Freight Cars.	Equipment. Floats. Number.	Floats. Total capacity, Cars	Steamers. Number.	Steamers. Total capacity, Cars.	Steamers. Total vessels.	Steamers. Total capacity, Cars.	Capacity of largest floats or steamers.	Average daily number of cars ferried	Average length of time cars are on the floats or steamers.	Average speed in miles per hour.
Cent. of N. J.	Communipaw.	Liberty St., N. Y. ... W. 23d St.,New York, and other points in New York harbor .	Average 2 miles.	F.	23	450	7 tugs.	..	30	450	22	..	....	....
Ches. & Ohio.	Newport News...	Norfolk	12	F. & P.	3	28	1 tug	..	4	28	12	34	2½ hrs.	8
	Norfolk	Port Norfolk	2½	F. & P.										
C., R. I. & P.	Hopefield, Ark..	Memphis, Tenn.....	1½	F.	..	..	1	10	1	10	10	120	20 min.	10
D., L. & W..	Hoboken, N. J...	Pier 41, N. R., N. Y.	1	F.	21	264	12 tugs.	..	36	264	17	196	12 hrs.	5
		Cortlandt St., N. Y..	1½											
		Brooklyn, N. Y.	5											
		Harlem, New York..	10											
Erie.....	Jersey City. ..... Weehawken.....	Various points, New York harbor.	1 to 15	†F.	24	240	11 tugs.	..	35	240	17	316	6 hrs.	5
Esquimalt & Nanaimo. .	Vancouver, B. C..	Ladysmith.	46	F.	1	12	1 tug.	..	2	12	12	24	6 hrs.	..
Grand Trunk	Windsor, Ont. ...	Detroit, Mich.	½	F. & P.	..	..	3	44	3	44	16	540	30 min.	6
	G'd Haven, Mich.	Milwaukee, Wis. ...	84	F. & P.	..	..	1	28	1	28	..	44	....	14
Ill. Central..	Brookport, Ill....	Paducah, Ky.	3	F. & P.	..	..	2	10 P. or 13 F.	2	10 P. or 13 F.	6 P. or 8 F.	40	20 min. 8 min.	... ...
	Trotter's Pt.,Miss.	Helena, Ark.	1											
Lehigh Val..	J. City Terminal	Various points, New York harbor	1 to 3½	F.	20	254	6 tugs...		26	254	22	225	....	6
Long Island..	Long Island City	Pier 32, E. R., N. Y..	4	F.	11	166	5 tugs.	..	16	166	20	250	....	7
		Penn. R.R., Jer. City	7											
		C. R.R. of N. J., J. C.	6½											
		Penn. R.R..Grnvl,N.J.	8½											
Me. Central..	Bath, Me.	Woolwich, Me.	¾	F. & P.	..	..	2	8 P. or 16 F.	2	8 P. or 16 F	6 P. or 12 F.	..	25 min.	...
Mich. Central.	Detroit, Mich. ..	Windsor, Ont.	½	F. & P.	..	..	4	84	4	84	21	1090	....	6
Mo. Pacific ..	Ivory, Mo.	East Ivory, Ill.	¾	F.	1	26	5	31	6	57	26	435	15 min.	5
	Bird's Point, Mo.	Cairo, Ill.	6	F. & P.									45 "	
	Belmont, Mo....	Columbus, Ky.	¾										15 "	
Nash., Chatt. & St. L....	Guntersv'le, Ala..	Hobbs Island	20	F.	3	24	2	..	5	24	10	18	3 hrs.	8⅖
N. Y. Central.	Uptown N. Y. Terminals	Various points, New York harbor	..	F.	41	485	20 tugs.	..	61	485	17	760	10 hrs.	6 to 8
N. Y., N. H. & Hartford..	Harlem R. Term. and Oak Point.	Various R. R. terminals, J. City & N.Y.	6 to 13	F. & P.	46	771	2, & 19 tugs.	16 P. or 31 F.	67	802	22	2000	3 hrs.	8
N. Y., Phil. & Norfolk. ..	Cape Charles,Va.	Port Norfolk	34	F.	6	186	6 tugs.	..	12	186	30	600	....	7½
Norf. & South	Edenton, N. C..	Mackey's Ferry	9	F. & P.	..	..	1	24	1	24	24	81	1½ hrs.	10
	Columbia		29	F.	1	10	1 tug.	..	2	10	10	10	....	5½
North Shore.	Sausalito, Cal. ..	San Francisco.....	6	F.	..	..	1	*17	1	17	17	..	....	7
Nor. Pac.....	Kalama, Wash.	Goble, Ore.	1¼	F. & P.	1	18	1	11 P. or 20 F.	2	11 P. or 38 F.	11 P. or 20 F.	165	20 min.	7
Norf. & West..	Coal Grove, Ohio	Ashland, Ky.	½	F.	1	6	1	..	2	6	6	40	30 min.	5 to 10
Pennsylvania	Jersey City.....	Various points, New York harbor.....	2 to 8	F.	60	700	8 tugs.	..	68	700	20	1000	2 to 24 hrs.	8
	Camden, N. J....	Various points, Philadelphia harbor...	2 to 10	F.	20	180	3 tugs.	..	23	180	10	300		
Pere Marq...	Ludington.	Kewaunee	57	F. & P.	..	..	9	245	9	245	30	450	....	12½
		Manistique	140											
		Manitowoc	56											
		Milwaukee	96											
	Port Huron	Sarnia	1	F.										
	Detroit.	Windsor.	1											
Phil. & Read.	Port Richmond ..	Camden, N. J., and Philadelphia	4	F.	28	224	4 tugs.	..	32	224	8	500	abt 1 hr	5
Southern Pacific....	Benecia, Cal.	Port Costa.	1	F. & P.	1	6 P. or 12 F.	7	58 P. or 106 F	9	61 P. or 118 F	24 P. or 44 F.			10
	Oakland, Cal.....	San Francisco.....	5¼ to 11				1 tug.							
		Visitation Point. ...												
	San Francisco...	Visitation Point. ...	8											
Tex. & Pac...	New Orleans....	Gouldsboro, La.	1½	F. & P.	..	..	2	28	2	28	16	210	15 min	10 to 12
Vicks., S. & P.	Vicksburg, Miss.	Delta Point, La.....	1	F. & P.	..	..	1	10 P. or 16 F.	1	16	10 P. or 16 F.	85	12 min	12 to 15
Wiggins F'ry.	E. St. Louis, Ill..	St. Louis, Mo.....	½ to 1	F.	3	54	2 & 2 tugs.	26	7	80	30	700	1 to 2 hrs	7
Wis. & Mich.	Peshtigo Harbor, Wis.	South Chicago, Ill..	240	F.	2	52	2	..	4	52	26	40	2 hrs	16

* Narrow gage. † Occasional special shipments of passenger cars ‡ Operated by Marquette & Bessemer Dock & Navigation Co
¶Same equipment available as on Kootenay Landing line; one trip per week.

one of the tracks, their weight warps the bridge, throwing an exceedingly heavy strain on the material of which it is made.

Twelve companies have given us figures showing the average cost of ferrying one car per mile. The average is about 48 cents, the highest being $1.20 and the lowest 13 cents. This large variation is to be expected, as it is reasonable that the company which does the greatest business should do it at the lowest rates; thus the New Haven, which has 67 vessels in service and carries about 2,000 cars per day, has the lowest cost, that is, 13 cents. The Long Island and the Baltimore & Ohio are the next lowest, with 19 cents. By comparing the Delaware, Lackawanna & Western and the Erie, we find that the length of time the cars are on the floats, and the ratio between the average number of cars ferried and the total capacity of the floats seem to be important factors as affecting the cost of operation. The distances traversed by the ferries of these two roads are about the same; they have nearly the same number of vessels, whose total capacity is 240 cars in the case of the Erie and 264 in the case of the Delaware, Lackawanna & Western. But with this equipment the Erie ferries an average of 316 cars a day, while the D., L. & W. only handles 196; also, the cars remain on the floats of the last-named road for about 12 hours as compared with six hours on the Erie, this indicating quicker handling at terminals in the case of the Erie, and consequently the cost per car per mile of the D., L. & W. is 60 cents, and on the Erie 26 cents. There are some companies which, according to the figures we can obtain, are exceptions to these general principles. Both the Northern Pacific and the Norfolk & Western ferry a large number of cars in comparison with their equipment; the cars are on the floats for only a very short time and the floats are moved at the average speed, yet the cost per car mile is $1 on the Northern Pacific and $1.26 on the Norfolk & Western; these figures are over twice as large as those of other companies which, in equipment and amount of business, are comparable to the two roads in question.

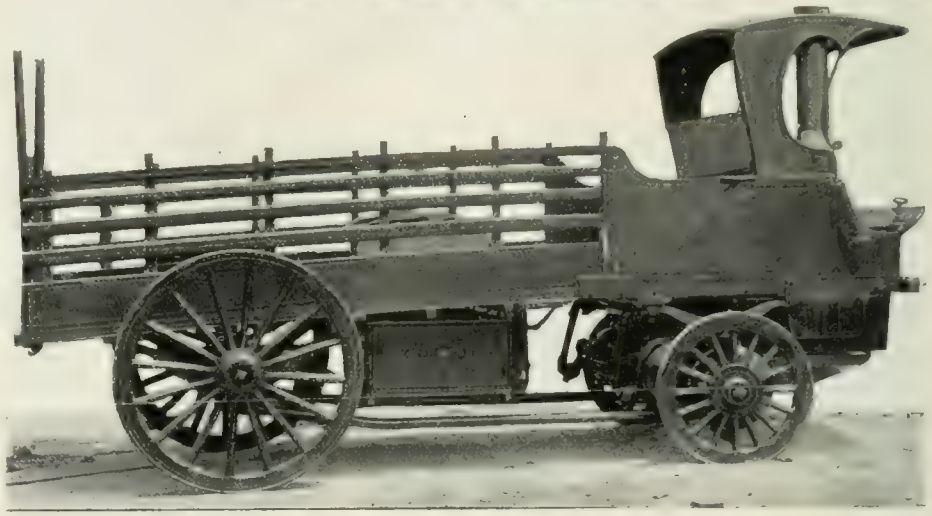
Steel car floats have not been in general use long enough to show actual figures as to their advantages over wooden floats as regards life and cost of maintenance, but all the estimates available make it clear that their use is much more desirable. The first cost is about 25 per cent. greater. This will probably not be true in a few years, as the timber supply is decreasing, especially timbers of such length as are necessary for the construction of car floats. The steel barges are much more convenient to handle, and, in fact, there is about 25 per cent. saving in convenience of operation. The time saved in docking them when there is ice in the slip has already been mentioned. A most important advantage is the strength of their construction. When the floats are loaded, the first string of cars run in on a side track causes the boat to list several feet, and, since the boat is secured rigidly to the bridge by means of toggle bars or similar devices, while the shore end of the bridge is hinged so as to allow only a vertical motion, the listing of the float causes a severe warping strain on both the bridge and the float. Such a wringing tends very soon to open the seams of a wooden float; it has been found that steel floats can be built so strongly that no trouble is experienced on this account. The New York, Philadelphia & Norfolk has had steel barges in use for nine years. They are in good condition and the superintendent estimates a life of 25 years, at least, for them. Their internal parts are more accessible than in the wooden floats.

The accompanying table gives figures concerning nearly every company in the United States and Canada operating car ferry lines. Unless otherwise noted, freight cars rather than passenger cars are understood.

Hermann von Budde, since June 23, 1902, Prussian Minister of Public Works, and as such the head of the Prussian-Hessian State Railroad administration, died of a cancer April 28 last. Von Budde was a soldier until 1900, serving on the general staff, latterly as the chief of the railroad division, which, as all the railroads of the Empire fall under military command in case of war, requires an intimate knowledge of railroad affairs. He retired from the army in 1900 to become the head of a great manufactory of arms and ammunition, but was called to the ministry as above mentioned two years later. He was a man of very great energy and activity, and impressed himself on the affairs of his department to a remarkable degree. The government appreciated him particularly for his success in carrying through Parliament long cherished plans for deep-water canals, which previously had been voted down. Shortly before his death he directed the following to his subordinates: "The dying Minister sends a heartfelt greeting to all railroad men. May the force stand together, a model of faithfulness towards the King and country. This is to be made known to all the railroad men. Minister von Budde."

A New Steam Rail Motor Car.

An interesting design of rail motor car, involving an entirely new application of power, is shown in the accompanying illustrations. The car, which is 52 ft. 9 in. over all, is mounted on two four-wheel trucks of a similar pattern to those used under heavy electric interurban cars. The body is divided into a passenger compartment seating 30, a smoking compartment seating 11, a baggage compartment, and an engineer's cab in the forward end. On each of the trucks are mounted two 50 h. p. (200 h. p. total) eight-cylinder steam motors, entirely encased, and suspended from the axle and the truck frame in a manner similar to the form of suspension used for electric motors on trucks. The shaft of each motor is geared directly to the car axle. Steam is generated in the boiler in the front end of the car, which extends across the entire width of the car just back of the motorman's cab. Eight hundred and fifty gallons of water are carried in the water tank hung under the floor of the car in the center.



8-Ton Steam Motor Truck with Halsey Motors.

This design of car has been evolved from the successful application of similar motors of smaller horse power and a similar steam generating outfit to commercial automobile trucks. Two of these trucks, one of five tons capacity, having two 30 h. p. motors mounted on the front axle and the other of eight tons capacity, having two 50 h. p. motors mounted on the front axle, have been in daily use in Philadelphia for a number of months. The essential feature of the car—the motors—have been successfully employed in stationary work for three or four years and are made in sizes from 2 to 500 horse power. The accompanying sectional drawings show the constructive features of the motors. They are arranged in two pairs of four cylinders each, mounted on a crankshaft within the casing. Two of the pistons have a straight reciprocal motion, the cylinders being fixed in the casing. The other pair of cylinders have a transverse movement on fixed guides and the interior pistons have longitudinal movement within the cylinders at the same time. The admission and exhaust of the steam is controlled by the port openings in the inside casing. There are no movable valves or



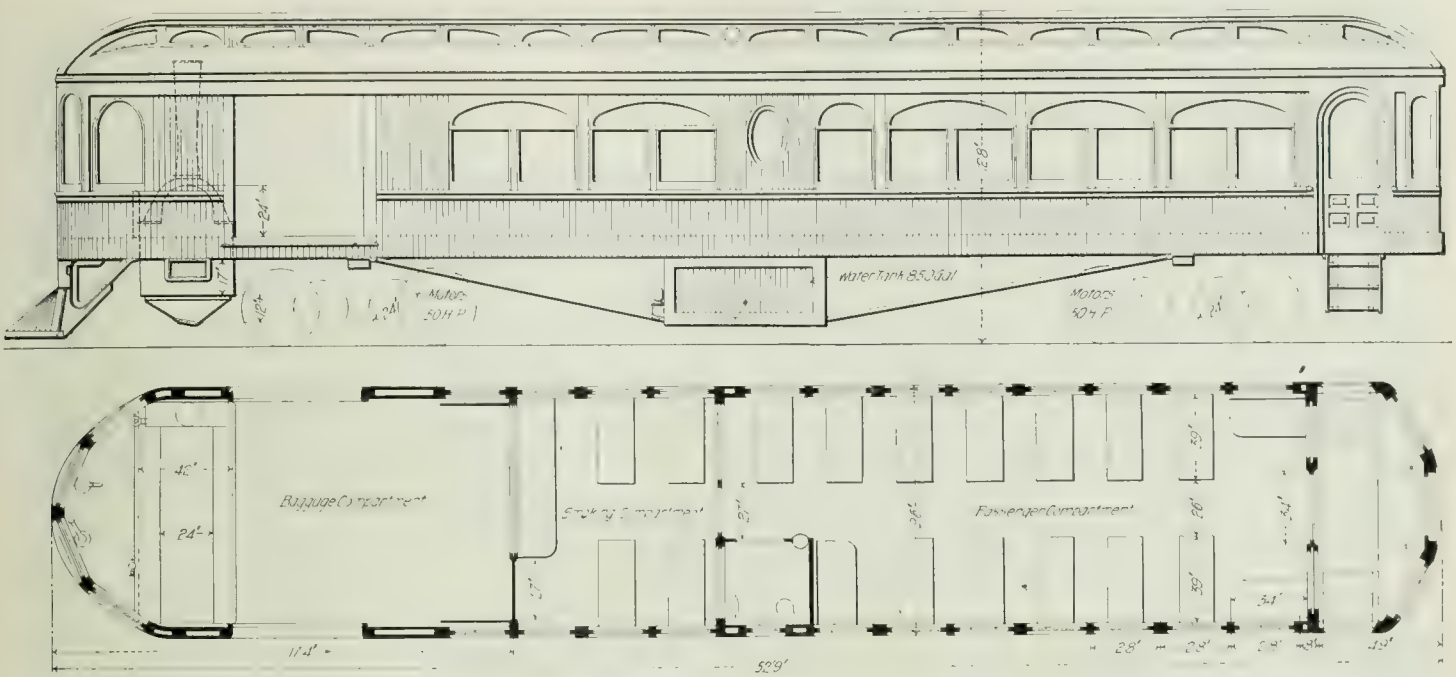
Motor and Casing.

valve gear requiring adjusting or care. The engine is perfectly balanced and is capable of running at 1,000 revolutions per minute at a piston speed of 600 ft. per minute. Variable cut off and reverse are obtained by revolving the crankshaft independently of the inside casing, thereby changing the relative position of the port openings. A quarter of a revolution to the right or left changes the cut off from one-half in forward gear to one-half in reverse gear. For traction work the engines are adjusted for a cut off in forward gear and a small auxiliary steam cylinder is used to revolve the crankshaft into the reverse position. The power control is obtained by the use of the throttle. The principal objection to engines of this class—that is, wear and consequent leakage—seems to have been successfully overcome in this design of engine, as units of this type have been in constant service for more than three years in stationary work without adjustment of any kind, the casing not having been removed during that time. Lubrication is provided for in the ordinary way through a plug hole in the outer casing.

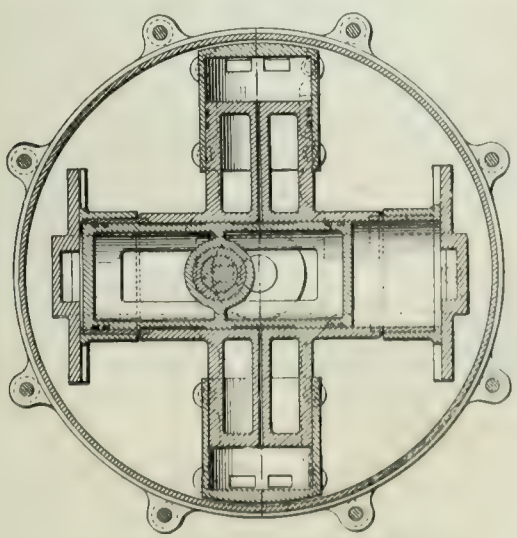
The boiler employed is a water tube marine type of boiler having a large grate area and arranged to highly superheat the steam, which is used at about 200 lbs. pressure. On the trucks now in service the boiler has 12 sq. ft. of grate area, the dimensions of the grate being 3 ft. by 4 ft. On this grate is laid a bed of anthracite pea coal from 6 to 9 in. deep. About 300 lbs. of coal can be fired at one time, sufficient to run the truck for 25 miles or more. By means of a variable exhaust nozzle in the stack the fire can be built up rapidly to supply any amount of steam required. The boiler superheats the steam to between 800 and 1,000 degrees and it is largely due to this superheat that the motors, which are free from stuffing boxes, can be successfully used, as there is little or no condensation when starting out after standing still, and therefore no necessity for draining the water out of the casing in order to have the engine start up quickly. A small reciprocating pump is mounted on the outside of the water tank. This pump takes steam from the main steam pipe back of the throttle valve. When the engine is stopped and the steam pressure begins to rise, the pump begins to work more rapidly and fills the boiler with cold water. At the same time, the exhaust from the stack having been cut off, the fire dies down and the steam does not blow off.

In the application of these motors and boiler to rail motor cars much of the complication involved on a truck is done away with. The 50 h. p. motors are about 24 in. in diameter over all and are geared directly to the axles. Each motor has a live steam and an exhaust steam connection, through universal pipes, with the boiler and stack. The steam reverse cylinder is also connected with the boiler through a small pipe which is first led to the controller. The boiler has a grate area of 24 sq. ft., 3 ft. wide and 8 ft. long. With a bed of coal about one foot thick it will hold 1,000 pounds of anthracite coal, which will supply steam for a run of 100 miles. Before starting out from a terminal the boiler is fired up and then requires no further attention until the end of the run, when the ashes would be shaken down and possibly a small amount of fresh coal fired. The feed pump is mounted on the water tank, as in the trucks, and has a gravity feed, so that it is not likely to get out of order or run dry. Injectors may be mounted on the boiler for emergency purposes. In the cab are mounted the air brake controller, a combined throttle and reverse valve for the motors, and the boiler feed pump valve. These, with the steam and air gages, are all the apparatus requiring attention from the driver. The boiler feed pump once being adjusted to supply the proper amount of water for any given run requires little or no attention, and the regulation of the fire is largely automatic.

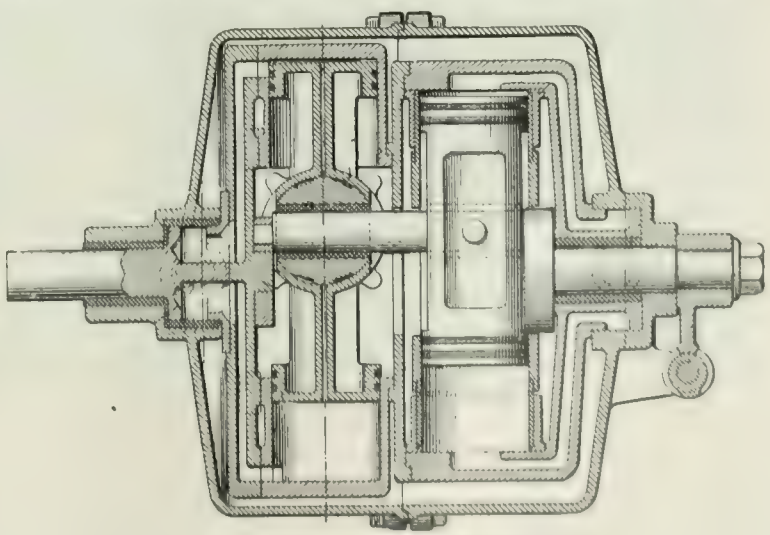
The principal advantages claimed for this design of car are



Plan and Side Elevation of Steam Rail Motor Car.



Cross-Section Through Motor.



Vertical Section Through Motor.

simplicity, low cost of operation, maximum starting and accelerating power, low weight of driving parts, and the small space in the body of the car occupied by the driver and the boiler. None of these cars have as yet been built, but the design appears to be quite feasible. Mr. James T. Halsey, 336 York avenue, Philadelphia, Pa., is the builder of the engines and motor trucks; the application to rail motor car is his also.

Cast Iron Wheels.

Years ago, in the days of light capacity cars, charcoal iron and low mileage, the car builder of a railroad scarcely knew that he had a wheel on his road, in the sense that a healthy man hardly knows that he has a stomach or lungs or a heart, for with the usual accidental exceptions that may come even to a normally healthy man everything went well. The cast-iron wheel was the boast of the American iron master, and was apparently firmly entrenched in use. But with the great increase in car weights and speeds, and the demand for "safety first," the steel-tired wheel gained its foothold and has held it on nearly all roads in passenger service. In freight work the cast wheel was universal, and it was not until the advent of the 50-ton car that the idea crossed the mind of even the most progressive railroad officials that the steel wheel, with its extra cost, would have a chance to compete successfully with the staple article that had done its work so well for so many years.

Attention has been called before in the *Railroad Gazette* to wheel failures that have occurred with cast-iron wheels on high capacity cars, especially on mountain roads, and how officials have been put to it to meet the new conditions. The cast-iron wheel has been greatly improved in strength under the stress of recent requirements by changes made in the shape of the brackets, the form and location of the plate, and by modifications in the mixtures and methods of casting, and there is no doubt that it can be still further improved. There is, however, a growing impression on the part of railroad officials that the 50-ton car is a little too heavy to be carried fully loaded on eight cast-iron wheels. There seems to be little trouble with cars of 40 tons capacity, but the increase of 25 per cent. apparently oversteps the limits of strict safety. It is known what the flange will withstand under a static load, but not as yet anything at all as to what it is called upon to sustain under the varying conditions of service, though an investigation is under way that should throw light on the subject.

In anticipation of these results we can only indulge in a surmise. Laboratory investigations have shown, and attention has already been called to, the fact that the flange of a cast-iron wheel will break under loads of from 40,000 to 116,000 lbs., with an average of about 70,000 lbs. Unfortunately, it so happens that the stronger the wheel the thinner will be the chill and the poorer its wearing qualities, whereas the deeper the chill the less the strength. It appears that this very wide limit in the ability of flanges to sustain a blow is in itself a source of danger, for it is a matter that no direct inspection can detect, and no one would claim that the breaking of any one wheel out of a hundred will give an exact indication of the individual conditions of each of the others. So the strength of the chain must be considered as that of its weakest link, and the resisting power of the flange placed at such a point as judgment and the willingness to take risk may dictate, whether it be at 40,000, 50,000, 60,000 or 70,000 lbs.

Having established this assumed basis of ultimate strength, what shall be the limit of load that is to be permitted? If the investigation referred to shall show that a car of 100,000 lbs. capacity puts a stress of 30,000 or 40,000 lbs. (a guess) on the flange, then it is evident if the factor of safety used in other branches of engineering is a precedent that there is too low a factor of safety on the wheels.

In this case, what is to be done? The cast-iron wheel is accepted as good and standard practice under cars of 100,000 lbs. capacity, yet some roads are putting steel wheels under these cars in order to avoid the dangers of breakages. In doing this on one large road, the question came up as to how the use of cast wheels could be prevented on these cars in repairs, as they would be allowable not only under the rules but by the practice of a road which had a large number in service. The difficulty was solved simply and ingeniously by marking up the capacity to 110,000 lbs. at the time the wheels are applied, and issuing orders that nothing but steel wheels shall be used under cars of that capacity. A 10 per cent. overload will still be allowed with the increased rating, as the bodies and trucks are amply strong enough to carry it. Thus two birds are killed with one stone; the rolling stock is protected from substitution of cast-iron for steel wheels during the transition period, and the operating department is having placed at its service rolling stock that makes a shorter train or an increased net tonnage possible, with a corresponding decrease of ton-mile expenses.

That the steel wheel is abundantly able to sustain the extra load and stresses is certain, for its capacity in this respect is probably more than 600,000 lbs., which leaves a wide margin for sharpening of the flange before the danger limit, that has been crossed by the cast wheel, is even approached. The fact that the steel wheel has gained a foothold in freight service not likely to be released is no reason why the cast-iron wheel should not continue to be improved. In fact, it will probably serve as an incentive to its improvement. In this work it is suggested that possibly the present standard tread is not altogether the best that can be designed for the straight running of the wheel and the prevention of sharp flanges. A straight taper has been used to marked advantage, and the subject, it would seem, is well worth the attention of the committee on standards of the Master Car Builders' Association.

Use of Steel Castings in Car and Truck Building

BY A. STUCKI.

The steel casting is a metal of comparatively recent date. But the development of its applications has proceeded at such a rapid gait that to-day it holds its own with the other cast metals which had been used for years before the manufacture of cast-steel had even been dreamed of. The improvement in the quality is possibly more wonderful yet, so that steel castings of to-day not seldom take the place of forgings, especially if they are of a rather intricate design.

The reason for such an evolution is not hard to find. In the first place the steel casting in general possesses properties which make it very suitable for conditions existing with rolling stock. Besides that, it is a material which can easily be changed in its composition to suit specific purposes. Owing to the fact that it is as a rule the product of the open hearth furnace, it is possible to try tests before pouring the bath and in this way to verify the proportions of the charge.

If desired, a tough and ductile material can be obtained, which has a tensile strength, elongation and reduction of area similar to rolled steel of low carbon. A well-known railroad official, a year or two ago, discovered what appeared to be a crack in one of his bolsters, ready to go under a car. He at once telephoned for his inspector, and it was decided to scrap the bolster. But before doing so it was decided to put it in the testing machine. Several loads were applied and the bolster straightened out again, after which it sustained a load of at least five times the maximum working load. It was put into service and has stayed there ever since.

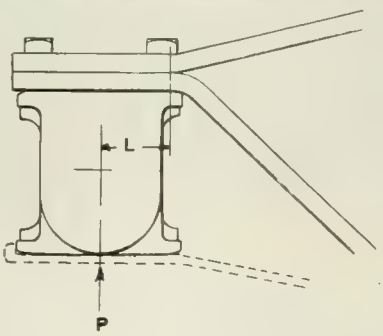


Fig. 1.

The fact that steel castings can be welded should not be underestimated, and even more should it be appreciated that they can be straightened out in case of derailments or wrecks. All these are items which will materially facilitate the repairing of the cars, and will save time and money. After accidents such material has seldom to be scrapped, and comparatively little work will restore these details to their original shape. This is certainly true economy.

To-day steel castings are successfully used in nearly every portion of the car and truck, such as couplers, striking castings, end sills, corner castings, center plates, bolsters, truck transoms, truck pedestals, brake heads and many other details. The substitution of cast-steel for the ordinary arch bars of a freight truck is another important application, and since there are many advantages in this practice a few remarks may be made on this special case.

The present arch bars, it is true, give excellent results throughout the country. None the less, their connection to the spring plank consists in most cases merely of the column bolts. These in turn are exposed to great shearing stresses and the metal in the arch-bars, just around the hole, to great crushing strains every time the bolster presses or hammers against the column. Is it any wonder that these holes wear oblong? But possibly more important is the fact that over 35 per cent. of the arch-bar material is cut away at that point, which naturally leaves the same amount undeveloped in the remainder of the bar. Still the material is there, it had to be paid for, and has to be hauled around the country without bringing in any return of usefulness. With the use of steel castings, the columns and the arch-bars are cast in one piece, so that the column bolt is not needed any longer. This will do away with the large holes in the bars ,while smaller bolt and rivet holes can easily be compensated for without making the remainder of the bars any heavier than necessary. Besides that, the cast arch-bar can be made wider at the center than at the ends, so as to provide for lateral stiffness, where such is mostly needed. This again can be done without the use of additional material.

The stresses existing in the present arch-bars are well under-

stood, none the less they are somewhat obscure at a point near the end, just where the two bars start to diverge from each other. Considering the bottom tie bar removed, as shown in the sketch, in the case of a 100,000 lbs. truck, bars 5 in. x 1¼ in., loaded car passing a curve at high speed, then the load per journal will be P = 22,850 lbs., distance from center of journal box to neck = L = 6 in., section modulus of two bars = $\frac{2 \times 5 \times 5^2}{6 \times 4^2}$ = 2.6, and the fibre stress = $\frac{P \times L}{2.6} = \frac{22{,}850 \times 6}{2.6}$ = 52,730 lbs., which shows that this portion of the present arch-bars depends entirely upon the bottom tie bar for its strength. This means that the journal box has to act as a diagonal brace and consequently is subjected to great strains whenever the car is loaded. Now supposing that the truck is derailed, and the box gets shocks and blows which could not be foreseen in designing it, is it not natural that the material, strained as it already is, will break? This condition can be very much improved in cast arch-bars, inasmuch as a small amount of metal in the form of ribs will add a great deal to the strength at that point. However, care should be taken that both journal box bolts are of the same length.

Casting the top and bottom bar integral with each other will also obviate the shearing stresses in the journal box bolts, otherwise present at the point where the two bars touch.

Denver & Rio Grande Observation Cars.

The accompanying illustration shows two views of the type of observation car used on the Denver & Rio Grande through the Grand Canyon, the Black Canyon of the Gunnison and the Royal Gorge during the summer months. The service this year was begun May 15. There is no extra charge for seats on these observation cars. Drawings of these cars were shown in the *Railroad Gazette* June 16, 1905.



Observation Car at Glenwood Springs, in the Canon of the Grand River.



Open Top Observation Car at the Hanging Bridge in the Royal Gorge.

Malleable Cast Iron, Its Manufacture and Its Physical Properties.*

When speaking of malleable cast iron, we understand by that term an iron casting made malleable by a process of annealing. In some branches of engineering we rarely meet with this interesting product of metallurgy, while in other branches—for example, freight-car building, the construction of conveying machinery and agricultural machinery, etc.—malleable cast iron is one of the most important materials the engineer has to deal with, and an intimate knowledge of the physical properties and peculiarities of this metal is therefore highly desirable.

In a modern technical reference book I find this definition on modern malleable cast iron:

"Malleable cast iron is the name given to castings made of ordinary cast iron which have been subjected to a process of decarbonization, which results in the production of a crude, wrought iron. The castings are made in the usual way, and are then embodied in oxide of iron, etc." Furthermore, it states: "It only requires proper mixtures and proper annealing, coupled with care in other particulars, to make malleable castings that will weld on itself; that will draw out to a knife edge on an anvil under a hammer; that will temper and cut soft iron like a cold chisel."

This, I think, is too good to be true for ordinary malleable castings, and I have not found any authorities, few as they are, to be as enthusiastic as that. If an engineer with the ability and reputation as that of the author of the definition referred to has such vague ideas about malleable cast iron, it is certainly not to be wondered at that the average engineer has an equally vague knowledge on the subject; and I therefore dare hope that we will all derive some benefit by the following discussion.

Cast iron, as extracted from the ore, is the base for all production of iron and steel with its numerous different properties and uses. We are accustomed to regard all substances accompanying iron as "impurities," but let us remember that chemically pure iron only exists as a curiosity of the laboratory—a substance without any value for structural purposes. Cast iron as a practical metal contains generally carbon, silicon, sulphur phosphorus and manganese, and the various proportions of these ingredients, together with the remarkable phenomena in regard to combined and graphitic carbon, form all the varieties of cast iron, malleable iron, wrought iron, mild steel and tool steel.

There is even more apparent difference between, for example, the gray iron center and the white iron rim in a cast freight-car wheel than there is between the two distinct metals lead and tin, and this great difference is not brought about by any "mixing" in the metal after it left the cupola, but simply by utilizing the well-known phenomena that a sudden cooling of the molten iron will cause a chemical combination between the iron and the carbon it contained previously in the form of graphite. To this phenomena is due the enormous production of chilled cast iron wheels for American freight cars; and it is again this very phenomena which forms the basis for the manufacture of malleable cast iron which, particularly in this country, has reached such enormous proportions and made possible the production of machines and implements at such a low cost as would be impossible without it.

In 1722 Reamur published the fundamental principles for the malleable cast iron process, but it is of comparatively recent years that the industrial world has utilized this knowledge. It was found that if a casting too hard to work were exposed to a continuous high heat for a number of days, imbedding in rolling mill scale (hammer slag) or iron ore, the casting would entirely change its nature, and at the time stated Reamur had collected those observations and found the principles which governed this change in the cast iron. The present generally accepted theory of the malleable cast iron process is to decarburize the metal by some oxide, which will impart a portion of its oxygen to the carbon in the metal at a red heat, forming carbonic oxide, which is given off, thus extracting the carbon. The oxidizing re-agents usually employed are rolling mill scale and red hematite iron ore.

It is important that this material should be as free as possible from sulphur, which is the most objectionable substance in malleable cast iron. The theory as expressed above does not, however, seem to cover the field, as malleable castings are now produced without any decarburizing material, the hard iron castings being packed in fire clay or sand instead of rolling mill scale or hematite ore. For small castings this treatment gives tolerably good results, but for heavier casting tests and analyses show an inferior product. It is already stated that malleable cast iron is produced from hard or white castings, and we will therefore consider the means by which this important property is secured.

The furnace most commonly used in malleable foundries is of the reverberatory type, as this furnace has the great advantage of melting the charge without the fuel coming in contact with the metal. These furnaces vary in details of construction, but the accompanying illustration will give an idea of the general arrangement.

The ash pit is enclosed and contains the air inlet from the blower. The grates are charged (commonly with good bituminous coal) through side doors, which are hermetically closed except at the time of charging. The flame passes the bridge, and in some furnaces there is given an additional supply of fresh air forced through a number of small pipes and in the direction the gases travel. The hearth is slightly inclined towards the bath where the molten metal collects, and on this hearth is carefully piled up the charge to be melted. The roof immediately over the hearth is composed of a number of built up arches which are handled by a small traveling crane over the furnace. In charging the furnace these arches are removed, and when again placed in position all cracks or joints are closed with fire clay. A little above the high level of the bath are located on each side of the furnace rather small rectangular openings. Through these the events inside the furnace are observed, and through these the wrought iron bars are inserted for skimming off the slag and for "rabbling" or puddling the molten metal until the desired quality is reached. Beyond the bath is the "choke," and finally the smoke stack, about 75 ft. to 100 ft. high. At the bottom of the bath, on each side of the furnace, are located the tapping holes closed by a clay plug as in a cupola. The day's work is started by charging the furnace with pig iron, wrought iron scrap or old steel rails in such proportions as is deemed desirable for the castings to be made from the charge.

The pigs and rails are placed in layers somewhat diagonally so as to permit the flames to circulate freely through the mass on its way over the bath towards the smoke stack. After the charge is placed in the furnace the "bungs" or sectional arches are placed in position, all openings closed and the fire started. Five to 10 tons is usually the charge, according to the size of the furnace.

During the process of melting, which takes three to four hours, the grate surface is kept even to prevent cold air from entering the furnace, and when the charge commences to melt such parts as show a tendency to bake together are separated and led towards the bath where the slag formed is skimmed off so as to present a clean surface of the molten metal to the flame in order to get the full benefit of the heat. After the charge is melted down the bath is vigorously "rabbled' or "boiled" to insure a thorough mixture and to reduce the percentage of silicon to the desired point. This point is determined by dipping out a sample which is rapidly poured into a cast iron mold, quickly cooled and broken. If the fracture indicates the presence of graphitic carbon the "rabbling" is continued until a sample is procured whose fracture shows the desired composition or state of the metal. The molders are now ready with hand ladles to carry off the metal to the flasks nearby, for not only does the metal cool very rapidly but chemical changes take place in the bath and everything has therefore to go with alacrity and dispatch. The tapping goes on from both sides of the furnace at the same time, and within about 30 minutes the whole charge is emptied and the furnace is allowed to cool down to receive a new charge.

The castings are removed from the flasks, the sprews and vents are knocked off, and all cores cleaned out. The metal is now almost as brittle as glass, and some care has to be exercised in its transportation to the annealing house. Here castings of similar weight and sections are grouped together and carefully "packed" in cast iron boxes or frames varying in size to suit the articles to be annealed. The first one of these frames is placed on a cast iron plate resting on two blocks in such a manner that the prongs of the hand charging machine can enter under. The pieces to be annealed are now placed so that they may be completely surrounded by the packing material (rolling mill scale or red hematite ore) and care is taken that some parts of the castings project over the edges of the box, in this way forming a guide for the next section.

A pile of about 5 ft. high is formed in this manner, and, when completed, removed by the charging carriage to the annealing furnace, where the piles are placed in rows so as to allow the flames from the fire grate free play. The opening of the annealing chamber is finally bricked up tight and the fire started. These annealing furnaces are arched chambers about 7 ft. high x 12 ft. deep and 8 ft. wide, with canals in sides and under the floor so arranged as to convey the flames and the hot gases evenly through the rows of piles, and thus produce an even temperature. Natural draft is used, and the firing carefully moderated during the whole period of annealing from two to six days or more, depending on the character of the castings.

The temperature is brought up to a bright cherry red or about 1800 degrees Fahrenheit. The furnace is provided with sight holes for observation and the blue flames at the joints of the boxes give an indication of the process going on inside where the combined carbon leaves its union with the iron to combine instead with the oxygen, in turn loosened from its combination with iron in the ore or scale, and forming a new combination carbonic oxide or dioxide, the gas producing the blue flames before referred to.

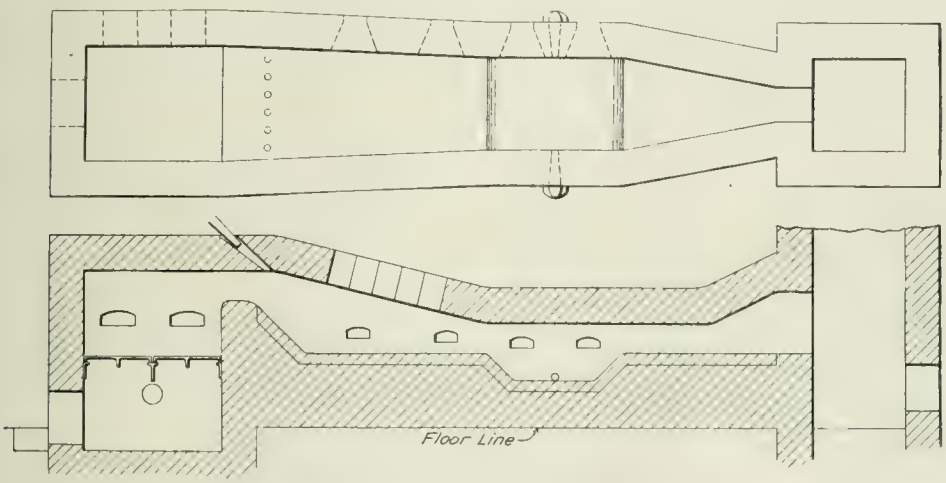
After the furnace is sufficiently cooled down the temporary brick wall in the opening is removed and the piles taken out by the charging carriage and placed on the floor, where the now annealed castings are taken out and placed in the rattlers for cleaning.

*Paper read at the April meeting of the Scandinavian Technical Society, by Mr. G. A. Akerlund, M. E., member of the Society.

If the castings are small and of delicate construction they are cleaned by being placed in wooden vats containing a weak solution of sulphuric acid and "pickled." To neutralize the acid after the pickling process, these castings are finally washed in lime water. After the annealed castings leave the rattlers they are carefully examined for cracks or other defects, and if sprung out of shape they are hammered or forced by hydraulic power to the correct shape. For such parts as are produced in great quantities—for example, like brake heads for railroad cars—steel dies are made and placed in a drop hammer. The annealing casting is then placed on the die, and one or two blows will insure its correct form. It may here be mentioned that nothing is gained by heating a malleable casting before hammering or forcing it. A temperature of 50 to 100 degrees Fahrenheit seems to be satisfactory.

I have endeavored to review the manufacture of malleable cast iron in its different stages, and I will now attempt to review some points which have a more direct bearing for the practical engineer or draftsman in considering malleable cast iron as a material of construction.

The tensile strength of malleable cast iron varies between 40,000 lbs. and 50,000 lbs. to the square inch, with an elongation in 6 inches of about 6 per cent. to 1 per cent., and a reduction of area of about 3 per cent. to ¾ per cent. respectively. This, of course, for a specially prepared test piece with symmetrical form. Let us remember that cast iron has a tensile strength of about 20,000 lbs. to 30,000 lbs. to the square inch, and is therefore about half as strong as malleable cast iron. This, however, only for tensile strength. For compressive strength cast iron is again the stronger of the two, and compares very nearly with steel. The position of a casting in a machine is oftentimes such that the definite stresses are very difficult, not to say impossible, to determine; and the engineer is here left to his own judgment, based on experience or the precedence of similar cases. If only lightness is the object for using malleable cast iron in place of ordinary gray cast iron, it is customary in railroad car construction to make a reduction in weight of 30 per cent. to 40 per cent., sometimes more. The introduction of malleable cast iron in railroad cars some 15 years ago was made more for the desire to reduce dead weight of the car than because the cast iron used was not found strong enough. The reason malleable cast iron is used to such a large extent in car construction to-day is not only the constantly increasing demand for reduced dead weight, but still more the rapid sup planting of wood by steel and the consequent substitution of rivets instead of bolts. The ductility of the malleable casting very readily permits the driving of rivets, which, as we know, cannot so readily be done with gray cast iron; and for certain parts of cars, like the journal boxes, malleable cast iron may well be considered to be supreme, leaving cast iron and "semi-steel" far behind, although for this particular detail lightness alone determines its use.



Reverberatory Furnace.

While white cast iron shrinks a great deal more in the flask than gray cast iron, and as the sections of malleable castings invariably are lighter than is the case in a similar casting of gray iron, fractures are very common, and it is therefore one of the designer's very first considerations to so arrange and distribute the metal as to meet these conditions. In pieces of an elongated shape, the stiffening ribs ought to extend lengthways so as to produce as little resistance as possible to the contraction of the metal at the time of solidification in the flask. If this be not possible, the molder provides a "crush core" with the exterior surface made of core sand in the usual manner, but whose interior is filled with crushed coke. This core barely stands handling, and when the metal solidifies in the flask it is crushed by the retarding casting and thus prevents shrinkage cracks. At other times a certain corner or junction of ribs in the casting will be found cracked. In order to prevent this a small piece of cast iron (chill) is embedded in the sand at this critical point, and the metal will cool here more quickly than elsewhere, and thus fortify this particular point, although it may happen that some other part of the casting will be found fractured instead, and in many cases the locations and the shape of strengthening ribs in the casting have to be altered until a casting is procured free from shrinkage cracks. Sometimes such defects do not appear until the casting is annealed, which, of course, entails a greater loss than if the casting had been scrapped before entering the annealing furnace.

In 1897 the writer, J. T. Carroll, designed and patented a malleable cast iron body bolster for freight cars. The malleable foundries at that time were making an effort to extend the use of malleable iron in freight car building, and so it came about that this casting of extraordinary size for such material was made for about 2,000 cars with perfectly satisfactory results. There were some failures, to be sure; but those were due to defective metal from the melting furnace, as the fracture proved, showing gray graphite cast iron. This casting was probably one of the longest and heaviest produced, and required therefore in its production special appliances, the very best material and workmanship, great care in annealing and final straightening to correct form. In the present state of the malleable foundries a casting of this kind would not be considered, and modifications in the construction of freight cars have therefore to be made with this point in view. One of the most intricate and heavy malleable iron castings made at present, as far as I know, is used by the W. H. Minor Co. in its combination draft sill and lug for a 100,000 lbs. capacity freight car, its length being 5 ft. and its weight about 200 lbs.

In conclusion, let me summarize the points I would like to emphasize regarding the designing of malleable cast iron details.

1. Endeavor to keep the metal in the different parts of the casting at a uniform thickness, depending on the size and weight of the casting. If a small casting of, say, 10 lbs. weight ¼-in. metal is about the practical thickness, $^{5}/_{16}$-in. metal is about right for a casting of 15 lbs. to 20 lbs., and ⅜ in. to $^{7}/_{16}$ in. or ½ in. for castings of, say, 40 lbs. and over. This is for freight car castings, with which I am most familiar. For commercial reasons the demand for light malleable castings sometimes forces the designer to give such dimensions for thickness of metal in his casting that the foundry cannot make it successfully, or else the manufacturer will insist on a price per pound that will protect him for the extra expense in making it and the loss due to a high percentage of cracked castings. These losses sometimes amount from 10 per cent. to 20 per cent. It is, therefore, generally better policy to modify the design to suit the foundry, although, on the other hand, these same commercial interests on your side have to be guarded as those prompting the foundry man to insist on a heavy easy casting.

2. Always endeavor to avoid sharp junctions of ribs or parts, and if the casting is long—say, 24 in. or more—bear in mind that the ends should be made of such shape as to offer as little resistance as possible to the contraction of metal when cooling in the mold.

If called upon to inspect malleable castings as to strength it is customary to break it with a sledge or under a "drop," and the difficulty of breaking it and the appearance of fracture forms the basis of opinion. A "good" casting will be found a pretty tough proposition to break. A fracture will show a distinct "skin" like wrought iron, while the interior is finely granulated, of a dark bluish color, without metallic lustre. A "bad" casting is comparatively easily broken, does not show the skin, but does sometimes a very dark bluish color, or in other cases a dark gray cast iron fracture. This is generally attributed to "poor annealing," but, as previously pointed out, if the metal in the furnace at the time of pouring does not have the right composition the resulting casting cannot be annealed. To guard against this it is sometimes practical for important castings to provide a small extension on a chunky part of the casting, where the chilling effect of the molding sand would be least and so break off this extension. The fracture will then show whether the metal is of the proper nature for annealing or not. It should be remembered, however, that there is such a thing as over-annealing; but in the present busy time this is hardly likely to occur very often.

As for pattern making, it may be mentioned that the common shrink rule, ⅛ in. to 1 ft. longer than the ordinary rule, is used. Malleable cast iron shrinks more in the mold than gray cast iron, but in the annealing process a slight swelling takes place.

The first pattern is made of wood, and from this the foundry patterns are made of aluminum, to which metal we are greatly indebted for the present growth in the malleable foundry business.

Without aluminum patterns heavier castings could not be made economically, as the old fashioned brass patterns required two or more men to handle them. A pattern shop in a malleable foundry is nowadays a far more comprehensive institution than formerly. The wood-working department is still there, but in addition a small foundry for the aluminum castings and a machine shop with planers, shapers, lathes and drill presses, etc., will be found. As in most foundries the foreman pattern maker represents a great deal of the "brains" of the establishment, and it is generally with him the engineer has to consult in regard to the feasibility of his design or overcoming difficulties developed in the making of the casting. The facts of the matter are that it is in co-operation by the individuals concerned in the actual production of a casting, a machine or what-not, that the best results are obtained. The scientific, theoretical training of the engineer is good and proper, and in certain branches of engineering absolutely necessary; but in most cases, I think, the engineer will greatly profit by learning the observations of men who have spent long years in the shops and the foundries and by learning as far as may be the life history, if I may be permitted to use this expression, of the metals and the materials with which he is dealing; and if these notes on malleable cast iron have helped to emphasize this fact, this paper has not been read in vain

Comparative Cost of Repairing Steel and Wooden Cars on the Harriman Lines.

Since October, 1904, there has been kept on the Harriman Lines a comparative record by months of the costs for repairing all cars of steel construction and an approximately equal number of wooden cars. The wooden cars chosen are of modern type, built about the same time as the steel cars and therefore comparable in age, capacity and kind. The figures for the first six months of the record were given in these columns last year (July 21, 1905). Below is the statement for 17 months, which brings the record down to February of the present year. Only the totals for all lines are here given instead of for each of the constituent lines as in the former statement.

	Steel cars			Wooden cars		
	Cars owned.	Total repairs.	Av'ge cost per car	Cars owned.	Total repairs.	Av'ge cost per car.
October, 1904	11,124	$19,139.45	$1.72	10,701	$35,209.02	$3.29
November, 1904	11,159	19,459.41	1.74	10,701	31,107.18	2.91
December, 1904	11,258	20,828.33	1.85	10,676	33,385.99	3.13
January, 1905	11,258	22,348.76	1.99	10,671	34,308.70	3.22
February, 1905	11,256	26,270.60	2.33	10,660	33,578.92	3.15
March, 1905	11,255	25,290.88	2.25	10,656	36,723.35	3.45
April, 1905	11,254	24,124.18	2.14	10,650	31,024.73	2.91
May, 1905	11,554	28,063.49	2.43	10,652	37,236.75	3.50
June, 1905	11,546	29,183.00	2.53	10,642	37,656.77	3.54
July, 1905	11,546	31,909.79	2.76	10,640	40,201.93	3.78
August, 1905	11,544	31,947.90	2.77	10,634	44,459.61	4.18
September, 1905	11,536	29,609.49	2.57	10,621	42,123.48	3.97
October, 1905	12,536	33,021.66	2.63	10,615	51,556.04	4.86
November, 1905	12,539	31,765.16	2.53	10,604	45,237.82	4.27
December, 1905	12,539	35,898.61	2.86	10,603	48,186.87	4.54
January, 1906	12,536	40,207.78	3.21	10,594	50,355.97	4.75
February, 1906	12,535	33,226.91	2.65	10,583	43,870.22	4.15
Av'ge per month	11,704	$28,370.32	$2.42	10,641	$39,777.84	$3.74

These cars are classified as follows, based on the February total:

	Steel cars.	Wooden cars.
Box	2,900	6,232
Coal and ore	3,013	152
Flat	2,287	317
Furniture	297	276
Oil	871	248
Stock	2,305	2,699
Ballast and side dump	862	459
Total	12,535	10,583

The average total number of steel cars involved was 11,704 against 10,641 for the wooden cars. The average monthly repair costs were $2.42 and $3.74 respectively, a difference of $1.32, or 35 per cent., in favor of the steel cars. The average total monthly difference was $11,407, or $136,884 a year. Referring to the classification it will be observed that the wooden cars are at a disadvantage in the much greater number of box cars and the relatively small number of coal, ore and flat cars, which cost less to maintain than box cars, especially the flats. And while this causes a greater difference in the figures for average cost per car than would exist if the several classes were on an equality as regards numbers, yet considering totals this disadvantage is offset, in part at least, by the greater total number of steel cars involved. For February, for example, they were 1,952 in excess of the wooden cars, yet the total cost for repairs to the 12,535 steel cars for this month was $10,000 less than for the 10,583 wooden cars.

One interesting thing to note in both instances is the increase in the average cost per car per month over the period covered by the statement. For the first six months, as given in the previous statement, the respective average figures were $1.98 and $3.19. These increased in the subsequent year to $2.42 and $3.74, or by 22 and 17 per cent. respectively—the effect of an additional year of service. During this time 1,300 steel cars were bought (April-May and September-October, 1905), but no new wooden cars were added.

The records are being kept at the instance of Mr. Julius Kruttschnitt, Director of Maintenance and Operation, to whom we are indebted for the statement.

The Sault Ste. Marie Canals.

In view of the great interest in the type of canal which shall be adopted at Panama, and President Roosevelt's reference, in his letter on the subject to Congress, to the successful operation of the Soo canal, which led him to favor the lock rather than the sea-level type, the following description of the two canals at Sault Ste. Marie, prepared as the annual report for the season of 1905 under the direction of the Engineer officer in charge of the United States canal, is of especial interest.

Lake Superior was not connected by nature with the other Great Lakes by a navigable passage. Before the building of canals, cargoes had to be unloaded, taken across a one-mile portage, and reloaded on boats. This was the method of interchange previous to the opening of the first ship canal in 1855. The St. Mary's Rapids, which occupy the space between Lake Superior and the lower lakes, are about one-half mile wide and three-fourths of a mile long. The fall ranges from 16½ ft. to 20½ ft. The first canal built at this point was built in 1797-1798 by the Northwest Fur Company. This was on the Canadian side of the river. The lock was 38 ft. long and 8 ft. 9 in. wide, with a lift of 9 ft. A tow path was made along the shore for the oxen to track the batteaux and canoes through the upper part of the rapids. The lock was almost entirely destroyed by United States troops in 1814.

The first ship canal, known as the State Canal, was built on the American side of the river in 1853-1855. It was $1^{1}/_{12}$ miles long, 64 ft. wide at the bottom, 100 ft. wide at the water surface and 13 ft. deep. There were two tandem locks of masonry, each 350 ft. x 70 ft., having 11½ ft. of water on the miter sills and a lift of about 9 ft. each. These locks were destroyed in 1888 by excavations for the present Poe lock.

In the years 1870-1881 the Weitzel lock was built by the United States Government. This is about 115 ft. long, 80 ft. wide, narrowing to 60 ft. at the gates, with 17 ft. of water on the miter sills when the upper pool is 601.9 ft. and the lower pool 584.4 ft. above mean tide at New York. During the same period the depth of the canal was increased to 16 ft. and the mean width to 160 ft. The stone slope walls were at this time replaced with vertical face timber piers.

The Canadian canal was built on the north side of the river in the years 1888-1895. It is 1⅛ miles long, 150 ft. wide and 22 ft. deep, with a lock 900 ft. long and 60 ft. wide, and with 22 ft. of water on the miter sills.

The Poe lock was built by the United States in the years 1887-1896. It is 800 ft. long, 100 ft. wide, and has 22 ft. of water on the sills. Since 1892 the American canal has been deepened to 25 ft., and its entrance piers extended so that its total length at the falls is 1⅜ miles. Its width is variable, being 500 ft. at the upper entrance, 108 ft. at the canal gate, 270 ft. at the basin above the locks, and 1,000 ft. at the lower entrance.

The canal also practically includes those parts of the channels through the St. Mary's river which have been improved through shoals of sand, clay, boulders, sandstone and limestone. The first appropriation for improving the channels was made in 1856. The draft was made 12 ft. in 1857-1866 and 1866-1869. Between 1879 and 1883 the depth was increased to 16 ft. The Hay Lake route was improved for a depth of 20 ft. at mean water in 1882-1894. Betterment of the channels has been steadily continued since that time, so that the dredged areas now amount to 34 miles in length, with a minimum width of 300 ft., increasing at angles and other critical places to 1,000 ft. In 1903 excavation of channels was begun for 21 ft. at low water. The accompanying map shows the situation of the canals and locks.

The cost of the different improvements has been about as follows:

Locks and canal of 1855	$1,000,000	Improving channel through river	$5,000,000
Weitzel lock	1,000,000		
Poe lock	3,000,000	Canadian lock, canal and approaches	5,000,000
Widening and deepening channel	3,000,000		

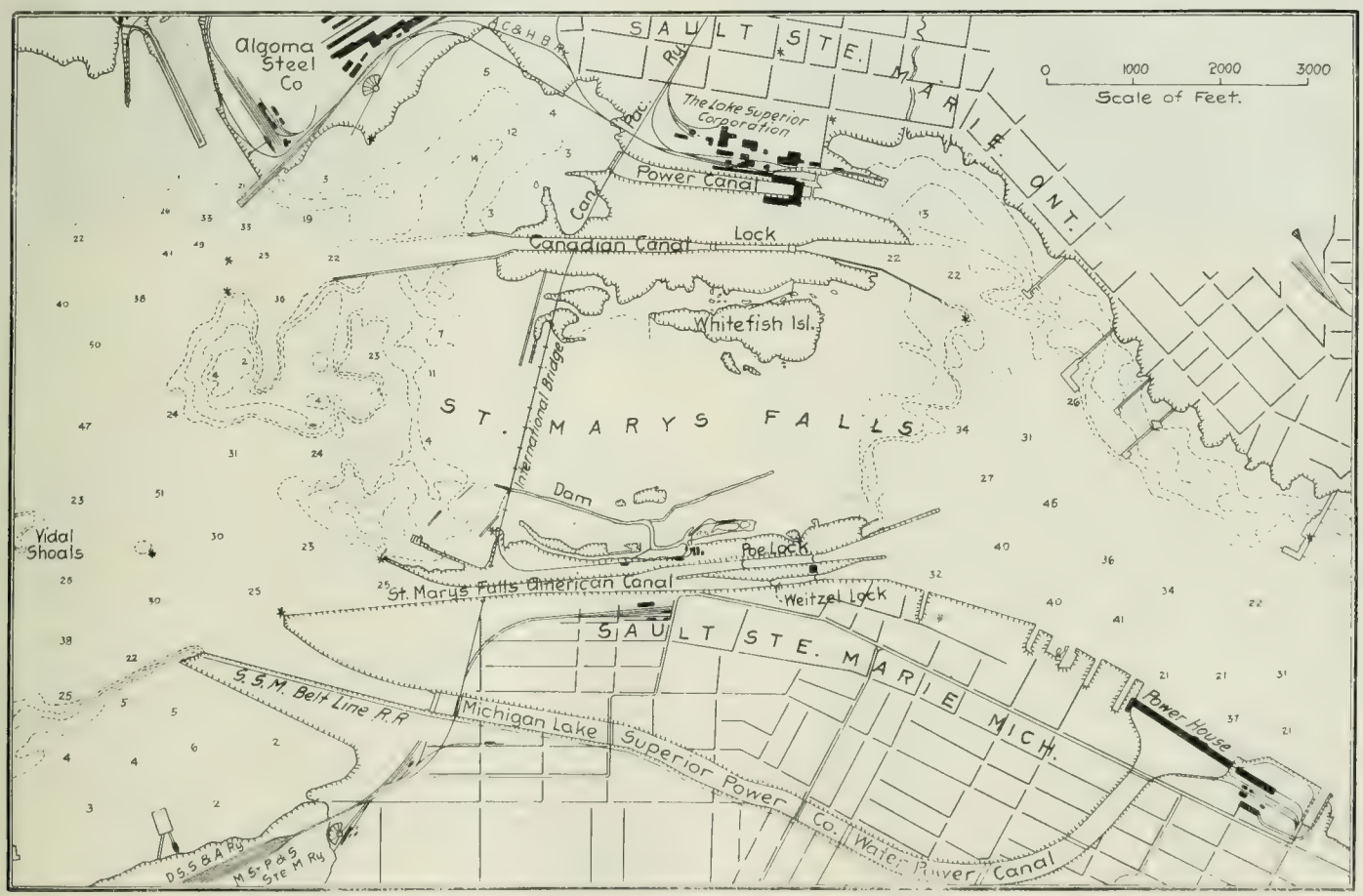
The American locks are operated by hydraulic power with a pressure of 115 lbs. to the square inch for the Weitzel lock machinery and 200 lbs. for the Poe lock machinery. The Canadian lock is operated by electricity, generated by water power. The Poe and Weitzel locks can be filled or emptied in about seven minutes, and the gates opened or closed in two minutes. The Canadian lock can be operated in about eight minutes. An up-lockage of a single boat 350 ft. long has been made through the Poe lock in 11 minutes. The average time, however, spent in making a lockage last year was about 29 minutes, due to the slow movement of boats while entering and leaving the locks. As many as five boats were often included in a single lockage. The average time of lockage through the Canadian lock was 15 minutes. The average time of passage

per ship was one to six minutes less than the average time of lockage.

From 1855 to 1888 the canal was controlled by the state of Michigan, and tolls charged to cover expenses, the rate at first being 6½ cents per registered ton. This was gradually reduced to 2½ cents, and the minimum charge for lockage of a boat similarly reduced from $5 to $3. Since the transfer of control to the United States in 1881, use of the American canal has been free, nor does the Canadian canal collect tolls for either foreign or domestic commerce. The expenses for the St. Mary's Falls canal (the American canal) were in 1905 $64,424 for operating and $20,822 for repairs; total, $85,246 for the year. This is at the rate of 2.48 mills per freight ton. The previous year, when much less traffic passed through the canals, the total cost was $93,248, or 4.25 mills per freight ton.

During the 51 years the canal has been in commission the growth of Lake Superior commerce has been enormous. The yearly traffic has increased from a minimum of 14,503 tons in 1855 to 44,270,680 tons in 1905, the high record. The increase of each year's tonnage over the preceding year has averaged about 20 per cent. In the decade 1895-1904 the traffic was over 253,000,000 tons, against 80,300,000 tons in the preceding decade. Last season's traffic shown by the change in the class of freighters used in the Lake Superior traffic. Until the year 1904 there was no vessel over 500 ft. long, or which carried over 9,000 net tons. In 1904 one vessel between 500 and 600 ft. long was put in service. On a capacity basis three vessels with a capacity of between 9,000 and 10,000 tons and one which carried over 10,000 tons were put in commission that year. In 1905 there were 28 new vessels put in commission for the Lake Superior trade, all freight steamers from 250 to 569 ft. long. Against the one vessel between 500 and 600 ft. long in 1904, there were last year in service 23 vessels over 500 ft. long and with 56 ft. beam. Against the four vessels in 1904 which carried over 9,000 tons, there were in 1905 14 vessels carrying between 9,000 tons and 10,000 tons, 10 vessels carrying between 10,000 and 11,000 tons, seven vessels carrying between 11,000 and 12,000 tons, and three vessels carrying 12,000 net tons and over—a total of 34 vessels carrying over 9,000 tons. This is a striking exhibit of the increased size of vessels which are being used, and especially of the great progress which has been made within the last year in the size of lake freighters.

For a single cargo, the steamer E. H. Gary, of the Pittsburg Steamship Company (United States Steel Corporation), holds the season's record of 12,368 net tons. The barge John Smeaton, owned



The Sault Ste. Marie Canals

of 44,270,680 net tons shows an increase of 12,724,571 tons, or 40 per cent. over 1904.

The American canal opened last year on April 14, and closed December 16. The season of navigation lasted 8 months and 10 days. The traffic through the American canal was 88 per cent. of the total freight, an increase of 16 per cent. over the preceding year. American vessels carried 95 per cent. of the total freight traffic.

Of the freight carried, cereals furnished 28 per cent., and iron, including iron ore, 27 per cent. In other words, the two principal articles of traffic were wheat and iron ore. There were 68,000,000 bushels of wheat carried, against 50,000,000 in 1904, and 31,000,000 tons of iron ore, against 19,000,000 in 1904. Of the total of 44,000,000 net tons passing through the canals, iron ore furnished about 70 per cent. The 31,000,000 tons were valued at about $94,000,000. Iron ore tonnage showed an increase of 60 per cent. and wheat of 37 per cent. over the previous year.

There has been a great reduction in freight rates for water transportation to and from Lake Superior in recent years. In 1887 the rate on coal was 90 cents a ton. In 1905 this had dropped to 33 cents a ton. Wheat cost 7 cents a bushel in 1887 against 2.3 cents a bushel in 1905. The rate on iron ore in 1887 was $1.75 a ton. It is now 68 cents a ton. On general merchandise the rate has in the 19 years decreased by half, from $4 to $2 a ton.

The main cause of the great reduction in freight rates is clearly by the same company, holds the single cargo record for barges of 9,184 tons. The steamer Augustus B. Wolvin, of the Acme Steamship Company, which in 1904 held the record for maximum single cargo, total cargoes and ton miles, retained last year the two latter records. Its total cargoes amounted to 274,401 net tons, and its ton miles to 249,038,482. The steamer Duluth, of the Western Transit Company (N. Y. C. & H. R.), has the maximum record for the season's run, with 41,374 miles.

Gasolene Motor Cars for Railroad Use.

Mr. William P. Kennedy in an article in the May issue of *Motor Traffic* gives some interesting facts in regard to gasolene cars and engines for railroad use. He states that the serious attention given the gasolene railroad car by prominent railroad companies of this country indicates that within the immediate future we may expect some practical development to prove the utility of the self-propelled car in certain branches of railroad service. Opinions differ as to the scope of its usefulness, but its practicability is generally conceded in view of its regular employment abroad and the preliminary work already done in this country.

On branch lines in isolated districts, where the service is intermittent, the cost of maintenance and operation of a locomotive and

one or two cars is far in excess of the revenue, and the gasolene motor car is certain to make such lines remunerative, the labor required being materially reduced and the fuel consumption being proportionate to the work performed.

Like all other innovations, however, the motor car proposition is meeting its share of antagonism. In its mildest form this appears in the scepticism expressed by the older type of railroad man, who has "run the gauntlet" in the development of the present steam locomotive, and who does not believe that any vest pocket motor can share in the same class of work. In his opinion, the gasolene motor may be all right as a necessary adjunct to the automobile, which is a toy and a luxury at the best, but that it can ever legitimately undertake the performance of real hard railroad work at a profit is dubious in the extreme. The cars which have proven to be impractical it would be unfair to criticize or describe, since they are the result of honest effort on the part of the well-trained mechanical engineer experienced in ordinary railroad work, but unfamiliar with the peculiarities of gasolene engine construction and operation.

It is generally conceded at the present time that the most effectual solution of the proposition will be to have each of the various parts required designed and developed by independent manufacturers, whose experience in these various lines qualifies them to insure the performance required. It is no more expedient or even feasible for a railroad to design and build gasolene engines in its own shops than it would be to attempt to efficiently make its electric motors. Where the engine is to be placed depends largely upon the form of transmission employed. If electric transmission is used the engine with generator attached must occupy a section of the car body. If mechanical transmission is used the engine may be placed either up in the body, on the truck and partially protruding through the car floor, or self-contained on the truck end and entirely independent of the body. It is quite possible to place a 150-h.p. engine measuring 85 in. long by 40 in. high and 30 in. wide and weighing 2,000 lbs. on the front truck, and not exceed the standard 90 in. wheel base with 5 in. clearance above the top of rail. The advantages of placing the engine on the truck are many. The truck and power equipment can be constructed independent of the type of body to be used, and the suspension and drive are more positive and effective than when the engine is placed in the car. The engine and mechanism are accessible and the general features are more in line with what has proved successful in automobile practice.

Every car at present in existence has a different size and type of engine, and a varying form of transmission, and each has its temporary advocate, as was the case at the beginning of the automobile industry. The engines in use vary in size and weight from a 150-h.p., 3-cylinder, 13½ in. x 16 in., 325 r.p.m., weighing 35,000 lbs., down to a 75-h.p., 6-cylinder, 8 in. x 10 in., at 400 r.p.m., weighing 4,000 lbs. It is quite possible to do the work of the former with an engine having 8 cylinders, 7 in. x 6½ in., at 1,000 r.p.m., weighing 2,000 lbs., and that of the latter with a 4-cylinder engine, 7 in. x 6¼ in. at 1,000 r.p.m., weighing 1,050 lbs.

At present cars are under construction equipped with these last-named engines, whose performance will undoubtedly go far to demonstrate that the nearer railroad men approach and take advantage of the practice of automobile constructors, the more rapid will be the development of the self-propelled railroad car.

The Coal Traffic Inquiry.*

At Washington, on June 1, the Interstate Commerce Commission resumed its inquiry into the relations of railroads with coal and oil companies, and took the testimony of E. T. Postlethwaite, of the Pennsylvania; J. E. Muhlfeld, of the Baltimore & Ohio, and others. Mr. Postlethwaite had disposed of his coal company holdings two years ago. Mr. Muhlfeld was questioned with a view to showing that the H. C. Frick Coal & Coke Co. had been favored by the Baltimore & Ohio in repairing the coal company's cars. The evidence tended to show that favors had been granted, but it was not at all definite. A coal dealer of Washington charged that he was unable to bring coal from West Virginia to Washington because the railroads had agreed to exact $3.20 a ton, while at the same time a rate of $1.10 had been granted to favored shippers.

At Philadelphia, June 5, officers of the New York Central were heard concerning the relation of that company to the Beech Creek Coal & Coke Co., which has now been absorbed in the Pennsylvania Coal & Coke Co. The New York Central acquired 5,000 shares of stock in the B. C. Co. in 1901, as a consideration in the contract which it made for carrying the coal from the mines, paying no cash. The coal company agreed to mine a million tons a year and the railroad agreed to furnish cars enough for that quantity. The road also agreed to buy 500,000 tons of coal for its own use, this apparently in addition to the million tons first mentioned. The New York Central owns the Clearfield Bituminous Coal corporation, formed to supply the road with fuel, and also the Gallitzin Coal Co.

Vice-President Rossiter said it was against the policy of the company for officers to hold coal stock, but there was no absolute rule. General Manager Smith, General Superintendent Bradfield, and other officers, testified that they had no ownership in coal or coke companies. C. H. Ewings, Superintendent of Freight Transportation, testified about the distribution of cars to different shippers. The company has never refused to inform a coal company as to its rating. John H. Herchardt, Secretary of the Buffalo, Rochester & Pittsburg, testified that the company owned nearly all of the coal companies on the middle and Pittsburg divisions of the road and produced 90 per cent. of the tonnage shipped over the road.

*See page 527 (May 25) and page 554 (June 1).

Rifled Pipe for Pumping Heavy Crude Fuel Oil.

BY JOHN D. ISAACS.
Consulting Engineer, Bridges, Buildings and Signals, Union Pacific System.

The crude oil product of most of the California fields is a very heavy, thick and viscous fluid with an asphalt base. The entire product of the Kern river fields, near Bakersfield, is particularly heavy, its density averaging about 14 deg., Baume.

Up to the present time, this oil has been transported from the fields in cars, but attempts have been made to facilitate its movement by long pipe lines. These trials met with little success as it was found necessary to use very high pumping pressures, necessitating expensive pipe, powerful pumping plants and these plants so close together that operating expenses were prohibitively high for practical economy, while even with such a plant the delivery is very small.

Various attempts have been made to overcome these difficulties, the most important of these being to heat the oil. This was a decided help in short pipe lines, but a temperature sufficient to be effective for long distance pumping caused the disintegration of the oil and the deposit of asphaltine, called by the oil men "carbonizing," clogging the line.

Water was introduced with the oil, but as much as 30 per cent. of water was needed to materially improve the results and the surging of the mixture through the line soon caused an emulsion of the oil and water, very difficult and expensive to separate, necessitating heating the oil to 180 deg. Fahr. for this purpose.

The mixing of the lighter oils with the heavy oils has made it possible to pump the mixture, but in the fields where only the heavy oils are obtained, this necessitates the pumping of the light oils to such fields from long distances and the mixing of the oils causes a loss in the value of the light oils, which have a market value much higher than the heavy fuel oils, making the process very expensive.

A new process has been adopted by the Southern Pacific Co. which has led to the construction of a "Rifled Pipe Line." The method is to rifle the pipe, giving it an interior appearance similar to that of a rifle barrel. A small percentage of water is pumped with the oil. The rifling of the pipe causes the entire liquid mass to whirl, and as the water is heavier than the oil, it is thrown to the exterior of the mass, causing the envelopment of the oil with a thin shell or film of water. This forms a water lubrication between the oil and the pipe, greatly reducing the friction and allowing the plug or core of oil to glide through the pipe readily.

When this principle was discovered the first experiment was made with a small lead pipe. In the process of drawing ordinary lead pipe, the interior surface is slightly scored in close longitudinal lines. The pipe was first used as received and friction coefficients determined; it was then twisted by hand, causing these longitudinal scorings to become helical. This was sufficient to cause a rotation of the oil and water when passed through the pipe. Experiments made with this rifled lead pipe indicated the soundness of the principle and led to an experiment on a larger and more practical scale. One-half mile of 3-in. standard line pipe was used in the next experiment, which was performed by the Southern Pacific Co. at West Oakland. The pipe was first rifled by the insertion of helical wires. This was accomplished by simply drawing tempered steel wire from a coil through the pipe in lengths of 500 ft. at one time, the spring of the wire causing it to cling closely to the sides of the pipe, forming a helix. This pipe was then laid and subjected to an exhaustive experimental operation with heavy Kern oil.

The best results were obtained by pumping about 10 per cent. water with the oil. A flow was obtained many times that obtained by pumping pure oil, or oil and water, through an ordinary plain pipe. The 3-in. line was rifled by passing the pipe through a series of rollers, to a pitch of 1.5 with the line of the pipe. (See description of rifling machine which follows.) Experiments on this line gave even better results and lower co-efficients than those from the lead pipe and justified the construction of a practical rifled pipe line for transporting oil commercially.

A pipe line was finally built, 31.17 miles long, between Volcan,

a point located centrally in the oil fields, on the Southern Pacific, and Delano, another station northward on the same railroad at an elevation of 120 ft. below Volcan. The pipe used was standard 8-in. line pipe, weighing 28.2 lbs. per foot, fitted with recessed line couplings and tested to 1,200 lbs. per sq. in.

The pipe was rifled in the following manner: The machine is shown in the accompanying sketch; the large discs "A" and "B" carry six rollers each, mounted in roller fork bearings. The central disc "C" is a floating disc, to which are attached wedges "w"; these wedges tapering outward on both sides of the disc, one wedge opposite each roller fork, and engaging with the fork. When the discs "A," "B" and "C" are apart, the rollers are open wide enough to allow a pipe coupling to pass freely between them. By means of the pulling rods "P" operated by the lever "L" the three discs are drawn together to any limit set by the adjustable stud bolts "S." This drawing together of the three discs causes the wedges to thrust the roller forks toward a common center, this is, indent them into the pipe to any desired depth. The rollers were set at a pitch of about 1.5 with the line of the pipe. The discs are so spaced that each roller in disc "A" lines up with the one just to the right in disc "B," so that when the pipe is drawn through it rotates one-sixth of a turn between the two discs. Thus, for one turn of the rifling in 10 ft. of pipe, the discs would be one-sixth of 10 ft. apart in the closed position, or 20 in. Circumference of pipe is about 25 in., so pitch of rollers to correspond to one turn of rifling in 10 ft. would be as 25: 120.

Each length of pipe was fitted with a pulling plug on the male thread, having an air vent, and a testing plug on the coupling end by which water was introduced. The pipe was filled with water, and screwed together by four pair of eight inch lay tongs handled by 16 men. The ditch was dug about 18 in. wide and the pipe laid zigzag within the easy elastic bending of the pipe to provide for expansion by heat. In the vertical plane, the pipe is also laid with a vertical zigzag or wave of about 400 ft. long or shorter. The depth of these waves is about the diameter of the pipe so as to form traps at 400 ft. intervals. The object of the traps is to accumulate water at frequent intervals when the line is shut down, preventing the formation of a long plug of solid oil, and facilitating the restarting of the line.

The pumping station consists of three 200 H.P. boilers of the return tubular type fitted with water heater, duplicate feed pumps and pressure burners. The main pump is a compound duplex steam pump, 25-in. and 42-in. steam cylinders with 9½-in. oil plungers with 36-in. stroke.

The auxiliary water pump is a duplex plunger steam pump, 16 in. steam cylinders, 5-in. plungers and 12-in. stroke. The oil supply tank is 30 ft. higher than the pump and a 27-in. suction pipe used, about 100 ft. long, insuring an ample supply for the pump.

The water is injected by means of a special injection nozzle. A piece of 7-in. well casing is introduced inside the 8-in. pipe; oil passes through the inner pipe and water is introduced through the annular space between the two pipes, both starting off in their proper relative position. A short baffle, or twisted plate, is placed in the inner tube at this point to give the oil an initial whirl.

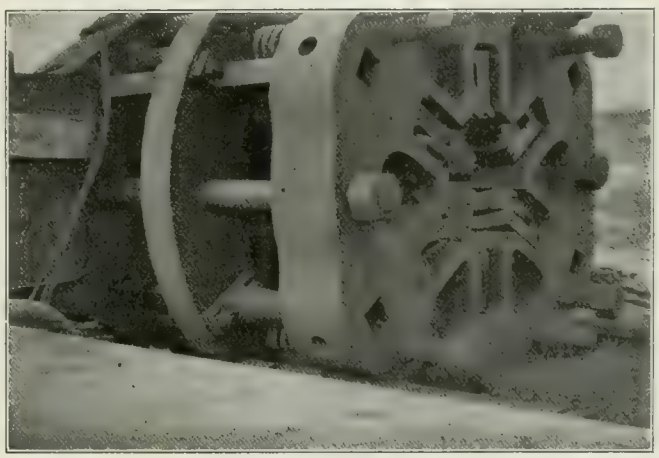
The line was first tested with water and all breaks and leaks repaired until the entire line held 1,000 lbs. pressure. The line was next subjected to a continuous operating test, lasting 24 days. During this run an average of over 14,000 barrels net oil in 24 hours was obtained for the entire run at an initial pressure of 800 lbs per sq. in. For several hours at various parts of the test over 675 barrels of net oil per hour was pumped at 800 pounds.

The oil furnished was exceptionally heavy and had stood for a long period in an earthen storage reservoir so that much of its light constituents had evaporated. The temperature of the oil was all below 60 deg. Fahr. when received at Delano, and in no case was over 75 deg. Fahr. when received at the pumping station, averaging much lower. Experiments show that the maximum flow of oil was obtained when about 10 per cent. of water was used.

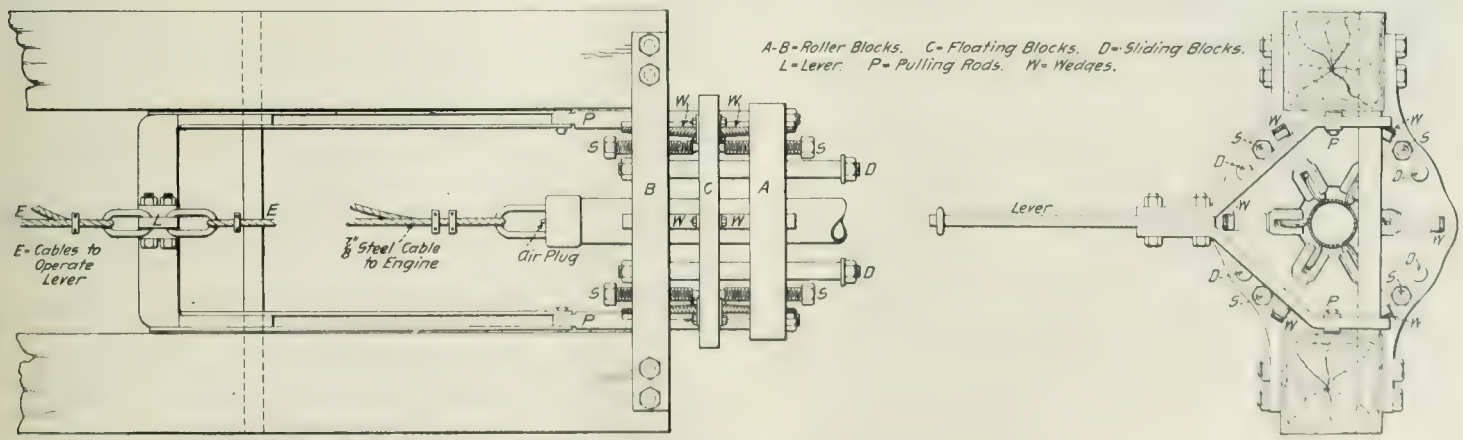
At the end of the line, the water and oil were found entirely separate and where run into the settling tanks the water was easily bled off, leaving only about 1 per cent. in the oil shipped.



General View of Rifling Machine.



Rifling Machine for Pipes 5 in. to 9 in. in Diameter.



Rifling Machine for 8-in. Standard Line Pipe.

From Delano the oil was shipped away in cars for commercial use. For comparison with water flow, we use the formula:

$$p = \frac{K\ v}{d}$$

p = head in pressure per 100 ft.,
d = diameter of pipe in inches,
v = velocity in feet per second,
K = constant of flow.

This formula does not hold good for all cases and is used for the purpose of comparison only for the flow of oil and water through the same pipe line.

8-inch Plain Pipe, Not Rifled.		
Straight oil, no water, average	K	70.00
90 per cent. oil + 10 per cent. water, average	K	41.00
8-inch Rifled Pipe.		
90 per cent. oil + 10 per cent. water, average	K	00.49
90 per cent. + 10 per cent. water, best result	K	00.37
3-inch Plain Pipe, Not Rifled.		
Straight oil, no water, average	K	148.00
3-inch Rifled Pipe.		
90 per cent. oil + 10 per cent. water, average	K	00.33
90 per cent. oil + 10 per cent. water, best result	K	00.25
Log Pipe Above.		
Straight water, no oil, average	K	00.18

The results show that the rifled process increases the flow of net oil through a long pipe line 8 to 10 times that of the plain pipe under similar conditions as to diameter of pipe, pressure, etc.

While the values of "K" for the 8-in. pipe are considerably larger than those for the 3-in. pipe for the rifled process of pumping, the faults developed in the Volcan-Delano line indicate plainly that in future lines the rifling may be so modified as to bring the value of "K" down to at least that shown by the 3-in. line.

Among the anticipated difficulties which did not develop were:

1st.—The difficulty of starting after stopping.

2d.—Emulsification of water in the oil.

3d.—Reversal of density under pressure of the oil and water. This was at one time regarded as a probable serious obstacle due to the fact that the oil is quite compressible (which, by the way, has considerable bearing on the facility in starting). It was surmised that possibly under pressure with an elastic oil approximating so closely to the density of water, that their densities might be reversed, in which case the application of the theory would fail in practice. Experiments were made on this phase of the matter by filling a pipe with oil upon a layer of water, the relative percentage being about that which was expected to be used in pumping. The pressure was then raised to various points and the pipe reversed awhile so as to see whether from a practical experiment such an obstacle actually occurred. From these experiments and theoretical considerations, it was determined that the density of the oil became the same as that of the water at pressures very greatly higher than those that would likely be used for such purpose.

4th.—The possibility was anticipated that the joints in the pipe (when the ends are screwed into the couplings, there is left a space of about ¼ in. between the two ends) might produce a turbulent flow and neutralize or destroy the separating effect of the centrifugal action upon the mass of oil and water. In practice it was found that such action did not take place and that this annular space was filled with a more or less permanent washer of water and the flow was still as definitely helicoidal as if the annular space had been filled, as it was in some experiments, with a lead washer carefully scraped out to the diameter of the pipe.

The above conclusions are not altogether surmised from results, but have been clearly visible by the introduction at intervals in the three-inch half mile pipe line, laid at Oakland, of sections of heavy glass pipe through which the action in starting, rotating, etc., was clearly observable.

This system of pumping fluids is the joint invention of Mr. John D. Isaacs, consulting engineer of the Harriman lines, and Mr. Buckner Speed, superintendent of pipe lines, Southern Pacific Co., and was developed after many attempts to accomplish the same result by other methods.

Canadian Railroad Notes.

Ottawa, June 2, 1906. The bill to incorporate the Toronto Union Station Company was ordered reported by the Railway Committee of the House of Commons on May 31. It creates a corporation of which Sir Thomas G. Shaughnessy, Charles M. Hays, David McNicoll, E. H. Fitzhugh, Francis H. McGuigan and James Wm. Leonard are charter members. The capital is to be $2,000,000, and bonds to the amount of $3,000,000 may be issued. The purpose is to erect a union station at Toronto for the use of railroads entering the city.

In July the National Transcontinental Railway Commission will call for tenders for construction of the line from Quebec to Moncton. There are now nine survey parties in the field.

Mr. Frank W. Morse, General Manager of the Grand Trunk Pacific, has just returned from a six weeks' inspection trip in the west. He comes home more delighted than ever with the prospects. In speaking of the vast amount of surveying which has been done, Mr. Morse says that the difficulties met with were far greater than had been expected. On the Pacific and New Ontario sections the work was very difficult. Despite this he believes that the road will be in operation long before the time specified. Mr. Morse was waited upon at many stopping places during his trip, and particularly in Carberry, Manitoba, was he urged to bring the Brandon branch of the road through that town.

A man is at present in Ottawa endeavoring to secure 1,000 men to work on Mr. Hill's railroads in the vicinity of Brandon, Manitoba.

Higher Technical Education in Germany.

During the past 30 years, in which German industrial development has been so rapid that it has outstripped the other European nations, technical instruction has increased to such an extent that it has far surpassed that of France. Without mentioning those industrial schools which care for the formation of practical men and workmen, there are *technische hochschulen* (technical high schools) in most of the capitals of the Confederation such as Berlin (Charlottenburg), Dresden, Munich, Hanover, Dantzig, Darmstadt, etc., which give diplomas to a regular army of engineers every year. The quality of the instruction and the perfection of the equipment of these schools are new and beyond compare. But the desire to enter upon the career of an engineer has exceeded the industrial development, and there is now a crisis in Germany that is perhaps more acute than that in France.

According to a statement in the *Zeitschrift des Vereins Deutsches Ingenieurs*, "in consequence of the democratization of the various classes of engineers, architects, chemists, etc., and their overproduction, accompanied by that industrial concentration which does away, more and more, with independent workers and transforms them into salaried servants of the great establishments, it is becoming more and more difficult to find employment." For example, the high schools admitted 5,432 students in 1890-91, and 15,866 in 1904-05; the faculties in the courses of natural sciences had 1,100 pupils in 1892 and 3,015 in 1905; the professional schools of mechanics of Prussia had 755 students in 1891 and 3,011 in 1903, and so on. According to statistics, only about 50,000 technicians of all classes are employed in German industries, so that one can readily see what there is for the last comer.

Hence while the wages of workmen and subordinates are gradually improving, the salaries of the technicians are falling with the increase in the number of men available; the relations between them and their employers are becoming less cordial and the discontent is general and persistent. Conditions more severe than those put upon ordinary workmen are also imposed, such, for example, as five years for the clause "deconcurrence" (the time during which the employee must not get to an establishment similar to that which he has left), while the legal prescriptions are that there shall be a delay of three years, which is not obligatory if the employer has without sufficient cause discharged him or has not fulfilled all of his engagements.

These circumstances have aroused among those interested a movement towards organization whose outward manifestation is the formation of a union of technical employees, which proposes to attempt to improve the working conditions of its 3,000 members, whose number is constantly increasing. According to a bulletin drawn up under its auspices, it asks for: A day of eight hours with extra pay for overtime; no work on Sunday; a vacation of six weeks; payment for every month; suppression of the "deconcurrence" clause in contracts; arrangements for the procuring of patents by engineers, independent of the employer; reform in the procedures regarding industrial employees; participation in insurance of state workman's pensions.

The example of this unfortunate condition is being used in France by those who are opposed to the multiplication of institutions of higher technical instruction in that country. This same party is opposing the courses already created, and urging the limitation of diplomas conferred on chemists and others, as well as the creation in Paris of a fifth Ecole des Arts et Metiers, or a school of electricity, which is agitated on all sides, since it would soon result in an overproduction that would condemn too large a number of intelligent men to idleness and misery. *La Nature.*

On a local railroad in Germany a pair of birds, there called "redtails," built a nest in a baggage car, which is hauled every morning, loaded chiefly with cans of milk, from Marbach to Beilstein, and back in the evening to Marbach. In this nest the hen bird has laid four eggs, and sits on them undisturbed by the clatter of the milk cans as they are loaded and unloaded. The cock bird keeps her company on the trips, and forages at the termini. He never misses his train.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS, WESTMINSTER, LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

The Union Pacific Gasolene Cars..... 609
Compound Locomotives 609
Flat Wear of Driving Wheel Tires..... 610
Committee Work 610
Individual Effort and Piece-Work Systems 611
Locomotive Performance Statistics..... 611
New Publications 612

ILLUSTRATED:

Consolidation Locomotive; N. Y. C. Lines 613
Balt. & Ohio Railroad Motive Power..... 616
The Davis Solid Truss Brake-Beam..... 619
Improved Roundhouse Facilities. 619
M. C. B. Association Committee Reports 624
American Passenger Locomotives..... 641
Balanced Compound Locomotives 644
New York Central Electric Locomotives.. 648
Anderson Auto. Valve and Water Column 654
A Historic Locomotive 655
Santa Fe Ash-Handling Plant, Argentine 656

CONTRIBUTIONS:

Freight Car Movement on the New Haven 613
Tickets to Station Platforms..... 613

MISCELLANEOUS:

Program of Master Mechanics' Convention 616
Pekin & Hankow Railroad (Note)..... 616
Cracked and Leaky Mud Rings..... 638
Chinese Railroads (Note)..... 638
Handling Engines at the Ash Pit..... 639
Exhibits at the Atlantic City Convention 639
Erie Electrification, Rochester-Mt. Morris 644
Chesapeake & Ohio Double Tracking..... 648
Gasolene Motor Cars..... 652
Russian Car Shortage (Note)..... 654
Railroad Mechanical Dept. Employees... 655
Foreign Railroad Notes:
Egyptian Railroads 656
Chinese Railroads .....

GENERAL NEWS SECTION:

Notes 169
Trade Catalogues 171
Meetings and Announcements 171
Elections and Appointments 171
Locomotive Building 172
Car Building 173
Bridge Building 173
Railroad Construction 174
Railroad Corporation News 176

VOL. XL., No. 24. FRIDAY, JUNE 15, 1906.

Most of the history of rail motor cars up to the present time has been written in England, where these cars, on a number of short services, have been able to run with considerable regularity, although the economy of their working has been questioned. But in the current issue of the *Railroad Gazette* Mr. W. R. McKeen, Jr., Superintendent of Motive Power and Machinery on the Union Pacific, gives a most entertaining account and diary of the seven gasolene cars which have been built by that company at its own shops. These cars are mostly at work on regular services. Numbers 1 and 2 each make a round trip daily on the branch between Kearney and Callaway, Neb., 65 miles. Car No. 3 is in regular service on the Southern Pacific between Houston and Galveston, Tex., 57 miles. Car No. 4, after temporary service on the Kearney branch, is now running on the Oregon Railroad & Navigation Line out of Portland, Ore. Car No. 5 is running out of Los Angeles, and car No. 6 is running between Leavenworth and Lawrence, Kan., making a round trip of 68 miles daily. Each of these runs is considerably in excess of what has been required of motor cars in Great Britain, but most interesting of all has been the preliminary education of the car, its grand tour after it graduated from the shops and before it settled down to its life work. Car No. 1 ran under its own power from Omaha to Portland, Ore., and return. Car No. 2 took out most of its education in speed runs; No. 3 went under its own power from Nebraska to Texas; No. 4 ran from Omaha to Oregon, and No. 5 from Omaha to Los Angeles. No. 6 seems to have been a stay-at-home, but the most recent graduate from the Omaha shops, Car No. 7, came from Omaha to New York, and is now running on the Erie. Except for faster time, better hill climbing power and stronger endurance than was anticipated, these extraordinary gasolene motor runs seem to have been quite without incident, and they demonstrate what can be done by good engineering work in a new field, without any previous experience to serve as a guide, except that derived from the skilled and tireless labors of the manufacturers of automobiles.

Mr. H. V. Wille, Assistant to the Superintendent of the Baldwin Locomotive Works, makes, on another page, an exhibit of the Vauclain four-cylinder compound locomotive, its present design, its accomplishments compared with simple locomotives, and its rapidly increasing use. It is probable that we should not have been obliged to wait until this late date for this evidence had it not been for the fear of conservative men of anything that has a suspicion of complication, to which was added the traditional unreliability of the crank axle for heavier work than is required in British practice, and as it was made in the old days of the inside-connected engine when we had neither the manual skill nor the tools wherewith to make such an axle properly. All this has now been overcome, and reports from every quarter are practically unanimous in confirming the claims of Mr. Wille's paper that a crank axle can now be made which is fully as reliable as a straight one. The figures given are significant. The actual number of compound locomotives of the Vauclain type (281) that have been built or which are in course of construction, is not large. We have not the data at hand, but it is probable that eight or nine years ago the same makers had a larger number of compound locomotive engagements on their books. The difference and significant part of the matter is that at that time compound locomotives were being urged on the railroads by the arguments of the builders; whereas, at present, the initiative comes largely from the railroads. This shows that the value of the system has won out in the fight with the simple engine. We hear comparatively little of late of the cross-compound. Possibly because it is an old story, but also probably because it soon found its limitations in the later growth of the locomotive by which such excessively large low pressure cylinders were required that they were debarred by the limits of the permanent way. So the four-cylinder machine has been adopted from European practice, and it now remains to be seen whether the compound in this form can win against a simple engine with a superheater or whether the final stage of the development will be in the form of a four-cylinder compound with a superheater. That there are other minor advantages inherent in the type there can be no doubt, for it appears from results obtained on the Danish State Railways that there will be a marked difference in the rate of wear of the driver tires, and we all know of the greater ease of riding. Mere ease of riding would in itself receive but scant attention did it not mean also decrease of strain on track and engine. The power development is also up to the modern requirements, and the amount of steam used

satisfactorily low. It appears, then, that these points are appreciated by railroad officers and that they are now asking for these engines, instead of receiving them under protest, as so often happened ten years ago.

FLAT WEAR OF DRIVING WHEEL TIRES.

Flat wear of driving wheel tires on two-cylinder locomotives is an incurable evil under usual conditions of service. It is one of the several inherent deficiencies of the mechanism that are beyond the power of the designer to overcome. That the trouble can be mitigated to a certain extent has been proven by the experiences of the many who have investigated the matter with the hope of applying an effective remedy. But the action is the natural result of a given set of physical conditions and will persist so long as the conditions are unchanged. This has been pretty generally accepted by motive power men in a spirit of resignation to the inevitable ever since the elaborate investigations made some ten years ago and summarized in a report to the Master Mechanics' Association. However, now and then a road which suffers excessively in this respect undertakes anew an investigation of the matter in an effort to correct the difficulty. An instance of this sort which lately occurred on a well-known road is of particular interest because of the care and thoroughness with which the study was prosecuted (it extended over a period of two years) and for the reason that it illustrates convincingly the fruitlessness of efforts to correct entirely the trouble.

In order to ascertain accurately how this wear was occurring on the wheels of different locomotives, a special gage was made and each roundhouse given one. This gage was designed to fit into the center of the wheel and to be so rotated that a sliding indicator, which was kept a uniform distance from the flange of the wheel, would trace a diagram which would be a correct reproduction of the worn condition of the tire. An immense number of these diagrams were made from different engines of different classes and from the same engines at different times. The results, however, showed little regularity. In fact, so contradictory were they as to lead to the belief that the wear was seriously affected by improper counterbalance.

To determine the correctness of this view, instructions were given to weigh every individual driving wheel of every locomotive passing through the shops for general repairs and carefully check the counterbalance. The records were kept by the general foremen and furnished absolute knowledge of the counterbalance of every individual wheel; also they assured that it was correct and uniform for each class. This having been done, further wearing diagrams were taken with the gages. The results were just as irregular as before. Needless to say, at the present time the investigators are if anything more puzzled about the matter than ever.

One thing that has been observed by different investigators of irregular tire wear, and by some referred to as most peculiar, is that the handling of certain locomotives by certain enginemen affects the results favorably or otherwise as the case may be. The Master Mechanics' report already referred to gave as the reason for this the slipping of the drivers at starting of heavy trains by careless enginemen. In fact, the larger part of the wear was said to be due to this cause.

In the April number of the Bulletin of the International Railway Congress, Mr. O. Busse, Locomotive and Rolling Stock Superintendent of the Danish State Railway, gives some figures on the relative wear of tires on inside and outside cylindered engines. The designs were practically alike except for the cylinder arrangement, the weights and dimensions being the same. After 18 months of service, according to the figures given, the inside-cylindered locomotives averaged 93 per cent. greater mileage between tire turnings for practically equal amounts of wear. The natural conclusion of Mr. Busse is that the inside cylindered locomotive, which is comparatively a new institution on his road, is very much more profitable than the other kind. Diagrams of the average wear on the main drivers are given and on that for the left wheel of the inside-cylindered locomotive a peculiar thing is noticed. All of the other diagrams show but one pronounced flat spot for each tire, but on the one in question there are three such spots of approximately equal depth: one corresponding to and in line with the similar spot on the right-hand wheel, which is about 10 deg. ahead of its crank and therefore 100 deg. ahead of the left-hand crank: the second being at the 225 deg. point, and the third at the 315 deg. point, or 45 deg. behind the crank. Mr. Busse does not refer to this in his paper nor does he offer any theory for the difference in wear between the two designs of locomotives. All of the drivers had Krupp tires made to the same specifications. However, according to the results obtained on the road first referred to in this article, this would not insure uniform results under similar conditions. This road has samples of tires of identically the same chemical analyses, some of which wore remarkably well and others very poorly. Yet upon being etched they showed plainly under the microscope a dense, solid structure in one case while in another the steel was of a spongy or porous nature. About the only conclusion reached in this road's tests was that a steel of the densest possible character and of great toughness is highly essential.

In connection with the comparative figures from the inside-cylindered locomotives on the Danish State Railway it is interesting to know what the results have been in this country with the balanced compounds. Inquiry of both the Burlington and Santa Fe discloses the fact that there has been no trouble from flat spots whatever. This, of course, means much greater mileage between tire turnings as compared with the two-cylinder locomotives.

COMMITTEE WORK.

Committee work for the Master Mechanics' and the Master Car Builders' Associations is generally a misnomer, as the reports are really papers by the nominal chairmen of the respective committees. Occasionally it happens that all the members assist in the work of research or compilation, but more often the proceeding is something like this: The chairman of the committee draws up a circular of inquiry; this is sent to the other members of the committee for their suggestions, or approval—generally approval without suggestions; the secretary sends out this circular, and a small number of the members reply. These replies are sent to the chairman, who compiles the few answers turned in, and composes the document; the committee reads, and again says "O. K.," or sometimes nothing, and the work is done.

It is fair to say that this is not always the case, but it is reasonable to assume that the formula obtains in at least 50 per cent. of the committee reports. There is a cause for this, however, and the reasons are fairly good ones. Members of the committee are supposed to be chosen on account of their particular ability to treat some special subject, because of particular study which they may have given to the matter, or to the general interest which they may have exhibited. So far, this is good and proper, but such members are apt to be separated by a thousand miles or more, and cannot get together conveniently for conference, which adds so greatly to the interest of their work. The chairman is therefore left practically to himself. The press of business in the ordinary railroad position is so great that this work is generally left until the last minute, and then it is very difficult to get the members together or for them to take time properly to consider the report prepared by the chairman. Sometimes minority reports are submitted, or sections of the reports prepared by the different members, but ordinarily the "good old way," as outlined above, becomes the standard method of operation. If this work is done by the chairman, he should get the credit (whatever that may mean) for the work performed, but this is always assumed to be equally divided.

The old time report of scheduling eighteen or twenty questions and the answers (like the early school book) seems, happily, to have passed. It was too much like this:

Question.—What experience have you had with such a device?

Answer.—Twenty roads replied to this question. Fifteen had no experience; two had it on one engine, but it was no good; three have it now on trial, but have not yet made up their minds as to its value.

When this was repeated eighteen or twenty times, and the whole thing read over slowly and impressively in convention, it was no wonder that members went to sleep—or wished they could!

A report should state concisely the purpose of the investigation; the general amount of information available or contributed; an expression of the views of the majority of the authorities and the deductions and recommendations of the committee. If long dissertations are needed in order to fully explain the subject, they should be placed at the end, in the form of an appendix, and not in the main body of the report. The presentation of the paper is also of great importance, as the matter is now printed and distributed to the members considerably in advance of the meeting, it is wearisome to have a long report read through verbatim, and if in drawing up the report some prominent features could be put together in a paragraph, or in such shape that they could easily be separated from the main body of the discussion, it would permit of a ready

means of abstracting and giving the principal points to the convention in a minimum amount of time, and allow the bulk of the time for a discussion which may be more or less animated. When a long paper is read through and the members have previously gone through the same document, they are apt to be so tired by the time the reading is finished that there is little life left to properly discuss the features presented; particularly if the morning be warm and if the dinner hour be approaching. It is hoped that the coming conventions will conduct their business more upon the lines suggested and reduce as much as possible the labored reading through of voluminous reports.

THE INDIVIDUAL EFFORT AND PIECE-WORK SYSTEMS.

Much has been written and said of late concerning the comparative merits of the individual effort or bonus system and the piece-work system of operating railroad shops, and a brief review of the points for and against each system may be opportune.

Under the individual effort system a standard time is set for doing each piece of work, based on a record, kept to fractions of a minute, of the time required by a competent workman to do the same. In this and many other particulars it agrees closely with piece-work, but it differs essentially in two features: (1) It guarantees to each man his day rate of pay even though he may do less than the standard amount of work, and (2) for each succeeding piece done in excess of the standard day's work the price per piece is increased by arithmetical progression, which offers an extra inducement for a man to increase his output up to the very limit of his capacity. A clear idea of the working of the individual effort and piece-work systems as compared with day-work, can best be given by illustrating with an example in which we will take a man whose day rate is 20 cents an hour, engaged in planing driving box wedges, for which the piece-work or individual effort price has been fixed at 20 cents each. The man's earnings and the cost of the work under the various systems will be as follows:

	Day work		Piece work		Individual effort system	
	Cost, total.	Cost, per piece.	Cost, total.	Cost, per piece.	Cost, total.	Cost, per piece.
6 wedges	$2.00	$0.333	$1.20	$0.20	$2.00	$0.333
8 "	2.00	.25	1.60	.20	2.00	.250
10 "	2.00	.20	2.00	.20	2.00	.200
11 "	....	...	2.20	.20	2.225	.202
12 "	....	...	2.40	.20	2.475	.206
13 "	....	...	2.60	.20	2.750	.212
14 "	....	...	2.80	.20	3.050	.218
15 "	....	...	3.00	.20	3.375	.225
16 "	....	...	3.20	.20	3.725	.233

In this example the day-work cost has not been extended beyond $2, because the price under the piece-work and individual effort systems has been based on an output which is slightly greater than the average obtained by day-work.

A prominent exponent of the individual effort system, writing in an engineering journal recently, itemized the good points of this system as follows:

1. "The standard time set is reasonable and one that can be reached without extraordinary effort, is in fact such time as a good foreman would demand.
2. "An extra reward of one-fifth of the regular wages for the operation is given to whoever makes standard time.
3. "Extra compensation above the hourly rate is paid even if standard time is not reached, although this extra compensation diminishes in percentage above standard time-and-a-half.
4. "If longer than time-and-a-half is taken, the regular day rate is paid Of this, the wage-earner is also sure.
5. "Standard time is carefully determined by observation and experiment, and is only changed when conditions change.
6. "The arrangement is one of mutual benefit to both parties of increased earning to the worker, of increased saving to the employer.
7. "The employer loses more than the wage-earner if schedules do not encourage co-operation.
8. "The wage earner, working on a schedule, becomes in a large degree his own foreman.
9. "The wage earner determines his own earning power, and by co-operating to cut out wastes increases his own value."

Now, let us see to what extent these same claims apply to modern piece-work, and in so doing it should be borne in mind that the up-to-date piece-work practice of the present day is quite different from that of twenty, or even five, years ago.

1. The present method of making piece-work prices is practically identical with that described for setting the "standard time" for a job under the individual effort system.

2. The piece worker also obtains extra pay for increased efforts.

3. This differs from the piece-work practice under which no extra compensation is paid until the work is turned out in what may be considered as standard time.

4. Here again piece-work differs, in that a man is paid for the actual amount of work performed, and if this does not come up to the average, his earnings will drop below his day rate.

5. If we use the word "price" instead of "time," this statement applies with equal force to piece-work.

6. This claim applies with equal force to piece-work.

7. In this respect piece-work differs because it is equally advantageous for the employer and the wage-earner to have the schedules fair and equitable to both.

8 and 9. These claims are also equally true of piece-work.

Advocates of the individual effort system admit that "nothing compels the employee to make standard time," which may be understood to mean that it permits the lazy and incompetent workmen to hold on to their job indefinitely, whereas such men soon voluntarily leave a piece-work shop. The matter of making prices and keeping a record of the earnings is somewhat more complicated under the individual effort system than under the piece-work system. Either of these systems will mean for the employer better men, better work and more of it, and for the employee they will mean better pay and, as a rule, steadier work than under the day-work system. A comparison of the pay-rolls of day-work with piece-work and individual effort shops will show that the average earnings for the two latter are between 15 and 40 per cent. higher per hour than for the day-work shops, which is a practical refutation of the claim commonly made by opponents of piece-work that it is a scheme for reducing wages.

Some of the claims made by advocates of piece-work in favor of their system as compared with the individual effort system are that supervision costs less in proportion to output; that it is simpler and more easily comprehended by the workmen, and is less expensive to install and check up. We see no grounds for advocates of either system claiming any advantage over the other in the matter of stimulating ingenuity and head-work on the part of the workmen, and, in fact, the term "individual effort" is as accurately descriptive of the modern piece-work system as it is of the "premium system" by which it has been appropriated.

To sum up, the two systems agree in most of their essential features; both are beneficial and absolutely fair to the employee, and at the same time advantageous to the employer; but the guaranteed day rate and more euphonious name may make the individual effort system more attractive and therefore easier to introduce in shops which have hitherto been run exclusively on a day-work basis.

LOCOMOTIVE PERFORMANCE STATISTICS.

The committee of statistical inquiry of the American Railway Association has at last presented a report that is intended at least to make a closer comparison of locomotive performances than has been possible under the conditions of compiling these statistics that have heretofore existed. The report, as it stands, must, however, be considered merely as a report of progress, for, in the opening paragraph, it calls attention to a previous report in which an opinion was expressed that a further index of efficiency is desirable, in the form of ton-miles per unit of tractive force, and that it had under consideration a method of adapting the same to the form submitted. It begs leave to state that the experimental tests which it considers necessary, before submitting such further index, have not yet been completed, and it is, therefore, not prepared to report on this branch of the subject at this time.

A valuable feature of the report is the fact that it divides the responsibility for engine delays between the motive power and the transportation departments, so that if there is a scarcity of power, the responsibility can be definitely placed either upon the motive power department for not having the engines ready for service; the transportation department for delays upon the road or in the roundhouse; or, these two acting with full efficiency, upon the management, for not providing sufficient power to do the work. The motive power department is held responsible merely for time consumed in engine house movements and in making repairs; the transportation department shoulders all of the rest, barring, of course, engine failures on the road.

In order that the working efficiency of the engines may be completely understood, the time is distributed among the passenger, freight, switch and work service so that there is no lumping of the whole, and thus allowing exceptionally good work along one line to leaven and conceal something perhaps decidedly bad in another.

What should constitute engine mileage has been a point of dispute for years. Should an allowance be made for movements between the roundhouse and the terminal station or yard? What should be credited to local freight engines for switching at station stops and what mileage should be attributed to switching engines? How is the mileage of work engines to be computed? All these items were causes of disagreement, and though the disagreement was often slight, it was quite enough to make considerable variation

in the results, and by the very fact that there was a possibility of a variation in the basis, a doubt was cast over each and every collection of these statistics because it was not certain how they were constructed.

The new form proposes that the mileage of passenger engines shall include such items as helping mileage, light mileage between terminals and light mileage between engine and train terminals. The conditions are practically the same for freight service. In the switching service there is a marked departure from previous standards. It will be remembered that on May 8, 1903, Mr. George L. Fowler published in the *Railroad Gazette* the results of an investigation of the mileage made by switching engines in service. The figures then given showed that in no case did a switching engine in freight service make more than 2.86 miles per hour, and that in passenger service, 3.27 was the highest average speed obtained, though these figures dropped to 2.52 and 3.07 miles per hour, respectively, when the time at water and coaling stations was not subtracted from the total time out of the roundhouse.

When these figures were presented to the Master Mechanics' convention in June, 1903, there was a protest that they were too low, although there were observers present who were ready to corroborate them. The established rate of six miles an hour was upheld by those in authority as being low enough. The following quotations are from remarks made at this 1903 convention:

"So far as mileage for switch engines is concerned, I personally think that the six miles is entirely too low for our modern locomotives, weighing 140,000 to 150,000 pounds on the drivers, that will haul double the tonnage of locomotives of 60,000 and 70,000 pounds on the drivers. To figure them on the same basis would be inconsistent." "This committee says that for strictly yard work, four miles an hour for passenger switchers and 3½ miles for freight switchers would undoubtedly be a liberal allowance." "I believe any one who has watched the expense of switching locomotives of heavy type, will agree with me that the switching locomotives prove to be the most expensive locomotives we have to maintain of a heavy type."

"I am thoroughly convinced that the mileage is too low at present on the heavy locomotives. The cost is running up on them and the mileage we are getting out of flues and tires is running down, and if any change is made, the mileage should be raised." "In my opinion, it would be ridiculous to consider anything less than six miles an hour."

The discussion ended in a resolution to refer the matter to the committee of statistical inquiry of the American Railway Association, and this committee now recommends that the mileage of switching engines in the yard and of road engines when switching at stations shall be computed at the rate of three miles per engine-hour, which is undoubtedly quite high enough and as close as accuracy as any convenient general average can be made.

The report then recommends a basis of comparison that is a novelty, and must be tried out in practical work before it can be unequivocally sustained. It is the reduction of the mileage as already determined to that of an equivalent mileage of an engine having 25,000 lbs. tractive force which is adopted as a standard. This is obtained by reducing the sum of the products of the mileage of each engine by the ratio of its tractive force as determined by the following formula, to that of the Standard Engine:

$$T = \frac{d^2 \times S \times .8\ p}{D}.$$

T = tractive force in pounds;
d = diameter of cylinder in inches;
S = stroke of piston in inches;
p = steam pressure in pounds;
D = diameter of driving wheels in inches.

There is nothing peculiar about the car or train mileage except that there is a separation of the empty and loaded freight car mileage.

In ton mileage, that of the passenger service is reduced to its simplest form of multiplying the mileage by the weight of the car; but in freight service there is a call for the total revenue ton miles, the total ton miles of lading, the total ton miles of cars and lading, and the same total for engines, cars and lading, with a final adjustment of the weight of each car and its lading plus car allowance factor (determined for each division) multiplied by the mileage of the car. This car allowance factor is to compensate for difference in resistance, owing to the various weights and number of cars in a train, as determined by dynamometer tests or otherwise. Finally, there is to be an adjusted ton mileage of the total engine capacity, that is to say, the sum of the miles made by each engine multiplied by its maximum capacity expressed in adjusted tons. Under the head of averages there are twenty-two items that cover a wide range of ratios between the several factors that have been determined, ending in the tons per standard engine, which includes passenger cars, revenue freight tons, revenue and company freight, cars and lading, passengers per car, tons per loaded freight car and the engine capacity utilized in freight service.

To compile a report along these lines will certainly require care and an elaboration of a quick working organization in order that it may be of real value to the manager and the superintendent. That it will have enough value to warrant such an organization, there is probably no doubt. It is evidently the result of a long and painstaking piece of work on the part of the committee, and is a strong corroboration of the assertion of Mr. Priestly in his report on American Railroads to the effect that the American manager lives in an atmosphere of statistics, by which all the inter-relations of the properties that he managed are shown in as nearly their true relations as it was possible to bring them.

NEW PUBLICATIONS.

High Tension Power Transmission. New York: McGraw Publishing Co. Cloth, 6x9 in., 415 pages, 114 figures. Price, $2.50.

This book contains a series of papers and discussions which were presented at the International Electrical Congress held in St. Louis in 1904. As these papers are by different authors and represent the results of practical working and observation in the field, there is naturally little or no connection between them other than that they cluster about and are based upon the general broad principles of the work which they represent, with such variations of detail as would naturally arise from diversity of operating conditions and the standpoint of the observer. They thus cover "various phases of the subject considered from various points of view," but this very diversity is valuable to one who wishes to study the subject at first hand, and it is safe to say that it is upon those very points where the greatest diversity exists that the most light is needed.

In all there are 17 papers, with the following titles: Electrical Power Transmission; The High-Tension Transformer in Long Distance Power Transmission; Notes on Experiments with Transformers for Very High Potentials; High Potential, Long Distance Transmission and Control; American Practice in High-Tension Line Construction and Operation; Spark Distances Corresponding to Different Voltages; The Use of Aluminum as an Electrical Conductor; Conductors for Long Spans; High-Tension Insulators; The Construction and Insulation of High-Tension Transmission Lines; Some Difficulties in High-Tension Transmission and Methods of Mitigating Them; Pioneer Work on the Telluride Power Company; Bay Counties Power Company's Transmission System; Some Practical Experiences in the Operation of Many Power Plants in Parallel; Maximum Distance to Which Power Can Be Economically Transmitted; Some Elements in the Design of High-Pressure Insulation; Insulating Materials in High-Tension Cables.

In the course of these papers there is a very complete resumé of the steps that have been taken in the development of the present methods of high-tension transmission from the early conditions in 1876, when, at the Centennial Exposition, there was a dynamo which could supply one arc lamp up to the beginning of the last decade, when there were practically no transformers in commercial service of a capacity as great as 100 kilowatts, or of a voltage exceeding 10,000, and so down to the present day, when there are approximately 10,000 transformers in America "with capacities ranging from 100 to 2,500 kilowatts and wound for pressures of from 10,000 to 60,000 volts," with possibilities and experience capable of handling 80,000 volts. So the subject of poles, insulators, conductors and the other items of construction are handled by men working in the field, and all are thus brought together in a form readily accessible for reference and consultation, making a volume that cannot fail to be of great value to the student, the investigator and the engineer.

The Engineering Experiment Station of the University of Illinois. By L. P. Breckenridge, Director of the Engineering Experiment Station. Urbana, Ill.: Published by the University.

This is Bulletin No. 3 of the University of Illinois Engineering Experiment Station. It describes briefly the plan of organization and the work already accomplished, giving a list of the publications so far issued, with a brief statement regarding the ground covered by each. The character of the work to be undertaken forms the subject of a section, and the titles of some of the most important investigations which have been submitted for approval of the station staff are listed under the various departments in which they would be made. The larger part of the Bulletin is devoted to the facilities for investigation available for this work. This is, of course, the equipment in the various departments of the College of Engineering. The descriptions are supplemented by a large number of half-tone engravings from photographs. The industrial interests of the state of Illinois are touched on under the four heads of Agriculture, Coal and Mining, Transportation, and Manufacturing. In closing, reference is made to the evident desirability of co-opera-

tion with similar state experiment stations and certain of the Government departments.

The Adjustment of the Engineer's Transit and Level. By Howard C. Ives, C.E., Assistant Professor of Civil Engineering, University of Pennsylvania. New York: John Wiley & Sons. Boards, 4½x6¾ in.; 15 pages; 11 figures. Price, 25 cents.

This small book deals with one of the little things that is apt to be overlooked in the training of an engineer. It opens with a brief description of the several parts that must be considered in the adjustment of the level, such as the bubble tube, reticule, line of collimation, and vertical axis, all of which are defined and their functions explained. Then follows explanation of the method of adjustment of the Y level. This is illustrated by figures. The explanation is clear but could be rendered much easier to follow by the use of reference letters on the figures by means of which the various lines could be detected at a glance without requiring the mental effort of remembering the definitions. The same general method is followed in the case of the transit though the criticism regarding the reference letters on the figures does not hold. The book cannot fail to be of value to young engineers. It would be well for all such to follow the rule laid down by the author in the matter of his own students, in that he has them "actually make nearly all the adjustments rather than simply to test them without touching the screws."

Directory of Directors in the City of New York. 1906. The Audit Company of New York, 43 Cedar Street. Price, $5.

The eighth annual edition of the Directory of Directors contains the names of over 24,000 directors, each director's name being followed first by the name of the firm or company with which he is directly associated and then by all the companies of which he is a director. Selected lists of corporations in banking, insurance, transportation, manufacturing and other lines of business, alphabetically arranged, accompanied in each case by the names of company's officers and directors, are given in the Appendix. This is a very convenient kind of a directory to have. Like the telephone book, it furnishes a rough selection, but a pretty good one, of the people one is apt to want to find, and, unlike the telephone book, it gives many additional facts about them and their interests. It is a book of 1,017 pages and is well worth its price to a New York business or professional man.

Poor's Railroad Manual, Appendix and Diary: Containing Poor's Ready Reference Bond List, Dividends Paid, Annual Meetings, etc. Special edition of February, 1906.

The new matter contained in this very convenient publication is the record of annual meetings and other corporate dates of railroad companies, and of gross earnings, month by month. Apart from this, however, there is a most valuable compilation of facts about the operation and finance of the properties included in Poor's Manual, but brought up to the close of 1905. As the Manual, containing this same information rather more elaborated, does not appear until November, the present appendix is in reality a presentation of the essential facts of the Manual six months ahead of time, and is therefore most acceptable. It is also noteworthy that an effort has been made, we believe, for the second time by the present publishers, to collate the street railway statistics, imperfect as they necessarily are, that are contained in Poor's Manual for 1905. These are not revised up to December 31, and are therefore somewhat old as presented, but the presentation is in useful and convenient form. The table of gross earnings of the leading railroads, month by month, from January, 1900, through December, 1905, is of great and unique value.

CONTRIBUTIONS

The Freight Car Movement on the New Haven.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your note of May 25 concerning demurrage on the New Haven road seems to call for a word from the "other side." The trouble of 15 months ago rested with the management of the road and not with the four-day rule or with the public. The public unloaded their cars then, as now, promptly or paid for the delay. But the public could not unload cars held in big yards 50 or 100 miles short of destination. There were thousands of cars so held on which the road was paying per diem of 20 cents, or penalty of $1 a day. As many of the cars so held were empties it was evident that the fault was not with the consignees. The public had good grounds for complaint; and if a reciprocal demurrage law had been in effect in Connecticut it would have cost the road a hundred thousand dollars, more or less, for the quarter ending March 31, 1905.

TRUTH.

[We have heard that an officer of the traffic department of the road complained to the operating department that consignees were being pressed so hard to unload cars that he (the traffic officer) was likely to suffer that is, to have business taken away from him by such consignees. This would seem to confirm the view that the pressure had been somewhat strenuous. Where cars are delayed on the road an operating officer always does his best to move them. In pushing consignees he seems often to do less than his best.—EDITOR.]

Tickets to Station Platforms.

New York, June 11, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I do not recall having seen mentioned in our railroad periodicals the convenient system used at the larger stations in Germany by which tickets of admission to the arrival and departure platforms which entitle the bearer to pass a train gate are sold by a slot-machine at a nominal price. These Bahn-Steig-Karte (please correct the German if wrong) would easily command a nickel at large stations in this country, and the revenue from them might go a long way toward paying station expenses. By using nickel-in-the-slot machines, the cost of the service is negligible. Perhaps American railroad managers fear to encourage petty thieves by the adoption of such a system, or it may be that our platforms are smaller in proportion to our train capacities than platforms are in Germany. But there must be some stations in the United States where this scheme would be both profitable and practicable. E. W.

Consolidation Locomotive for the New York Central Lines.

The American Locomotive Company has recently delivered from its Brooks Works 24 heavy consolidation (2-8-0) locomotives to the Lake Shore & Michigan Southern. Their general design is based on the types previously built for the New York Central, the Lake Shore, the Big Four and the Indiana Harbor. It is interesting as the standard type adopted by the New York Central Lines.

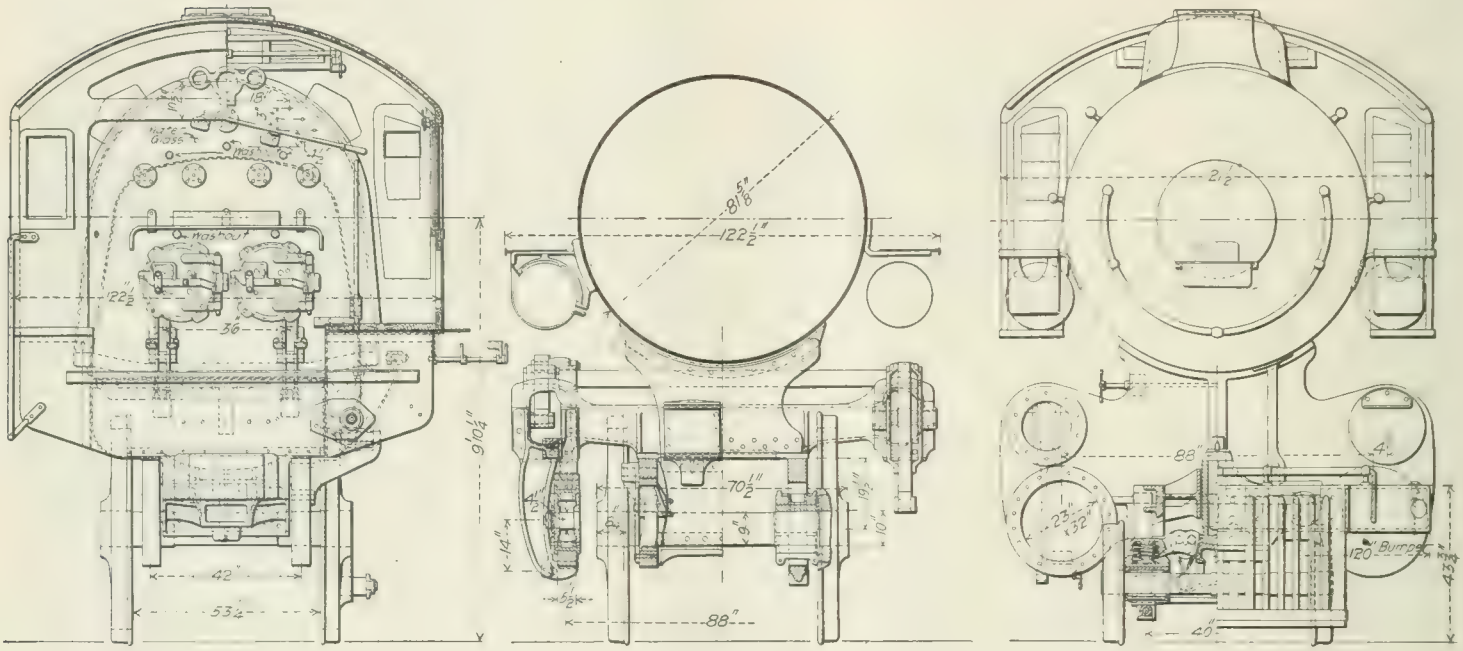
The weight of the engine is somewhat more than that of those earlier built, due to some slight modifications of details such as the use of cast-steel bumpers. A point to attract attention at once in the photograph is the use of the Walschaert valve gear. This is one of the notable innovations that seems to have established itself in American practice. It calls for some changes in detail to which our eyes are not yet quite accustomed. The reversing lever, as shown in the rear elevation of the engine, has its lower end in the form of a casting by which the lever itself is brought up well inside the cab and close to the boiler, while the reach rod is thrown outside the wheels and runs on an incline down to the end of the pendant lifting shaft lever. The arm of the lifting shaft lever extends back toward the cab and carries the hanger of the radius bar at its back end. The counter-balance cylinder is at the back end next the reverse lever instead of forward, as in the case of the link motion. A single heavy casting is used as a bracket for the bearings for both the lifting shaft and the link so that the whole is made not only very compact but exceedingly strong. This casting is bolted to the back of the guide yoke, which with it is provided with an opening for passage of the radius bar. The guide yoke itself is a strong steel casting of an I section that drops down from the frame brace on the outside of the guides and gives them the necessary vertical and lateral support. The valve is of the piston type, 14 in. in diameter, with a 5½-in. stroke.

At the front end there are several points of interest. The first is the location of the headlight, which has been removed from its position on top of the smoke-box to a bracket in front of the center of the shell. The reason for this is, of course, the height of the top of the boiler above the rails (13 ft. 4⅝ in.), which necessitates the short external stack. This stack rises only 16½ in. above the smoke-box, not enough to accommodate a headlight. To make the headlight higher than the stack would not only be inartistic in appearance, even though clearances would permit it, but experience has shown that a headlight whose ventilator rises above the top of the stack has a bad effect on the draft; so bad, in fact, as to make the cab uninhabitable when the engine is running without steam. The short external stack is supplemented by an internal or lift stack which drops down into the smoke-box 23½ in. to a point just above the top row of tubes where the smoke-box flares to a wide bell-mouth, thus forming an unbroken extension to the stack above. The whole stack thus is 40 in. long.

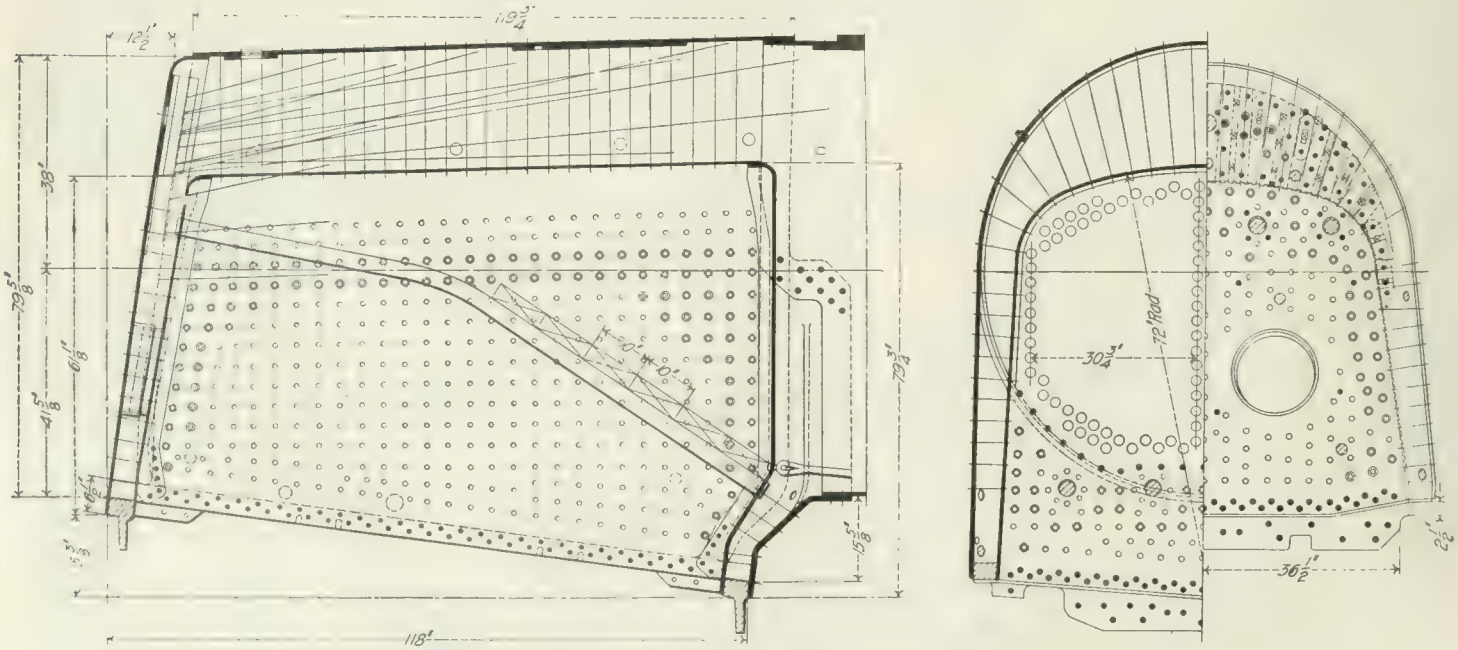
The method of fastening the smoke-box brace by the use of a pin and jaw on the buffer casting is simple and effective. So is the uncoupling device in which there is a rigid connection from the vertical arm on the main shaft to the bell-crank by which the lock is lifted. The pony truck is designed with helical carrying springs resting directly on the axle boxes and well protected by the housings in which they are placed. The truck is equalized with the two forward pairs of drivers instead of the front pair only, as in earlier practice. In this equalization and spring suspension the helical spring is freely used. It is over the truck boxes and at the ends of the equalization system for the two back pairs of wheels. Elliptics are used over each of the two forward pairs and between the two back pairs, or three on each side. This method



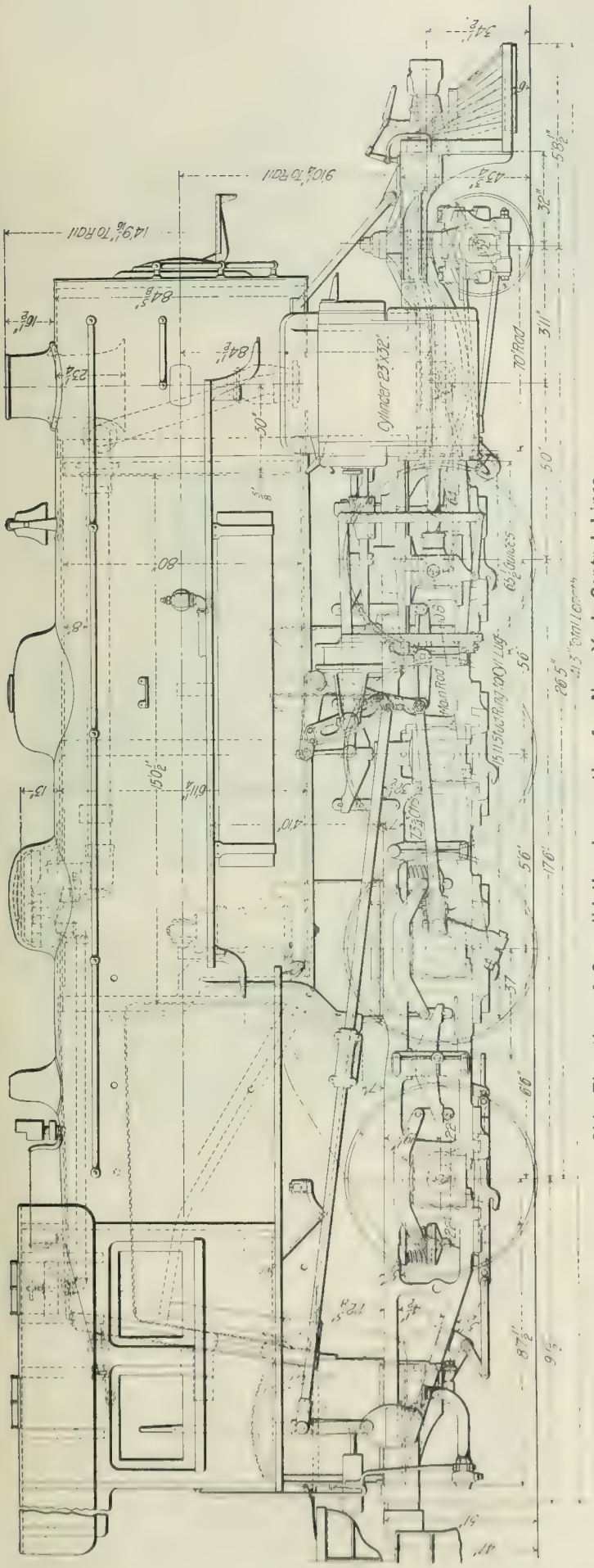
Consolidation Locomotive for the New York Central Lines, Built by the American Locomotive Company.



Elevations and Sections, Consolidation Locomotive for New York Central Lines.



Boiler and Firebox for Consolidation Locomotive, New York Central Lines.



Side Elevation of Consolidation Locomotive for New York Central Lines.

probably produces a mixed movement of the engine, as it were, compounded of the quick vibrations of the helical and the slow movement that would result if elliptics alone were used.

The Westinghouse-American driver brake is used, and with it an 11-in. Westinghouse pump and two brake cylinders of 14 in. diameter and 12 in. stroke. These cylinders are set vertically and are bolted to the front face of the frame brace at the guide yoke.

The locomotive cylinders are 23 in. in diameter, with a piston stroke of 32 in. dimensions, calling for the ample boiler capacity supplied. The boiler shell is 80 in. in diameter inside the smallest ring, and this with sheets $^{13}/_{16}$ in. thick brings the top 13 ft. 2¼ in. above the rail with its center 9 ft. 10¼ in. above the rail. The allowable clearances that cut the height of the external stack down to 16½ in. put a similar limitation on the height of the dome, which rises only 13 in. above the shell, to which about 3 in. more should be added for the thickness and curvature of the cover. This cuts the available rise of the throttle valve down to 9¾ in. above the shell, to which point the standpipe for the turret also rises. The space between the highest point in the crownsheet at the front end and the inside of the shell is 21¾ in., so that there is an available distance of 31½ in. between the crown and the upper throttle valve opening, which is reduced by about 5½ in. for the lower. The three water gages are set 3 in. apart vertically with the lowest, 4½ in. above the crownsheet, so that with two gages of water in the boiler there is a distance of 18½ in. between the surface of the water and the lower opening of the throttle valve.

The boiler is straight-top. The firebox is fitted with a brick arch resting on circulating pipes extending from the tube-sheet to the back sheet of the firebox. The firebox itself is 7 ft. 5 in. wide outside, so that it comes well out over the driving wheels, and is provided with two fire-doors each 15 in. in diameter. It is carried, in accordance with current practice, by buckle plates which raise the mudring 7 in. above the frame at the front end and 23⅜ in. above at the back. The staying is radial and the Tate flexible staybolt is freely used at the sides and back. This staybolt is used in the two outside rows in the back head, as indicated by the double circles, and also in the two front and back rows of the sides, the third and fourth rows from the top longitudinally with a filling in at the corners as indicated on the drawing. The grate slopes forward and a shallow combustion chamber is formed by the dishing of the tube sheet.

This locomotive marks a notable advance over 25 years ago on the New York Central. At that time the standard freight and passenger locomotive was one having cylinders 16 in. x 24 in., and a boiler with about 1,175 sq. ft. of heating surface, carrying a steam pressure of 125 lbs. This latest engine has increased piston area 107 per cent., stroke 33⅓ per cent., heating surface 225 per cent., and steam pressure 60 per cent., so that the capacity of the engine to do work for each stroke of the piston has been increased nearly four and one-half times, thus somewhat outstripping the increase of heating surface.

The principal dimensions of the modern engine are as follows:

Diameter of cylinders	23 in.
Stroke of piston	32 in.
Tractive power	45,677 lbs.
Wheel base, total	26 ft. 5 in.
" " rigid	17 " 6 "
" " engine and tender	66 " 9½ "
Weight in working order	232,500 lbs.
" on drivers	207,000 "
" engine and tender	332,100 "
Heating surface, tubes	3,492.12 sq. ft.
" " firebox	185.64 "
" " arch tubes	27.41 "
" " total	3,705.23 "
Grate area	56.5 "
Axles, main driving journals, diameter	10 in.
" main driving journals, length	12 "
" driving journals, diameter	9½ "
" driving journals, length	12 "
" truck journals, diameter	6 "
" truck journals, length	12 "
Boiler, outside diameter, smallest ring	81⅝ "
Boiler, steam pressure	200 lbs
Firebox, length	108⅛ in
" width	75½ "
" thickness of crown sheet	⅜ "
" " of tube sheet	½ "
" " sides and back	⅜ "
" water space, four sides	4½ "
Tubes, diameter	2 "
" number	446
" length	15 ft. ⅛ in.
Exhaust	Single.
Smokestack, diameter	20 in.
" height above rail	14 ft. 9½ in.
Water capacity	7,500 gals.
Coal capacity	12 tons
Valves, travel	5½ in.
" diameter	14 "
" steam lap	1⅛ "
" exhaust lap	
" lead	17-64 in.
Wheels, driving, diameter	63 in.
Wheels, truck, diameter	33 "
Weight on drivers ÷ tractive effort	4.53
Total weight ÷ tractive force	5.09
Tractive effort × diam. of drivers ÷ heating surface	776.64
Heating surface ÷ grate area	65.6
Firebox heating surface ÷ total heating surface	.05
Weight on drivers ÷ heating surface	55.86
Total weight ÷ heating surface	62.75
Volume of two cylinders	1,[illegible] cu. ft.
Heating surface ÷ cylinder volumes	240.56
Grate area ÷ cylinder volumes	3.67

Program of the Master Mechanics' Convention, Atlantic City, N. J., June 18-20.

The sessions of the convention will be held in the sun parlor near the ocean end of the steel pier. There will be no hotel headquarters. The office of the President, Executive Committee and Secretary will be in the sun parlor. The Secretary will also have a desk in the office of the Enrollment Committee in the entrance to the pier.

Immediately upon arrival each member of the Association should report to the Secretary, register and receive his membership button, if he has none, and be furnished a properly numbered celluloid disc showing his registration. The members of the Association will also be furnished with badges for the members of their families. Cards for registration will be furnished at the Secretary's desk in the entrance to the pier.

Any members who have attended the M. C. B. convention should register again after the adjournment of that convention. It will only be necessary to register once for each convention.

OPENING SESSION, MONDAY, JUNE 18, 9:30 A. M. TO 1:30 P. M.

Prayer	9:30 A.M. to 9:35 A.M.
Address of President	9:35 A.M. to 10:00 A.M.
Intermission	10:00 A.M. to 10:05 A.M.
To allow those who wish to retire to do so, although all are requested to remain.	
Action on Minutes of Last Meeting	10:05 A.M. to 10:10 A.M.
Report of Secretary	10:10 A.M. to 10:20 A.M.
Report of Treasurer	10:20 A.M. to 10:25 A.M.
Assessment and Announcement of Annual Dues	10:25 A.M. to 10:30 A.M.
Election of Auditing Committee	10:30 A.M. to 10:35 A.M.
Unfinished Business	10:35 A.M. to 10:40 A.M.
New Business: Consideration of matters pertaining to the Association; appointment of committees on Correspondence, Resolutions, Nominations, Obituaries, etc., and such other business as may be presented	10:40 A.M. to 11:00 A.M.
Reports of Committees on Shrinkage Allowance for Tires and Design of Wheel Centers	11:00 A.M. to 11:30 A.M.
Flexible Stay Bolts	11:30 A.M. to 12:00 M.
Topical Discussion: 1. Is not a boiler pressure of 185 lbs. better than 200 lbs. for locomotives. To be opened by Prof. W. F. M. Goss	12:00 M. to 12:20 P.M.
2. The necessity of proportioning brake pressure to wheel loads. To be opened by Mr. Geo. L. Fowler.	12:20 P.M. to 12:40 P.M.
3. Is it practical to use the Prosser tool in roundhouse running repairs? To be opened by Mr. F. R. Cooper	12:40 P.M. to 1:00 P.M.
Discussion of Individual Paper on Valve Gears for Locomtives. By Mr. C. J. Mellin	1:00 P.M. to 1:30 P.M.
Adjournment.	

MIDDLE SESSION, TUESDAY, JUNE 19, 1906, 9:30 A. M. TO 1:30 P. M.

Discussion of Reports on Locomotive Tests of Penn. R. R. at St. Louis Exposition	9:30 A.M. to 9:45 A.M.
Water Softening for Locomotive Use	9:45 A.M. to 10:00 A.M.
Locomotive Front Ends	10:00 A.M. to 10:45 A.M.
Mechanical Stokers	10:45 A.M. to 11:00 A.M.
Classification of Locomotive Repairs	11:00 A.M. to 11:30 A.M.
Enginehouse Running Repair Work on Locomotives	11:30 A.M. to 12:00 M.
Topical Discussion: 1. Grease vs. oil in driving box cellars. To be opened by Mr. F. H. Clark	12:00 M. to 12:20 P.M.
2. (a) The relation of roundhouse to shop and road. (b) The best roundhouse organization for properly taking care of locomotives. To be opened by Mr. S. W. Miller	12:20 P.M. to 12:40 P.M.
3. Distortion of wheel centers and tires out of round due to heavy counterbalance on 100-ton engines. To be opened by Mr. Geo. W. West.	12:40 P.M. to 1:00 P.M.
Discussion of Individual Paper entitled "The Modern Locomotive Injector," by Mr. Strickland W. Kneass.	1:00 P.M. to 1:30 P.M.
Adjournment.	

CLOSING SESSION, WEDNESDAY, JUNE 20, 1906, 9:30 A. M. TO 1:30 P. M.

Discussion of Reports on Locomotive Lubrication.	9:30 A.M. to 10:00 A.M.
The Use of Cast Iron in Cylinders	10:00 A.M. to 10:30 A.M.
Electricity on Steam Railroads	10:30 A.M. to 11:00 A.M.
Discussion of individual papers on Best Method of Welding and Repairing Locomotive Frames without Taking Down or Removing from Engine. To be opened by Mr. R. P. C. Sanderson	11:00 A.M. to 11:30 A.M.
Fire Kindling: Cost of material, labor and time kindling fire in locomotives using either anthracite or bituminous coal. To be opened by Mr. P. Maher.	11:30 A.M. to 12:00 M.
Topical Discussions: 1. To what extent should an engine be repaired in the main shop, and what class of repairs can be made to advantage in the roundhouse? To be opened by Mr. C. A. Seley	12:00 M. to 12:20 P.M.
2. Relative advantage of the piston valve as compared with the slide valve. To be opened by Mr. E. A. Miller	12:20 P.M. to 12:40 P.M.
3. Is the Walschaert valve gear an improvement over the Stephenson link movement? To be opened by Mr. Geo. W. West	12:40 P.M. to 1:00 P.M.
Discussion of Reports on: Subjects	1:00 P.M. to 1:05 P.M.
Correspondence and Resolutions	1:05 P.M. to 1:10 P.M.
Election of Officers	1:10 P.M. to 1:30 P.M.
Adjournment	

The Pekin & Han-Kow Railroad, 754 miles, from Pekin southward to the Yang-tze-Kiang at Han-Kow, is now in operation for its whole length, except for the bridge, nearly two miles long, over the muddy Hoang-ho. In the absence of sleeping cars, the passenger trains take three days for the journey, not running at night. French contractors are building a branch from a point about 150 miles south of Pekin on this railroad westward to Ta-yu-en, the capital of the province of Shansi, and another short railroad crosses it about 65 miles north of the Hoang-ho, extending from the river Wei, a little east of the line, westwards to anthracite mines just beyond the borders of Shangsi. The United States Steel Co. will do well to watch these branches, for, according to Baron Richthofen, who studied this country pretty thoroughly, there is another Pennsylvania in Schansi.

Baltimore & Ohio Railroad Motive Power.

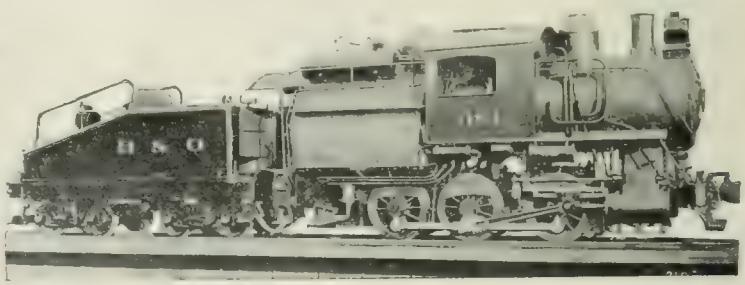
During the past three years the Baltimore & Ohio Railroad has put in service several of the most powerful designs of steam and electric freight, passenger and switching service locomotives that have been recently built.

Among these are the Mallet type mountain helper steam locomotive, the total weight, without tender, of 334,500 lbs. being distributed over twelve 56-in. diameter driving wheels, having a total flexible wheel base of 30 ft. 8 in. and a rigid wheel base of 10 ft. This locomotive has a tractive power of 74,000 lbs. in compound, and 84,000 lbs. in simple gear, with a capacity for hauling 2,200 tons in freight cars at a speed of 10 miles per hour on a 1 per cent. grade.

The new consolidation type of fast through freight steam locomotives have a total weight, without tender, of 208,500 lbs. distributed over a wheel base of 25 ft. 7 in., and a weight of 185,900 lbs. distributed over eight 60-in. diameter driving wheels, on a rigid wheel base of 16 ft. 8 in. These locomotives have a tractive power of 42,000 lbs. and a capacity to haul 1,180 tons in freight cars at a speed of 10 miles per hour on a 1 per cent. grade.

The six-wheel type of switching steam locomotives have a total weight, without tender, of 161,000 lbs. distributed over a total and rigid wheel base of 11 ft. on six 52-in. diameter driving wheels. These locomotives have a tractive power of 29,700 lbs. and a capacity to haul 720 tons in freight cars at a speed of 10 miles per hour on a 1 per cent. grade.

The two-section freight helper electric locomotives have a total



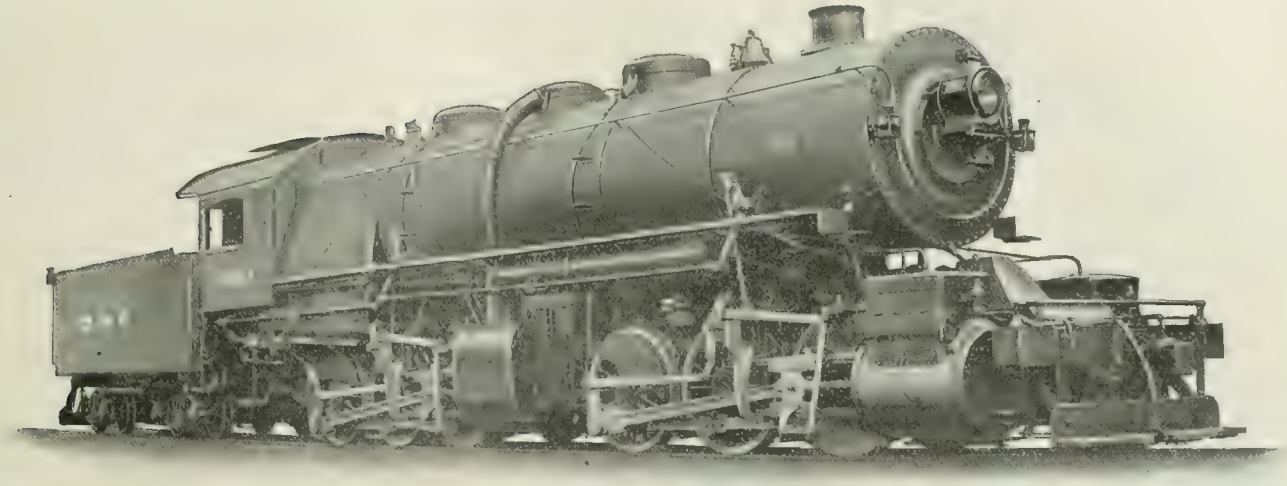
Baltimore & Ohio 6-Wheel Switcher.

weight of 320,000 lbs. distributed over a total flexible wheel base of 44 ft. 2¾ in., with a rigid wheel base of 14 ft. 6¾ in. The total weight is distributed over sixteen 42-in. diameter driving wheels, which gives these locomotives a total tractive effort, at full working load on eight motors, of 70,000 lbs. and a capacity for hauling 2,200 tons in freight cars at a speed of 10 miles per hour on a 1 per cent. grade.

Two two-unit type of passenger helper electric locomotives, which have been in service for the past ten years, will also compare most favorably with the more recent designs of passenger electric locomotives put into service and undergoing construction for modern terminal requirements. These locomotives have a total weight of 196,000 lbs. distributed over a total flexible wheel base of 23 ft. ¾ in., with a rigid wheel base of 6 ft. 10 in. The total weight is distributed over eight 62-in. diameter driving wheels, and these locomotives have a tractive effort at full working load on four motors of 42,000 lbs., and will haul 1,500 tons in freight cars at a speed of 10 miles per hour on a 1 per cent. grade.

The most recent acquisition is a lot of 35 Pacific type passenger steam locomotives having a total weight of 229,500 lbs., without tender, distributed over a total wheel base of 34 ft. 3½ in., with 150,500 lbs. on a rigid wheel base of 13 ft. 2 in. over six 74-in. diameter driving wheels. They have a tractive power of 35,000 lbs. and a capacity to haul 970 tons in freight cars at a speed of 10 miles per hour on a 1 per cent. grade. One of the points of advanced practice in these engines to which attention should be called is the use of tubes 20 ft. long.

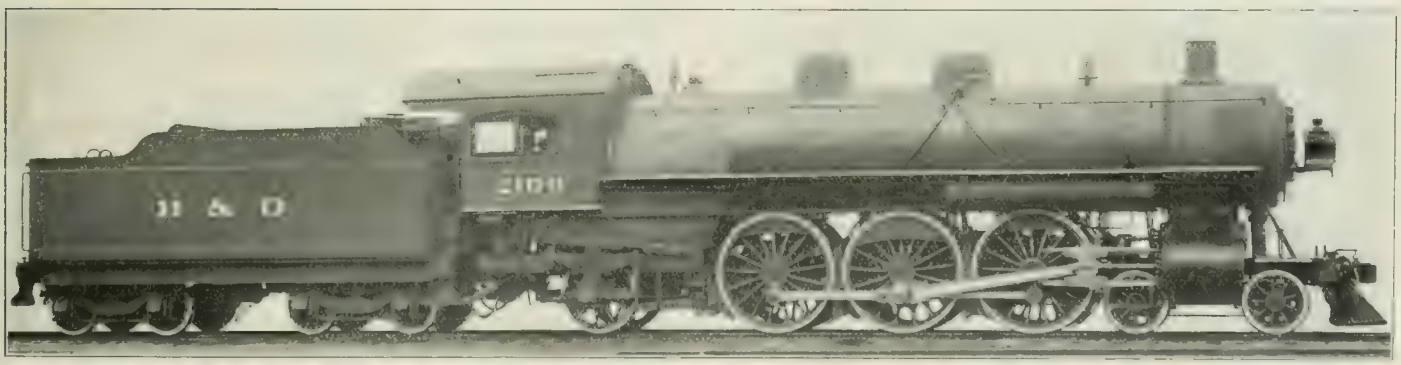
These passenger locomotives are now in regular service, and haul without a helper through passenger trains consisting of 1 baggage, 1 postal, 2 vestibule coaches, 1 dining, 3 sleeping and 1 observation parlor car, or a total of 9 cars,, approximating 425 tons, for a distance of 31.6 miles from Cumberland, Md., to Manila, Pa., near the crest of the Allegheny mountains, the total rise in altitude being 1,588 ft., in 63 minutes. This distance is made up of an average gradient of .4 per cent. between Cumberland and Hyndman, a distance of 13.9 miles, and of 1.4 per cent. between Hyndman and



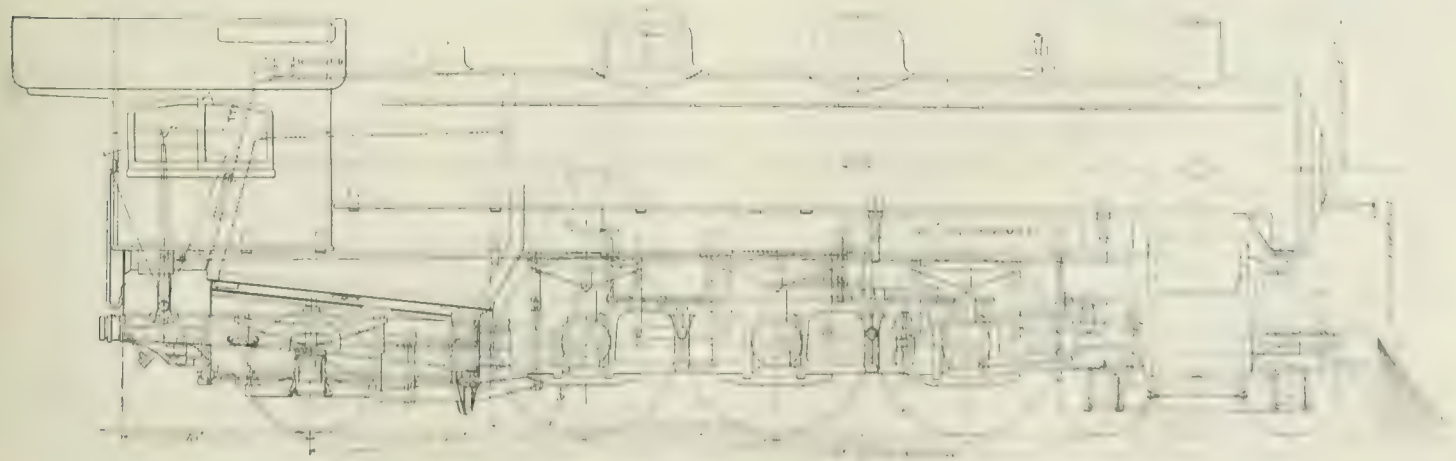
Baltimore & Ohio Mallet Compound.



Baltimore & Ohio Electric Locomotives Nos. 7 and 8.



Pacific Locomotive for the Baltimore & Ohio Designed by J. E. Muhlfeld, S. M. P., Built by the American Locomotive Co.



Pacific Locomotive for Baltimore & Ohio R. R., Built by the American Locomotive Co.

Manila, a distance of 17.6 miles. The maximum work to be done over this distance consists of 6.1 miles run on a 1.5 per cent. grade with 8 deg. curvature between Roddy and Manila, and a 1.5 mile run on a 1.93 per cent. grade.

These locomotives are also hauling passenger trains consisting of 11 cars and approximating 500 tons from a dead stop for a distance of 7 miles on a 1 per cent. grade, with from 1 to 8½ deg. curvature, in 14½ minutes.

The accompanying drawings and tabulations give an idea of the general design and proportions of these passenger locomotives, which

In addition to the above, the requirements to be met by the designers in these locomotives were as follows:

The greatest proportion of adhesive to total weight of engine and tender in working order.

A substantial construction of the least number of parts.

A capacity to perform continuous service without liability for failure, and economy with respect to maintenance and fuel and water consumption.

A boiler of simple design and substantial construction, with ample grate area in one plane and firebox heating surface, together

BALTIMORE & OHIO RAILROAD LOCOMOTIVES OF RECENT CONSTRUCTION

Class	0-6-6-0	2-8-0	0-6-0	1-6-2	0-8-8-0	0-4-4-0
Type	Mallet Articulated.	Consolidation	6 wheel.	Pacific	2 section 8 wh'l	2 unit 4 wheel
Service	Freight.	Freight.	Switching	Passenger	Freight.	Passenger.
Motive power	Steam.	Steam.	Steam.	Steam.	Electricity.	Electricity.
Diagram	000 000	oOOOO	OOO	oo OOO o	OOOO OOOO	OO OO
Kind of fuel	Bituminous coal.	Bituminous coal.	Anthracite culm.	Bituminous coal.	625 volts, D. C.	625 volts, D. C.
Weight of locomotive in lbs On Drivers	334,500	185,900	161,080	150,500	320,000	196,000
On leading truck	.....	22,600	.....	40,500	.....	.....
On trailing truck	.....	.....	.....	38,500	.....	.....
Total locomotive	334,500	208,500	161,080	229,500	320,000	196,000
Tender loaded	145,000	143,500	85,000	147,000	.....	.....
Locomotive and tender	479,500	352,000	246,080	376,500	.....	.....
Wheels: Driving Number and diameter over tire	(12) 56 in.	(8) 60 in.	(6) 52 in.	(6) 74 in.	(16) 42 in.	(8) 62 in.
Leading Truck Number and diameter over tire	.....	(2) 33 in.	.....	(4) 37 in.	.....	.....
Trailing Truck Number and diameter over tire	.....	.....	.....	(2) 50 in.	.....	.....
Cylinders: Simple or compound	Compound	Simple.	Simple.	Simple	.....	.....
Type of compound	Mellin.	.....	.....	.....	.....	.....
Diameter—High or simple	20 in.	22 in.	19 in.	22 in.	.....	.....
Diameter—Low	32 in.	.....	.....	.....	.....	.....
Stroke	32 in.	30 in.	28 in.	28 in.	.....	.....
Number of cylinders	4	2	2	2	.....	.....
Ratios: Total weight to adhesive weight	1.00	1.12	1.00	1.52	1.00	1.00
Weight on drivers to tractive power	4.48	4.41	5.41	4.29	4.0	4.0
Tractive power to heating surface	13.3	15.10	18.03	10.26	.....	.....
Heating surface to grate area	77.5	49.6	22.5	60.7	.....	.....
Tube heating surface to firebox	24.45	14.57	8.54	18.02	.....	.....
Tractive power to grate area	1,033.0	749.7	405.5	622.6	.....	.....
Cyl. volume divided by diam. of wheel to grate area	4.97	6.76	4.16	5.11	.....	.....
Hauling capacity:						
Tractive Power—Comp. or simple locomotive	74,660	42,168	29,740	35,020	70,000	42,000
Tractive Power—At starting	84,000	.....	.....	.....	80,000	49,000
Tons of loads capable of hauling at 10 m. p. h., on 1 per cent. grade	2,200	1,180	720	970	2,200	1,480
Firebox: Length	108⅛ in.	108⅛ in.	110 in.	108⅛ in.	.....	.....
Width	96¼ in.	75¼ in.	96 in.	75¼ in.	.....	.....
Boiler: Type	Straight top; sloping roof, sheet wide firebox.	Straight top; wide firebox.	Wooten firebox	Straight top; wide firebox.	.....	.....
Style of stays	Radial & sling.	Radial stay.	Radial.	Radial stay.	.....	.....
Working pressure, pounds	230	205	180	225	.....	.....
Diameter of barrel	84 in.	74 5/16 in.	70 in.	72 in.	.....	.....
Brick arch	.....	.....	.....	.....	.....	.....
Heating surface: Firebox	220.0 sq.ft.	179.4 sq.ft.	172.84 sq. ft.	179.4 sq. ft.	.....	.....
Tubes, water sides	5,380.0 "	2,612.8 "	1,476.67 "	3,234.6 "	.....	.....
Total	5,600.0 "	2,792.2 "	1,649.5 "	3,414.0 "	.....	.....
Water tubes	.....	.....	.....	.....	.....	.....
Tubes: Length over sheets	21 ft. 0 in.	15 ft. 10 in.	11 ft. 6 in.	20 ft. 0 in.	.....	.....
Number	436	282	220	276	.....	.....
Outside diameter	2¼ in.	2¼ in.	2¼ in.	2¼ in.	.....	.....
Grates: Area	72.20 sq. ft.	56.24 sq. ft.	73.33 sq. ft.	56.24 sq. ft.	.....	.....
Type	Finger rocking.	Finger rocking.	Plain perforated rocking.	Finger rocking.	.....	.....
Wheel base: Driving	10 ft. 0 in.				14 ft. 6¾ in.	6 ft. 10 in.
	10 ft. 0 in.	16 ft. 8 in.	11 ft. 0 in.	13 ft. 2 in.	14 ft. 6¾ in.	6 ft. 10 in.
Total locomotive	30 ft. 8 in.	25 ft. 7 in.	11 ft. 0 in.	34 ft. 3½ in.	44 ft. 2¾ in. (coupled.)	23 ft. 0¾ in. (coupled.)
Locomotive and tender	64 ft. 7 in.	59 ft. 8¼ in.	40 ft. 9½ in.	65 ft. 6¾ in.	.....	.....
General Dimensions: Length over all Locomotive	51 ft. 5½ in.	41 ft. 3 in.	31 ft. 4½ in.	46 ft. 9½ in.	58 ft. 7½ in.	35 ft. 10 in.
Length over all Locomotive and tender	79 ft. 5½ in.	68 ft. 7¾ in.	55 ft. 4⅞ in.	74 ft. 3¾ in.	.....	.....
Height, center of boiler above rail	10 ft. 0 in.	9 ft. 10 in.	8 ft. 9 in.	9 ft. 4 in.	.....	.....
Extreme height above rail	15 ft. 0½ in.	14 ft. 10 in.	14 ft. 11¼ in.	14 ft. 7 in.	15 ft. 0 in.	14 ft. 7½ in.
Gage	4 ft. 8½ in.	4 ft. 8½ in.	4 ft. 8½ in.	4 ft. 8½ in.	4 ft. 8½ in.	4 ft. 8½ in.
Valves: Type of gear	Walschaert.	Stephenson indirect.	Stephenson indirect.	Stephenson indirect.	.....	.....
Kind of valves	H.P. 10 in.; piston. L.P. Slide-d'ble ports.	Balanced; slide.	Balanced; slide.	Inside admission piston.	.....	.....
Greatest travel	6 in.	6 in.	5 5/16 in.	6 in.	.....	.....
Lap—Outside	H. P., 1¼ in., L. P., 1 in.	1¼ in.	¾ in.	I. L	.....	.....
Lap—Inside	H. P., ¼ in., L. P., ¼ in.	⅛ in	1/32 in.	1 in.	.....	.....
Lead—In full gear	H. P., ⅛ in., L. P., ¼ in.	3/16 in.	1/16 in.	1/16 in.	.....	.....
Constant	Yes	No.	No.	No.	.....	.....
Variable	No.	Yes	Yes.	Yes.	.....	.....
Tender: Type	Water bottom.	Water bottom.	U-sloping back.	Water bottom.	.....	.....
Capacity Coal	16 tons.	15 tons.	6 tons	15 tons.	.....	.....
Water (U. S. gals.)	7,000 gals.	7,000 gals.	4,000 gals.	7,000 gals.	.....	.....
H. P. at 10 m. p. h. behind tender	2,096	1,124	686	924	2,096	1,410

are of the largest and most powerful type for the class now in existence. They were particularly designed for the handling of heavy through passenger trains at the required speeds over level and mountainous, open and tunneled railroad, of varying curvature and gradient.

Especial attention was given to the design of a motion gear that would provide for the quick starting and acceleration of trains, so that the schedule time could be maintained, or time made up without the use of tandem or helper locomotives on heavy grades and curvature, nor the necessity for unusually fast running on down grades.

with provision for a circulation of water and unrestricted passage of gases, and suitable for the consumption of a cheap grade of either gas or soft run-of-mine bituminous coals. Especial attention was given to insure dry steam at the valve chest and cylinders by the design and location of crown sheet, steam space, throttle valve opening and surge plates.

A cylinder, frame, running and motion gears, and general design that would permit of increasing the weight and tractive power of the locomotive when the boiler tubes, tire, cab, running boards, lagging, jacketing, grates, ash pan and other similar parts require replacement, due to ordinary wear and tear, and at the same time allow

for a reduction of the boiler pressure should age and general depreciation of the boiler necessitate the same without the renewal of any parts not entirely worn out or destroyed.

The same details of design, construction and material as specified for the consolidation locomotives were embodied in the Pacifics, so far as practicable, in order to insure the greatest interchangeability of parts between these and the older classes of locomotives in the stock, as could be done without the continuance of obsolete or unsatisfactory details, which would not provide for the greatest economy in maintenance and performance.

As in the case of the 210 consolidations, a sample Pacific type locomotive, No. 2,100, was constructed, in advance of the regular order, to give opportunity for a practical test and development of a design and construction to best meet the requirements, and in order to discover and correct errors, which, had they been embodied in the balance of the locomotives, would have resulted in some embarrassment from an operating and maintenance standpoint.

The above complement of steam and electric motive power now places the Baltimore & Ohio in a position to handle its constantly increasing business with despatch, reliability and economy.

The Davis Solid Truss Brake-Beam.

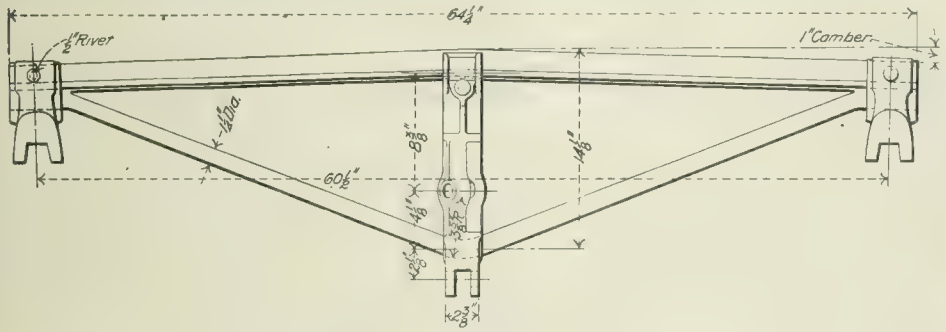
The Davis solid truss brake-beam shown in the accompanying engravings combines the advantages of the strength of a trussed beam and the solidity and simplicity of a one-piece rolled beam. The construction of other trussed brake-beams is necessarily such that after some length of service the connections of the separate members become loosened due to abrasion between the abutting surfaces of the tension and compression members, or in time break. To overcome these objections many types of rolled section brake-beams and one-piece pressed steel shapes have been designed. Such beams have a greater deflection under load per unit of weight than the truss beam and their ultimate strength is reduced. The Davis solid truss brake-beam is made in one piece, as its name implies, and has greater strength than a built up trussed beam of similar weight. The section from which the beams are made is rolled and was designed with special reference to making this particular brake beam. It allows the maximum amount of metal in the compression member to lie nearest the tension member and at the same time provides a section in the compression member best suited to resist buckling strains. One of the illustrations shows a section of the bars as rolled.

The truss is made by a special process which consists of cutting the bulb loose from the tee section for a part of its length and leaving it uncut at each end. The tee section, which forms the compression member, is then shortened by upsetting or compressing lengthwise. This shortening causes the round section, the tension member, which has been severed from the compression member, to move outward, forming the truss rod. During the process of upsetting the compression member, the tension member, or truss rod, is not stretched or compressed, but simply bent in the center to form a seat for the strut, or brake lever fulcrum. The original length of the bar is 68 in. The compression member is upset 3¾ in., making the length of the finished truss 64¼ in. Special powerful hydraulic machinery is used throughout in making these brake-beams. The trusses are finished from the bar at one heat and are of uniform dimensions throughout.

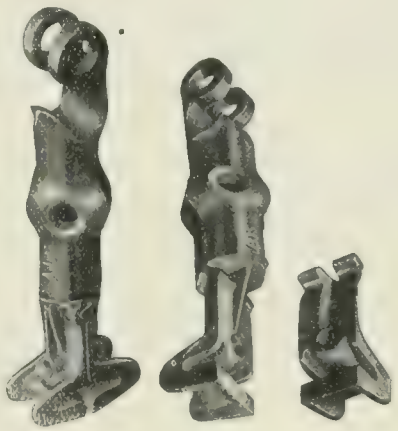
One of the illustrations shows the struts which are used with the Davis solid truss brake-beam. They have been designed so as to place the metal where most needed. The larger, or main member, of the strut is first placed on the tension rod and the upper end forced against the compression member, thus placing the truss under its initial tension. The smaller member is then forced into place and a $^{11}/_{16}$-in. rivet is inserted hot and riveted under heavy pressure. This riveting by heavy pressure and the cooling of the hot rivet produce a tight grip.

The report of the M. C. B. Committee on brake-beams, printed elsewhere in this issue, shows the high strength and rigidity of these beams under test. In compiling the order of merit of the beams tested under direct tests, the Davis brake-beam stood first in all four of the items for beams of less than 110 lbs. weight; namely, maximum strength, minimum deflection under 7,500 lbs. load, minimum deflection under 15,000 lbs. load, and combination of the above three. The beam tested weighed 94¾ lbs. and was tested to a load of 42,000 lbs. without breaking. The deflection at 7,500 lbs. was .040 in. and the set .005 in. or .035 net. At 15,000 lbs. the beam had a deflection of .086 in. and a set of .017 or .069 net.

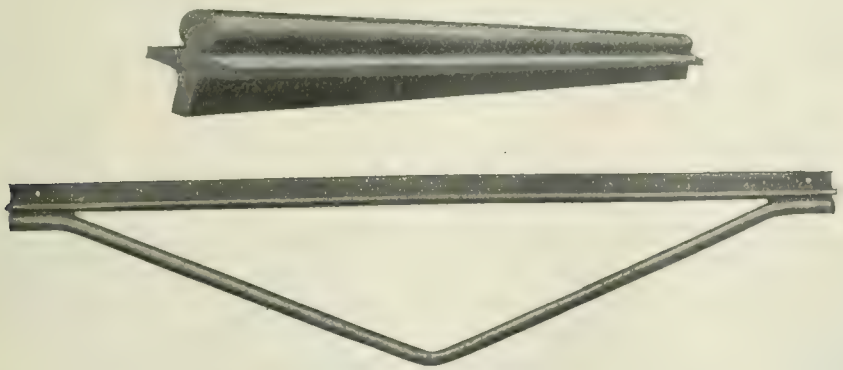
Mr. Nathan H. Davis, inventor and designer of the beam, is also the inventor and designer of all of the machinery used in its making. The beams are made by the Davis Pressed Steel Company, Wilmington, Del.



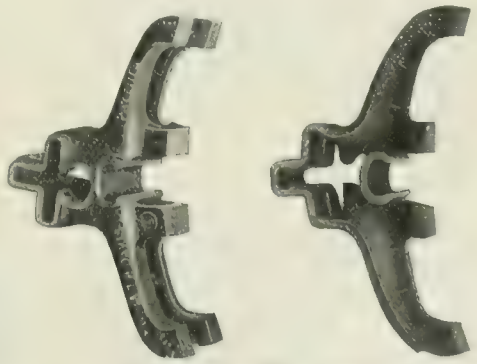
Davis Solid Truss Brake-Beam.



Davis Brake-Beam Struts.



Bar for Davis Solid Truss Brake-Beam and Finished Truss.



Davis Brake-Shoe Heads.

Improved Round House Facilities.

BY J. C. STUART.
General Manager, Erie Railroad.

The present day large locomotive, with all the parts increased in size and weight, and therefore more difficult to handle, having a capacity of two and one-half times that of engines in service 15 years ago, carrying almost twice the amount of steam pressure and doing more than twice the amount of work, requires fully twice as much care and attention at terminals as the old locomotive did, and yet, it is evident, from an examination of the average round house and engine terminal, that there has not been the same percentage of effort expended in the development of facilities for the care of the modern large engine.

It is no uncommon sight on many railroads to-day to find men

in cinder pits shoveling cinders from the pits to the ground, and from the ground to the top of a coal car; to find a shallow cinder pit with a capacity of one engine, where the capacity, based on the number of engines handled, should be three or four. It is not uncommon to see a turntable about the same length, or six to eight inches longer than the wheel base of the engines that are obliged to use it. It is not uncommon to see round houses with engines inside so large as to render it impossible to close the doors, and it is very common to find engine houses so short that, after an engine has been put in and the doors closed, it is impossible to move material or do any work at the front end of the engine. The houses are dark, ventilation poor, badly lighted, pits heated by radiating pipes with many leaky joints, two or three inches of water in each pit from lack of proper drainage, and, at times, heated with open stoves with a stovepipe perhaps six or eight feet long and the houses filled with gas.

Based on the importance of transportation facilities at a time when the maximum power is required, particularly in winter and when the cold weather conditions produce the greatest harm to the power and reduce its capacity



Locomotive Crane Loading Tender from Coal Cars.



10-Stall Round House and Engine Terminal at Hammond, Ind.—Erie Railroad.

to the greatest extent, all of the possibilities just mentioned are emphasized and their detrimental effect is fully developed, with the result that, at a period when transportation is most important, yards will be filled with cars, approaching trains unable to get in yards, engines attached to them held out, no room in yards because engines cannot be made ready to take trains out, and a complete demoralization is effected by inadequate roundhouse facilities, poor methods of repairing power and an expensive organization that is not able to effect the results desired.

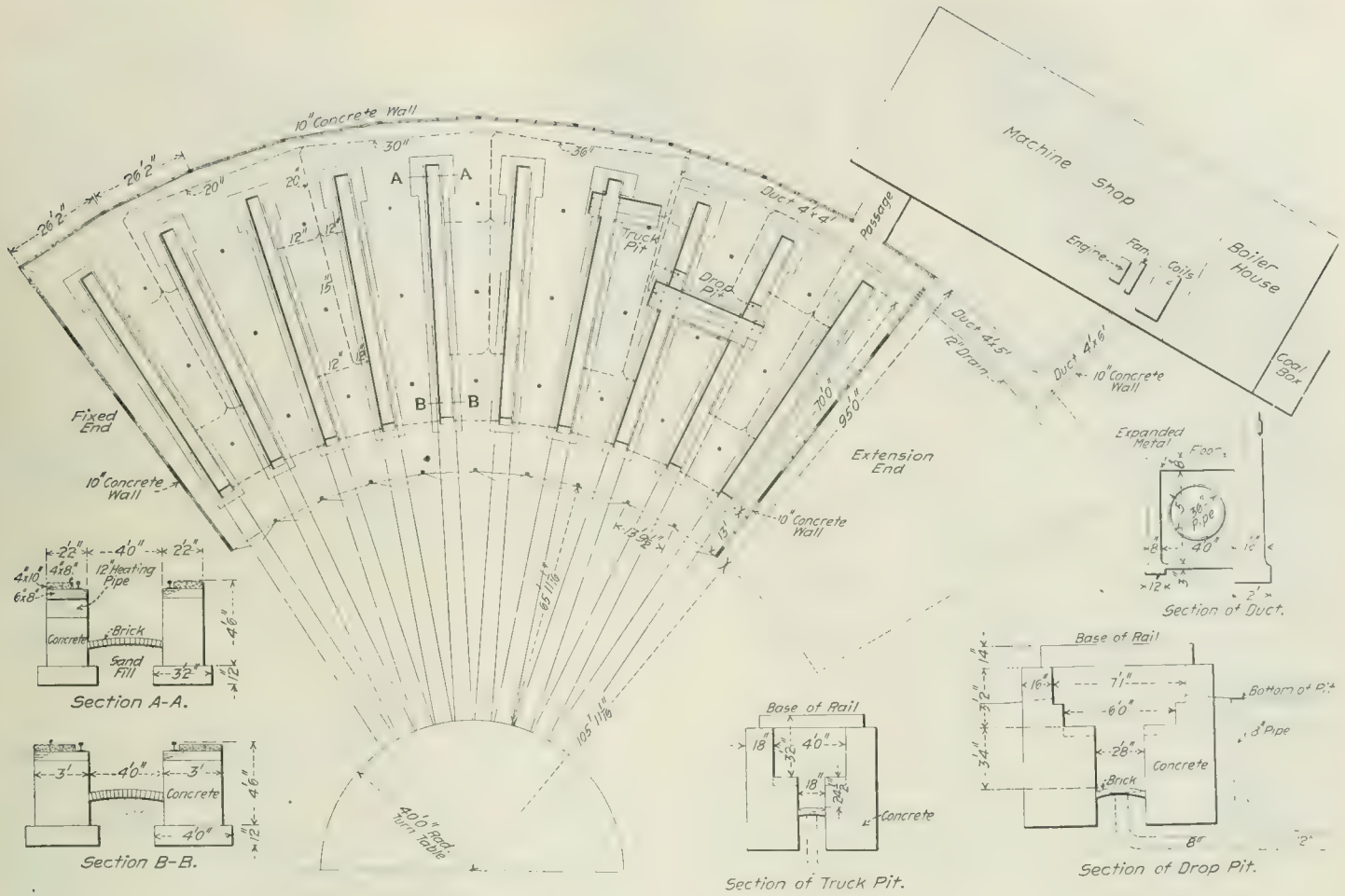
With all of these problems and the necessity for their improvement apparent, the Erie Railroad has adopted a standard division terminal, and, during the past year, has established 168 round house stalls, locating them in units of from 8 to 25 at various terminals.

All of the difficulties that have presented themselves in caring for and turning engines were carefully considered and an effort made to install facilities that would overcome these difficulties, and, at the same time, do it by the most economic methods.

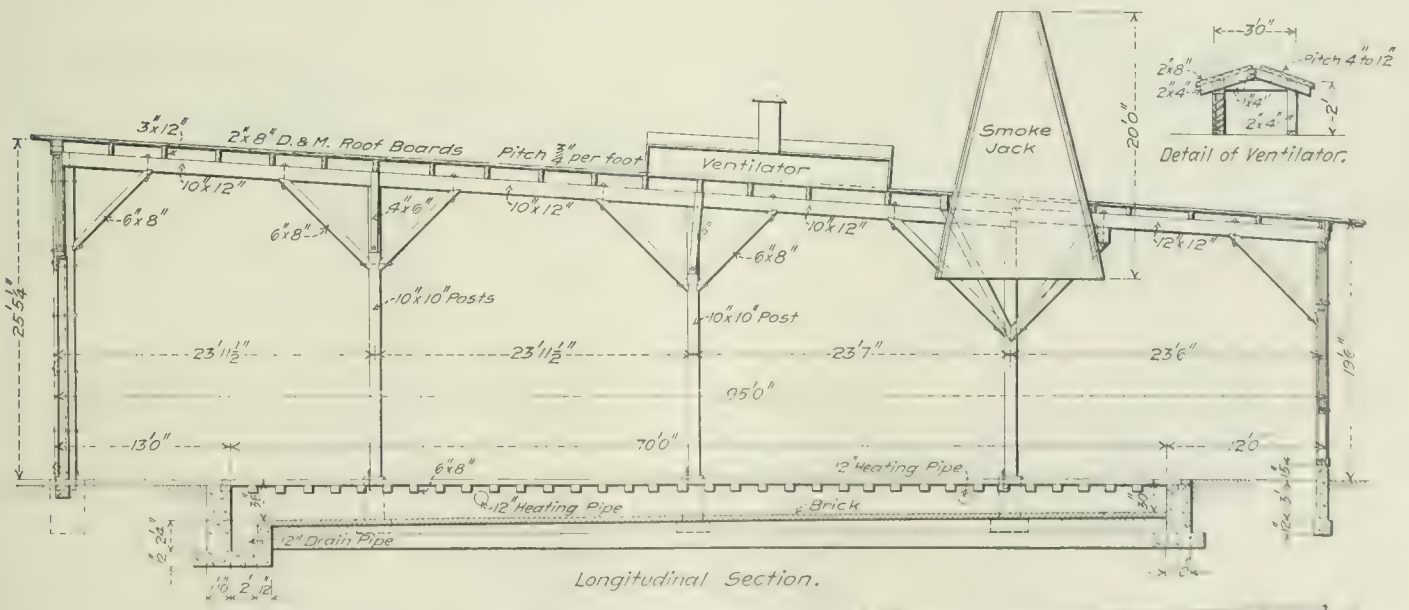
The features of improvement that were considered in the standard round house design are illustrated in the accompanying drawings,



Locomotive Crane Loading Ashes into Cars.



Plan and Details of Engine House and Drop Pits.

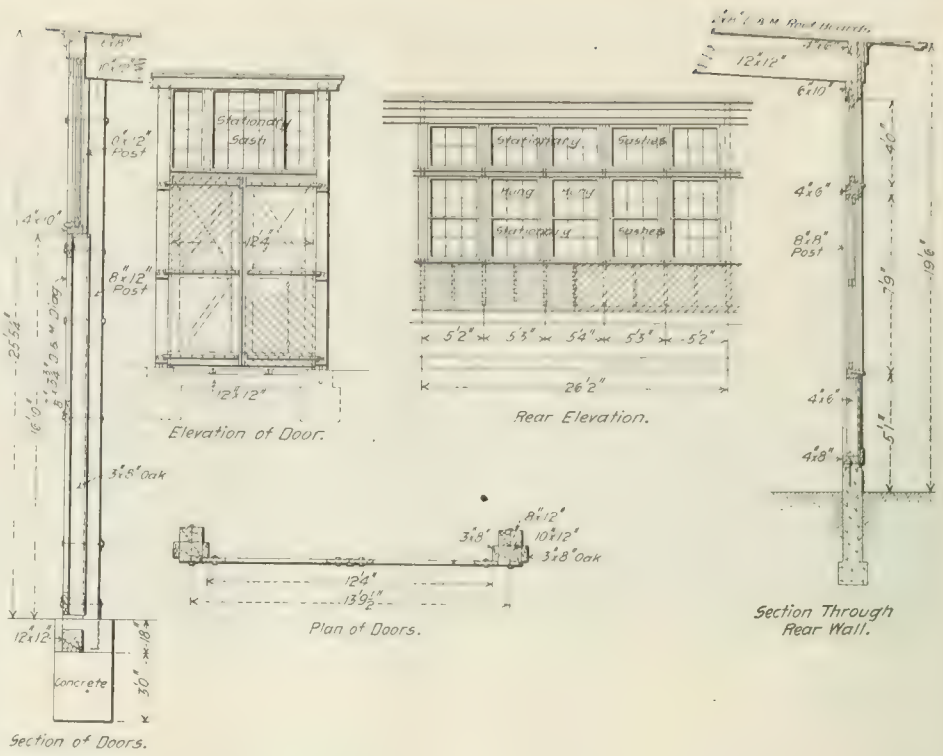


Part Plan and Cross-Section of Round House.

which show the 10-stall house recently built at Hammond, Ind. A brief explanation will be made under each heading.

Cinder Pit. The pit is built of concrete, supporting a cast iron column which, in turn, supports a box girder upon which the rail is fastened. The slope of the pit is sufficient to drop the cinders into the receiving pit. The cast iron column is intended to resist the action of the hot cinders. The pit is designed with a drainage pipe, with a valve attached which can be closed, thus retaining the water in the pit to cool cinders, and, at times, avoid unnecessary waste of water. The length of the pit is governed by the number of engines handled at each particular terminal; it can be made any length necessary. The capacity of the cinder pit is usually sufficient to carry at least two days' accumulation of cinders.

Coal Pit.—The coal pit is made of concrete and of very similar design to the cinder pit, with the exception of the cast iron columns, which are necessary, as the concrete can be carried up to the base of the girder. The coal pit can be made any size necessary, the controlling feature being the carrying of at least 24 hours' supply of coal, so that a night force is not required to dump coal. Its location should be about opposite the cinder pit, so that the locomotive crane, which will operate between the cinder pit and the coal pit, can perform the dual part of loading coal on engines as well as loading cinders into empty cars.

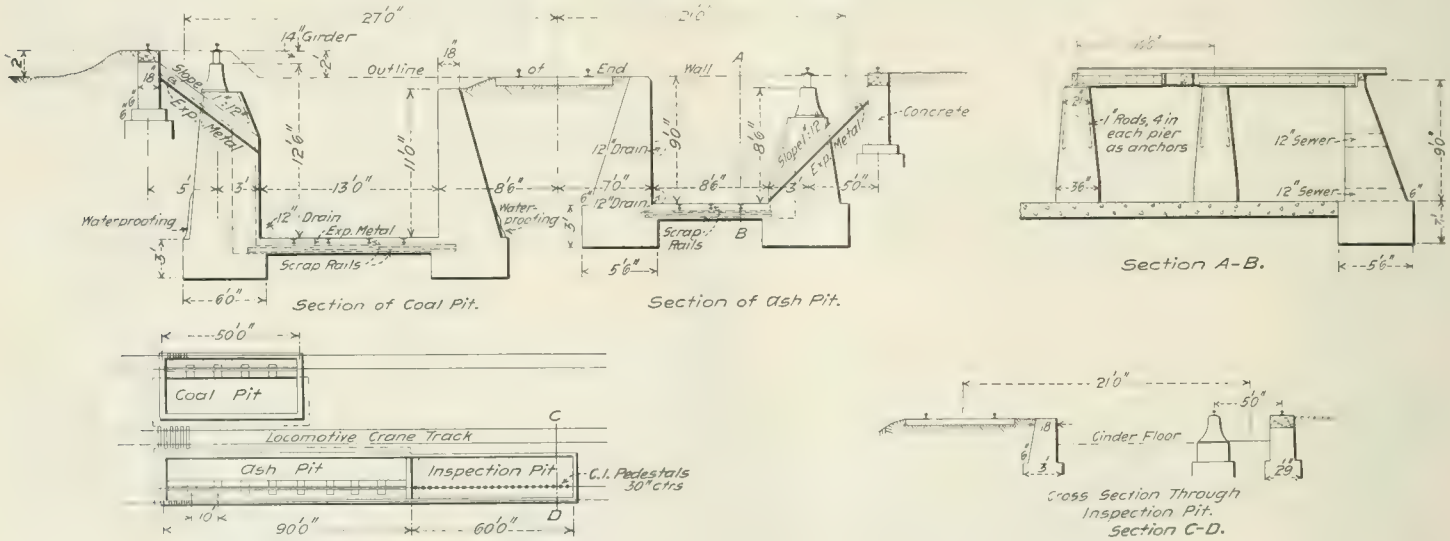


Details of Doors and Windows in Engine House.

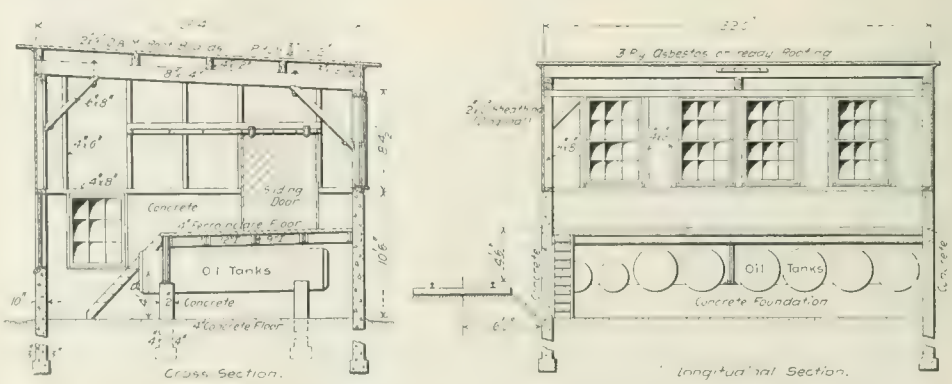
Locomotive Crane.—A locomotive crane of 10 or 15 tons' capacity will easily care for a monthly consumption of 8,000 tons of coal and the usual amount of cinders produced by the engines that are coaled at the station. The advantage of the locomotive crane as against other mechanical appliances, or trestle work, are many. It is a machine that is simple in its maintenance and can easily be cared for by the forces employed at the round house terminal. As the machine is metal, it obviates the maintaining of a wooden trestle, consequent repair work by carpenters and mechanics other than machine workers, the expense and danger of pushing cars up a steep grade and bringing them down again and insurance on an expensive structure that is liable to burn down. The locomotive crane is also used to unload sand from open cars through the roof of the sand house, thus eliminating any excessive labor charge for the handling of sand. It is also used to gather up refuse material which accumulates in the yard adjacent to the round house.

Turntable.—The standard turntable adopted is 80 ft. long. The total length from drawbar to front of pilot of the longest passenger engine in service on the Erie Railroad is 76 ft. 4 in., and it has been found by actual use that an 80 ft. turntable is of about the proper dimensions. It is quite easy to balance any type of engine regardless of the load on the tender, and it cannot be done with a table any smaller in size.

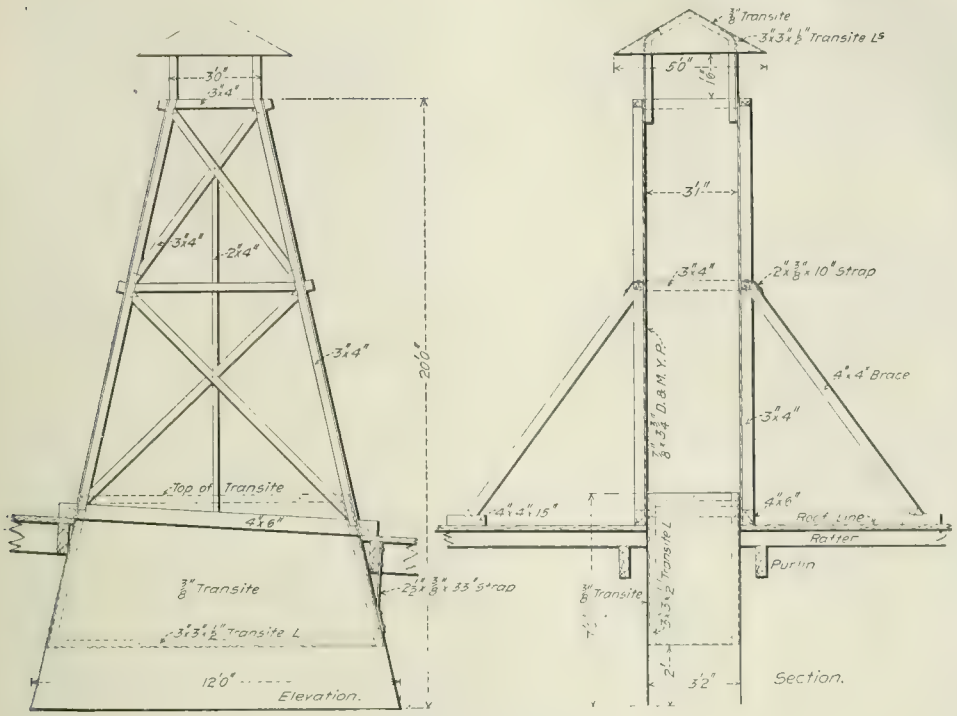
Round House.—In designing the round house, three important features were considered: First, the elimination of snow and ice in the inside of the circle, which so frequently obstructs the opening and closing of doors and consequently affects the temperature of the interior. Second, the elimination of girders of any descrip-



Plan and Sections of Coal and Ash Pits.



Cross-Sections Through Oil House.



Standard Smoke Jack.

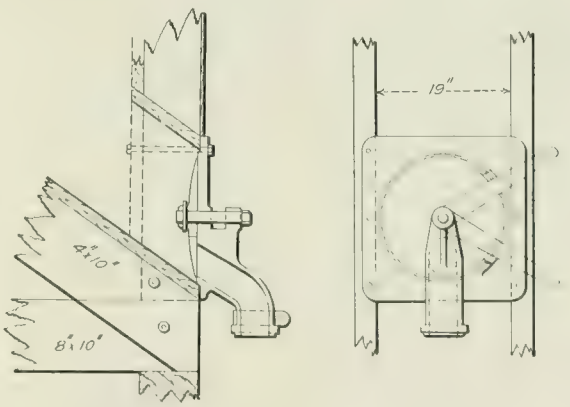
tion in the interior of the house. Third, a sufficient amount of light to permit of proper work being done on engines.

To accomplish the first aim the roof was sloped from the center to the outside, so as to carry the water away from the circle instead of towards it. All previous experiments with troughs or other devices for caring for the water, when the roof sloped towards the circle, have been found ineffective. The detail drawings show how the second and third considerations were carried out. The annoyance of leaky radiating pipes in pits, or in any portion of the round house, was eliminated by adopting the hot air system with openings leading to the pits to concentrate the heat for thawing out engines. Actual results during this last winter have demonstrated that on several occasions when the thermometer was below zero, a very comfortable temperature was maintained in round houses so equipped. Two standard drop pits were installed in each house, one for truck wheels and one for drivers. The standard length established for each round house was 95 ft. This length makes it possible to detach an engine from the tender, separate them and do work indoors in winter that otherwise could not be done without detaching the tank and moving it outside the house.

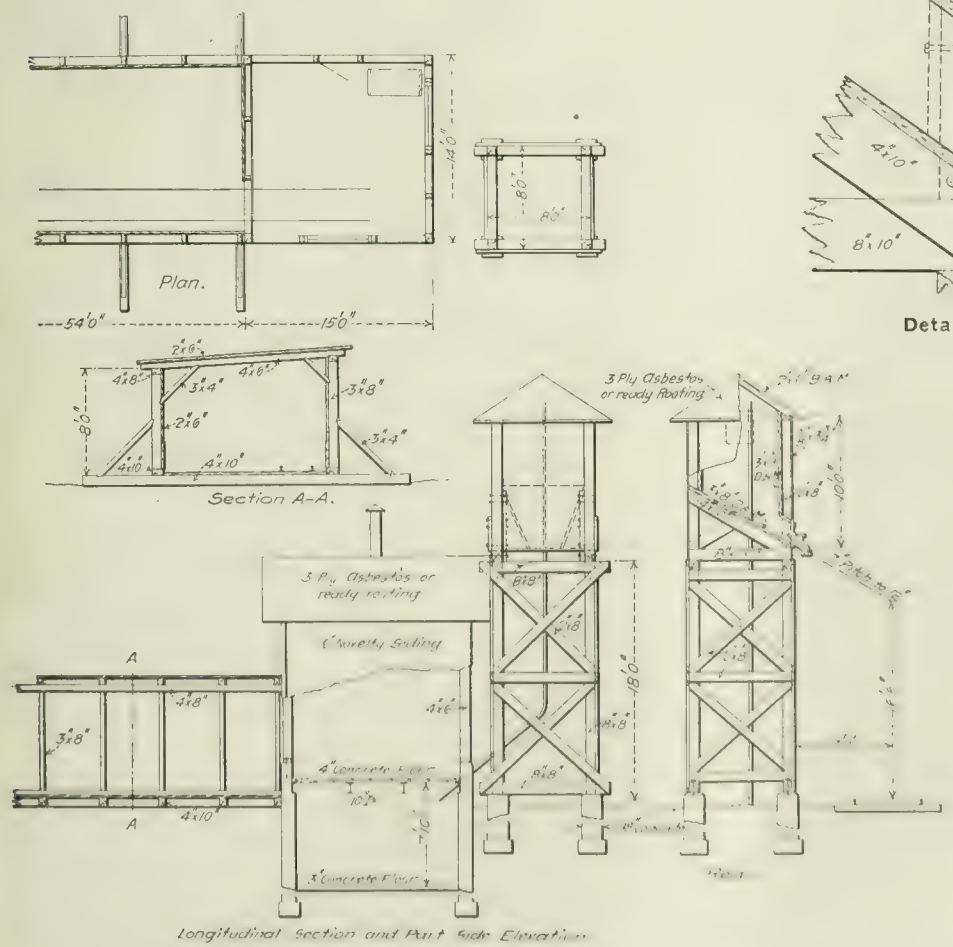
The peculiar construction of the houses—the greatest height of the roof being towards the inner circle—made it necessary to construct a very high smoke jack. This jack was made 12 ft. wide at the base, so that the smoke would be taken out of the house without making it necessary to spot an engine at any particular place. An engine can be moved a distance of 12 ft., to do work on it, and, at the same time, the gas and smoke can be carried out of the house. An additional ventilator is placed in the house which takes care of steam that might be produced from pop valves. Actual experience has demonstrated that the method of ventilation is entirely satisfactory and that houses are free from smoke and gas.

The round house pits are all of concrete, in which a small square tie is imbedded to spike the rail to; good drainage is also provided. Floors of round houses are filled with cinders to within five inches of the permanent level, then five inches of limestone screenings wetted down and rolled.

Machine Shop.—The standard machine shop was designed and so located as to connect directly with the round house at a central or convenient point, so that the material can be transported back and forth without undue loss of time. In each shop, a standard set of tools has been installed.



Detail of Sand Spout and Valve.



Standard Sand House.

The boiler house, store house and office for the round house foreman are simple, inexpensive buildings suitable for the purposes intended.

The sand house is so located as to make it possible for the locomotive crane to unload the sand. The sand is dried and forced by air pressure to a tank and is dropped from the tank to the engines by gravity.

The foregoing cites the most important features that were considered. There are a number of other improvements that have been worked out to advantage, such as convenient locations for water cranes, steam and water pipes in round houses located overhead, injectors for washing out boilers and other details. It is believed that these round house improvements will meet more nearly the general requirements for round house terminals, particularly in bad weather, than anything heretofore in use on the Erie Railroad; and it is also believed that the liberality of dimensions will more nearly approach the increased size of locomotives now in commission, and the increased labor thereon than anything before attempted.

Master Car Builders' Association Committee Reports.

The committee reports of the Master Car Builders' Association are, with one or two notable exceptions, quite short, this year. We have given considerable space to the excellent report on brake beams, and have made an abstract of such of the others as are important for record.

ARBITRATION COMMITTEE.

During the current fiscal year but 12 cases, Nos. 692 703 inclusive, have been submitted to the commission for decision. This is the smallest number of cases that have been arbitrated in many years and is a good indication that Rules of Interchange in their present shape are fairly satisfactory to the railroads of the country. As in previous years the report includes the committee's recommendations regarding proposed changes in the Rules for Interchange. The principal changes of which the committee approves or suggests the appointment of other committees to investigate are as follows: Appointment of committee to consider proposed increase in allowable variation of height of couplers. Appointment of committee to formulate combinations of defects denoting unfair usage for steel cars. Methods of splicing sills for steel and wooden cars. Increasing the price allowed for lumber from 3 cents to 3¼ cents a foot. Appointment of committee to consider additional prices for labor and material not now covered by Rule 106.

The report is signed by J. J. Hennessey, P. H. Peck, E. D. Bronner, T. W. Demarest, F. H. Clark.

COMPOSITE DESIGN OF COUPLER.

The special committee appointed by the Master Car Builders' Association to confer with the standing committee on Tests of M. C. B. Couplers to consider the question of a composite design of coupler, held a meeting in New York City, December 11, 1905, and begs to submit the following report:

The duties of the special committee, outlined in the report of the standing committee on Tests of M. C. B. Couplers, June, 1905, read as follows:

"That the coupler committee be empowered to act in conjunction with the specially appointed committee (in which should be included representatives of the manufacturers) to early decide upon a composite design of coupler which shall contain, as far as possible, the desirable features of the best couplers as now designed, and that all patent rights involved be waived and all manufacturers be permitted to manufacture the composite coupler as adopted."

The special committee is unanimous in its opinion on this subject, and after a thorough discussion of every phase of the subject that could be thought of it was decided that the instructions could not be carried out and were impracticable at this time.

It developed that of all the couplers currently bought and used in the United States to-day probably 90 per cent. were made by manufacturers who were represented on the committee.

It was agreed that only three or four of the couplers made (all of which were represented on said committee) complied reasonably well with the Interstate Commerce Safety Appliance Act; that none of the manufacturers were willing to give up their patent rights and surrender them to the association. The reasons given by their side were principally two-fold:

First, That we were asking them to surrender a considerable and valuable portion of their stock in trade, whereby they control the manufacture of the couplers for their own benefit.

Second, That if the manufacture of couplers were thrown open to any steel foundry or any malleable iron foundry there would be no possible way in which the manufacture of inferior couplers, by any and every manufacturer, to the detriment of the standard manufacturers, could be prevented, the presence of which in the cars of the country would entail great cost on the railroads, and be unfair to those who wished to purchase an efficient coupler complying with the specifications.

It was the consensus of opinion of the railroad representatives that it would be entirely unfair and not in accordance with business ethics to ask the manufacturers to surrender their rights without compensation, and that the Master Car Builders' Association is not a body which can properly acquire rights of this character and sell them or give them to manufacturers, without rendering itself liable to charges of unfair discrimination.

And further, that the adoption of such a standard as was proposed by the instructions would stop and impede progress in the coupler business, unless this work were undertaken by the association, through the agency of the standing committee at the expense of the association; whereas now all reputable manufacturers spend considerable money yearly in developing and perfecting the couplers presented to railroad companies, thus meeting the increased demands of service without cost to the user.

It was agreed that it was a probable impossibility that any coupler could be designed which did not embody infringements on existing valid patents.

As the instruction required that the principal and best features of existing couplers shall be embodied in the design the committee was to work out, the position taken by the manufacturers blocked any possible action that could be taken by the committee.

As it seemed that the principal reason for the appointment of this committee was the trouble experienced by railroad companies to-day in keeping a stock of, and making repairs to, the very large number of patterns of couplers, and that this was the principal and real reason for the desired action, and as it was agreed that the existing couplers of many patterns could not be arbitrarily expunged from the cars, but would have to wear themselves out, it would be impossible, even if a standard coupler could be adopted to-day, to do more than gradually reduce the many patterns of couplers now in existence.

It was admitted and agreed that if we only had three or four kinds of couplers there would be no cause for complaint under this heading, and that other action would not be needed.

As it was shown, that for the reasons first mentioned the purchase of couplers had practically narrowed itself down to three or four makes, in this country, and the elimination of the many different patterns of couplers was already in progress, and that as the old couplers disappeared, renewals all being made by couplers of three or four makes, the principal source of annoyance now existing would be eliminated.

It was agreed that the second recommendation of the standing committee on Tests of M. C. B. Couplers, in its report to the M. C. B. Association in June, 1905, which was "That the present policy of the association be followed out; that is, that the gradual improvement of the M. C. B. standard coupler and the elimination of poorly designed and weak couplers be carried on as at present by making the requirements to be met by the M. C. B. coupler more and more rigid, thus compelling a higher degree of efficiency, and closely prescribing the limits for the future within which designers may work, while at the same time in no way preventing beneficial competition" —and which recommendation was not acted on by the convention— is far the best, and, in fact, the only plan which the association can follow; that is, to have standard requirements for couplers and narrow these requirements down so as to limit the number of couplers which can successfully fulfil such requirements, and in this way drive out of the field inferior makes and multiplicity of patterns, leaving the field open for reasonable and honorable competition and development.

This committee strongly recommends that in the future no couplers be purchased by railroad companies unless they meet the requirements of the Master Car Builders' Association and the recommendation of the standing committee on Tests of M. C. B. Couplers, as in this way the elimination of all couplers which do not fulfil the requirements would soon be effected.

The report is signed by F. W. Brazier, R. P. C. Sanderson, A. Stewart, T. S. Lloyd, C. E. Fuller, J. T. Chamberlain, for the M. C. B. Association, and H. C. Buhoup, the Janney Coupler Co.; Samuel Lewis Smith, Nat'l Mall. Castings Co.; S. P. Bush, Buckeye Steel Castings Co.; W. L. Jacoby, Latrobe Steel Coupler Co.; F. P. Huntley, Gould Coupler Co., for the coupler manufacturers.

AUTOMATIC CONNECTORS.

This committee was appointed to prepare standard dimensions for automatic couplings for steam heat, air brake and air signal, also to fix the relative locations and dimensions of the different parts so that as cars are equipped from time to time with such automatic couplings, the various makes will be interchangeable, one with another.

It is recommended that these devices be called connectors, instead of couplings, so that they may be distinguished the more readily from the drawbar device. This report will refer to them as automatic connectors.

Of the automatic connectors now in use, there are two general types, the important difference and the one which must be reconciled before the instructions to the committee can be carried out is the line on which two engaging connectors are parted. In the one type the parting is on a line at right angles to the center line of track; these make a butt joint and may be refered to as butting connectors. The other type is parted on a line parallel with the center line of track; this may be referred to as the lapping connector. It would be impossible to couple one type directly to the other.

The lapping type is made by one company and in their opinion their patents would prevent others from making a connector similarly parted. The butting connector is made by at least four companies and the interchangeability of the four butting connectors can be readily accomplished. There are some of both types in service.

The committee thinks that under the circumstances it is not warranted in recommending either type as standard, but because of the patent situation it favors the butting connector. If these views meet with the approval of the association it is recommended that

the present committee be continued, or a new committee be appointed and requested to follow out, with respect to the butting connector, the instructions quoted in the first paragraph of this report.

The committee recommends further that the railroads discourage the use of automatic connectors until the manufacturers make arrangements by which any company may make a connector which will couple with the connector made by any other company.

The report is signed by F. M. Whyte, C. E. Fuller, F. H. Clark, George W. Smith.

AXLE LIMITS.

In its report to the convention of 1905, the Arbitration Committee, in connection with Rule 23 of the Rules of Interchange, refers to a suggestion made by two of the railroad clubs and by two railroad officers, in regard to the replacing of axles under foreign cars on account of defective wheels or axle, and providing that axles should be not less than the limits stated in the recommendations, and proposing that, instead of basing the limiting diameters of axles on the capacity of cars, they should be based upon the light weight added to the capacity and plus 10 per cent. of the capacity, calling the total weight on the rails thus obtained the maximum weight.

The limits for axle diameters given in Rule 23 should be understood as interchange limits. Modifications in these limits have been discussed at various times, but it must be remembered that the substitution of M. C. B. standard axles for those of older designs necessarily takes time, and the committee is satisfied, from information which it has obtained, that if the present limits in Rule 23 were increased at this time it would bring serious hardship upon a number of railroads and result in the stopping, at interchange points, of cars that still have axles of the older designs.

It would, therefore, seem unwise, at this time, in view of the fact that there is no serious difficulty in moving cars under the present limits, to change them, especially in view of the general effort being made to substitute the M. C. B. standard axles for those of the older designs, as far as operating conditions will permit. The committee, however, cannot refrain from urging all members of the association to continue their efforts in this direction, in order that axles of the earlier design may be eliminated at the earliest practical date.

There seems to be good reason, however, why the general suggestion made to the Arbitration Committee, in 1905, should be the subject of discussion and recommendation.

The load carried on the axles is made up of the light weight of the car and the weight of the lading, from which would properly be deducted the weight of wheels and axles, as the weight of these is not transmitted to the journals. The standard axles are designed to carry stated loads, and not for cars of stated capacity. A comparatively light car body carried by axles of designated size is entitled to a larger weight of lading when the capacity of a car is made the basis of axle diameters, regardless of the weight of the body, comparatively light cars are not carrying as much lading as they should; and, further, that axles are, in some cases, overloaded where the car body is excessive in weight and the marked capacity is not reduced accordingly.

The committee, therefore, proposes that the present method of marking cars be changed and that all cars ultimately should be stenciled with light weight and maximum weight. The former is, of course, the present light weight as used on all cars. The latter is the limiting weight that should be carried on four axles, depending, of course, on their diameters. It is not thought that shippers or others will be seriously inconvenienced by this change, and, on the contrary, the benefits to the railroads will be considerable.

The table entitled "Limits of Axles Based on Maximum Weight of Car" shows the present nominal capacity, the designation of each of the M. C. B. standard axles, and the load each was designed for. To this latter weight may be added the weight of wheels and axle, in order to arrive at the permissible weight per axle at the rail, as given in the fifth column. This permissible weight multiplied by 4 gives the total permissible weight at the rail for a car with four axles, and column 7 gives, in round numbers, the proposed maximum weight as recommended by your committee.

The table entitled "Comparison of Axle Diameters" shows the proposed limits as compared with those of Rule 23. It will be noted that for cars of nominal capacity of 100,000 pounds and 80,000 pounds, the only change is in the center of axle "C," which should be increased $^1/_{16}$ of an inch. For 70,000-lb capacity cars it is proposed to increase the limits for all diameters of the axle. For cars of 60,000, 50,000, 40,000 and 30,000 lbs. capacity, the limiting diameter for wheel seat and center would have to be increased. For cars of 20,000 lbs. capacity the limiting diameter of center only should be increased.

It should be understood, in the plan proposed, that the limiting diameters as now given in Rule 23 would hold good for all cars having capacity marks, but that where the marking on cars is changed to show light weight and maximum weight the proposed limits, as shown in the table mentioned, would hold good. It is naturally assumed that cars having the older designs of axles will continue to have capacity marks up to the time when the axles under them may be changed to the standard axles, at which time the capacity marks would be removed and the maximum weight substituted.

Assuming that the plan above described meets with the approval of the association, it would appear necessary to make modifications in both Rules 23 and 74, and the recommendation of the committee is that they should be changed to read as follows:

"Rule 74. When second-hand axles are applied under conditions which make them chargeable to the owners, the diameters of the wheel seats and center must not be less than, and the diametr of the journal must be ⅛ inch greater than the limiting diameters given in Rule 23. If cars are marked with the word 'Capacity,' the first set of limits must be followed. If cars are marked 'Maximum Weight,' the second set of limits must be followed."

"Rule 23. Axles less than the following prescribed limits:

For Cars Marked with "Capacity."				*For Cars Marked "Maximum Weight."*			
Capacity of car.	Journal.	Wheel seat.	Center.	Maximum weight.	Journal.	Wheel seat.	Center.
100,000	5 in.	6¾ in.	5⅞ in.	161,000	5 in.	6¾ in.	5⅞ in.
80,000	4½ "	6¼ "	5 15/16"	132,000	4½ "	6¼ "	5⅞ "
70,000	4 "	5⅞ "	4⅞ "	112,000	4¼ "	6 "	5¼ "
60,000	3¾ "	5 "	4⅜ "	95,000	3¾ "	5½ "	4¾ "
50,000	3½ "	4¾ "	4⅛ "	79,000	3½ "	5¼ "	4⅝ "
40,000	3¼ "	4⅝ "	3⅞ "	66,000	3¼ "	4⅞ "	4¼ "
30,000	3 "	4¼ "	3½ "	58,000	3 "	4⅝ "	4⅛ "
20,000	2¾ "	4¼ "	3½ "	46,000	2¾ "	4¼ "	3¾ "

"All cars to have their light weight and capacity or their light weight and maximum weight stenciled on them."

The report is signed by E. D. Nelson, J. H. Manning, C. D. Pettis.

HIGH SPEED BRAKES.

The committee, appointed to look into the question recommended practice for high-speed, foundation brake gear for passenger equipment cars, finds that the gear for four-wheel trucks is satisfactory. There are some small changes in the gear for six-wheel trucks which should be made before it is passed to M. C. B. Standard. The objects to be accomplished by these changes are: Means for taking up by hand the slack, which accumulates from brake shoe and tire wear, more quickly and in smaller increments than is now possible. The committee has in service an arrangement for accomplishing these results, but the information so far collected is not sufficient to warrant making definite recommendations covering the six wheel truck. The committee asks for another year in which to complete its investigations.

The report is signed by F. M. Gilbert, C. B. Young, M. Dunn, J. J. Hennessey.

LOCATION OF TEMPORARY STAKE POCKETS.

The committee, having been instructed to investigate and report on a standard location for temporary stake pockets, made many

COMPARISON OF AXLE DIAMETERS.

Nominal Capacity	Axle.	Load for Axles in Pounds.	Limiting Diameters					
			Journal.		Wheel Seat.		Center.	
			Rule 23.	Proposed.	Rule 23.	Proposed.	Rule 23.	Proposed.
100,000	D	38,000	5″	5″	6¾″	6¾″	5⅞″	5⅞″
80,000	C	31,000	4½″	4½″	6¼″	6¼″	5 15/16″	5⅞″
70,000	C	26,000	4″	4½″	5⅞″	6″	4⅞″	5¼″
60,000	B	22,000	3¾″	3¾″	5″	5½″	4⅜″	4¾″
50,000	B	18,000	3½″	3¼″	4¾″	5¼″	4⅛″	4½″
40,000	A	15,000	3¼″	3¼″	4⅝″	4⅞″	3⅞″	4¼″
30,000	A	13,000	3″	3″	4¼″	4¾″	3½″	4¼″
20,000	A	10,000	2¾″	2¼″	4¼″	4¼″	3½″	3¾″

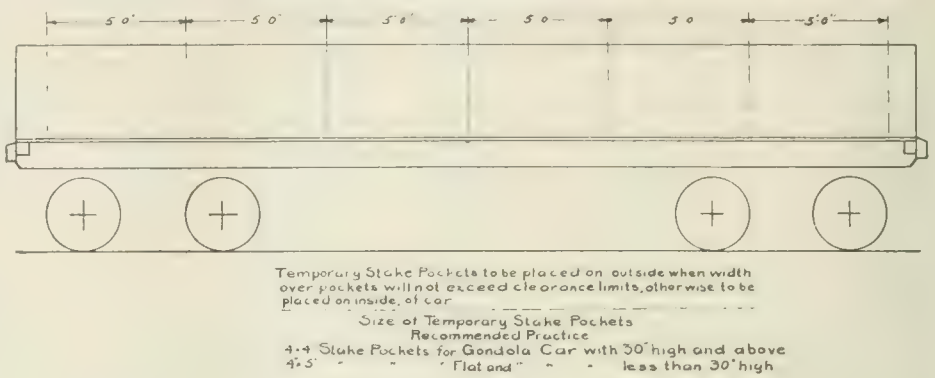
LIMITS FOR AXLES BASED ON MAXIMUM WEIGHT OF CAR.

Nom. Cap. of Car, Lbs.	Axle.		Weight of Axle and Wheels.	Permissible Weights per Axle at Rail	Permissible Weights of Car and Lading at Rail.	Proposed Maximum Weight of Car and Lading at Rail.	Limiting Dimensions.					
	Designation.	Load. Lbs.					Journal.		Wheel Seat		Center.	
							Calculated.	Proposed.	Calculated.	Proposed.	Calculated.	Proposed.
100,000	D	38,000	2,200	40,200	160,800	161,000	4.75	5	6.70	6¾	5.73	5⅞
80,000	C	31,000	1,925	32,925	131,700	132,000	4.32	4½	6.21	6¼	5.32	5⅞
70,000	C	26,000	1,925	27,925	111,700	112,000	4.15	4¼	5.89	6	5.03	5¼
60,000	B	22,000	1,675	23,675	94,700	95,000	3.71	3¾	5.48	5½	4.67	4¾
50,000	B	18,000	1,675	19,675	78,700	79,000	3.43	3½	5.22	5¼	4.51	4⅝
40,000	A	15,000	1,450	16,450	65,800	66,000	3.10	3¼	4.80	4⅞	4.09	4¼
30,000	A	13,000	1,450	14,450	57,800	58,000	2.97	3	4.58	4¾	3.90	4⅛
20,000	A	10,000	1,450	11,450	45,800	46,000	2.72	2¾	4.19	4¼	3.57	3¾

inquiries, but with little success or encouragement. This question was mentioned last year in connection with the size of temporary stake pockets, then under discussion. The size for the pocket was quickly disposed of by a motion made to the effect that a 4 by 5-in. pocket for flat cars and gondola cars with sides less than 30 in. high, and a 4 by 4 in. pocket for gondola cars with sides 30 in. high or over, be considered as recommended practice. This question was put to letter ballot and adopted.

The establishment of a uniform location for temporary ballot stake pockets grew out of a suggestion on the part of the pipe manufacturers, they alluding to the apparent wisdom of uniformly spacing the pockets if practicable, so as to accommodate at least the more common or stock lengths; and this also seemed reasonable from the standpoint of the lumbermen.

Ordinarily the temporary stake pockets are spaced uniformly between the permanent stakes, their distance from center to center varying but little from the dimensions indicated on cut shown herewith. Again, the temporary stake pockets are spaced midway between alternate permanent stakes, while others are located without apparent reference to the position of the permanent stakes; the distance between centers being as much as 7 ft. 4¼ in., and perhaps higher. This, of course, is considerably in excess of what would give us three stakes for material 18 ft. long, which is one of the requirements of the rules for loading long material. The same may also be said of the pockets placed on the inside of steel cars, there being no apparent uniformity in their location. This, no doubt, has been done by the car owners upon the assumption that such spacing is quite sufficient for the traffic they expect to handle.



Longitudinal Spacing for Temporary Side Stake Pockets on Gondola Cars.

The committee did not hope to be able to recommend a standard location for temporary stake pockets or even a location for a recommended practice; but, through the kindness of some of the pipe manufacturers who have manifested a particular interest in this work, have been able to secure a suggestion that would seem to at least satisfy that class of traffic, and incidentally would accommodate lumber shipments except loads handled on twin and triple cars, where it is required they be spaced, from center to center, not less than 2 ft. nor more than 3 ft. 6 in., as referred to in Rule 48 (Rules for Loading Long Materials). The latter, however, is somewhat special and refers to a shipment usually handled on flat cars where the stake pockets are but seldom in excess of that measurement.

The cut herewith shows the longitudinal spacing for temporary side stake pockets, which, as above mentioned, would seem to conveniently accommodate the general run of short lumber and pipe shipments handled in gondola cars.

The report is signed by A. Kearney, C. E. Fuller, A. Stewart, F. H. Clark, T. H. Curtis, J. S. Lentz, W. F. Keisel, Jr., L. H. Turner.

TANK CARS.

The Executive Committee on February 12, 1906, reappointed the former committee on Tank Cars, with a request that revised specifications be submitted for consideration as Recommended Practice. The necessity for this has already been brought to the attention of railroads which have issued circulars on the subject of tank car interchange, and the recommendations hereinafter submitted are taken almost bodily from one of the railroad circulars, which circular was issued after joint conference of a number of roads issuing similar circulars, namely:

Requirements for Tank Cars.

Tank cars offered for movement over the lines of this company must conform to the following general and detail specifications:

General Specifications.

Tank cars which bear evidence of damage from fire must be withdrawn from transportation service.

Each truck must have a strength equal to or greater than the strength of the axles used. Table following specifies the maximum weight of loaded car which can be used with various designs of axles:

Minimum Journal diameter.	Minimum Diameter of wheel fit	Diameter at center.	Maximum weight of loaded car.
3½ in.	4⅞ in	3⅞ in.	66,000 lbs.
3¾ "	4¾ "	4⅛ "	76,000 "
4 "	5 "	4⅜ "	96,000 "
4½ "	5⅝ "	4¾ "	106,000 "
4½ "	6¼ "	5 "	132,000 "
5 "	6¾ "	5⅜ "	161,000 "

(NOTE.—The above rating for axles is based on maximum weight of loaded car, because of the wide variation in specific gravity of loads carried and on account of the impossibility of determining the weight of the load by inspection. The dimensions correspond with the present Interchange Rules. In case of a modification of the Interchange Rules to include maximum weight of loaded car as a basis for axle limits, such rules should supersede the axle requirements here given.)

Each car must be equipped with air brakes of a capacity equal to 70 per cent. of the light weight of car, and at least one hand brake operating brakes on both trucks.

Each end of car must be provided with the necessary steps, grab irons, etc., to comply with the requirements of the M. C. B. Association. Each tank car must be provided with adequate side hand railing. This may be either as shown on Sheet No. 19 of the M. C. B. Association, or by adequately securing it to the tank itself, but must be so placed as to be readily within reach of trainmen. Where from the construction of a car, a side hand railing is inadmissible, the construction involving an overhead running board and high brake staff, each end of car must be provided with such ladders as will comply with the requirements of the M. C. B. Association.

After September 1, 1906, there shall be a push-pole pocket at each corner of the car. Where from the construction of the car, the push-pole pockets cannot well be placed on the body, they may be applied to the trucks, placed above the end journal boxes.

Tanks must be secured from turning on the underframes, either by center anchors riveted to the tank and underframe, or by means of dome yokes, and must also be secured to underframe by means of tank straps, two for tanks not more than 76 in. in diameter, and four for tanks of greater diameter. The sectional area of dome yokes and tank bands must at no place be less than ¾ sq. in. Cars having no underframe, with tanks securely riveted to body bolsters, do not require dome yokes or tank bands.

Tanks must be carefully inspected and tested with cold water pressure at least once in five years. The test for new tanks should be at 60 lbs. per sq. in., and for old tanks at 40 lbs. per sq. in., which they must stand without serious leak or evidence of distress. This inspection and test must be made by the tank car owners, and all tanks must be so tested by January 1, 1908. Tanks, when tested, must be stenciled with date and place where test was made, and by whom, as follows:

Tested (Date) .....
Pressure (pounds per square inch) .....
At (Place) .....
By (Name of firm) .....

New steel or iron tanks must be designed for a bursting pressure of not less than 240 lbs. per sq. in.

Application of Safety Valves.

All tanks carrying volatile or inflammable material, such as crude petroleum, fuel oil, benzine, naphtha, kerosene, illuminating oils, petroleum products, turpentine, etc., must be equipped with 5-in. safety valves of the recommended design; one valve for a capacity of 6,500 gallons or less, and two valves for a capacity of more than 6,500 gallons. Where tank cars carrying such products are subdivided into compartments, each compartment must be provided with a safety valve. Where only one valve is used, it must be set to open at a pressure of 8 lbs. per sq. in.; where two valves are used, only one must be set to open at a pressure of 8 lbs. per sq. in., and the other at 12 lbs. per sq. in.

Tank cars carrying volatile, non-inflammable products, such as gas liquor, ammonia liquor, etc., where the prevention of evaporation is essential, may be provided with vents depending on frangible lead discs for safety, which vents shall be of recommended design, the discs to be of a thickness that shall insure rupture at pressure not higher than 25 lbs. per sq. in.

In the case of coal tar, where from the nature of the product absolute tightness is desired, either the frangible lead disc or the 5-in. safety valve will be accepted, or, if the shippers so elect, an open vent may be used.

Tank cars carrying non-inflammable or non-volatile material,

such as sulphuric acid, vinegar, linseed oil, cottonseed oil, lard oil, fish oil, tannery products, glucose, molasses, calcium chloride, caustic soda, silicate of soda, etc., need not be provided with 5-in. safety-valves, but each tank should have a small open vent or valve.

Old Tank Cars Having Wooden Underframes.

Tank cars having wooden underframes, of railroad, foreign or individual ownership, will be required to conform to the foregoing general specifications, and, in addition, must be as strong as the construction covered by the following detailed specifications:

If cars are not equipped with intermediate sills, the underframes must have two center sills, each not less than 5 in. wide by 10 in. deep, spaced not more than 18 in. apart. If the car is equipped with intermediate sills, the center sills should not be less than 5 in. wide by 9 in. deep.

Where draft timbers are underneath the center sills, the space between the center sills must be filled in with timbers not less in depth than center sills, extending from end sill to center of nearest cross-bearer or cross-timber, provided the latter is located not less than 4 ft. 6 in. from center of bolster. Center sills and filling timbers must be securely bolted together by means of ¾-in. bolts. On cars having center or intermediate sills not less than 10 in. wide by 10 in. deep, the filling timbers may be omitted.

End sills must not be less than 9 in. wide by 10 in. deep. End sills 6 in. wide by 12 in. deep, reinforced with buffer blocks not less than 6 in. wide by 10 in. deep and of sufficient length to overlap center sills, will be accepted as a substitute for the 9 by 10-in. end sills.

Draft timbers secured to inside of center sills and extending to cross-bearer or cross-timber, will be accepted as a substitute for filling timbers referred to above. Where center sills are 9 in. wide by 10 in. deep in section or over, and draft timbers are placed between same, they need not extend farther back than body bolster, provided they are adequately secured to center sills by means of seven ⅞-in. bolts or their equivalent, and butt against body bolster. Draft timbers located underneath the center sills must not be less than 4 in. wide by 8 in. deep, and each draft timber must be held to end sills and center sill by means of seven or more ⅞-in. bolts. Draft timbers extending beyond bolster must be secured to center sills by additional bolts.

The draft gear and draft attachments must be at least as strong as the recommended design. (Not shown.)

In all cases, tail yokes must be used; and tail bolts, tail straps or American continuous draft gear will not be accepted. Tail yokes as per M. C. B. standard, or attachments of equal strength, are acceptable.

Head blocks must not be less than 10 in. wide, unless reinforced by metal plates, and of sufficient depth to extend at least 6 in. above bottom of tank and may be made of two pieces bolted together and bolted to underframe by means of not less than four ⅞-in. vertical bolts. Head blocks must be cut out to suit curve of tank and, preferably, be supported at center by means of substantial casting securely bolted to end and center sills. Where the construction does not permit of this casting, then head blocks secured by stay-rods 1⅜ in. in diameter anchored to center sills, will be accepted. Where stay-rods are but 1 in. in diameter the ends of head block must be tied to corresponding ends of head block at the other end of car by means of two rods not less than 1 in. in diameter with 1⅛-in. threaded ends, or two 1-in. rods passing diagonally through head blocks towards bolster and secured to underframe, or straps not less than ¾ in. thick and 3 in. wide, passing over head blocks and securely fastened to underframe, will be accepted.

Where tank cars are fitted with cast-iron dome heads and covers not sufficiently strong to stand the necessary 40 lbs. hydraulic test, they may be replaced by others of pressed steel or of malleable iron.

Tank heads less than $^{7}/_{16}$ in. thick, bearing evidence of damage from impact with head blocks, should be reinforced at bottom by means of steel plate shoes ⅜ in. thick, riveted to head and shell.

New Tank Cars.

All tank cars built hereafter must be equipped with steel underframing or with reinforced shell. The design must be at least as strong as that shown in cut H on page 323 of the 1903 M. C. B. Proceedings.

New tank cars must conform to the general specifications given in the foregoing, in addition to the following detail specifications:

The center sill construction of the underframe, between bolsters, must have a sectional area of at least 30 sq. in.

Each car must be equipped with steel body and truck bolsters, steel couplers and a draft gear (preferably of the friction type) of approved design, having a capacity of at least 60,000 lbs. Tail bolts or straps must not be used.

All longitudinal and head seams must be double riveted. Where head blocks are not used, head seams need not be double riveted.

The construction of the car throughout must be at least as strong as the recommended design. (Not shown.)

If the car has no underframe, the tank shell at bottom must be at least ⅝ in. thick, and all circumferential seams must be double riveted. The sectional area of the additional metal in bottom of tank shell must be at least 20 sq. in.

Particular attention must be given to the longitudinal anchorage of the tank, which must be thoroughly substantial, to prevent end shifting.

Dome heads and covers must be made of either cast or pressed steel or of malleable iron.

With the view of complying with the above-mentioned construction, the Pennsylvania Railroad Company has had patented the design shown in cut H on page 323 of the 1903 M. C. B. Proceedings and then assigned to the P. R. R. Company. The opinion of the Eastern Railroad Association on the design in question was ascertained in order to see whether such car could be constructed anywhere without liability of patent infringement. The Pennsylvania Railroad has therefore thrown open to the public the right to use this design, so that it may be followed anywhere without liability to claims for royalty or infringement.

Within the past year or two there has been considerable friction due to enforcing the tank car requirements. This is becoming materially less, and the committee believes that if these requirements are generally enforced, it will require but a comparatively short time to adapt thereto the few cars now remaining to be brought up to the requirements.

The report is signed by A. W. Gibbs, C. M. Bloxham, Robert Gunn.

SUBJECTS.

The committee recommends for noon-hour discussions, Convention of 1906:

Circumferential variation allowable in mating wheels.—To be opened by Mr. George L. Fowler, Consulting Mechanical Engineer, New York.

Piece work on freight car repairs.—To be opened by Mr. Le Grand Parish, Asst. Supt. M. P., L. S. & M. S., Cleveland, Ohio.

Should not the practice to hinge the running boards at the ends, to uncover ice hatches on refrigerator cars, be abandoned?—To be opened by Mr. John S. Lentz, M. C. B., Lehigh Valley R. R., Packerton, Pa.

Should not the uncoupling chains on passenger equipment cars be so arranged as to guard against the uncoupling of cars in transit by passengers who may be on the platform?—To be opened by Mr. F. W. Chaffee, General Inspector, N. Y. C. & H. R., Albany, N. Y.

Advisability of splicing center sills on cars of 50,000 lbs. capacity, or less, in order to perpetuate the cars for two or three years longer with the least expense possible.—To be opened by Mr. F. H. Clark, Supt. Rolling Stock, Pittsburg Coal Co., Coraopolis, Pa.

Methods of handling car scrap and usable material.—To be opened by Mr. R. F. McKenna, M. C. B., D. L. & W., Scranton, Pa.

Desirability of adjusting brake pressure to light and loaded cars.—To be opened by Mr. George W. West, Supt. M. P., N. Y. O. & W. R. R., Middletown, N. Y.

Better fitting up of couplers, even to the point of machining, or at least drilling, the pivot pin hole through coupler lugs and knuckle, with knuckle in place and tail of knuckle forced against lock and proper contour preserved under this condition.—To be opened by Mr. F. W. Brazier, Supt. Rolling Stock, N. Y. C. & H. R., New York.

Subjects for Committee Investigation During the Year 1906-1907.

First.—Up-to-date passenger car cleaning.

Second.—By introduction or use of the solid knuckle, would it not be advisable to increase the limit of variation in height of couplers from 3 in. to 4 in., minimum height 31 in., maximum 35 in.

Third.—The present brake head should be made so as to allow the brake beam to hang horizontal as near as possible for either inside or outside hung brakes, at the M. C. B. standards heights of 13 in. for inside and 14½ in. for outside, and make a standard distance between the face of the M. C. B. standard brake shoe and the fulcrum hole of the beam for live and dead lever.

Fourth.—Passenger car ventilation.

Fifth.—Wheels for cars of 100,000 lbs. capacity and the stresses to which they are subjected.

Sixth.—Best location and use of the conductor's brake valve.

The report is signed by James Macbeth, W. E. Fowler, O. M. Stimson, R. P. C. Sanderson, E. E. Davis.

LOCATION OF SIDE AND END LADDERS ON BOX AND STOCK CARS.

The committee, after a careful consideration of the question, is of the opinion that it is inexpedient for this association to recommend the exclusive use of either side or end ladders. We have not heard of any serious accidents due to uncertainty on the part of trainmen as to the location of ladders. We believe it is the general practice to locate the roof grab irons parallel to the side or end of the car on which the ladder may be placed, and are of the opinion that this roof grab iron is a sufficient indication as to the location of the ladder. We recommend that the committee on Standards be instructed to modify the M. C. B. sheets and rules covering the loca-

tion of grab irons to show the roof grab irons parallel to the side or end of the car on which the ladders are located, these grab irons to be placed between the limits of 12 or 15 in. from the edge of the car.

The report is signed by W. E. Fowler, Joseph E. Buker, F. H. Clark, T. H. Curtis, W. R. McKeen.

Prices for Repairs to Steel Cars.

In response to a circular of inquiry the committee received but twelve replies, seven of which recommended that no change be made in the present prices, three recommending that changes be made and two making no recommendations whatever.

After very thoroughly going into this matter, the committee recommends that Rule No. 106, of the 1905 Code of Rules, be changed to read as follows:

"All rivets, 10 cents per rivet, which covers removal and replacing of rivets, including removing, fitting, punching or drilling holes when applying patches or splices, and replacing damaged parts, not to include straightening or repairing."

"Straightening or repairing parts removed from damaged car, 50 cents per 100 pounds."

"Straightening or repairing parts not removed from damaged car; also any parts that require straightening, repairing or renewing, not included on rivet basis, 20 cents per hour."

"Credit for scrap material removed from cars constructed of pressed steel or structural steel, ½ cent per pound."

The report is signed by T. H. Russum, R. F. McKenna, W. F. Eberle, G. N. Dow, E. B. Gilbert, R. W. Burnett, James Macbeth.

Air-Brake Hose Specifications.

In submitting the air-brake hose report from the Engineering Laboratory of Purdue University, the committee arrived at the following conclusions:

1. It thinks that a chemical standard should eventually be set for the rubber in the tubes and friction. It is believed at the present time that the physical tests which are now the standard of the Association are not conclusive, and from information which has been brought to the attention of the committee during the past year, the committee believes that the government chemists and superintendents of tests, and the chemists of some of the large corporations, have now arrived at a point in connection with tests of rubber where they are able to determine within a very small per cent. the amount of shoddy or substitute which is being used to adulterate the pure gum.

2. It believes that the bursting pressure and chemical analysis of the rubber and grade of duck should eventually make up the specifications. In order to effect this, the committee would recommend that a committee composed of several of the railroad chemists give the matter of chemical analysis a thorough investigation with a view of making a report to the Association.

3. The life of the air-brake hose depends upon the purity of the rubber. This conclusion is arrived at from a study of the report, which shows plainly the rapid deterioration of the inner and outer tubes.

4. The committee is satisfied, from a careful study of the stretching test (Table A), that a physical test will not give any idea of the life of the hose. This leads to the conclusion that it is possible to develop a system of ageing the hose by some thermal or chemical method, which will give a general idea of what the condition of the rubber would be after various periods of service. This will eliminate a great deal of the uncertainty of determining the cause of the failure.

In the foregoing expression as to chemical and other requirements for specifications, the committee does not feel that provision should be included which will throw the burden of maintaining the quality of the hose on to the Association, but on the members thereof.

The Committee desires to bring out strongly the necessity of the safety of air-brake hose, especially on two, three and four-track roads, and the danger to single-track roads when the trains are pulling in on side tracks, which makes the situation equivalent to double-track operation. The necessity for careful inspection of air-brake hose in service is not as apparent to a single-track line as to one operating more than one track, on account of the danger to passing trains. This has been brought very forcibly to the attention of the committee on account of several accidents caused by burst hose where the train on the opposite track ran into the wreck.

While it is a fact that the purchase of inferior hose will show a low first cost per car per year the subject should be analyzed from another point of view: The operating, purchasing and mechanical departments are all involved. Within the past few years air-brake testing plants have been quite generally introduced at division terminals, for the purpose of knowing the actual condition of the air-brake apparatus previous to leaving the terminal. The educational value of these air-brake testing plants has been enormous, and one of the things brought out prominently is the fact that it is necessary to remove a large number of air-brake hose in order to insure the safety of the trains. Even with this precaution, on lines which are thoroughly equipped with testing plants, serious accidents have occurred due to burst hose.

The interchange of cars is so general that inferior hose applied, where this matter is not considered, does not give the roads proper protection. The relative freedom from damage due to burst hose should be the proper measure of efficiency of inspection and quality of hose.

The committee feels that we should call attention to the mechanical conditions which bring about failure in air-brake hose. Observations lead to the belief that very little advance has been made in eliminating the cause of this damage. The committee has had presented to it report from one of the prominent railroads, which shows conclusively the fact that 85 to 90 per cent. of the failures may be attributed to external or mechanical causes, and cannot be said to be due in any way to the quality of hose.

It is a well-known fact that some roads are now using a cheap hose and thus getting a low cost per car per year. The committee feels that this is not the only object to be considered, but that safety of trains, passengers' lives, and the tremendous cost on account of wrecks, must not be lost sight of.

All of the tests were made under 1903 specifications.

The committee presents a specification for woven and combination wrapped and woven air-brake hose for the consideration of the Association. In submitting this specification the committee has had in mind the necessity of having it in line with the present wrapped hose specification. It is believed that the tensile test will be valuable in determining the quality of the rubber. It will not be possible to present the copyright label for air-brake hose at this time.

Specifications for Woven and Combination Wrapped and Woven Air-Brake Hose.

All air-brake hose under this specification is to consist of not less than three plies of woven, braided or knitted fabric, or of two or more plies of canvas wrapping surrounded by at least one ply of woven, braided or knitted fabric. The hose should be flexible without kinking easily. The rubber, fabric or duck should be the best of its kind made for the purpose, and no rubber substitute or short fiber fabric will be allowed.

The inner tubes should be composed of three calenders of rubber and not less than $^3/_{32}$ in. thick at any point. Should a machine-made tube be used, it must not be less than ⅛ in. thick at any point. It must be free from holes and imperfections, and in joining it must be so firmly united to the cotton fabric that it cannot be separated without breaking or splitting the tube. Each ply of the hose should be separated by a distinct layer of rubber, and over this is to be a cover [illegible] in. thick and at each end a [illegible] in. cap should be vulcanized on, the cover and the cap to be of the same material as the inner tube.

AGE IN MONTHS.	PRESSURE TEST				FRICTION TEST			STRETCHING TEST.		
	AVERAGE BURSTING PRESSURE IN POUNDS PER SQUARE INCH	TOTAL NUMBER OF TESTS	NUMBER OF HOSE PASSING M.C.B SPECIFICATIONS	PERCENT OF HOSE PASSING M.C.B SPECIFICATIONS	NUMBER OF HOSE PASSING M.C.B SPECIFICATION	TOTAL NUMBER OF TESTS	PERCENT OF HOSE PASSING M.C.B SPECIFICATIONS	NUMBER OF HOSE PASSING M.C.B SPECIFICATIONS	TOTAL NUMBER OF TESTS	PERCENT OF HOSE PASSING M.C.B SPECIFICATIONS
6	768	73	61	83.5	24	73	32.5	7	75	9.3
12	752	172	150	87.2	57	176	32.4	13	173	7.5
18	720	196	153	78.0	60	199	30.1	7	196	3.5
24	716	117	93	79.5	43	120	35.8	2	120	1.6
30	684	61	44	72.1	17	65	26.1	1	64	1.5
36	614	30	14	46.7	8	30	26.6	0		
42	688	16	13	81.2	5	16	31.2	0		
48	613	7	5	71.4	0			0		
54	598	8	4	50.0	0			0		
60	800	2	2	100.0	0			0		
66	620	2	2	100.0	0			0		
72	565	3	1	33.3	0			0		

Summary of Results—Table A.

The hose is to be furnished in 22-in. lengths, and variations exceeding ¼ in. from this length will not be permitted. The rubber caps at each end are not to be less than $^1/_{16}$ in. nor more than ⅛ in. thick. The inside diameter of the hose must not be less than 1[illegible] in. nor more than 1[illegible] in., nor must the outside diameter be less than 2[illegible] in. nor greater than 2[illegible] in. The hose must be smooth and regular in size throughout its entire length.

Each hose must have vulcanized to it a badge of white or red rubber as shown; on the top of the badge the name of the pur-

chaser, on the bottom the maker's name, on the left-hand end the month and year of manufacture, and on the right-hand end the serial number and the letters "M. C. B. Standard." The letters and figures must be clear and distinct, not less than $^3/_{16}$ in. in height, and stand in relief not less than $^1/_{32}$ in., so they can be removed by cutting without endangering the cover. Each hose must also have vulcanized to it a badge of rubber showing the copyright, as shown.

Each lot of 200 or less must bear the manufacturer's serial number, commencing at "1" on the first of the year and continuing consecutively until the end of the year, and the serial number should not be duplicated, even though the hose bearing the original numbers be rejected. For each lot of 200, one extra hose must be furnished free of cost.

RELATION OF WEIGHT OF HOSE TO BURSTING PRESSURE

WEIGHT OF HOSE IN POUNDS PER FOOT.	INCLUDING ALL AGES: AVERAGE BURSTING PRESSURE IN POUNDS PER SQUARE INCH.	INCLUDING ALL AGES: TOTAL NUMBER OF TESTS.	TWELVE MONTHS OF AGE: AVERAGE BURSTING PRESSURE IN POUNDS PER SQUARE INCH.	TWELVE MONTHS OF AGE: TOTAL NUMBER OF TESTS.
.7	320	1		0
.8	708	50		0
.9	732	219	757	22
1.0	724	267	797	63
1.1	723	103	741	94
1.2	643	38	742	49
1.3	751	5	715	10
1.4	833	3	620	2
1.5	730	2	910	1

Summary of Results Table B.

RELATION OF NUMBER OF TURNS OF CANVAS TO BURSTING PRESSURE

NUMBER OF TURNS OF CANVAS	INCLUDING ALL AGES: AVERAGE BURSTING PRESSURE IN POUNDS PER SQUARE INCH	INCLUDING ALL AGES: TOTAL NUMBER OF TESTS	TWELVE MONTHS OF AGE: AVERAGE BURSTING PRESSURE IN POUNDS PER SQUARE INCH.	TWELVE MONTHS OF AGE: TOTAL NUMBER OF TESTS
2	660	4	645	2
2½	740	1	740	1
3	726	20	636	4
3⅛	701	35	788	6
3½	661	11	840	2
3¾	630	2		0
4	723	260	759	32
4⅛	728	216	755	88
4½	714	94	768	30
4⅞	681	7	725	4
5	720	20	797	5
5⅛	806	7	880	1
5½	754	9	710	2
5¾	670	1		0

Summary of Results—Table C.

Bursting Test.—All hose selected for test will have a section 5 in. long cut from one end and the remaining 17 in. will then be subjected to a hydraulic bursting pressure of 400 lbs. per square inch for 10 minutes, which it must stand without failure. At a pressure of 100 lbs. per square inch it must not expand more than ¼ in. in diameter or change in length more than ¼ in., nor develop any small leaks or defects.

Friction Test.—A section 1 in. long will be taken from the 5-in. piece previously cut off, and the quality determined by suspending a 20-lb. weight to the separated end, the force being applied radially, and the time of unwinding must not exceed 8 in. in 10 minutes.

Stretching Test.—Another section 1 in. long will be cut from the balance of the 5-in. piece and the inner tube or lining will be separated from the ply and cut at the lap. Marks 2 in. apart will be placed on this section and then the section will be quickly stretched until the marks are 8 in. apart and immediately released. The section will then be re-marked as at first and stretched to 8 in. and will remain so stretched 10 minutes. It will then be released and 10 minutes later the distance between the marks last applied will be measured. In no case must the test piece break or show a permanent elongation of more than ¼ in. between the marks last applied. One-inch strips will also be taken from the cover and will be subjected to the same test.

Tensile Test.—Another section 1 in. long will be cut from the remainder of the 5-in. piece and the rubber tube or lining will be separated from the ply and cut at the lap. It will then be reduced in the middle for a distance of 2 in. by ½ in. wide parallel. The parallel section shall be spread to the full width of 1 in. at the end by curves of ½-in radius. This specimen shall be stretched uniformly by gripping the enlarged ends and in no case should the tensile strength per square inch be less than 400 lbs., nor the elongation at the time of failure less than 8 in., measured by marks placed originally 2 in. apart before breaking.

If the test hose fails to meet the required tests the lot from which it was taken may be rejected without further examination and returned to the manufacturer, who shall pay the freight charges in both directions. If the test hose is satisfactory the entire lot will be examined and those complying with the specifications will be accepted.

Report of Tests Made During the Year.

The apparatus employed in conducting these tests were the same as used last year, and will be found fully described on pages 114 and 115 in the Proceedings of the Master Car Builders' Association for 1905.

The hose tested were received at the laboratory in lots varying in number from 10 to 37. With but two or three exceptions, all samples of hose subjected to test had been removed from service for the purpose, and ranged in age from one to 72 months. The hose tested were received from 57 different sources.

In the preparation of the hose for test, each specimen was given the same treatment. The sample was first mounted on a hardwood mandrel, placed in a lathe and rotated, and cut into sections by means of a sharp knife supported by the tool rest. The process consisted, first, of removing a section from each end of the hose, of sufficient length to eliminate the enlarged and damaged portion; second, a section 4 in. in length to be used in securing a sample for the stretching test; and third, a section 1 in. in length to be used in determining the friction. The portion of the hose remaining after sectioning was used in determining the bursting pressure. By the process described above, accuracy and uniformity were secured in the form of all test specimens, which in every case were taken from the same relative position in the hose.

The log sheets used in recording results obtained from tests were similar to those used last year, a sample of which will be found in the appendix of this report.

The tests were conducted along the same lines as previously followed, each sample hose being subjected to three distinct tests, namely, bursting, friction and stretching.

In conducting the bursting test, the sample was first carefully fitted with nipples, then filled with water and placed in the machine, where it was subjected to 500 lbs. pressure for a period of 10 minutes. If, after this time, the test piece was uninjured, the pressure was gradually increased until rupture occurred. It might be mentioned, however, that before the sample was fitted with nipples, its weight, length and number of turns of canvas were accurately determined.

The friction samples were carefully prepared, with a view to having the section as nearly as possible one inch in length. The friction was determined for both the outer and inner wrapping, time being taken by means of a stop-watch. When the friction was sufficient to sustain the 25-pound weight for a period of ten minutes without unwrapping six inches, the actual amount unwrapped was recorded. If, however, the friction failed to support the weight for ten minutes, then the time of unwrapping six inches was taken.

The stretching test was made on a longitudinal strip of rubber taken from the inner tube at the lapped or thickest part. In conducting the stretching test, marks two inches apart were first carefully made on the sample. The sample was then placed in the machine and stretched until the distance between the marks measured 10 inches. The stress was then immediately removed and the sample measured to determine the permanent elongation or set. Marks were again placed on the sample two inches apart and the sample again stretched until the distance between the new marks measured 10 inches. The sample was held in this elongated state for a period of 10 minutes, when it was removed from the machine and permitted to shorten for a further period of 10 minutes. At the termination of this time the permanent elongation or set was recorded. If, however, the sample failed to stretch to the 10 inch limit, in either case, the actual elongation at that point was recorded. No trials were made from samples of the outer cover, owing to the uncertain character of the surface.

The time required in removing the stretching strands from the canvas was greatly reduced by applying carbolic oil to the parts involved. The process also resulted in uniform clearness of specimens, no cutting with a knife being necessary to separate the

COMPARISON OF MAKES

MAKERS	NUMBER OF TESTS	AGE IN MONTHS	AVERAGE WEIGHT, *PER FOOT	AVERAGE NUMBER OF TURNS OF CANVAS	PERCENT PASSING FRICTION TESTS: OUTER	PERCENT PASSING FRICTION TESTS: INNER	PERCENT PASSING STRETCHING TEST	PERCENT PASSING PRESSURE TEST	AVERAGE BURSTING PRESSURE OF HOSE PASSING PRESSURE TEST	AVERAGE BURSTING PRESSURE OF HOSE NOT PASSING PRESSURE TEST
Goodrich Rubber Co	21	1 to 12	1.02	4.23	66.6	71.5	19.3	95.2	786	500
N.Y. Belting & Packing Co	35	1 to 12	1.05	4.21	91.5	88.5	11.4	85.7	745	500
U.S.G. Rubber Co	45	1 to 12	1.06	4.18	33.3	33.3	2.2	84.5	797	483
Boston Belting Co	9	1 to 12	.91	3.92	11.1	11.1	0	55.5	768	495
Cleveland Rubber Co	18	1 to 12	.99	4.20	55.5	50.0	0	94.5	814	480
Peerless Rubber Co	28	1 to 12	.99	4.18	78.5	78.5	3.5	92.2	789	435
Revere Rubber Co	24	1 to 12	.97	3.95	46.0	54.0	25.0	100	870	—
Diamond Rubber Co	14	1 to 12	1.12	4.09	71.5	64.2	0	85.5	775	450
Goodrich Rubber Co	30	13 to 24	1.00	4.15	60.0	46.5	6.6	56.5	769	500
N.Y. Belting & Packing Co	13	13 to 24	1.06	4.10	53.8	38.5	0	92.3	765	500
U.S.G. Rubber Co	41	13 to 24	1.05	4.11	19.5	12.6	0	53.6	800	415
Boston Belting Co	33	13 to 24	1.04	4.22	11.0	0	0	60.6	741	468
Cleveland Rubber Co	14	13 to 24	1.00	4.0	28.5	7.2	0	92.8	835	450
Peerless Rubber Co	44	13 to 24	1.02	4.15	54.9	47.7	2.2	79.5	751	434
Revere Rubber Co	55	13 to 24	98	4.00	29.1	23.6	5.5	90.0	842	370
Diamond Rubber Co	14	13 to 24	.98	3.78	42.8	14.3	0	64.3	823	432

Summary of Results—Table D.

rubber from the canvas. The effect of the gasoline on the rubber was insignificant, as the actual time required in removing the strip of rubber, in many cases, was only 10 or 20 seconds. To test the effect of the gasoline, a piece of rubber was immersed in gasoline for 20 minutes, after which time a careful examination failed to show the slightest noticeable change in the character of the specimen.

A general summary of results is presented in Tables A, B and C, which were prepared without any special reference to brands or manufacturers.

In the preparation of Table A, the ages of all samples ranging from one month to six months were reckoned as six months of age; all sizes ranging from seven months to 12 months, as 12 months of age; all ages ranging from 13 months to 18 months, as 18 months of age, etc. In the summary of the friction tests, if a sample met the requirements for either the outer or inner wrapping, the sample was considered as passing the M. C. B. specifications.

In Table B, all weights per foot included between 0.61 and 0.70 are given as 0.70; all weights included between 0.71 and 0.80 as 0.80; all weights included between 0.81 and 0.90 as 0.90, etc.

A study of the data obtained discloses the following facts:

1. Seventy-eight per cent. of the total number of hose tested passed the M. C. B. specifications for the bursting test.

2. Thirty-two per cent. of the total number of hose tested passed the M. C. B. specifications for the friction test.

3. Four per cent. of the total number of hose tested passed the M. C. B. specifications for the stretching test.

4. There is a gradual decrease in the bursting pressure with an increase in age.

5. The friction appears to decrease with an increase in age, but not to a very marked degree.

6. As the age increases, the per cent. of samples which pass the M. C. B. specifications for stretching decreases very rapidly.

7. Neither the weight of the hose per foot nor the number of turns of canvas appear to affect the bursting strength of the hose to any great extent.

8. The maximum bursting pressure attained by any sample was 990 pounds.

9. The minimum bursting pressure was found to be 100 pounds.

A piece of the inner tube of each hose was properly labeled and filed away for future use in case any chemical analysis was thought desirable.

While preparing the report on tests of air-brake hose submitted under date of March 8, 1906, it developed that valuable information would be obtained if comparison were made of the results obtained from the tests of hose made by different manufacturers. To this end, Table D was prepared, showing the comparative results of tests of air-brake hose of different manufacturers. At first an attempt was made to prepare this table with reference to brands, but this was found impracticable, since in a great many cases the brand was not given. A total of 35 different manufacturers were represented in the series of tests. Of this number, only eight of the leading manufacturers have been considered because of the comparatively small number of samples tested. It was found that beyond two years of age only a few tests under each condition were available. For this reason the results given are confined to those obtained from samples under two years of age. The table is prepared in two parts. First, on samples ranging from 1 to 12 months of age, and, second, on samples ranging from 13 to 24 months of age.

The report is signed by Le Grand Parish, J. Milliken, T. S. Lloyd and R. L. Ettinger.

TESTS OF MASTER CAR BUILDERS' COUPLERS.

At the 1905 Convention the standing committee on Tests of M. C. B. Couplers submitted two propositions to the members relative to the method to be pursued in the future to bring about the adoption of a standard design of coupler. The first proposition, reading as follows, was unanimously adopted:

"That the coupler committee be empowered to act in conjunction with a specially appointed committee (in which should be included representatives of the manufacturers) to early decide upon a composite design of coupler which shall contain, as far as possible, the desirable features of the best couplers as now designed, and that all patent rights involved be waived and all manufacturers be permitted to manufacture the composite coupler as adopted."

This committee, composed of five railroad members and five representatives of coupler manufacturers, with Mr. F. W. Brazier as chairman, conferred with the coupler committee and has framed its report to the association, from which it will be seen that it was decided the instructions given could not be carried out and were considered impracticable at the present time, for reasons given in their report.

The report of the committee on Composite Design of Coupler terminated the work of the standing committee on Tests of M. C. B. Couplers for this year, as both committees were working under instructions to early decide upon a composite design of coupler. In view of the action taken by the special committee, the coupler committee now recommends that the second proposition contained in the 1905 report of the coupler committee be adopted to govern the standing committee on Tests of M. C. B. Couplers for the ensuing year, which reads as folows:

"That the present policy of the association be followed out, that is, that the gradual improvement of the M. C. B. standard coupler and the elimination of poorly designed and weak couplers be carried on as at present, by making the requirements to be met by the M. C. B. coupler more and more rigid, thus compelling a higher degree of efficiency closely prescribing the limits for the future within which designers may work, while at the same time in no way preventing beneficial competition."

There are several slight inaccuracies and omissions in the M. C. B. drawings of standards and recommended practices in the Proceedsings of 1905, for coupler and coupler yoke, to which the committee draws attention as follows:

M. C. B. Sheet 11. End view of coupler at bottom of sheet shows slotted instead of solid knuckle. As the solid knuckle has been adopted as standard, the drawing should be changed accordingly.

M. C. B. Sheet "B." Yoke for twin-spring gear and yoke for tandem-spring gear shows a dimension of 6⅛ in. between legs of yoke. These yokes were designed for the 6½-in. coupler butt and therefore this dimension should read 6½ in. The over-all dimension of 9 in. (over legs of yoke) is correct and the 6⅛ in. is a typographical error and should be corrected.

M. C. B. Sheet "B." There is no 5 by 5½ by 6½-in. butt shown on this sheet with 1 5-16 in. holes for the 1¼-in. rivets adopted as recommended practice. Inasmuch as the yokes are shown for this size butt, the coupler butt should be included on this sheet.

As the above corrections and additions do not involve any changes in the standards or recommended practices as adopted by the association, the coupler committee recommends that the secretary be instructed to incorporate the same in the drawings.

The report is signed by R. N. Durborow, J. E. Buker, Theo. H. Curtis, F. H. Stark.

REVISION OF PASSENGER CAR RULES.

Code of Rules Governing the Condition of and Repairs to Passenger Equipment Cars in Interchange.

1. Each railroad shall give to foreign cars, while on its line, the same care and attention that it gives its own cars, except in case of cars on which work is done under special agreement existing between the company owning the cars and the road operating the same.

2. The expenses of maintenance of passenger equipment operated in interchange or line service, shall be divided into three classes, namely:

(a) Owner's defects.

(b) Delivering company's defects.

(c) Line expenses pro-ratable against the roads comprising the lines on a mileage basis.

3. (a) Owner's defects are those due to ordinary wear and tear.

(b) Delivering company's defects are those due to unfair usage, derailment or accident. Delivering company is solely responsible to car owners for any improper repairs made by them.

(c) Line expenses shall consist of the expense of terminal cleaning, lubrication (oil, waste, tallow and labor), lighting (oil, wicks, chimneys, burners, shades, gas, candles and broken glass).

4. The railroad making the repairs for the defects not pro-ratable against the line is privileged to bill the car owner for these repairs, unless there is evidence to indicate that the damage was occasioned by unfair handling on the part of the delivering company.

5. Information as to mileage made by cars must be furnished promptly on request of owners by railroads over which cars are run.

6. (a) Cars shall be thoroughly oiled at terminals.

(b) No charge to be made for lubrication at intermediate points.

7. Only one journal bearing per journal may be charged per trip.

8. No labor charge shall be made for applying brake-shoes, journal bearings, hose (air, steam or signal) or for icing, filling lamps, gassing tanks or coaling cars.

9. No credit to be allowed for scrap brake-shoes removed.

NOTE.—Steel back brake-shoes not to be removed if over ½ in. thick; grey iron shoes not to be removed if over ¾ in. thick.

10. Loss of metal from tires of steel-tired wheels, caused by flat sliding, is chargeable to the company on whose road the damage is inflicted.

NOTE.—Loss of service metal from steel-tired wheels as a result of sliding to be measured from point where slide begins. One-sixteenth inch of metal to be allowed for flat spots under 2½ in. long and ⅛ in. of metal to be allowed for flat spots 2½ to 3½ in. in length, both inclusive.

11. (a) Axles broken under fair usage or having journals

½ in. or more under the standard for car (except for 3¾ by 7, which will be condemned at 3½ in.) may be renewed at the expense of the car owner.

(b) Cut journals, axles bent or broken or rendered unsafe by unfair usage, derailment or accident, shall be renewed at the expense of the railroad on whose line damage is inflicted.

(c) Where necessary to true up axles in cases of cut journals, where the journal is reduced below the limit as prescribed in Rule 11*a*, axle must be changed at the expense of company cutting journal.

12. Charge for car heating to be 10 cents per day per car. Cars lying at stations for over 48 hours, expense of heating to be borne by railroad in whose possession cars may be.

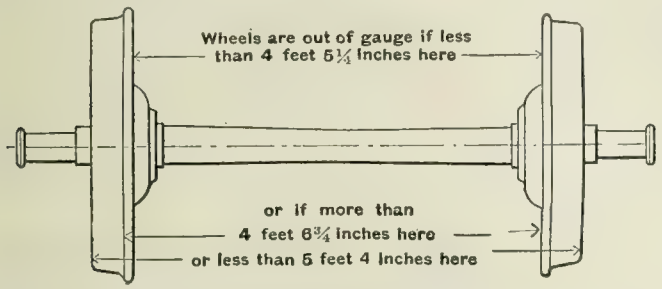
13. (a) Brakes must be in perfect working order. Cylinders and triple valves must have been cleaned and oiled within six months, and in case of cars equipped with high-speed brakes, triple and high-speed valves must be cleaned every three months and date of last cleaning and oiling stenciled on brake cylinder and triple valve with white paint.

(b) The adjustment of piston travel based on not less than 70 lbs. initial pressure must not be less than 5 in. nor more than 8 in.

Defects in Wheels—Owners Responsible.

14. (a) Loose wheels.

(b) Variation from gage if less than 4 ft. 5¼ in. inside of wheel at flange, or, if more than 4 ft. 6¾ in. outside of flange or less than 5 ft. 4 in. outside of tread.



Wheels—Cast-Iron.

15. (a) Shelled out; wheels with defective treads on account of pieces shelling out; if the spots are over 1 in. or so numerous as to endanger the safety of the wheel.

(b) Tread worn hollow; if tread is worn hollow ⅛ in. or over.

(c) Worn flanges; flanges having flat vertical surfaces extending more than ¾ in. from tread, or, flanges less than 1⅛ in. thick.

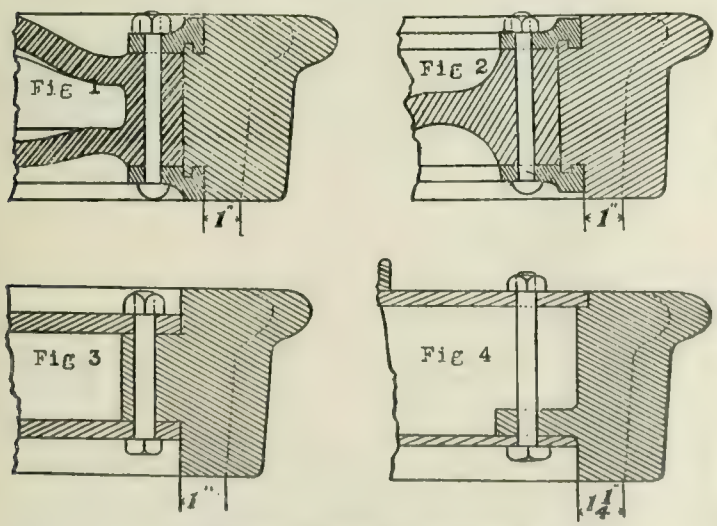
(d) Burst; if wheel is cracked from wheel fit outward by pressure from axle.

(e) Flange, rim, tread, plate brackets or any other part of wheel, either cracked, chipped or broken under fair usage.

Wheels—Steel Tired.

16. (a) Loose; broken or cracked hubs, plates, bolts, retaining ring or tire, occurring under fair usage.

(b) Worn flange or tire; with flange less than 1 in. thick or having flat vertical spot extending more than ¾ in. from tread, or with tire thinner than shown in Figs. 1, 2, 3 and 4.



Delivering Company Responsible.

17. Flat spots; if flat spots, caused by sliding, exceed 1 in. in length.

18. (a) If a car is transferred from the service of one railroad to that of another, the receiving road shall issue gas certificate authorizing the delivering road to bill against it for the number of atmospheres of gas and number of holders at the time car was received.

(b) Cars in interchange requiring holders to be filled, the receiving road shall be charged for the quantity of gas supplied.

(c) For cars stored in shops for repairs the company having car in its possession shall be responsible to the delivering company for the gas in holders. This will apply to sleeping-car companies when cars are in their possession and out of service.

19. The depreciation of all passenger equipment cars due to age shall be 3 per cent. per annum, to continue not to exceed 50 per cent. of the original value of car body. The depreciation of trucks shall be 3 per cent. per annum, to continue not to exceed 50 per cent. of the original value. No depreciation shall be allowed on the value of air-brakes.

20. This code of rules is understood to apply to all equipment interchanged in passenger trains.

21. Bills for line charges shall be made and rendered monthly and prices for materials and labor shall be in accordance with accompanying schedule.

22. This Code of Rules shall take effect Sept. 1, 1906. The committee make recommendation that specifications be prepared for standard steam and signal hose.

Air-brake hose applied subsequent to Sept. 1, 1906, must be made in accordance with M. C. B. specifications and so labeled.

.....
(Name of road.)

GAS CERTIFICATE.

.....
Car No..... Initial.....
No. of Atmospheres.....
No. of Holders .....
Size of Holders .....
.....Station, ...190....
.....Inspector.

List of Prices Agreed Upon for Expenses of Maintenance of Passenger Equipment in Interchange.

		New.	S. H.	Scrap.
1.	Axles, 4¼x8 in.	$14.00	$7.75	$5.25
	Axles, 3¾x7 in.	12.00	6.50	4.50
2.	Burners, round wick, each			.50
3.	Burners, dual wicks, each			.30
4.	Bell or signal cord and couplings, per car			.75
5.	Bearings, journal, applied, per lb.			.16
6.	Bearings, journal, credit for scrap bearing one-half weight of new bearing, per lb.			.11
7.	Bolts, nuts, and forgings, per lb.			.03
8.	Bolts, nuts and forgings, credit, per lb.			.00¾
9.	Bowls, opal, gas, 9-in., each			.50
10.	Chimneys, round, wick, each			.11
11.	Chimneys, dual wick, each			.06
12.	Candles, per lb.			.15
13.	Coal (including labor), per ton			6.00
14.	Chain, per lb.			.05
15.	Chain, credit, per lb.			.01
16.	Cleaning parlor and sleeping cars, exclusive of bedding, per car			1.35
17.	Cleaning vestibuled passenger and combination cars, each			.85
18.	Cleaning common passenger and combination cars, each			.50
19.	Cleaning vestibuled baggage and mail cars, each			.50
20.	Cleaning common baggage and mail cars, each			.30
21.	Taking out carpets, seats, draperies, etc., from parlor and sleeping cars and beating them, per car			1.00
22.	Taking out and beating cushions and backs of seats of passenger cars, either vestibuled or common, per car. (No additional charge for cleaning trucks of parlor or sleeping cars.)			.65
23.	Domes, gas, each			.50
24.	Diamond S brake shoes, applied, each. Diamond S brake-shoes, no credit for scrap.			.50
25.	Gas, Pintsch, per receiver			.85
26.	Globes, gas, 4-in., each			.50
27.	Globes, opal, gas, each			.50
28.	Glass, per light			At Cost.
29.	Glass, setting, per light			.25
30.	Hose, air-brake or signal, complete with fittings, applied to car, each:			
	1 in. air signal			1.75
	1¼ in. air brake			2.00
31.	Hose, air-brake or signal, credit for fittings			.80
32.	Hose, 1½ in. straight port, steam, complete with fittings, applied to car			6.50
	1 in.			5.00
33.	Hose, 1½ in. steam, credit for fittings			5.25
	1 in.			4.00
34.	Ice (including labor), per cwt.			.30
35.	Iron, cast, per lb.			.01¾
36.	Iron, cast, credit per lb.			.006-10
37.	Iron, malleable, per lb.			.03
38.	Iron, malleable, credit, per lb.			.00½
39.	Labor, on lubrication, per hour			.20
40.	Labor, on repairs, per hour			.25
41.	Lumber, oak, pine, hickory, poplar, and elm, per ft			.03
42.	Oil, Galena, car, per gal			.22
43.	Oil, Galena, coach, per gal			.35
44.	Oil, illuminating, American roads to charge, per gal.			.11
45.	Oil, illuminating, Canadian roads to charge, per gal			.16
46.	Shades, acme, lamp, each			.15
47.	Shades, common lamp, each			.25
48.	Steel, spring (not springs), per lb.			.04
49.	Steel, spring, credit, per lb.			.00½
50.	Steel castings, per lb.			.04½
51.	Steel castings, per lb.			.04½
52.	Tallow, per lb.			.05
53.	Waste, woolen, per lb.			.12½
54.	Waste, cotton, per lb			.06
55.	Wicks, round, each			.02
56.	Wicks, dual, each			.03
		New	S. H.	Scrap
57.	Wheels, cast, 36 in.	$14.00	$7.40	$5.00
58.	Wheels, cast, 33 in.	8.50	6.75	4.50
59.	Wheels, new, steel			Cost
60.	Wheels, second hand and scrap steel, $4 per 1.16 in. in thickness of tire, unless tires are loose or broken			
61.	Loss of metal from steel tired wheels, $2.00 per 1.16 in.			
62.	Labor, changing, per pair			2.00
63.	Removing, turning and replacing steel tired wheels			1.00
64.	Steel tired, cost of refitting to be same with addition of freight charges			

The report is signed by F. W. Chaffee, G. W. Wildin, J. E. Baker, F. N. Hibbits, J. T. Chamberlain.

BRAKE BEAMS.

Inefficient Brake Beams

A large number of brake beams now being used do not even meet the specifications of 1889. The result is that such brake beams not only give inefficient service but soon fail.

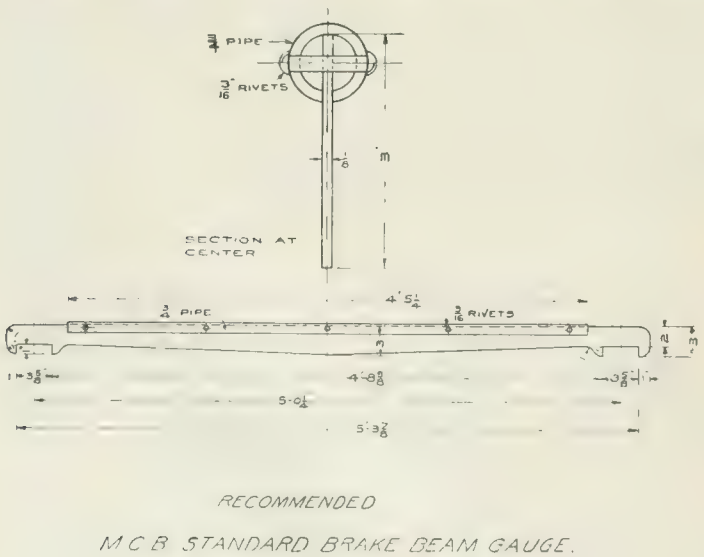
Investigation shows that many new freight cars have been equipped with brake beams hung at variance with the M. C. B. standard height, also at variance with the height for which the brake beams were designed. This misapplication produces a torsional strain on the beams when the power is applied.

Many roads are still applying "outside hung" brake beams, which we believe is radically wrong, as it is impossible to obtain satisfactory results with beams so hung. Outside hung beams are affected by the action of the bolster springs, curving of the trucks, sagging of the car body, etc., all of which prevents effective braking, and particularly under the varying conditions of loaded and empty cars. There is no argument in favor of such an arrangement, with the one exception, that they are more accessible.

A brake-beam should be hung inside of the wheels to some *rigid* portion of the truck, so that it will always maintain the same relative position to the wheels; when so hung the beams are easier to maintain, and not being exposed are less liable to be struck by obstructions on the track (impromptu bumping posts, etc.). The first cost of the inside hung brake-beam is less, they cost less to apply, and most important of all, give more effective results in braking.

Vertical Stress.

Owing to the large number of brake-beams which have become twisted or buckled in service, some have asserted that brake beams are subjected to a severe "transverse" or vertical stress. From a mechanical standpoint there can be practically no "transverse" stress produced in a brake beam in service. Even under extreme misapplication, which produces *torsional* or twisting strains, only a nominal amount of "vertical" stress will result. The question therefore naturally arises, why do some brake beams become twisted or buckled in service? This is due to the use of brake beams which do not have sufficient strength in the normal line of pull. Being overloaded they fail and naturally in the line of least resistance, this being "transversely" or up and down in relation to the position of the beam on the car. If the proper *stiffness* in the *normal line of pull* is specified and used, the vertical strength will be sufficient. This has been further demonstrated by the satisfactory service of thousands of brake beams of proper design,



RECOMMENDED

M C B STANDARD BRAKE BEAM GAUGE.

Fig. 3.

and strength, on light weight and low capacity cars, such service covering a long period of years.

A brake beam cannot be subjected to *any* stress or strain in service until the brakes are applied, and then any strains, other than those due to the applied power, must come from the rotation of the wheels, or if the brake beam is misapplied, from the improper contact of the brake shoes on the wheel. The rotation of the wheels owing to the friction of the brake shoes, has a tendency to move the brake beam up or down, as the case may be. This tendency is resisted and overcome by the brake hangers, which transmit the *stresses directly* from the brake heads and shoes to the truck frame, to which the hangers are rigidly attached. It is therefore apparent that this action, which is limited to the play of the brake hangers, does not produce any stress at the center of the brake beam. (See Fig. 1 showing the line of forces.)

If a rigid head beam is hung at a height other than that for which it was designed, one end of the brake shoe will naturally come in contact with the wheel before the other, and on being forced into full impact by the application of the brakes, will cause, not transverse, but *torsional* stresses, or a twisting of the brake beam about its own axis, the greatest stresses being produced at or near the brake heads.

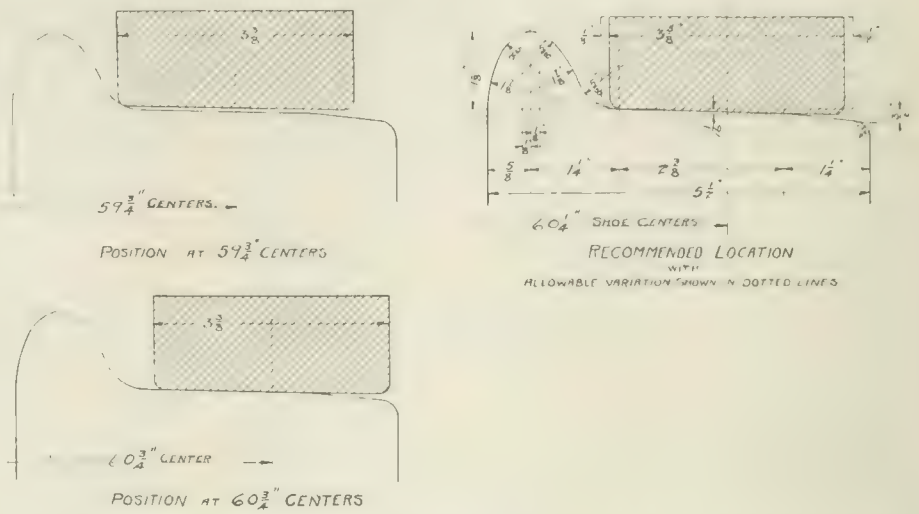


Fig. 2—Relation of M. C. B. Brake Shoe to Wheels of M. C. B. Standard Gage and Contours.

The use of automatically adjustable brake heads will take care of all conditions of application, and eliminate any and all stresses on the brake beam structure, other than those produced by the normal braking force or lever pull.

The real cause of the many failures of brake beams attributed to "transverse" or vertical load, is the overloading of a structure which is primarily too weak, and where the line of least resistance is at right angles to the lever pull, resulting in the buckling of the beam in a vertical direction.

Many brake beams are used to-day on equipment where the service loads are double the capacity of brake beams at the allowable deflection of ½ in. Investigation of this subject also shows that the types of brake beams which have sufficient normal capacity even when they have *little* "vertical" strength, give satisfactory service, and do not show any weakness or tendency to fail by cross-bending, while other types of brake beams, of much greater vertical strength, but less normal stiffness, have failed in the same service. Some of the brake beams now being used in the most exacting service ("high speed" passenger service) and which are proving

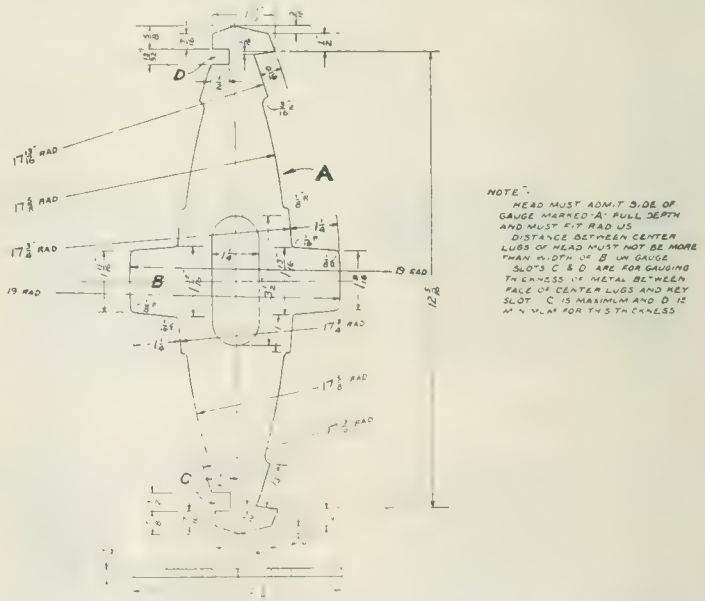


Fig. 5—Recommended M. C. B. Standard Brake Head Gage.

most satisfactory, have less "transverse" strength than many of the light types of freight brake beams which fail by buckling in ordinary freight service, where the requirement is very much less than the "high speed" service.

Capacity.

When it is considered that some 60,000-lb. capacity furniture and rifregireator cars weigh over 50,000 lbs., and that some 100,000-lb. capacity flat and gondola cars weigh as little as 30,000 lbs., it will be seen that the mere "capacity" of a car can hardly be used as the basis of determining this question. The *load applied to the brake beam* is what we wish to determine, and under the present conditions this is fixed by the light weight of the car, and the ratio

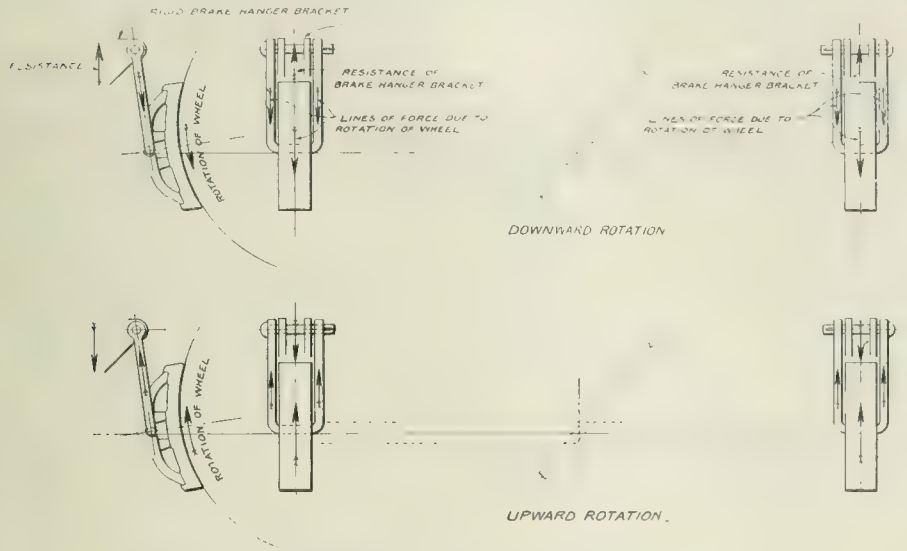


Diagram of Brake Beam and Hangers Showing Lines of Force Due to Friction of Shoes on Wheels.

of braking power to same. This condition will obtain until some method is adopted for braking in proportion to loaded and empty cars.

While there is considerable variation in the weight of cars, the disadvantage of having two or three capacities of beams in addition to the different makes now in use will be apparent, and after a careful consideration of this question, it is believed that one new standard should be arrived at, which will take care of the maximum conditions, but the use of the present M. C. B. No. 1 beam (7,500-lb. capacity) should be permitted where the car does not exceed 30,000 lbs. in weight, and braking power does not exceed 70 per cent. of light weight of the car. This will admit of the continued use of all brake beams that meet the present standard of 7,500-lb. load with only $^1/_{10}$ in. deflection, on this light equipment, but will give a common standard for all cars weighing more than 30,000 lbs., which will practically include all new and modern cars.

Further application of brake beams which do not meet the present M. C. B. requirements should be abandoned, and after a specified date such beams should be refused as improper material for interchange.

In arriving at the desired working capacity, we may assume 50,000 lbs. as the maximum weight of line or general service freight cars; there may be some instances of special construction where this weight is slightly exceeded, but these exceptions need not be considered in view of the allowance to be made later. Now, assuming 1,500 lbs. unbraked weight per axle as a minimum which can be allowed to avoid slid flat wheels, and we will have a maximum braking power of 50,000 lbs., less 6,000 lbs., or 44,000 lbs.; this divided by four gives a maximum braking force of 11,000 lbs. per beam. Adding to this value a reasonable factor of safety necessitates a capacity in the brake-beams of 15,000 lbs.

Deflection.

In establishing the proper capacity of beams the present M. C. B. allowable deflection of $^1/_{10}$ in. has been used, it not only being the recognized standard by which to measure all capacities of brake-beams, but experience has shown that this can be easily met in economical design, and it also leaves sufficient elasticity to withstand the shocks of service without injury or permanent set.

Length of the Brake Beam.

Manufacturers are now called upon to furnish three different

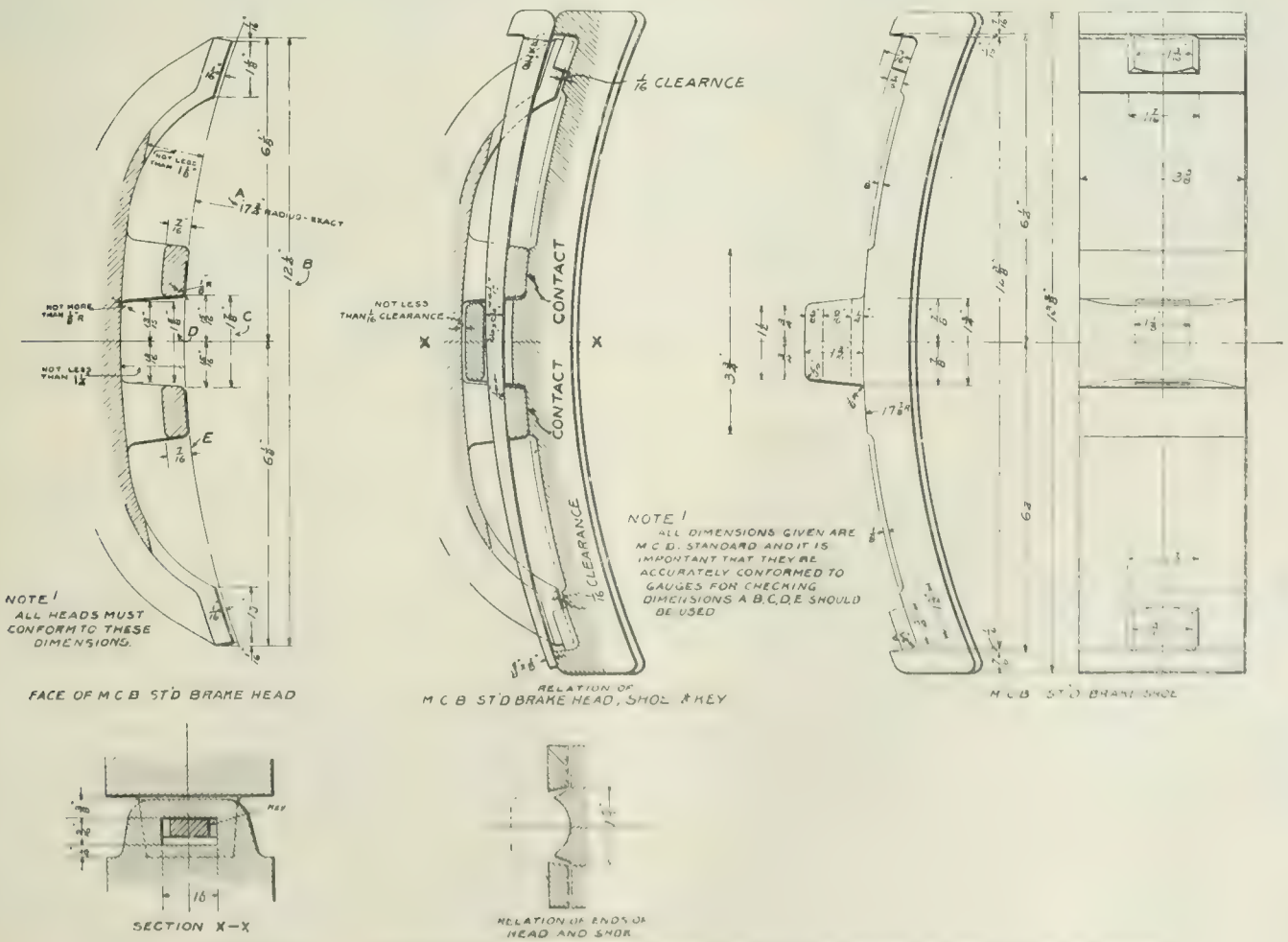
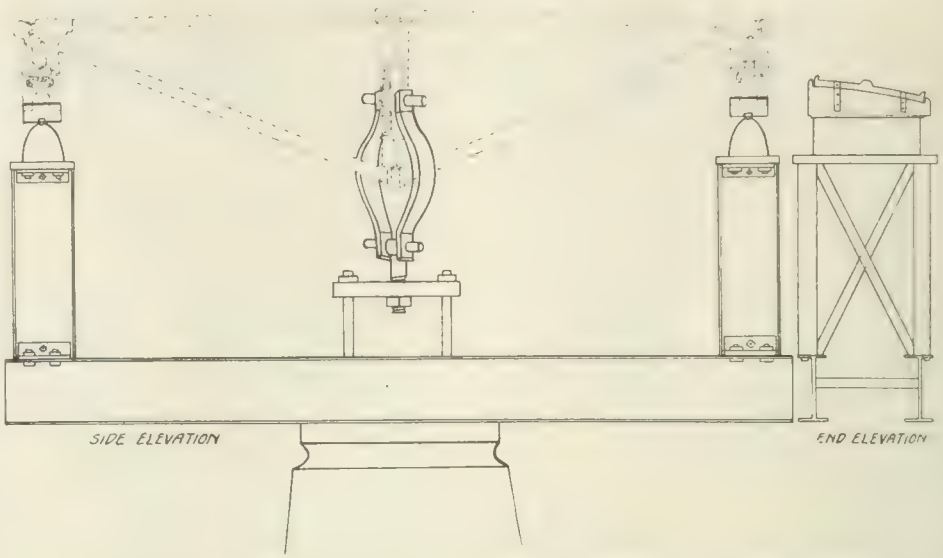


Fig. 4—Standard M. C. B. Contours of Brake Head, Shoe and Key and Their Relation to Each Other.

lengths of brake beams, namely: 60 in., 60¼ in. and 60½ in. center to center of brake shoes. This with allowable and unavoidable variations of ¼ in. in manufacturing gives the extremes in length of 59¾ in. and 60¾ in.

Fig. 2 shows the position of the standard shoe on the wheels at the two extremes of 59¾ in. and 60¾ in. It will be noticed that both of these positions are objectionable; in the former case the shoe crowds into the throat of the flange of the wheel; and in the latter it is seen encroaching so closely to the outer edge of the tread of the wheel, that with a slight variation in hanging, it would overlap. The present M. C. B. standard of 60½-in. centers would be satisfactory if it were not exceeded or could be maintained. The usual variation of ¼ in. either way from the specified length, allowed by most railroads, does not seem to be too much. This allowance, with the present standard of 60½ in., would permit of brake-beams being made 60¾ in., which is too long, and with beams specified at 60 in. from center to center it would admit of beams being made 59¾ in. long, which would cause the shoe to crowd into the throat of the wheel. It would therefore seem best to decide upon the mean of 60¼ in., with an allowable variation of not over ⅛ in. either way. This would then give us the extremes of 60 in. and 60½ in., neither of which lengths is objectionable when not exceeded. (See Fig. 2, showing position of shoe on the wheel at 60¼-in. centers, with the allowable variation from this length shown in dotted lines.)

We recommend that the association specify that all brake-beams should be 60¼ in. from center to center face of the brake heads with an allowable variation of not over ⅛ in. either way from this dimension. Gage shown on Fig. 3 should be adopted as standard for checking these dimensions and measurements should be taken at the center and at each end of the brake heads.



Method of Testing Showing Arrangement in Machine in Direct Test.

Brake Heads.

Difficulty has been experienced in fitting the brake shoes on many of the brake heads now on the market, because the brake heads do not conform to the M. C. B. dimensions. Fig. 4 shows the relation of the M. C. B. standard Christie brake head and brake shoe. The plan contemplates contact or bearing at the center lugs of the brake head, while the ends of the brake head clear the back of the brake shoe, their function being merely keep the shoe in vertical alinement while the center lugs transmit the load directly to the beam and fit the shoe lug so snugly as to prevent any upward or downward movement of the shoe. In practice a great deal of play is often found at this point, which is very objectionable, as it allows the shoe to chatter up and down with the rotation of the wheels. Also many brake heads are found which bear at the ends and lack contact at the center, causing the shoes to break at the center when worn. Many brake heads also will not allow the brake shoe key to be properly driven into place.

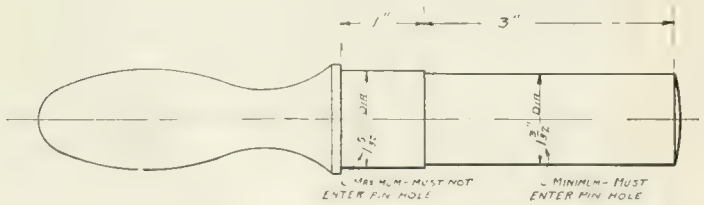


Fig. 6—Lever Pin Hole Gage.

All of these difficulties can be remedied by specifying that all brake heads shall be made in conformity to present standard dimensions, at least in the essential points. In order to insure these results the gage shown by Fig. 5 should be adopted as standard with which to check up these dimensions.

It is important that all brake heads be of such an angle in relation to the center line of the fulcrum, or the normal line of applied force (which is horizontal), that the shoes shall be in perfect contact with the tread of the wheels when applied. When rigid heads are used they should be designed for the particular height at which they are to be hung. Brake beams with adjustable heads can be hung at any height.

Lever Fulcrums.

The present M. C. B. standard angle of 40 deg. from the vertical for the lever slot is now almost universally used on freight brake beams and should be maintained as a standard. The present M. C. B. standard lever pin which is 1 3-32 in. in diameter is also generally used and should be maintained, having ample shearing and bearing value for a brake beam of the increased capacity previously recommended, but the *diameter of the lever pinhole* in the brake beam fulcrum should have our attention. Inspection has shown that the standard of 1⅛ in. in diameter in many instances is not being adhered to. Many brake beams have pinholes roughly cored, and both too large in diameter and out of round, many being found 1 3-16 in. to 1¼ in. in diameter. It is very important that these pinholes do not exceed 1⅛ in. in diameter, so as to eliminate lost motion as well as to reduce the wear at this point. The tendency to wear increases very rapidly in proportion to the amount of play. In the case of malleable iron fulcrums these holes should be drifted (not drilled) to size. In the case of wrought iron or steel fulcrums, these holes should be drilled or punched and reamed to size. In order to check and maintain a 1⅛-in. pinhole a gage should be adopted for this purpose, and such a gage limiting the variation from the exact size desired is herewith submitted. It will be noted by reference to Fig. 6 that the small diameter of the gage pin, which must enter the fulcrum hole, is 1 3-32 in., or the same diameter as the lever pin. The larger diameter of the gage pin, which is 1 5-32 in. in diameter, must *not* enter the fulcrum hole, and is only 1-32 in. larger than the desired diameter.

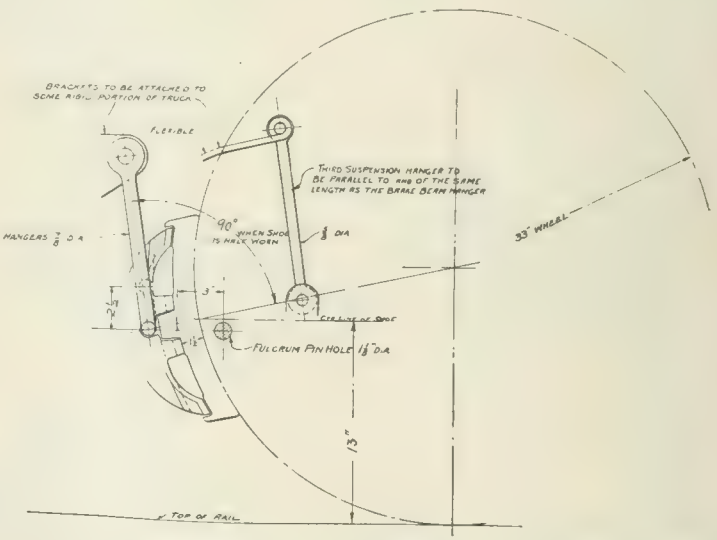


Fig. 7—Recommended Application of Inside Hung Freight Brake Beams.

While there is at present a wide range of variation in the position of the pinhole of freight brake beams, the majority (probably 80 per cent.) are located approximately either at 2 in. or 3 in. in front of the face of the brake heads. The latter dimensions would probably be preferable. This would bring the pinhole 1½ in. forward of the face of a standard 1½-in. thick brake shoe. The position of the lever pinhole should be specified in relation to the face of the *brake heads*, and not the brake *shoes*. In order to insure uniform results this dimension, whatever may be determined upon, should be limited to not over 1-16 in. variation either way.

The committee would recommend that 3 in. be made the stand-

ard distance from face of brake head, measured from the center on line of curve on top of lugs to center of lever pinhole. (See Fig. 7.)

Application.

As the best results can only be obtained when beams are inside hung, we recommend to the association that all brake beams be inside hung, and that the present M. C. B. standard height of 13 in. from top of rail to the center of the face of brake shoes be adhered to on all new equipment. When this height can not be obtained on old equipment, it is recommended that the beams be hung as high as possible; if provided with rigid heads they should be designed to suit the height at which they are hung. In all cases the lever fulcrum and the center line of the brake beam should be horizontal, which is in line with the applied power. In addition to the above we recommend this association adopt as recommended practice the following features of application as shown on Fig. 7, namely:

All brake hangers should preferably be attached to the brake head at the center of same, just back of the central brake shoe lug so that they will be firmly locked in position by the brake shoe, and by bringing them as close to the shoes as possible, overcoming the tendency of the beam to rotate about the hangers. This will also admit of the use of longer brake hangers, than if they were attached to the brake heads at a point above the center of same, and which is a desirable feature.

Where by reason of design of brake beam the recommended location of brake hanger eye is impracticable an alternate location 2½ in. above the preferred location for brake hanger eye as shown by Fig. 7 is permissible.

The slot for the brake hanger should be limited in dimension as much as possible, in order to prevent wear and overcome the chattering or excessive movement of the beams up and down with the rotation of the wheels. In order to obtain a minimum play at this point of attachment, a standard size hanger ⅞ in. diameter should be adopted, and this size is now in general use.

In order that the proper release of the brake beam be obtained by gravity, the brake hangers should have an angle as nearly as possible to 90 deg. from a line drawn from the center of the brake shoe to the center of the axle when the shoes are half worn. This will also prevent any possible wedging of the beams.

Third suspension hangers should be used on all brake beams when practicable to prevent the shoes from dragging on the wheels when the brakes are released. They should be attached to flexible (not rigid) brackets, and should have the same exact angle and length as the brake hangers to prevent binding or tilting of the beam.

Chains are preferable for safety hangers, as the yoke and similar forms of safety attachment are often so arranged that they strike the beams, causing a loss of power and a tendency to damage the beam.

Fifty-one inches center to center of safety hangers is now generally used and should be adopted as standard.

Facilities for Testing Brake Beams.

In order to insure that purchasers obtain brake beams which

DIRECT TEST.

Lab. No.	NAME.	Make-Up.	Weight.	Mark.	LOADS AND DEFLECTIONS. 7,500 Load.	7,500 Deflection.	7,500 Set.	15,000 Load.	15,000 Deflection.	15,000 Set.	Elastic Limit. Load.	Elastic Limit. Deflection.	Elastic Limit. Set.	AT MAXIMUM. Load.	AT MAXIMUM. Strength per Lb. of Beam	Resilience.
					Lbs.	Inch.	Inch.	Lbs.	Inch.	Inch.	Lbs.	Inch.	Inch.	Lbs.		Lbs.
4	Simplex	Solid	95.00	C-2	7,500	.098	.000	15,000	.188	.000	17,000	.217	.000	21,000	221.0	1844.5
5	Simplex	Solid	124.00	F-2	7,500	.062	.000	15,000	.135	.006	16,000	.146	.010	22,500	181.5	1168.0
15	Simplex	Truss	137.75	G-1	7,500	.018	.000	15,000	.035	.001	24,000	.060	006	50,000	363 0	720.0
18	Simplex	Truss	131.50	H-1	7,500	.022	.000	15,000	.044	.003	Indefinite.			61,900	470.6	.....
1	Davis	Truss	94.75	B-1	7,500	.040	.005	15,000	.086	.017	Indefinite.			42,000	443.2	.....
7	Pressed Steel	Solid	85.25	A-1	7,500	.100	.000	15,000	.211	.025	14,000	.192	.010	21,000	246.4	1344.0
6	Pressed Steel	Solid	92.25	Extra	7,500	.085	.000	15,000	.172	.005	16,000	.185	.005	24,575	266.3	1480.0
8	Monarch	Solid	82.50	S-1	7,500	.101	.000	15,000	.....	.....	12,000	.170	.005	15,575	188.8	1020.0
12	Sterlingworth	Solid	88.00	R-1	7,500	.110	.000	15,000	.231	.015	14,000	.210	.010	23,675	269.0	1470.0
23	Diamond	Truss	157.50	E-2	7,500	.053	.000	15,000	.085	.001	Indefinite.			56,890	361.2	.....
17	Central	Solid	80.75	P-1	7,500	.055	.000	15,000	.117	.001	20,000	.159	.005	27,400	339.5	1590.0
13	Vanderbilt	Solid	105.00	D-1	7,500	.064	.000	15,000	.128	.002	18,000	.160	.005	23,000	219.0	1440.0
10	Buffalo	Solid	110.00	M-1	7,500	.048	.000	15,000	.105	.000	20,000	.147	.000	22,850	253.1	1470.0
14	Waycott	Truss	94.50	L-2	7,500	.063	.012	15,000	.137	.033	Indefinite.			29,950	317.0	.....
16	National Hollow	Truss	69.00	J-1	7,500	.082	.000	15,000	.174	.023	Indefinite.			25,200	365.2	.....
19	National Hollow	Truss	74.00	Extra	7,500	.070	.004	15,000	.202	.006	10,000	.097	.010	18,325	247.6	485.0
21	Atlas	Truss	127.00	None	7,500	.064	.008	15,000	.115	.020	Indefinite.			51,400	404.7	.....
11	Marden	Solid	91.00	Q-1	7,500	.110	.000	15,000	.214	.003	14,000	200	.000	17,000	186.8	1400.0
22	Keystone	Truss	115.00	None	7,500	.038	.001	15,000	.081	.011	Indefinite.			62,600	544.3	.....
20	Haskell & Barker	Truss	65.00	K-2	7,500	.100	.008	15,000	.267	.115	Indefinite.			20,160	310.1	.....
24	?	Solid	105.00	None	7,500	.083	.000	15,000	.160	.004	16,000	.180	.005	20,500	195.2	1440.0
42	Creco	Truss	68.5	None	7,500	.070	.005	15,000	.139	.009	22,500	.211	.015	28,300	413.1	2373.8
43	Creco	Truss	86.0	None	7,500	.043	.002	15,000	.089	.003	28,000	.187	.009	38,050	442.4	2618.0
44	Creco	Truss	91.5	None	7,500	.040	.000	15,000	.078	.003	18,000	090	.003	41,645	455.1	810.0
48	Pressed Steel	Truss	94.5	None	7,500	.048	.000	15,000	.110	.007	14,000	.100	.005	28,500	301.5	700.0

TRANSVERSE TEST.

27	Simplex	Solid	96.50	Extra	1,500	.459	.031	3,000	1.275	.420	2,000	.620	.070	3,800	39 4	620.0
3	Simplex	Solid	94.50	C-1	1,500	.534	.017	3,000	1.263	.260	2,000	.712	.051	6 250	66.1	712.0
28	Simplex	Solid	124.00	F-1	1,500	.205	.008	3,000	.420	.030	4,000	.580	.060	6,660	53.7	1160.0
36	Simplex	Truss	138.50	G-2	1,500	.195	.027	3,000	.415	.065	Indefinite.			9,400	67 8	.....
40	Simplex	Truss	131.50	H-2	1,500	.343	.113	3,000	.656	.223	Indefinite.			8 975	68.2	.....
33	Pressed Steel	Solid	94.75	A-2	1,500	.757	.062	3,000	2.050	.550	1,400	.690	.050	5,000	52.8	483 0
26	Monarch	Solid	80.50	S-2	1,500	.645	.051	3,000	2 475	1.040	1,400	.590	.033	4,200	52 2	413 0
25	Sterlingworth	Solid	85.50	R-2	1,500	.785	.150	3,000	2 110	.740	1,200	.610	.040	1,435	51 9	366 0
34	Central	Solid	80.75	P-2	1,500	.435	.032	3,000	.930	.120	3.000	.930	.120	1,350	53 8	1395 0
38	Vanderbilt	Solid	103 00	D-2	1,500	.370	.080	3,000	.740	.080	3,000	.740	080	8,400	81 5	1110 0
29	Buffalo	Solid	108.50	M-2	1,500	.301	.017	3,000	.621	.058	3.000	.621	058	8,400	73 7	951 5
35	Waycott	Truss	95.00	L-1	1,500	.452	.040	3,000	1.050	.260	Indefinite.			4,955	52 1	
31	National Hollow	Truss	69 00	J-2	1.500	.852	.325	3,000	.....	.....	800	.250	025	2,590	37 5	100 0
9	Atlas	Truss	127.00	None	1,500	.542	045	3,000	1.095	.170	2,800	.980	.140	5,530	43 5	1372.0
30	Marden	Solid	94 50	Q-2	1,500	.602	.011	3,000	2.410	1.380	1,800	730	025	3,225	34 1	657 0
39	Keystone	Truss	115 00	None	1,500	.464	.041	3,000	.879	.234	2,000	590	.076	5,380	46.7	590 0
32	Haskell & Barker	Truss	66 50	K-1	1,500	2.007	1 115	3,000	.....	.....	Indefinite.			2,700	40 6	.....
37	?	Solid	105 00	None	1,500	.352	018	3,000	800	.140	2,200	520	040	5,470	52 1	572 0
45	Creco	Truss	68 0	None	1,500	1 733	154	3,000	3 935	1 010	Indefinite.			3 220	47.3	.....
46	Creco	Truss	86.0	None	1,500	1 237	.280	3,000	2.569	645	Indefinite.			1,240	49 3	.....
47	Creco	Truss	92 0	None	1,500	880	.272	3,000	2 105	.475	Indefinite.			5,550	60 3	.....
49	Pressed Steel	Truss	95 0	None	1,500	597	053	3,000	1.514	.485	Indefinite.			1,140	43 5	.....

Table 2—Summarized Data of Brake Beam Tests.

meet these specifications, if adopted as standard, some provision should be made for testing the beams. Very few, if any, of the railroads now have the proper facilities for doing this work. It would seem desirable for testing machine builders to design a machine for the special purpose of testing brake beams, and either requiring that the manufacturers purchase such a machine for the purpose of making tests when called upon by the purchaser, or that the association purchase such a machine and locate it at some convenient point, so that it can be used by the railroads and the members of the association.

The committee accordingly recommends for adoption as standard two brake beams, which shall be known as beam No. 1, for use under cars having a light weight of 50,000 lbs. or less, and beam No. 2 which shall be used under cars having a light weight in excess of 50,000 lbs. Both beams shall conform to the following specifications:

Specifications.—1. All beams shall be 60½ in. in length from center to center of brake head, with an allowable variation of ⅛ in. in each direction, and shall be proven by the gage shown by Fig. 3, applied to the center and each end of the brake heads, which shall be the standard gage for this purpose.

2. All brake heads shall conform to the M. C. B. standard dimensions, and shall be proven by the gage shown by Fig. 5, which shall be the standard gage for this purpose.

3. Attachments for safety hangers shall be 51 in. from center to center.

4. The angle of the lever fulcrum shall be 40 deg. from the vertical.

5. The lever pinhole shall be 3 in. in front of the top of the brake head lugs. The variation in either direction shall not exceed ⅛ in.

6. The lever pinhole shall not be less than 1 ⅜ in. in diameter, nor more than 1 5/32 in. in diameter, and shall be proven by the gage shown by Fig. 6, which shall be the standard gage for this purpose.

7. The maximum distance from the lever pinhole to the extreme back of brake beam should not exceed 9½ in.

Test.—8. For each 500 brake beams, or less, which pass inspection and are ready for shipment, one representative beam shall be taken at random, and subjected by the company manufacturing the beams, and in the presence of the railroad company's inspector, to the following test in a suitable machine:

The beams shall be equipped with suitable heads and shoes, and the shoes placed in contact with castings representing the tread of the wheel; when mounted in this manner, the load shall be applied to the fulcrum in the normal line of pull. As a preliminary to the test a load of 6,000 lbs. shall be applied and released, after which observations for records shall be taken. Beam No. 1, under a load of 7,500 lbs., shall not deflect to exceed .0625 in., beam No. 2, under a load of 15,000 lbs., shall not deflect to exceed .0625 in.

9. In case a beam shall fail in this test, then a second beam shall be taken from the same lot and similarly tested. If the second beam stands the test, it shall be optional with the inspector whether he shall test a third beam or not. If he does not do so, or if he does, and the third beam stands the test, the 500 beams, or less, shall be accepted as filling the requirements of this test.

10. Individual beams will not be accepted which (1) do not conform to standard dimensions, and (2) those that have physical defects. Any lot of 500 beams, or less, submitted for test, that fail to meet the prescribed test (Pa. 8) will not be accepted.

The committee further recommends for adoption by the M. C. B. Association as recommended practice:

1. That all beams be inside hung.
2. That all beams be hung 13 in. from the rail.
3. That brake hangers shall be attached to the brake head at the center, and just back of the central brake shoe lug.
4. That brake hangers shall be ⅞ in. in diameter.
5. That brake hangers should have an angle as nearly as possible to 90 deg. from a line drawn from the center of the brake shoe to the center of the axle, when the shoes are half worn.
6. Third suspension hangers should be used on all brake beams. They should be attached to flexible brackets, and should have the same angle and length as the brake hangers.
7. For safety hangers, chains should be used.
8. That, in order that these specifications may be generally observed, after September 1, 1910 all cars not equipped with brake beams built in accordance with these specifications, be subject to rejection in interchange on account of improper equipment.

The tests of brake beams made during the year at Purdue University for the committee were of two kinds: The direct test* and the transverse test.

Direct Test.

In the direct test, the load was applied at the lever fulcrum in the direction of the plane of the brake beam and at right angles to a line joining the brake shoes. Shoes were inserted in the shoe holders, and the beam along with the shoes was supported on castings, which represented a segment of the circumference of a car wheel. These castings constituted a convenient method of supporting the beam. The plane of the beam was adjusted to the vertical in the testing machine, and the line of pull was in the axis of the testing machine. The span was defined to be 5 ft. 0½ in. by knife edges upon which these castings rested.

Loads were applied to the beam thus supported, in increments through the lever fulcrum, and each load was released after having been applied. A 30,000 lb. Olsen testing machine was used for the lighter beams, and a 100,000 lb. Olsen testing machine for the heavier beams.

The deflection of the beam under each loading and the set after each loading, were observed by a special deflectometer.

Transverse Test.

The shoes were attached to the holders and bolted to a special casting. These castings rested on knife edges, which fixed the span of the beam as 5 ft. 0½ in. and disposed the plane of the brake beam at right angles to the direction of the loading. The plane of the beam was horizontal in the testing machine, and the loads were applied in the direction of the axis of the machine. Loads were applied transversely or at right angles to the plane of the brake beam, through the lever pinholes. Loads were applied in increments, and each load was released after having been applied.

Results of Tests.

The main results of the tests are presented in Table II, which gives the Laboratory or Test number, the name of the beam, its weight, mark, etc. The stiffness is shown by the amount of deflection. The strength is given in pounds of load.

The strength of the beam per unit of its weight is also quoted, and the resilience.

Conclusions.

The following conclusions may be drawn:

Under the Direct Test:

(1) The truss beams are stronger than the solid beams, both absolutely and per unit of their weight.

(2) The truss beams are stiffer than the solid beams.

Under the Transverse Test:

(3) The solid beams are stronger than the truss beams.

(4) The solid beams are stiffer than the truss beams.

In General:

Under the direct test the primary cause of failure is the yielding of some part of the beam (the truss rod, or else the compression member, of truss beam, or the compression flange of a solid beam) under the direct action of the load. Subsequently the beam buckles sidewise. It appears that the beams tested are sufficiently stiff in the transverse direction to develop their strength under direct loading.

(7) Inasmuch as transverse stiffness and strength are necessary in order to develop the direct strength of the beams, it would seem that the proper specifications for strength under direct loading will insure strength under the transverse loading.

The report is signed by A. E. Mitchell, R. B. Kendig, W. E. Sharp, W. F. M. Goss, G. W. Wildin.

TRIPLE VALVE TESTS.

During the past year a triple valve containing new features has been placed on the market by the Westinghouse Air Brake Company, and this valve in two sizes was submitted to the committee for test.

This valve, which is designed for freight equipment, contains three principal features not found in valves previously tested for the Master Car Builders' Association. They are as follows:

First, a quick service application.

Second, a retarded release.

Third, a retarded recharge.

The two sizes of this valve are designated as K-1 for 8-inch cylinders and K-2 for 10-inch cylinders.

The Westinghouse Air Brake Company has, for some time, furnished a triple valve designated as H-49 for 10-inch brake cylinders. This valve is similar in design to the F-36 valve, and only differs from the latter in the capacity of handling larger volumes of air. No previous tests of the H-49 valve have been made by an M. C. B. committee.

The committee expected that an entirely new type of triple would be submitted for test on the Purdue rack and arrangements were completed for making these tests. However, at the last moment the manufacturers withdrew from the test, intimating that a test of 50 cars was not satisfactory, and stating that if the M. C. B. requirements were changed from 50 to 80, 90 or even 100 cars, they would be glad to turn their valve over to the committee for test. This communication was received too late for the committee to make arrangements for conducting the test on a 100-car rack.

The committee fully appreciates the fact that a 50-car test as provided for in the M. C. B. code does not develop the conditions that must be met in handling trains of 80 or more cars.

The Westinghouse Air Brake Company, in offering its new type of triple for test, stated that these valves would materially improve

the operation of brakes on trains of 50 cars or less, and were especially designed to meet the conditions which develop in handling trains of 80 or more cars. This company also stated that there was little to be gained by making a 50-car test, and that they would prefer making a test of 75 or 100 cars. The committee advised the Westinghouse Air Brake Company that the testing rack at Purdue could not be used for more than a 50-car test. The Westinghouse Air Brake Company then offered the committee the use of either one or both of its 100-car test racks at Wilmerding. This offer was accepted with the understanding that the committee should have the exclusive use of the rooms, with the privilege of using either rack for testing triple valves manufactured by other companies.

The committee arranged to make test on April 5, 6 and 7, 1906, and invited the Air Brake Association to appoint a committee to assist in making tests.

All application tests were made with an 8-in. piston travel, while the code specifies 4, 6 and 12 in. piston travel. The committee found that an 8-in. piston travel more nearly approximated actual conditions in road service, and therefore felt justified in making tests under road conditions.

The G-6 brake valve was used throughout the tests.

The report has two appendices, one giving a full explanation of the new Westinghouse type "K" triple valve and the other the complete report of the tests made. This valve was described in the *Railroad Gazette* March 23, 1906. The following is a brief summary of the results of the tests:

Service Application Tests.—This test demonstrated that the K-2 triple valve prevents the back flow of air from the auxiliary reservoirs to the drain pipe, and leakage from the brake cylinder to the atmosphere through the leakage groove which is common to standard triples, thereby insuring maximum equalized pressure in all cylinders in trains of 100 cars or less.

Time of Emergency Application.—The time required to obtain 45 lbs. and 55 lbs. in the brake cylinder was slightly longer than the time specified in the code, this applying to both the H-49 and K-2 types of triples. This can be accounted for as a result of the test being made with an 8-in. piston travel, also with the H-49 to the increased size of feed groove.

Application Test—Emergency.—This test, known as the jumping test, was made with H-49 and K-2 valves on 50-car and 100-car trains. The valves jumped all right, but for the reason given in the test above, they failed slightly in the 55 lbs. time requirement on the 50th car.

Graduating Test, 50-Car Train.—The valves met the requirements of this test. It was not found necessary to make 30 lbs. reduction.

Sensitiveness of the Valve—Service and Emergency Disc Tests.—All the valves applied in service application within the code limits. Four of the valves applied partial emergency with a 10-64-in. disc opening. This action should not have taken place with less than an 11-64-in. disc opening, this showing that some of these valves are more sensitive to emergency applications than is provided for in the code.

Holding Power of the Brake.—The committee did not make this test with the valves.

Release Test.—While this has always been regarded as the most severe test in the code, the results were very satisfactory. While none of the brakes released before the expiration of five minutes, 14 released between five and 10 minutes, 22 between 10 and 15 minutes, 13 between 15 and 20 minutes, and the last in 21 minutes and 9 seconds.

Time of Charging Auxiliary Reservoirs.—This test showed the retarded recharge of reservoirs which would take place at the forward end of a train, and which results in a more uniform recharging of the auxiliary reservoirs in a long train.

Service Application Followed by Emergency.—The valves met the requirements. The tests demonstrated that quick action will follow service application as called for in the code.

In addition to these standard tests the committee made four other tests as follows:

Application Tests.—(a) Comparative tests to show the number of brakes applied with a H-49 and K-2 valves with varying train line reductions.

With a 3-lb. train-line reduction the H-49 failed to apply any brake, while with the same train-pipe reduction (3 lbs.) the K-2 applied 98 of the 100 brakes, and the K-1 applied all of the 100 brakes. With a 5-lb. reduction the H-49 valve applied but 29 brakes out of 100, while with the same train-pipe reduction (5 lbs.) the K-2 triple valve applied 100 brakes. This superiority in the performance of the K type triples is the result of the "quick service" feature. The quick service feature of the K triple results in a much shorter train-pipe exhaust at the brake valve for a given reduction.

(b) Comparative tests to show the rapidity of application with service reductions in train line pressure.

A careful study of records of this test showed a marked superiority of the K type as compared to the H-49 triple and the rapidity of service application of the K type throughout the train. Particular attention is called to one test in which an interval in time of 56½ seconds was shown between brake application on the first and last cars of a 100-car train with the H-49 triples, while the K triple showed but 16 seconds interval. This will go far in preventing shocks when service applications are made.

(c) Time of graduations. This test, supplementing (b), further demonstrated the difference between types H-49 and K triples as regards time of obtaining 10, 25 and 45 lbs. pressure in brake cylinders. The type K valves gave uniformly quicker results in this respect.

(d) Release test, time required for piston to move back in cylinder.

These tests plainly showed the retarded release feature of the K type of triple valve. In every test of the K type of valve, except one, the rear brakes released first. This feature should prove an important factor in preventing break-in-twos on long trains.

The committee is of the opinion that a new code of tests for trains of 75 or 100 cars should be compiled. It would also recommend that the testing rack at Purdue University be redesigned to allow of testing as many as 100 brakes of either 8-in. or 10-in. equipment.

The report is signed by A. J. Cota, T. W. Demarest, E. W. Pratt, F. H. Scheffer, F. W. Brazier.

BRAKE SHOES.

To the President and members of the Master Car Builders' Association:

Gentlemen—The committee on brake shoes, at a meeting held at Indianapolis Oct. 10, 1905, agreed that some inquiry should be made to ascertain the frictional quality of the shoes now being supplied to railway companies in comparison with the specifications of the Association. A circular was issued, requesting the railroad companies to submit shoes for tests, shoes submitted to be taken from service after having been approximately one-third worn. It was requested also that all shipments be made prior to January 1, and it was announced that in case a considerable number of shoes were received, to keep the research within manageable limits the committee would reserve the right to select from the whole number received such shoes for test as seemed to be most representative of the whole collection.

Under this arrangement a total of 100 shoes were received from nine different railroad companies; two of the shipments, however, arriving too late to receive attention during the present year. As the shipments came in, each shoe was assigned a laboratory number, the first having been given No. 151 and the last No. 251.

All shoes received were delivered to the Engineering Laboratory of Purdue University, where they will be held for future reference or for further tests. The tests were made under the direction of the university, the work being in the immediate charge of Prof. W. O. Teague.

It had been requested that each shoe be marked with a statement of the service from which it had been taken. In cases where the accompanying statement showed that the shoe had been taken from freight service, it was tested upon a cast-iron wheel only; where the statement showed that it had been taken from passenger service it was tested on a steel-tired wheel only, and where no statement as to service accompanied the shoe it was tested on both cast-iron and steel-tired wheels.

The results disclosed the fact that of the 15 shoes tested on the cast-iron wheel, three (Nos. 179, 183 and 209) completely met the specifications of the Association. Eleven of the 15 (Nos. 158, 172, 175, 179, 183, 186, 194, 200, 205, 209 and 220) met the specifications as to the mean coefficient of friction, but eight of this number exceeded the limits allowed at the end of the stop. Five shoes (Nos. 161, 178, 179, 183 and 209) met the specifications as to the rise in the coefficient at the end of the stop. Of the nine shoes tested on the steel-tired wheel, all met the specifications as to the mean coefficient of friction during a stop, but all failed to meet the specifications as to rise in the coefficient of friction at the end of the stop.

The committee would call attention to the fact that while the specifications provide for a minimum coefficient of friction they do not fix a maximum, also to the fact that at least two shoes which were tested possess frictional qualities which are far in excess of the minimum values specified. While a high coefficient of friction is, in the abstract, a desirable characteristic to be possessed by a brake shoe, operating conditions make uniformity of action desirable. For example, the records of the Association show that a large amount of attention has been bestowed upon the triple valve for the purpose of securing uniformity both in time and intensity of its action, that the surging of trains may be prevented. But the retarding force which is set up through the action of the brakes is as much a function of the frictional qualities of the brake-shoe as of the action of the triple valve. Assuming all cars of a train to have the same brake leverage and to be equipped with triple valves possessing identical characteristics, if the frictional qualities of the brake-shoe are disregarded, that car which is fitted with shoes developing a high coefficient will tend to stop more quickly than an

adjoining car having brake shoes possessing inferior frictional qualities. If variations in the coefficient of friction of brake shoes are allowed to become great, the surging of the several cars making up the train is likely to become severe. A brief summary of the tests is as follows:

Mean Coefficient of Friction Developed upon a Cast Iron Wheel under a Brake-shoe Pressure of 4,152 Lbs.

Brake shoe No.	Coefficient Of friction.	Coefficient Of friction at point 15 ft. from stop.	Brake shoe No.	Coefficient Of friction	Coefficient Of friction at point 15 ft. from stop.
Values provided for by specifications	20.0	7.0	179	33.2	6.3
			183	37.4	2.6
			186	21.3	8.6
158	20.0	5.2	194	22.3	7.6
161	21.6	2.2	200	20.3	6.9
163	21.3	7.0	205	21.4	7.7
172	20.6	6.9	209	23.8	5.5
175	27.2	7.0	214	19.3	6.7
178	17.7	6.4	220	24.4	7.0

Mean Coefficient of Friction Developed upon a Steel Tired Wheel under a Brake shoe Pressure of 4,152 Lbs.

Brake shoe No.	Coefficient Of friction.	Coefficient Of friction at point 15 ft. from stop.	Brake shoe No.	Coefficient Of friction	Coefficient Of friction at point 15 ft. from stop.
Values provided for by specifications	14.0	7.0	175	18.4	12.4
			178	16.7	9.2
			179	22.8	7.8
158	17.0	9.0	205	16.3	8.9
161	14.8	10.1	209	16.0	11.1
163	18.9	8.8	215	16.5	10.8

Thus far the standing committee on brake-shoes has concerned itself with the frictional qualities of brake-shoes. The question has often been raised as to whether it would not be practicable for the committee to test the wearing qualities of brake-shoes. Response to inquiries of this kind has uniformly been made to the effect that the processes of the laboratory proceed too slowly to permit such tests to be made, and those inquiring have been referred to road tests as the readiest means of determining the endurance of shoes. The committee is, however, convinced that many interests would be served if manufacturers, in submitting shoes for tests, could be given a statement covering wearing qualities, as well as a statement covering coefficient of friction. It is also possible that if a satisfactory test could be formulated, specifications covering wearing qualities might be framed.

In its consideration of this matter, the committee has reached the conclusion that such tests are possible provided some additional mechanism could be attached to the testing machine. The purpose of the proposed addition to the testing machine would be to permit a shoe to be brought in contact with the wheel of the testing machine for a predetermined interval, after which it would be automatically raised from the wheel and remain in released position for another and a much longer interval, after which it would again automatically make contact with the wheel. It is believed that by such a cycle, any shoe could be given a definite amount of exposure to wear and that by the automatic action of the machine in alternately making the application and release, all chances of excessive heating would be avoided.

Mr. Fritz Ernest, instructor in Car and Locomotive Design, Purdue University, undertook a study of the problem with the result that the details of a satisfactory mechanism have been designed. The cost of making the proposed additions will be between $300 and $400.

In conclusion, to summarize its report, the committee would call attention to the following matters:

1. That shoes taken from service have in most cases met the requirements of the Association with reference to the mean coefficient of friction to be developed during a stop.

2. That shoes taken from service have in most cases failed to meet the requirements of the Association with reference to the rise in the coefficient of friction at a point 15 ft. from the end of the stop.

3. That shoes are now in service which give a coefficient of friction so much in excess of the minimum specified as to permit great variation in braking effect. The logic of the situation would seem to require, either that the present specification be raised, or that a maximum coefficient as well as a minimum be specified.

4. That it would be well to equip the Association's testing machine for determining the wearing qualities as well as the frictional qualities of brake-shoes, and to this end we would recommend that the question of proceeding with the construction of such equipment be referred to the Executive Committee.

The report is signed by W. F. M. Goss, Wm. Garstang, Geo. W. West.

REVISION OF STANDARDS AND RECOMMENDED PRACTICE.

The committee has few changes to suggest. It recommends the appointment of special committees to investigate and report on changing standard height of couplers and the design of passenger car journal box and pedestal for journals 4¼ in. x 8 in. and 5 in. x 9 in.; changing the wording of part of the Standards referring to protection of trainmen to conform to the drawings and striking out from among the miscellaneous paragraphs that one relating to the storage of private line cars. The report is signed by C. A. Schroyer, T. S. Lloyd and M. Dunn.

Cracked and Leaky Mud Rings.

At the recent convention of International Railway Master Boiler Makers the subject of cracked and leaky mud rings was one of the principal topics discussed. In the three brief papers presented on the subject it was agreed that the corner is the place where trouble develops. As a general thing, in the case of light single-riveted rings the crack will start at the top of the inside corner and work down and through it along the line of stress. Where the rings are double riveted the crack will start on the end close to the corner at the bottom and run up to a rivet hole, and there stop. It would appear that the failure in the case of the light ring is due to the stresses set up by variations in expansion, while those in the heavy ring are caused by the pounding of the ring on the frame or its supports.

A crack of this kind can be repaired by applying a copper patch to the bottom of the ring over the crack, first taking care to chip the face of the ring down flush with the edges of the sheets. The patch itself should be put on with patch bolts, and allowed to lap over the bottom edges of the sheets. Where the crack extends all the way through the ring, however, it will hardly be worth while to attempt to patch it, as the stresses will be the same as those that caused the original failure, and there will be a second one and leakage. Hence patching under these conditions is only a temporary expedient. The only real remedy is to remove the ring and weld the corner. A patch will sometimes hold, however, when the crack merely extends up into the rivet hole.

As prevention is better than cure or mending, it is well to take pains with the designing of the ring. The aim should be to get a corner that will resist the great stresses to which it may sometimes be subjected. For this purpose the corners of light rings may be raised. Thus something will be added to the strength. Sharp angles or short radii on the inside should be avoided, as more likely to cause a crack to start than where the curve is easier. A radius of at least 2½ in. should be used at this point, and the surface milled so that the sheet may come down smooth and tight against the ring. It is also well to have the corners extended with a flange ¾ in. thick forged on the inside, so that the inside sheets may have three additional rivets. When a mud ring has been made and applied along these lines, and the sheets have a bearing for the full depth, and the calking and riveting has been well done mechanically, it is difficult to see how it can be improved.

The fact that good work is to be done on the sheets must not be lost sight of, for much depends upon proper laying, if leaky corners are to be avoided. For this it is well to heat them to a flanging temperature after the firebox has been put together and the mending is in position. In doing this a fuller of the proper size to suit the radius of the corners of the mud ring should be selected so that the sheet may be set back tight, for there is no advantage in using a 4-in. mud ring and having the sheet in contact with it for only half its width. The benefit of the full width of ring should always be obtained. In order, too, that the sheet may be made to lie close to the ring it should be fullered 3 in. or 4 in. above the top of the latter, depending on the distance that it stands off when first applied. This is an important matter, and if the suggestion is followed it will avoid a sharp offset in the sheet at the top of the ring, besides keeping the sheet snugly in position at this point. Cases are known where this has not been done, and the sheets stood off as much as ¼ in. at the top, although the calking edge was tight.

A very good method of laying up firebox sheets, especially when renewing them, is to use sufficient material so as to have a long scarf on the side sheet, which will extend around the inside corners when the ring is in place. This may then be raised to a red heat by an oil burner, and the metal set up solidly against the ring with a fuller. The holes should be counterbored and the rivets driven on the inside. When fireboxes are fitted in this way they will be satisfactory. The top of the ring should also receive attention by being rounded off on the edge and not left with a sharp corner, which is apt to cut into and injure the sheet.

These may all seem to be trifling matters in themselves, but probably 75 per cent. of the leaky mud rings are due to an improper laying up of the sheets. The best method of remedying leaking will frequently be found to be to remove the rivets at the corner, close the sheets up tight against the ring, and redrive the rivets. This should invariably be done if the ring still continues to leak after it has been well calked. Continued calking is of little use. Cases have even been observed where the metal has been entirely cut away without stopping the trouble. Cast steel mud rings are being introduced, and are working well as a whole. They are giving no trouble from breakage, but they should be most carefully inspected before using, as they are apt to be honeycombed with blowholes that will cause leakage.

The North China Railroad from Pekin's port, Tientsin northeastward into Manchuria, parallel with the Chinese Eastern Railroad (late Russian), is to be extended by the Japanese about 40 miles to Fa-Ku-Men, where it will be about 30 miles west of the

Chinese Eastern. This new line will be near to and parallel with the borders of the province which is under the protectorate of Japan, and will make it easier to defend. The country through which it extends is very productive, especially in Sorghum (the bread of the country) beans (of which 20,000,000 bushels have been exported in one year from the Manchurian port New-Chwang) and hogs, and ought to support a railroad.

Handling Engines at the Ashpit.

In the paper presented to the International Railway Master Boiler Makers' Convention on this subject by Mr. Batchman, of the Lake Shore & Michigan Southern, a point was made of the necessity for care in the use of feed water. If the water is low it should be replenished before the engine is taken to the ashpit. The engine should be kept in motion as much as possible while the injector is at work. A large percentage of failures due to leaky flues and fireboxes has been traced to the improper handling of engines at terminals and on the ashpit. Feeding water while standing on sidings or over the ashpit will cause tubes to leak nine times out of ten. For that reason the engine should be kept in motion, which causes the water to circulate and prevents it from going to the bottom. Engines will frequently come in from a run of 135 miles or more and be in first-class condition, with not a leak to be found, and then in an hour will be in the roundhouse with half the tubes leaking simply because improperly handled over the pits. The engine should be brought to the pit with the boiler filled. The fire may then be knocked out, dampers closed, front end cleaned and the machine taken to the roundhouse. When there is no work to be done, the fire should simply be cleaned and banked. When washing is to be done, steam should be blown off and the boiler cooled through the check or injector pipe, with the blow-off cock open. But in no case should the water be allowed to drop below the crown-sheet until the bare hand can rest upon the boiler head. In doing this work, all plugs should be removed and the crown-sheet washed first; then the arch tubes and the space above the fire door, after which the barrel, where good results can be obtained by having at least two tube-pockets in the back tube-sheet, which should be removed every month or so for washing the barrel and throat-sheet.

Exhibits at the Atlantic City Convention.

The large and small exhibits at Atlantic City are located on the Steel Pier, with the exception of the large Niles-Bement-Pond driving wheel lathe, for which a special booth has been erected within 10 minutes walk of the pier, and the track exhibits which are located on the side tracks at the Pennsylvania station. The exhibits this year, both in number as well as in the total floor space occupied, greatly exceed any previous year's exhibits at these conventions. A comparison of the present Atlantic City exhibit and of the exhibit held at Manhattan Beach last year is of interest. Last year the official figures show that there were 208 exhibitors, occupying a total floor space of 38,123 sq. ft., whereas this year the number of exhibitors is 254, covering a total floor space of 66,350 sq. ft. The following is a partial list of the exhibits. The remainder will be printed in another list next week.

Adams & Westlake Co., Chicago. Adlake acetylene gas car lighting system; railroad lanterns; non sweating, down draft signal lamps; car hardware, and gas and electric chandeliers. This company also has an exhibit truck, consisting of a demonstration of the Newbold system of electric car lighting from the axle.

American Balanced Valve Co., Jersey Shore, Pa. Various types of semi-plug and high pressure valves, including external admission, reversible, double end and triple end semi plug piston valves, also a semi plug piston valve for passing over ports without bridges, and an American plug piston valve after 2 years and 9 months service; Jack Wilson high pressure double acting valves, internal admission, for low cylinder clearance and external admission three ring type; Jack Wilson slide valve as used on Philadelphia & Reading Atlantic City fast locomotives, and a model of the Walschaert valve motion as used on the Pennsylvania Atlantic type locomotives.

American Brake Shoe & Foundry Co., Mahwah, N. J. Showing the reinforced brake shoe for modern railway service, both steam and electric.

American Car & Foundry Co., New York. All steel electric motor car built at the Berwick Works for the N. Y. Central New York City suburban service. Equipped with Sprague G. E. multiple-unit control and 2 G. E. 69 200 h.p. motors and American Locomotive Co.'s electric trucks.

American Locomotive Company, New York. Baltimore & Ohio consolidated locomotive, fitted with Walschaert valve gear. Erie Pacific type passenger locomotive, electric motor truck for N. Y. C. & H. R. R. R. suburban service; also a trailer truck; and a joint exhibit with the General Electric Co. of the N. Y. C. & H. R. R. R. electric locomotive.

American Lux Light Co., Dunkirk, N. Y. The Lux arc light for vaporizing and burning ordinary kerosene oil on an incandescent mantel as gas. This light is so graduated as to furnish any candle power desired, ranging from 200 c.p. to 1,200 c.p. in one and the same lamp.

American Mason Safety Tread Co., Boston, Mass. Lead and carborundum safety treads for car steps, stations, etc.

American Steam Gauge & Valve Mfg. Co., Boston, Mass. Locomotive steam specialties, such as open and muffled pops, steam gages, blow-off valves, globe and angle valves, chime whistles, air brake records, etc.

American Steel Foundries, Chicago. Cast steel locomotive frames; cast steel driving wheel centers; Simplex brake beam; Simplex driving wheel and coach springs; Simplex car and tender bolsters; cast steel bolsters; cast steel side rods and crossheads; Janney cast steel coupler; the Davis cast steel car wheel; Susemihl roller side bearings; Andrews cast steel side frame, and spring controllers.

American Vibrator Co., New York and St. Louis. Electric vibratory massage motors.

Armstrong Brothers Tool Co., Chicago.—Various designs of tool holders for all purposes.

Baeder, Adamson & Co., Philadelphia, Pa.—Large model of refrigerator car, showing hair-felt insulation.

W. C. Baker Heating & Supply Co., New York.—Baker car heaters and steam attachments.

Barnett Equipment Co., Newark, N. J. Demonstration of the Barnett Connector automatically coupling the steam heat, signal and air-brake service and safety hooks (in lieu of safety chains) between cars.

Besly, Chas. H., & Co., Chicago.—Spiral-grooved steel grinding disks; heavy spiral cloth and paper circles; Helmet temper taps for threading nuts; Helmet-Babbit for bearings, Helmet oil and Helmet grease cups.

Bettendorf Axle Co., Davenport, Ia.—Bettendorf passenger, freight and tender trucks; passenger I-beam truck frame; removable journal box truck frame and riveted arch bar truck frames.

Bleibtrey, John E., Waterford, N. Y.—McAndrews locomotive rod-key.

Bordo, L. J., Co., Philadelphia, Pa.—Blow-off valves, hydraulic valves and swing joints for locomotive and tender connections.

Bowser, S. F., & Co., Fort Wayne, Ind.—Oil house equipment for railroads and factories; also shop tanks, cabinets, etc.

Boyd, Jas., & Bro., Philadelphia, Pa.—Complete fire fighting equipments for shops, including the "Keystone" fire extinguishers, "Boyd's Champion" chemical engine, 1,250 ft. of 1-in. "Electric" hose made in one piece; also air, steam heat and signal hose.

Brady Brass Co., Jersey City, N. J.—Cyprus bronze locomotive castings and bearings; Cyprus bronze journal bearings; motor bearings for electric railways; babbit metal solder; battery zincs and phosphor bronze.

Buckeye Steel Castings Co., Columbus, Ohio.—Major coupler for freight cars; Ohio passenger coupler and a number of old Major freight car couplers which have been in service for 2 years and more; also the Buckeye cast-steel yoke, adapted for any and all kinds of draft gears.

Butler Draw-bar Attachment Co., Cleveland, Ohio.—Butler draw-bar attachments.

Cardwell Mfg. Co., Chicago.—Cardwell friction draft-gear and Cardwell rocker side bearings.

Carey, Philip, Mfg. Co., Lockland, Cincinnati, Ohio.—Plastic freight car roofing; building roofing, locomotive boiler lagging; train pipe covering, and magnesia and asbestos goods of all kinds.

Chicago Car Heating Co., Chicago.—Full-sized models of the vapor system of car heating, in operation; also steam specialties.

Chicago Pneumatic Tool Co., Chicago.—Boyer pneumatic hammers; Keller pneumatic drills and other pneumatic tools for railroad use; Duntly air cooled electric drills; electric grinders; also a duplex steam two stage air compressor fitted with mechanically-operated inlet valves. The compresses supply air for operating a number of the compressed appliances on the Steel Pier.

Chicago Railway Equipment Co., Chicago.—The "Monitor" car bolster; National Hallow, Creco, Diamond and Kewanee brake beams; Creco roller-side bearings, and the "Creco" journal box and lid.

Cleveland Pneumatic Tool Co., Cleveland, Ohio.—Reversible and non-reversible air drills; wood boring machines; electric drills; pneumatic shipping, calking, beading and riveting hammers; pneumatic drift bolt drivers; Bowes hose-coupling and plain and armored air hose.

Coe Brass Mfg. Co., Ansonia, Conn.—Patent Extruded Brass in step nosings, step treads and platform bindings; car door, window and cave moldings; architectural and automobile moldings; special shaped bars and rods and extruded metal in various forms to supersede castings.

Columbus Pneumatic Tool Co., Columbus, Ohio.—The U. & W. piston air drills; Dunlop piston air drills, and the Ulrich "Perfect" flue roller.

Commercial Acetylene Co., New York.—Acetylene gas lighting fixtures and apparatus for the storage of acetylene gas in cylinders filled with porous substance and acetone. This system is shown in operation on a New York, New Haven & Hartford passenger car on track; also acetylene locomotive headlight; locomotive marks; yacht searchlight and portable table lamps.

Consolidated Car Heating Co., Albany, N. Y.—Steam car heating apparatus; automatic steam couplers; automatic traps; heavy valves and fittings; electric heaters; regulating switches, and the McElroy automatic axle lighting system shown in operation.

Consolidated Railway Electric Lighting & Equipment Co., New York. "Axle Light" system for electric car lighting, showing new type "D" dynamo running at all speeds without variation in current output or voltage, the current and voltage being controlled by the new "Kennedy" regulator.

Crandall Packing Co., Palmyra, N. Y. Crandall packing for air pumps, throttle valves, etc.

Crescent Machine Co., Leetonia, Ohio. Band saws; saw tables; joiners and other woodworking machinery.

Crosby Steam Gage & Valve Mfg. Co., Boston, Mass. Recording gages, steam and hydraulic gages, safety valves, locomotive chime whistles, globe and angle valves and Johnstone blow-off cocks.

Curtain Supply Co., Chicago. Car curtains fitted with Forsyth No. 86; Forsyth "Ring"; Keeler eccentric and Burrowes roller tip fixtures; also Acme and Climax cable fixtures, as well as a full line of curtain materials.

Davis, John, Co., Chicago. Steam specialties; air hose couplings; flexible steam joints; reducing valves; back pressure valves and swing joints.

Davis Pressed Steel Co., Wilmington, Del. Davis solid truss brake beams for 100,000 lb. capacity freight cars; also high speed beams for passenger car service. A special brake beam testing machine of 150,000 lbs. capacity in operation.

Dearborn Drug & Chemical Works, Chicago. Boiler compounds; anti foaming compounds for locomotives, and samples of scale.

Detroit Seamless Steel Tube Co., Detroit, Mich. Seamless steel locomotive flues; also samples of material showing the process of manufacture from the billet to the finished tube.

Dickinson, Paul, Chicago. Engine house smokejacks, including "Vitrilhestos" jacks, cast iron movable engine house jacks; also cast iron ventilators and chimneys.

Dill, T. C., Machine Co., Philadelphia, Pa. 16-in. traveling head Dill slotting machine.

Dixon Crucible Co., Joseph, Jersey City, N. J. Dixon silicate graphite paint and Dixon's graphite lubricants; Dixon's American graphite pencils, graphite greases and plumbago crucibles.

Dossert & Co., New York. Solderless connections and terminals for electrical wires and cables; one sample connection for a 2,000,000 c.m. hard drawn copper cable for the N. Y. C. & H. R. R. R. having a tensile strength of 30,000 lbs.

Dressel Railway Lamp Works, New York. Headlights, switch and signal lamps, semaphore lamps with long burning tanks, interchangeable classification lamps, and steam and water gage lamps, also past and caboose lamps.

Duner Co., Chicago, Ill. Water closets for railroad cars.

Edwards Company, The O. M., Syracuse, N. Y. An entire new exhibit of window fixtures, vestibule trap doors and tin barrel spring rollers for curtains.

Electric Storage Battery Co., Philadelphia, Pa. Latest types of Chloride Accumulator" for car lighting, signal service etc.

Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio. Hollow staybolt bars of various diameters in 10-ft. lengths, also samples of raw materials from which the bars are rolled.

Flannery Bolt Co., Pittsburg, Pa. The Tate flexible staybolt and special tools for applying the same, also illustrations of various installations.

Foster, The Walter H., Company, New York. Two Lagonda stayboit threading and reducing machines and samples of work; also one model tool grinder.

Fox Machine Co., Grand Rapids, Mich. Fox universal wood trimmers.

adjustable saw dado or gauge head; valve seat reamers, heavy tube or flue cutting machines, and the Fox high speed single and multiple spindle drills and light milling machines.

Franklin Railway Supply Co., Franklin, Pa.—McLaughlin lock nuts, McLaughlin metal flexible packing. Franklin driving box lubricator. Franklin pneumatic fire door opener. Franklin Piston Head and Cross Head Attachment and Holland Metal Packing Joint.

Frost Railway Supply Co., Detroit, Mich.—The Harvey friction draft spring shown as applied to the Butler, Farlow, Adjustable and Monarch draft gears.

General Electric Co., Schenectady, N. Y.—Track exhibit of electric locomotive No. 3401 for the New York Central lines.

General Storage Battery Co., New York.—Blum "High Duty" type standard car lighting; 64 in double compartment tanks, as provided for the Pennsylvania Railroad; two types of charging boosters, for charging Blum "High Duty" battery, consisting of a constant speed motor driving a separately excited generator; several sizes of one and two-cell types of Exide storage batteries; standard battery case for railroad signals, and a switch board demonstrating on a miniature scale the operation of fluctuating loads such as met with on electric elevators, electric hoists and electric cars and trains.

Good Car Heating & Lighting Co., New York.—Electric, hot water, steam and storage car heating apparatus.

Gould Coupler Co., New York.—Gould Z-beam steel platform for passenger cars, friction buffer draft gear, freight car couplers, journal boxes, car bolsters and draft arms and friction draft gear, tandem draft gear, for wood and steel sills, spring buffers and tender couplers and brake-beam clamps.

Gould Storage Battery Co., New York.—The Gould electric car lighting system; also storage battery cells for signal use, and portable and stationary type batteries.

Green, Tweed & Co., New York.—Palmetto packing and the Favorite reversible wrench and the "Exacto" packing cutter.

Grip Nut Co., Chicago.—Grip nuts from ⅜ in. to 1¼ in.

Hale & Kilburn Manufacturing Co., The, Philadelphia, Pa.—Full line of car seats for all service, including both single and double reclining chairs.

Edwin Harrington Son & Co., Inc., Philadelphia, Pa.—Differential, screw and spur-geared chain hoists.

Heath & Milligan Mfg. Co., Chicago.—Steel panels showing "Ferrigo" joint; also crystals showing coach and car colors.

Heywood Bros. & Wakefield Co., Wakefield, Mass.—Seats for street and railroad cars; also brass model showing mechanism of the Wheeler seat.

Home Rubber Co., Trenton, N. J.—Samples of "H. R. O." sheet packing and **sectional tubular gaskets; also air brake and steam hose, throttle packing and** inlaid rubber matting, as well as a full line of mechanical rubber goods.

Hunt Spiller Mfg. Corporation, Boston, Mass.—Hunt Spiller gun iron castings for locomotives such as eccentrics, eccentric straps, cylinder bushings, cylinder packings, piston valve packing, piston valve cages, driving boxes, driving box shoes and wedges, cross-head shoes and gibbs, superheater headers, gears, etc.

Homestead Valve Mfg. Co., Pittsburg, Pa.—Homestead valves, including straight-way, three-way, four-way, locking cock and locomotive blow-off valves.

Independent Pneumatic Tool Co., Chicago.—Pneumatic tools and appliances, including "Thor" pneumatic drills, hammers, air turbines, flue rollers, air operated cold saws, etc.

Ingersoll-Rand Co., New York.—Pneumatic tools, including drills and hammers, also motor hoists, forges, etc.; also a Class H. C. compound air compressor. This compressor is in operation and furnishes air for operating pneumatic tools on the Steel Pier. An Imperial Class X air compressor is also on exhibit.

H. W. Johns-Manville Company, New York.—"Transits," asbestos smoke jack and fireproof lumber; Portland sectional conduit; asbestos textile materials, fibres and cements; Keystone hair insulator, roll fire felt, asbestos mill board, pipe coverings, cement felting, Kearsarge flange joint packings and gaskets; Standard piston-rod packing, Canada asbestos wick packing; asbestos roofings; Keystone combination pump packing, Vulcabeston pump packing, union washers and throttle-rod packing and, 85 per cent. magnesia and fire felt and sectional boiler lagging.

Johnson & Johnson, New Brunswick, N. J.—Equipments for first aid to the injured, specially designed for railroad use. The booth is made up exclusively of the products of the company.

Philip S. Justice Co., Philadelphia, Pa.—Reliance hydraulic jacks and Justice spring power hammers.

Kennicott Water Softener Co., Chicago.—Photographs of water softener installations, also map showing location of the company's apparatus on the various railroads of this country.

Kent Co., Edward R., Chicago.—Allen's high-speed tool steel and carbon steel high speed twist drills, also samples of the ingredients used in making this steel.

Landis Machine Co., Waynesboro, Pa.—Bolt threading and nut tapping machines; also samples of work.

Landis Tool Co., Waynesboro, Pa.—No. 3, plain grinding machine and a No. 16 gap railroad grinder, also samples of work.

Latrobe Steel & Coupler Co., Chicago.—Chicago, Melrose, Latrobe, Lewis-Seedy pilot and tender couplers, Goodman wrecking hook; repair knucklers and pivot pins.

Locomotive Stoker Co., The, Chicago.—The W. H. Strouse automatic locomotive stoker in operation.

Lupton's Sons Co., David, Philadelphia, Pa.—Automatic sheet metal window frames and sashes, glazed with wire glass, ornamental copper panels, skylights, etc.

Maccood & Co., Walter, Cincinnati and New York.—Oil rivet forge; **"Buckeye" light; whitewash sprayer; tire expander; sand blast and Buckeye** heaters, compound air type and independent type, also an acetylene torch light.

McConway & Torley Co., Pittsburg, Pa.—Janney freight couplers; Kelso freight couplers; Pitt freight couplers; Kelso tender couplers; Kelso pilot couplers; Janney passenger car couplers, and Buhoup 3-stem coupler, the Buhoup 3-stem coupler applied to standard steel platform.

McCord & Co., Chicago.—Gibraltar bumping posts; McCord journal boxes, draft gear; spring dampeners. McCanna force-feed lubricators for both car and locomotive use in operation. McKim gaskets; an an hydraulic testing machine for showing the capacity of draft gear.

Manning, Maxwell & Moore, New York.—Grimsley automatic machine reamer and a Moore twist drill grinder; also The Hancock Inspirator Co.'s inspirators and ejectors; steam and check valves and whistles; The Hayden & Derby Mfg. Co.'s metropolitan injectors and ejectors; The Consolidated Safety Valve Co.'s safety valves; The Ashcroft Mfg. Co.'s steam gages, air gages, hydraulic gages, vacuum gages, and the Edson recording steam gages and indicators and planimeters.

Mason Regulator Co., Boston, Mass.—Full size models of the Mason locomotive reducing valve and Mason regulator.

Michigan Lubricator Co., Detroit, Mich.—New type of double, triple and quadruple sight feed lubricators with the sight-feed glasses around the oil reservoir as well as the displacement automatic drain stem which drains the water from the lubricator, and closes automatically, thus avoiding the loss of oil.

Modoc Soap Co., Philadelphia, Pa.—A demonstration of the "Perfect" car washer on a car at the Pennsylvania station.

Morse Boiler Joint Co., Louisville, Ky.—Metallic flexible joints and steam couplers.

Morse Twist Drill & Machine Co., New Bedford, Mass.—Morse drills, reamers, cutters, taps, dies, chucks, etc.

Moss, Vesper, Allegheny, Pa.—The Moss "Excelsior" car coupler for freight cars, passenger cars and locomotives.

National Mfg. Co., New York.—Monitor and Simplex injectors, both lifting and non-lifting; Buckeye lubricators, 2, 3 and 4 feeds; "Phillips" double safety boiler check; "Freedmans" force-feed lubricating pumps; fire extinguishers; locket washers and testers; oil cups of various designs, and the Coale safety pop valve, etc.

National Car Coupler Co., Chicago.—Working models showing National passenger platforms and platform buffers; National centering yoke and the improved National passenger coupler No. 6; also Hinson emergency knuckle and Hinson draft rigging.

National Lock Washer Co., Newark, N. J.—Nut locks, curtain fixtures, car curtains, sash locks and sash balances.

National Malleable Castings Co., Cleveland, Ohio.—Tower and Climax couplers.

New Castle Forge & Bolt Co., New Castle, Pa.—Bolts, forgings and chains.

New York Air Brake Co., New York.—Forsythe automatic air and steam couplings in operation.

Niles Bement Pond Co., New York.—Niles 90-in. driving wheel chucking lathe in operation, located in a special booth near the Pennsylvania R. R. station, also an office on Steel Pier.

Norton Emery Wheel Co., Worcester, Mass.—The main feature of the exhibit is a column, 15 ft. high, composed of 18-in. "Alundum" wheels, surmounted by a large ball and an American eagle all made of "Alundum." Various forms of wheels and oil stones are also shown.

Norton Grinding Machine Co., Worcester, Mass.—Samples of work, such as piston rods, crank pins, valve stems, etc., done on a grinding machine especially designed for railroad work.

Norton A. O., Boston, Mass.—Norton ball-bearing lifting jacks and "Safe Drop" track jacks.

Page Car Company, Boston, Mass.—Track exhibit of the Page flat bottom dump car.

Pennsylvania Rubber Co., Jeanette, Pa.—Pennsylvania interlocking rubber tiling; pebbled and corrugated rubber matting; "Century" white sheet packing, "Century" tubular gaskets, red sheet packings and tubular gaskets, red, white and black garden hose, suction hose and corrugated tender hose.

Phillips, F. R., & Sons Co., Philadelphia, Pa.—Lathite welding plates and "Velos" high speed twist drills.

Pittsburg Steel Co., Pittsburg, Pa.—"Pittsburg Perfect" electrically welded fence. Fence making machine in operation making about 7 miles of railroad right of way fence per day.

Ralston Steel Car Co., Columbus, Ohio.—Track exhibit of the Ralston flush floor drop bottom steel car.

Rice Geo. R., Mfg. Co., Buchanan, Mich.—Improved high-speed flat drills and chucks, expanding mandrels, boring bars; arch bar drill presses and other improved machine shop appliances.

Rubberset Brush Co., Newark, N. J.—"Rubberset" paint brushes for railroad use.

Jos. T. Ryerson & Son, Chicago.—Lenox bevering shear, Ferguson flue welder, Simplex track and car jacks, Ryerson's key seating machine; model of Ryerson's flue cleaning machine, Ryerson's oil furnace for flue welding, and a number of small tools such as flue cutters, etc.

Safety Car Heating & Lighting Co., New York.—"Standard" system of steam heating. Models showing the system as applied to passenger cars; also various parts of the apparatus cut out to show construction. Safety steam coupling.

Schoen Steel Wheel Co., Pittsburg, Pa.—Pressed and rolled steel wheels, showing the various stages of manufacture.

Seamless Tube Co., of America, Pittsburg, Pa.—Seamless wrought steel locomotive boiler flues, seamless forged steel locomotive safe ends and seamless forged steel locomotive arch or Superheater tubes.

Shelby Steel Tube Co., Pittsburg, Pa.—Seamless steel tubing for locomotive flues, link bushings, and seamless steel locomotive bells.

F. F. Slocomb & Co., Wilmington, Del.—Two portable pneumatic punches; one pneumatic riveter and one Slocomb hot air engine.

Sprague Electric Co., New York.—Sprague electric trolley hoist; also steel armor hose for compressed air or steam.

Standard Paint Co., New York.—Model of the Pennsylvania R. R. roundhouse, covered with Ruberoid roofing. Ruberoid roofing for railroad cars and locomotive cabs; Giant insulating papers, P. & B. and S. P. C. insulation, and Ruberoid permanent colored roofing, flexible metal preservative paints and P. & B. new insulating varnishes baking and air-drying. The exhibition pavilion is covered with Ruberoid colored roofing.

Standard Steel Works, Philadelphia, Pa.—Solid rolled steel wheels; steel-tired wheels, steel tires and springs.

Starrett, L. S., & Co., Athol, Mass.—Full line of mechanical instruments; also hack saws and leveling instruments, steel tapes, etc.

Stoever Foundry & Mfg. Co., Meyerstown, Pa.—Pipe threading and cutting-off machines.

Symington, The T. H., Co., Baltimore, Md.—Journal boxes; ball bearing center plates and side bearings for railroad cars; also a demonstration showing method of grinding side bearing race plates for ball-bearing side bearings.

Underwood Co., H. B., Philadelphia, Pa.—Portable cylinder boring bar; **portable 2-cylinder air motor for driving tools, dome facers, portable valve facing machine, Mongs boring table for lathes and a portable crank-pin turning machine.**

U. S. Metal & Mfg. Co., New York.—The Columbia nut lock; Victor cast steel car replacers; "Perfect" cast-steel car replacers; Gilbert automatic hose reel, the West malleable iron brake jaw; "Almet" lumber stake; "Ideal" draw-bar centering device and the Feusable drop brake staff; also a track exhibit of a car equipped with the various specialties made by the company.

Wagenhorst Co., J. H., Youngstown, Ohio.—Electric blue printing apparatus in operation.

Wells Light Mfg. Co., New York.—Lights of one, three and five burners for contractors and general outside use, tire-heating device and a tripod stand for use in foundries.

Westmoreland Coal Co., Philadelphia, Pa.—Full-size wooden model of standard locomotive tender loaded with Westmoreland screened coal.

Westinghouse Air Brake Co., The, Pittsburg, Pa.—Two 75-car racks of 10-in. freight equipment, combined type, for the purpose of comparing present standard and improved freight equipment; also a comparison of old engine and new "ET" equipments; new 8½ in. cross-compound steam driven air pump; Westinghouse friction draft gear. Westinghouse type "K 1" and "K 2" triple valves shown in section, also No. 5 distributing valve used in connection with new "ET" equipment; American Brake Co.'s automatic slack adjuster for passenger equipment; model of engine truck fitted with equalized brake and slack adjuster, also model of locomotive driver fitted equalized brake gear. Westinghouse Automatic Air & Steam Coupler Co.'s automatic air and steam couplers applied to freight and passenger equipment (shown in model cars); Westinghouse Electric & Mfg. Co.'s enclosed type multiple d. c. arc lamps and the Cooper-Hewitt mercury vapor lamps, also various types of a. c. and d. c. fan motors and different types and sizes of a. c. and d. c. motors, ranging in size from 1/4 h. p. to 15 h. p. The power for operating the various equipments mentioned is furnished by four D 4 E G and one C 4 A G motor-driven air compressors, which are governed by five "J 12" electric pump governors, all built by the Westinghouse Traction Brake Co.

West Disinfecting Co., New York.—Disinfectants for all purposes and apparatus for applying the same.

Western Railway Equipment Co., St. Louis, Mo.—Western drill and car-line pockets. Western brake jaws. Hoerr tandem draft gear. Acme pipe clamps. Lunstrom syphon pipes. Lunstrom eccentrics. Missouri Hoerr Western flush, St. Louis flush, and Interchangeable car doors; Western truck end castings. Economy track adjusters. Western bell ringer, car door fastenings; Fish hook tie plate and brake pins.

Wheel Truing Brake Shoe Co., Detroit, Mich.—A brake shoe fitted with an abrasive for truing and dressing flat and worn wheels.

Whitney Mfg. Co., Hartford, Conn.—Photographs of hand-feed milling machines; 20-in. water tool grinder; "Presto" chuck and collets; Woodruff system of keying, roller and block chains for automobiles, and the Hartford printer for hotel menu cards.

Yale & Towne Mfg. Co., New York.—Three types of chain blocks, including triplex, duplex and differential hoists. Also electric hoists and overhead trolleys. A large assortment of locks, including Yale locks, cabinet locks and padlocks. A full line of builders' and car hardware and Blount door checks.

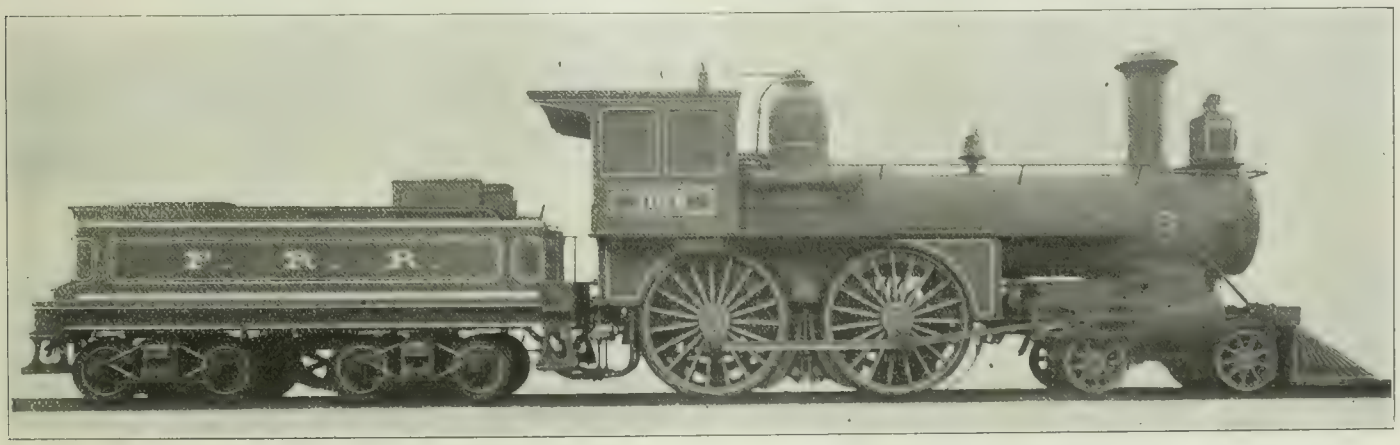
Recent Development of American Passenger Locomotives.

BY GEORGE L. FOWLER.
Associate Editor of the *Railroad Gazette*

In the latter part of the seventies it was thought by a goodly number of American railroad men that the locomotive had reached the upper limit of its power. The standard stroke of practically all road engines in the country was 24 in., and 16 in. was the diameter of the cylinders, with a few scattering ones of 17 in. and 18 in. for particularly heavy work. The boilers were carrying an average pressure of 125 lbs., with 140 lbs. in exceptional instances, and contained a total heating surface of about 1,200 square feet. In a discussion before the Master Mechanics' Association it had been the consensus of opinion that 12,000 lbs. was the limit of weight that could be safely placed upon a single wheel. Under these limiting conditions we find that the passenger locomotive was what was long known as the American or eight-wheeled type, having two pairs of driving wheels and a four-wheeled truck in front, and weighed complete in working order about 80,000 lbs., of which 58,000 lbs. was upon the drivers.

The boiler was of ⅜ in. steel and was carried with the center of its shell about 6 ft. 6 in. above the rails. The firebox was narrow and dropped down between the bar frames, the upper member of which was usually 4 in. square. The length was also limited by the distance between the driving axle, and this was, in turn, restricted by the length that it was considered safe to run the side rods. Under these conditions the grate surface of the best engines was about 36 in. wide and rarely more than 6 ft. 6 in. long.

At the same time the weights of the sleeping car equipment had increased so that forty or more tons per car was a common figure, and the operating departments of all of the trunk lines were calling for engines to haul heavier trains on a faster schedule.



Standard Eight Wheel Passenger Locomotive of the Pennsylvania Railroad, 1875.

I remember being present at a conference in the office of a superintendent of motive power at the time, when a great variety of propositions were made with the end in view of securing a speed of sixty miles an hour with a heavy train. At the close the statement was made that it was a very simple thing to build a locomotive that would run at a speed of sixty miles an hour. But to build one that would attain and maintain that speed with a train of a dozen cars was an entirely different proposition.

The question then, as now, was a matter of steam, and most of the attempts at improvement were made along the lines of increasing the efficiency of the current type of boiler. Firebrick arches were introduced to a small extent, and the extended front fad, that made the locomotive look like a pouter pigeon, swept the country.

When designs had apparently reached their limits, a revolution was created by the introduction of the class K locomotive upon the Pennsylvania Railroad by Mr. Theodore N. Ely, who was at that time superintendent of motive power. He simply raised the boiler and placed the mud ring on top of the frames, above the driving axles, by which he was enabled to add about 7 in. to the width of the grates, while the length was limited only by the ability of the fireman to properly distribute the coal.

This move, on the first engine so built, increased the grate area from about 18 sq. ft. to 35 sq. ft. and the heating surface from 1,150 sq. ft. to 1,240 sq. ft. The steam pressure was held at 140 lbs. per sq. in. The weight in working order was 96,700 lbs., of which 70,600 lbs. were upon the driving wheels.

Many and dire were the predictions as to the instability of the new design, because of the unprecedented height of 7 ft. 5¼ in. at which the center of the shell was placed above the rails. But the machine not only did not upset, but ran with remarkable steadiness, and demonstrated from the outset the safety of the arrangement.

The advantages were so apparent that the wide firebox boiler at once became the vogue, and it was ordered upon new locomotives in constantly increasing numbers. The stability being established, the boiler was raised and increased in diameter until by 1892 we find engines of the eight-wheeled type in service weighing 123,000 lbs., of which 82,000 lbs. were upon the driving wheels. Such engines had cylinders 19 in. in diameter, with a piston stroke of 24 in. The boiler had a shell of 58 in. in diameter, the center of which was 9 ft. above the rails, and contained 1,800 sq. ft. of heating surface, with a grate 8 ft. long and 41 in. wide, while the steam pressure had risen to the unprecedented height of 180 lbs. per sq. in.

It will be at once apparent what a tremendous advance such an engine exhibited in comparison with the light machines of a decade before. The tractive weight, the heating surface and the steam pressures had all been increased by 50 per cent., resulting in a much greater ratio of increase of power for the engine as a whole.

Of course this weight of more than 20,000 lbs. upon the driving wheels could only be used on roads where the rail was heavy and the whole construction of the roadway of the most substantial character. Where light rails were still in service and it was desired to obtain the full benefits of the large boiler and the great total weight on drivers, the ten-wheeled locomotive was used. This had the same four-wheeled truck at the front, but was fitted with three pairs of driving wheels instead of two. Such engines frequently had cylinders 20 in. in diameter, and with the 1,800 sq. ft. of heating surface available, had a weight of about 100,000 lbs. on the driving wheels. This gave a somewhat greater tractive power than the lighter engine of the eight-wheeled type, but had the disadvantage of the extra side rod. So, while such engines did good service, they were not regarded with great favor by the officers of the motive power department, though many of them were built.

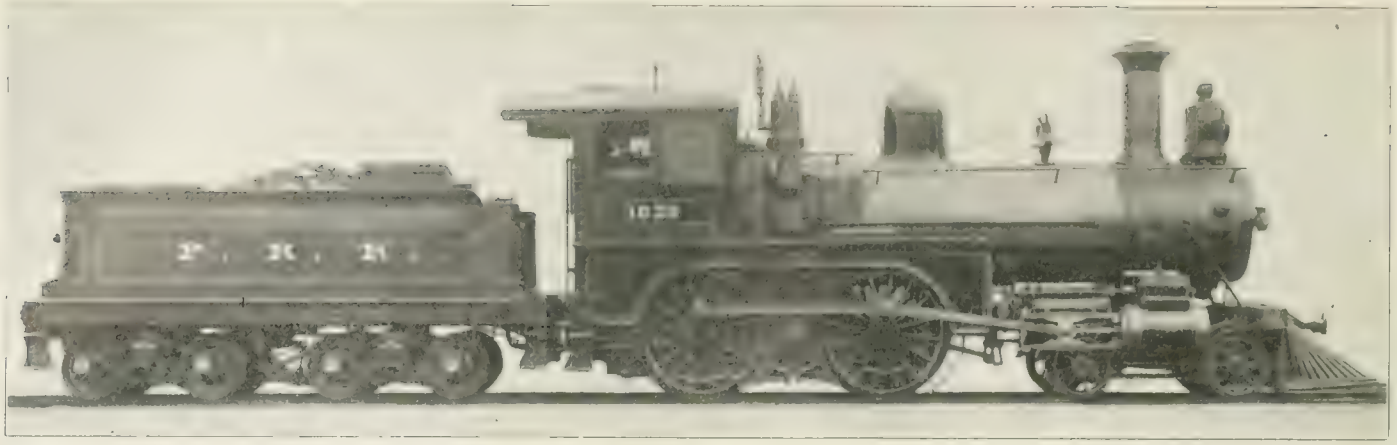
Up to this date the increase of heating surface had been obtained by an increase in the diameter of the shell and in the number of tubes placed therein, no change having been made in the diameter of the latter and but little in their length. Two inches had been the standard diameter of tubes in all American engines for many years, and their length had been about 12 ft., with an occasional spurt of 13 ft.

Once again the railroads were confronted with the same problems that they had faced a dozen years before. The limits of locomotive growth seemed to have been reached. The only apparent solution was to increase the length of the tubes. This was cautiously undertaken. There was the fear that the vibration of longer ones would cause undue leakage at the firebox, while the looked for gain in efficiency was but slight because of the rapidly decreasing evaporative power at the front end.

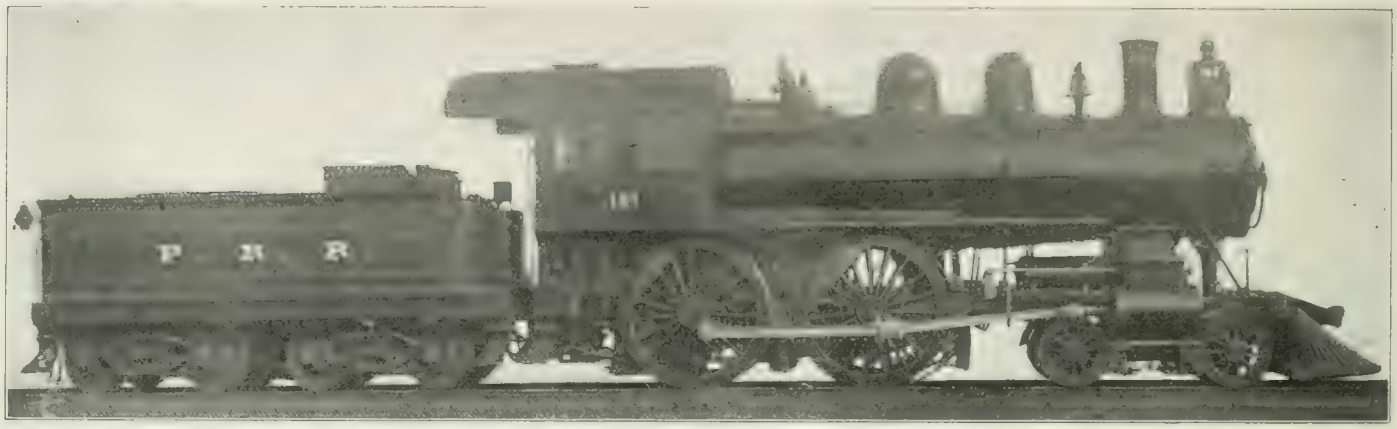
As in 1881, Mr. Ely solved the problem of the narrow firebox by putting a wide one on top of the frames, so in 1893 the Baldwin Locomotive Works solved the problem of the so-called wide firebox by the introduction of a still wider one, in the engine Columbia, which was exhibited at the Chicago Exposition. As this engine had a two-wheeled truck in front, and as the American railroad man is prejudiced against this arrangement for high-speed work, only this one exhibition engine was built, and the type was at once modified into what is now known as the "Atlantic." This engine has a four-wheeled truck at the front, followed by two pairs of driving wheels, both of which are in front of the firebox, the rear pair being the main drivers. The firebox is carried by a single pair of trailing wheels of a somewhat larger diameter than the forward truck wheels, but still small enough to permit the bottom of the firebox to extend out over them.

With this arrangement the width of the firebox was limited only by the clearances of the permanent way, and the length was left unrestricted as heretofore, an increase merely involving an increase of engine length.

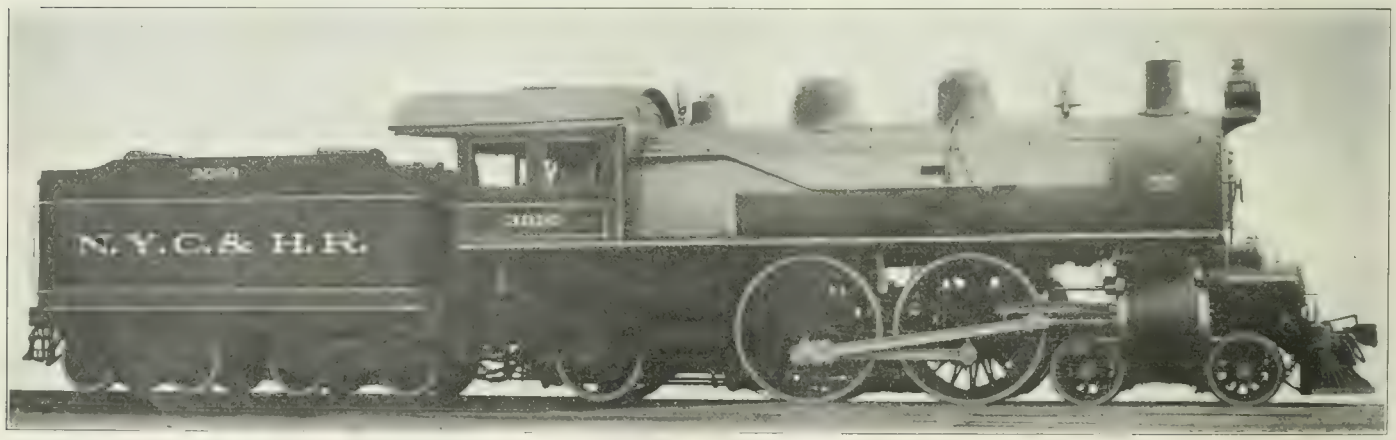
Naturally the first engines built on these lines were not very



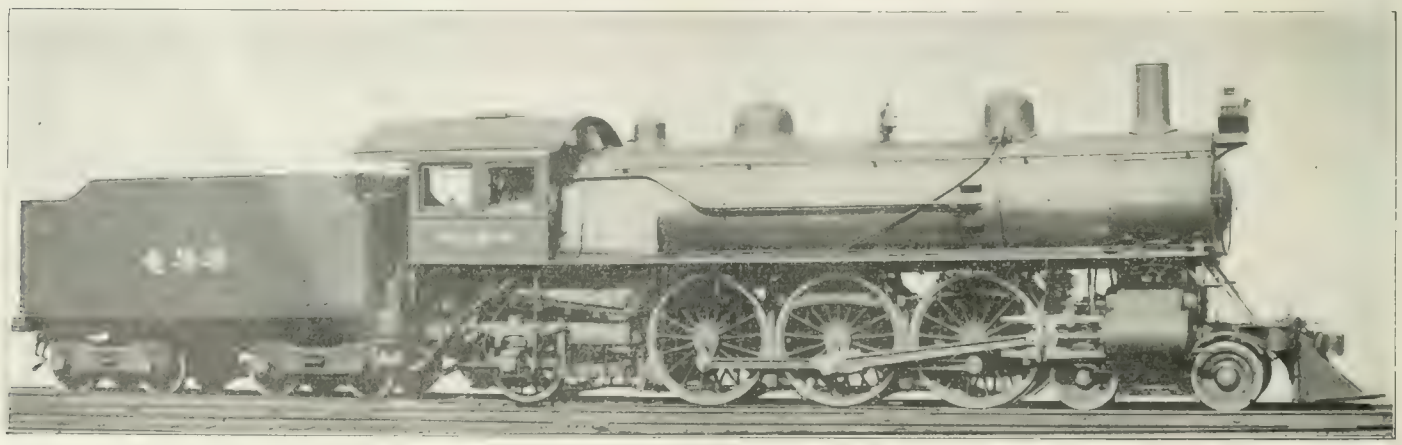
Class K Locomotive, Pennsylvania Railroad, 1882, for Passenger Service.



Eight Wheel Passenger Locomotive for Pennsylvania Railroad.



Atlantic Type Passenger Locomotive for New York Central & Hudson River.



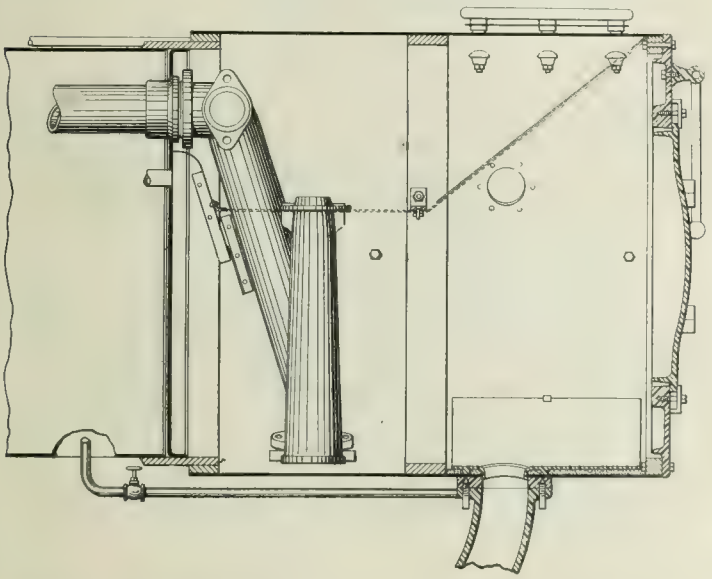
Pacific Type Passenger Locomotive for the Michigan Central.

much larger than those they were to supersede. We find in the Columbia, for example, that there was 83,140 lbs. upon the driving wheels, while the heating surface was but 1,478 sq. ft. Such conditions, however, with such opportunities, could not be expected to stand; though at a date of more than a year after the close of the World's Fair we find engines of the Atlantic type sent out with 86,000 lbs. upon the driving wheels and a heating surface of less than 1,600 square ft. The advantage gained by the new construction lay solely in the decreased rate of combustion upon the grates.

Soon the demands for higher sustained speed for heavy trains began to make itself felt, and the boiler of the Atlantic type of engine began to grow. We find a lengthening of the tubes, an increase in the diameter of the shell and the number of the tubes, until at the opening of the new century, the Pennsylvania Railroad presents, as its latest development, an engine of this class having a firebox 8 ft. wide and 8 ft. 6 in. long; a total heating surface of 2,320 sq. ft. and a weight on the four driving wheels of 101,500 lbs., or more than twice as much per wheel as was considered proper practice 20 years before. Still, even in this engine the tubes had not grown very much, as they are still but 13 ft. long between the sheets. The cylinders were 20½ in. in diameter, with a piston stroke of 26 in.

Since then these dimensions of cylinders have not been greatly exceeded, 21 in. in diameter being about the upper limit for passenger service, but the tubes have been lengthened to 16 ft. 6 in. for common practice and even to 20 ft. on occasions, and a heating surface of more than 3,100 sq. ft. obtained. The diameter of the boiler has risen to 72 in., in which more than 300 tubes are placed, while the steam pressure carried stands at 200 lbs. or more per square inch.

The Atlantic type of engine shows the lines along which the



General Smokebox Arrangement on American Locomotives.

passenger engine has been developed, and with it we find modifications of the ten-wheel or 4-6-0 type.

A recent example of this modification is to be found in the Pacific, or 4-6-2 type, in which the trailing truck of the Atlantic is added to the ten-wheeler.

Such an engine of modern dimensions would weigh about 230,000 lbs., of which 150,000 lbs. would be on the driving wheels. It would have a cylinder diameter of 22 in., with a piston stroke of 28 in. The boiler would carry a steam pressure of 200 lbs. per sq. in. and have a firebox measuring 9 ft. by 6 ft. 3 in., and a shell 6 ft. in diameter, containing 354 tubes 20 ft. long, with a total heating surface of 3,894 sq. ft. This may be regarded as the latest development in the increase of power of the passenger engine.

Let us now glance back and see what this growth really means. In the seventies our large engines had cylinders 17 in. in diameter, with a stroke of 24 in., working with a steam pressure of 140 lbs per sq. in. Now these dimensions are 21 in. and 26 in., respectively, and the boiler pressure 200 lbs., making an increase in tractive effort of a little more than 151 per cent., which corresponds almost exactly with the increase in heating surface from 1,200 to 3,100 sq. ft. In other words, the American passenger locomotive of to-day is capable of doing two and a half times as much work as its predecessor of twenty-five years ago, while if we base the estimate on the heavy Pacific instead of the Atlantic type, 20 per cent. must be added to that, and we have a machine capable of doing more than three times the amount of work that could be done by the heavy engines of the seventies.

It would be but a meager source of pride for the American engineer, if mere bigness was all that he had to show for the work of a quarter of a century. He has, however, far more than this to his credit. The locomotive has not only grown in size but in efficiency. While he has been adding to the dimensions he has been developing and perfecting every detail of the design. In the conventions and railroad clubs he has discussed the machine, item by item, from the nose of the pilot to the drawbar at the rear of the tender.

When Mr. Ely brought out his class K, the valves were so heavy and hard to move that a steam reversing gear was installed to do the work. Then came the balanced valve, and experiment upon experiment was tried until the valves of heavy engines with 20 in. cylinders could be moved more easily than the old ones with 16 in. diameter. This was followed by the introduction and development of the piston valve.

In the machinery of the engine of 1878 cast-iron entered very largely into all parts. Pistons, crossheads and driving boxes were all of this material. As the size of the engines increased, the weights of reciprocating parts tended to become so heavy as to threaten destruction to the machine and the track. Then steel castings were introduced and the weight saved here was put into the boiler to increase the steaming capacity.

In the boiler we find first the almost universal use of the crown-bar for staying. This has been supplanted by the radial stay, or by fireboxes of the Belpaire type. After the firebox was lengthened when placed upon the top of the frames, there came increased trouble with broken staybolts, due to the greater variation in the expansion between the inner and outer sheets. This led to trial upon trial of various forms and flexible stays, and of various classes of metals of which to make them.

The increased duty demanded of the engine called for an increase in coal consumption, and, at the same time the complaints of passengers on the score of smoke nuisance were loud and bitter. The combination of the two led to the work of developing the firebox and front end, with the result that a far better combustion than was dreamed possible in the early days is now attained, and that, too, with but comparatively little production of smoke. The three elements contributing to this are the brick arch in the firebox, the Master Mechanics front end, and the instruction of the engineers and firemen as to the proper methods of firing in order to obtain the desired results. Before the present form of what is known as the front end recommended by the Master Mechanics' Association was brought out, and subsequently modified, the American locomotive carried many and curious contrivances to prevent the production of smoke.

In addition to work on the locomotive proper there has been a great improvement in all the fittings. The air-brake has been a marvelous development, from the straight air of the early seventies to the automatic and thence to the quick action. The headlight, that characteristic feature of the American engine, has been brightened from the oil lamp that merely served to make the darkness visible to the man behind it, to the electric arc that really does illumine the track ahead.

Thus it would be possible to go on through all of the items of construction and find in each a subject worthy of a chapter, by the combination of which that whole has been accomplished which has already been set forth.

In what has been said regarding the development of the American passenger locomotive, attention has been confined strictly to the bituminous coal burning engine, as that really represents typical American practice. Other classes of engines are found in special localities, but their use is restricted. For example, we find, on the roads leading out of the Pennsylvania anthracite coal fields, that the wide firebox of the Wootten type placed above the driving wheels is in universal use, and that it has felt the influence of the growth of the bituminous coal burning engine and shows important modifications along the same lines.

In the extreme southwest the discovery of the oil fields of Texas and southern California placed a cheap fuel at the disposal of the railroads that was at once utilized, and oil-burning engines are extensively used in those regions. But they can never spread over the country as a whole, and the bituminous coal burning engine will always remain the standard.

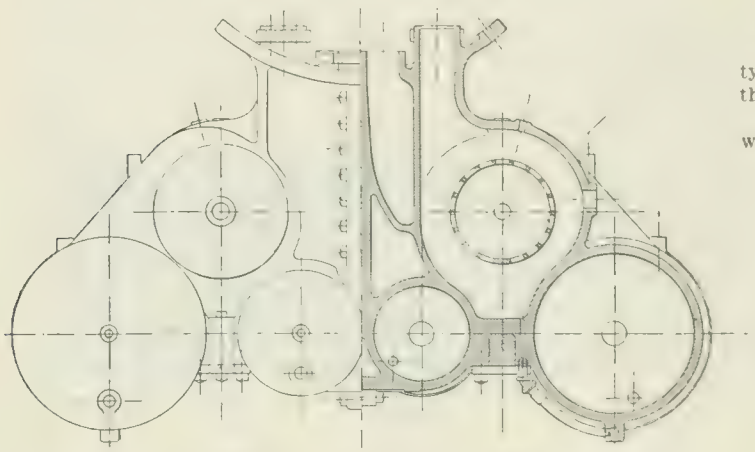
It must not be inferred that the Atlantic type of engine has entirely supplanted the eight-wheeled or the ten-wheeled for passenger service. Such is far from being the case, it merely represents an advanced type of development and should be considered as such. Very many of the older classes are being built every year and will probably continue to be for an indefinite period in the future.

Whether the development of that engine has reached or even approached its final form would be dangerous to say. Twice we have apparently been up to the stopping point but a means was found to cross the barrier and the growth continued. The difference between those past conditions and the present is that then the engines were small and had room to grow, while now they are about out to the limits of the permanent way. Engines that measure 15 ft. from the rail to the top of the stack, that require a clear

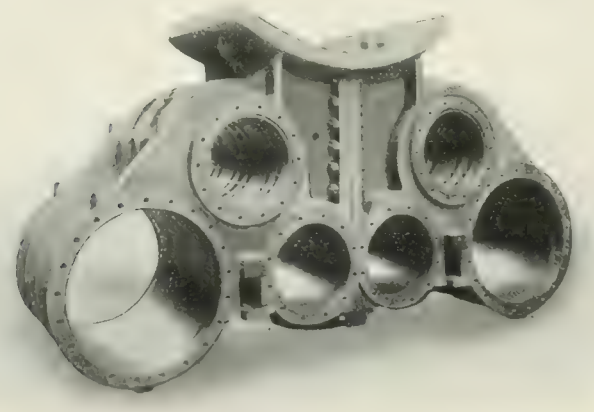
width of 20½ ft. to let them pass, and call for 75 ft. turntables to swing them, are no toys, and if they are made much larger they will call for an increase in permanent way clearances. Indeed, on some roads this is already being done. Finally, we are now facing the limits of elasticity in the materials of the rail and tire, and it remains to be seen as to how much farther the stresses on present material can be carried or if new material be brought out that will meet the increased demands that railroad managers stand ready to impose.

Electrification of the Erie from Rochester to Mount Morris.

A length of 34 miles of the Rochester division of the Erie Railroad, Rochester to Mount Morris, is to be equipped for running cars by electric power, conveyed through an overhead trolley wire, and it is proposed to run trains of one car, or more if needed, each way every hour throughout the day. Electricity is to be bought from one of the companies which are preparing to transmit power from Niagara Falls, about 70 miles. On this long line the current will be transmitted at 60,000 volts. It will be delivered to the railroad through a transformer at Avon, 19 miles south of Rochester and 15 miles from Mount Morris, the transformer converting it to a pressure of 11,000 volts, which will be the pressure on the trolley wire. The design for the line shows wooden poles at one side of the track, 120 ft. apart. The brackets will support over the center of the track a ⅜-in. galvanized steel "messenger" wire, and this in turn supports a [illegible] copper wire, with six intermediate supports between each two brackets. The contact to convey the current to the car is not by a trolley wheel but by rubbing contact with a loop supporting a horizontal transverse wire or rod.



Balanced Compound Cylinders.



Balanced Compound Cylinders.

The company designs to use a passenger car weighing 35 tons, loaded, of which the body is estimated to weigh 11 tons. This will have two 100-h.p. a.c. motors, both on the same truck. The car will be 52 ft. long, over all. The passenger compartment will seat 44 passengers, while the baggage and smoking compartment, 8 ft. long, will have folding seats.

The motors are designed to propel the cars at an average speed of 22 miles an hour, including stops every mile, and the maximum speed on a level will be 50 miles an hour. In accelerating, a car will use 186 k.w. The motor truck will have 36-in. wheels and a wheel base of 6 ft. 8 in. The trailer truck will have a wheel base 14 in. shorter.

The transformer house at Avon will be 28 ft. x 40 ft. x 30 ft. high, and will have three 375 k.w. transformers.

The contract for the electrical work has been given to Westinghouse, Church, Kerr & Company, of New York City, and it is expected to have the work done within four months, or thereabouts.

Balanced Compound Locomotives.

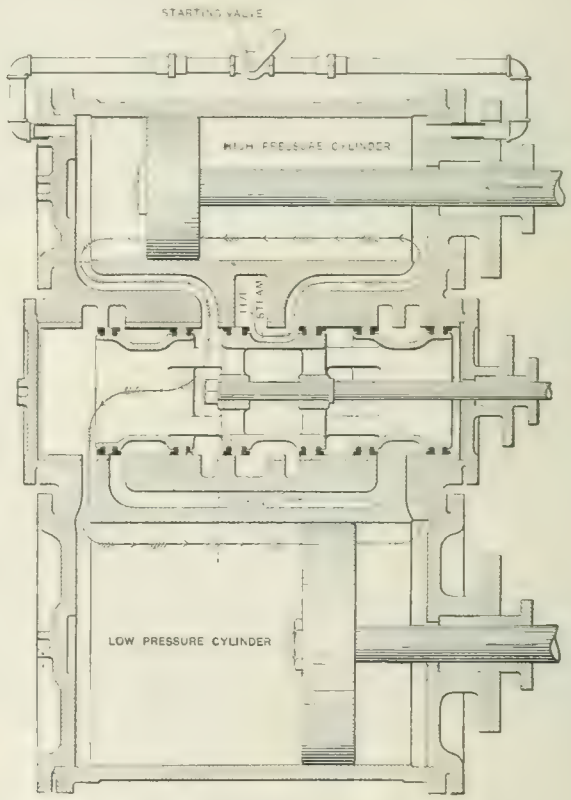
BY H. V. WILLE,
Assistant to the Superintendent of the Baldwin Locomotive Works.

The Baldwin Locomotive Works have built, or have under construction, 281 balanced compound locomotives distributed among a large number of railroads, as the following table will show:

No. of engines	Type	Baldwin Loco. Works Class					Name of road
41	Pacific	12	28	50	¼	D	Atchison, Topeka & Santa Fe
96	Atlantic	10	24	44	¼	C	Atchison, Topeka & Santa Fe
56	Prairie	10	29	52	¼	D	Atchison, Topeka & Santa Fe
20	Atlantic	10	24	44	¼	C	Chicago, Burlington & Quincy
4	Pacific	12	28	50	¼	D	Oregon River & Navigation Co.
15	Atlantic	10	26	48	¼	C	Associated Lines
10	Atlantic	10	24	44	¼	C	Great Northern R. R.
10	Ten wheel	10	25	44		D	Italian Government
8	Atlantic	10	24	44	¼	C	Chicago, Rock Island & Pacific
6	Ten wheel	10	24	44		D	Seoul Fusan R. R.
3	Ten wheel	10	26	48		D	N. C. & St. Louis
2	Ten wheel	10	25	46		D	Chicago & Eastern Illinois
2	Atlantic	10	26	48	¼	C	Erie R. R.
2	Atlantic	10	26	48	¼	C	Pennsylvania R. R.
2	Ten wheel	10	24	44		D	New York, New Haven & Hartford
2	Ten wheel	10	24	44		D	Missouri, Kansas & Texas
1	Atlantic	10	25	46	¼	C	New York Central & Hudson River
1	Ten wheel	10	24	44		D	Chicago Short Line
281	Total						

It is apparent from the foregoing table that the merits of this type of engine are being determined by a court upon whose verdict the railroad world can place absolute reliance.

The progressiveness of the Atchison, Topeka & Santa Fe Railway, however, is largely responsible for the rapid growth in favor of these engines, as this road alone has in operation, or in the course of construction, 193 engines of this type of locomotive with various arrangements of wheel base, and it was the first railroad in the United States to fully appreciate the value of the balanced compound locomotive. They have divisions where balanced compound passenger engines are exclusively used, and the quiet assurance of their roundhouse men responsible for the maintenance of the engines is in strong contrast to the excitement usually prevalent when a new type of power is being used.

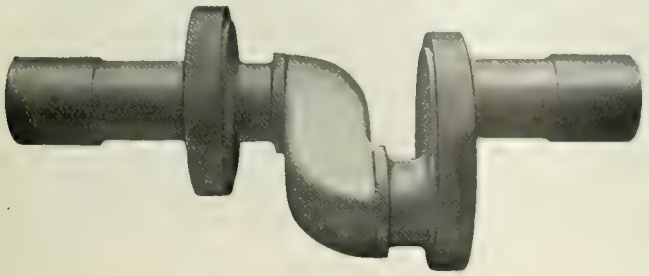


Steam Distribution of Balanced Compound Locomotive.

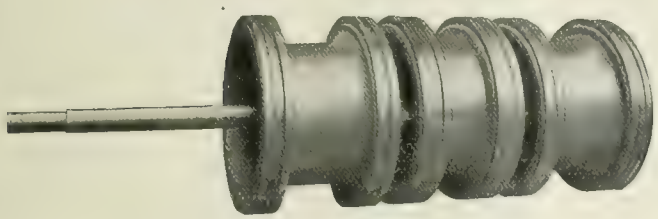
It has been but a step from the four-cylinder Vauclain compound locomotive, developed by the Baldwin Locomotive Works from 1890 to 1900, to the four-cylinder balanced compound of today. The earlier type of engine demonstrated that economy would result from compounding, and that such engines because of the wide port openings could maintain a higher speed than a single expansion engine. They also demonstrated that the use of four-cylinders was not objectionable because of high cost for maintenance or cylinder repairs. They were, however, more difficult to balance, and it was a natural step to accept the crank axle, which had always been looked upon by American engineers with prejudice

and misgivings. This fear, however, has been proven by the test of time to be groundless, as no trouble has been experienced with crank axles of American manufacture. In this American manufacturers have been more successful than their European brethren, because the Baldwin Locomotive Works was able to insist that crank axles should meet certain requirements before allowing them to be made.

The writer was sent abroad with instructions to negotiate for the purchase of 40 crank axles and to make a full report upon the



Built Up 2-Webbed Crank Axle.



Valve of Balanced Compound Locomotive.

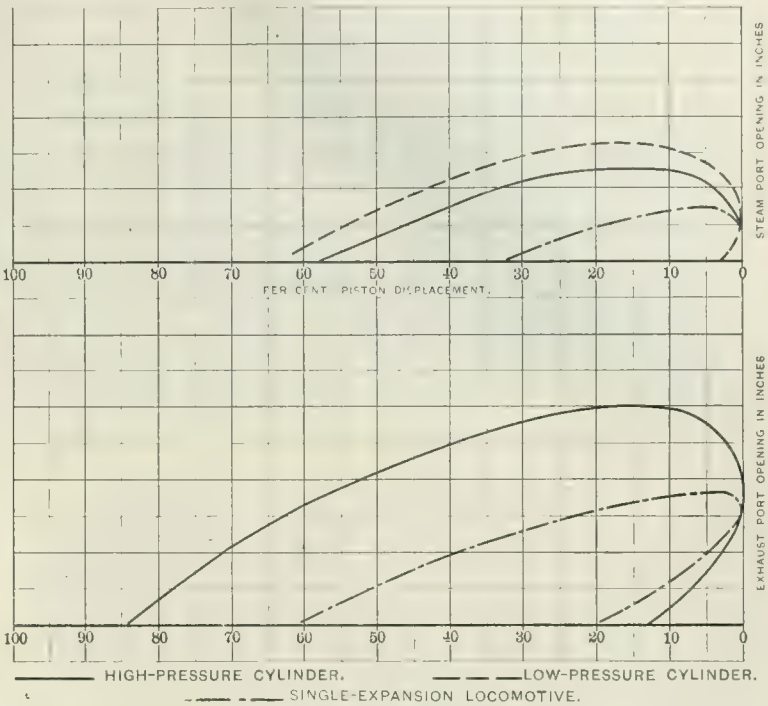


Diagram of Port Opening of Compound Engine and Single-Expansion Engine.

quality of material employed, the method of manufacture, the design and the cause of failure of crank axles in Europe, and the following facts developed from this investigation:

1. Axles are forged from small ingots and have insufficient work put upon them.

2. A great number of axles are made from soft steel.

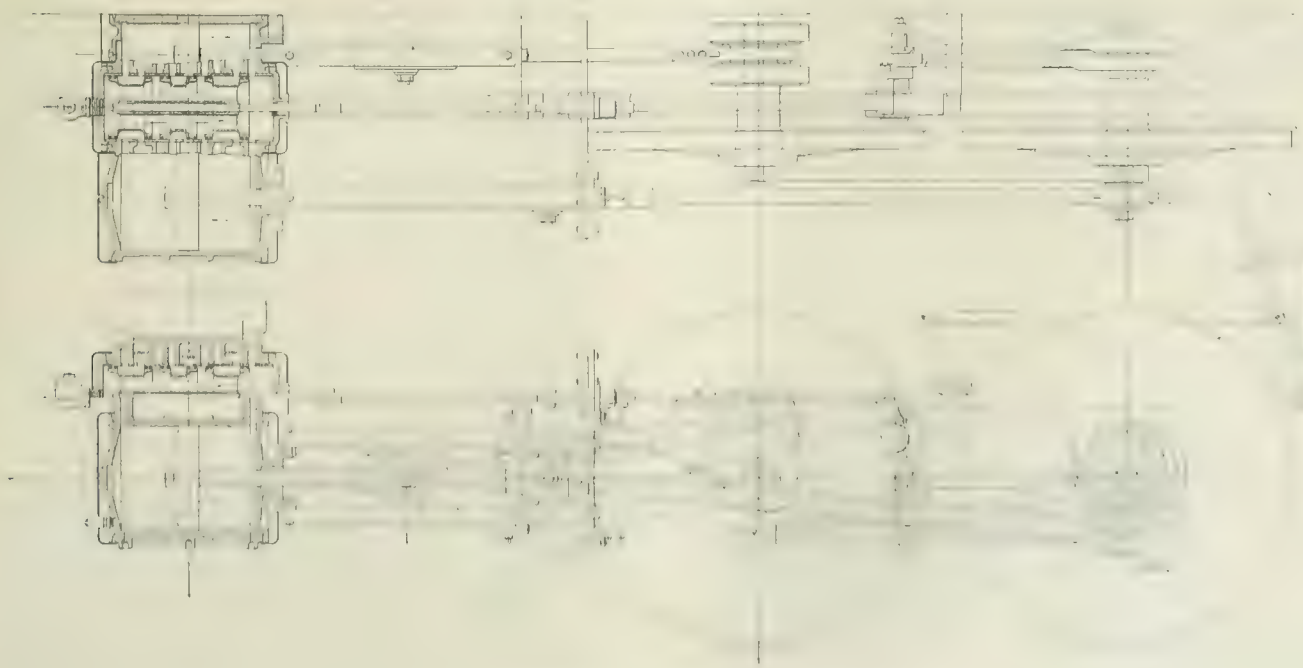
3. Axles are generally designed by rule of thumb and in the light of previous experience rather than by calculation.

The webs are slotted out of the solid forged axle and the pins are composed of the central core of the ingot which may not only contain segregation and pipes, but which also derives but little beneficial effects of hammering or forging particularly when forged or pressed from a solid ingot. A solid axle of European make forged from a small ingot which was cut up for test amply confirmed this theory and showed the success of the American solid forged axle to be altogether due to the use of high carbon steel, large ingots, plenty of work and careful annealing.

The difficulty and the time required to make a proper crank axle forging led to the adoption of the built up axle. The component parts of this axle can be well worked and forged, and they are not liable to failure by fracture, and when the pins are worn below the limiting size it is easy to remove and replace them. This axle has met with a good deal of favor not only because of its low first cost and rapidity of manufacture, but also because of its low cost of maintenance.

The development of the compound locomotive was simultaneous with the introduction of heavy types of power now so prevalent, and many failures have been attributed to compounding features which were chargeable to rapid increase in the size of power. The stresses, however, in a balanced compound are much lower than those in a single expansion engine and seem to have provided a remedy for many of the most annoying and expensive engine failures. For example: There has been no frame or cylinder failure on any of this type of engine built by the Baldwin Locomotive Works, notwithstanding the fact that a single front frame rail has been employed upon the heaviest engines built.

In analyzing frame failures for a committee of the Master Mechanics' Association, the writer was impressed with the fact that



Plan and Elevation of Balanced Compound Locomotive.

90 per cent. of these failures ahead of the main drivers occur upon the side of the engine of the leading crank pin.

The majority of the stresses act equally on both frames, but the stresses set up by the pounding of the journal boxes between the pedestals when the cranks pass their dead points are not equally distributed. When the right hand crank leads, the right hand frame is stressed more severely than the left hand, and when the left hand crank leads the left hand frame is more severely stressed. The diagram shows the forces which produce the pounding of the boxes at the four dead points. The elevation shows the crank pin positions and the direction of the forces transmitted from the cylinders through the rods. The full arrows represent the right crank and dotted arrows the left. In the plan view the arrows at the ends of the axle represent the forces coming from the rods, while the arrows inside and close to the frames represent the resulting stresses acting on the frames.

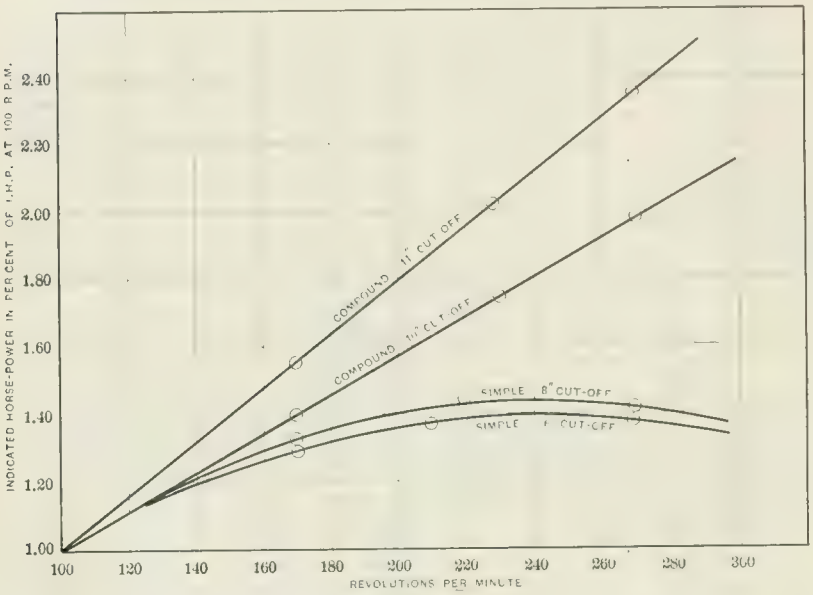
In Fig. No. 1 the right-hand crank is passing the forward dead point. The right hand box is thrown backwards and the left-hand box pulled forward. As will be seen, the forces from both right and left-hand cylinders throw the right-hand box back.

In Fig. 2 the left hand crank is passing the forward dead center. At this point the left-hand box is thrown from front to back of the pedestal, but as the right-hand cylinder is pushing the axle backward it tends to throw the left-hand box forward and thus counteracts to some extent the pounding of this box against the frame.

In Figs. 3 and 4 the right and left cranks are shown passing the back dead center. The effects are similar to those shown in Figs. 1 and 2, with the forces acting in the opposite directions. Although the direction of the forces is changed, the right-hand box is acted on by the combined forces while the left box is acted on by the opposed forces. It is thus seen that whenever the right crank throws the right box from one side of the pedestal to the other, the left crank increases the effect of the blow, but when the left crank throws the left-hand box from one side of the pedestal to the other, the right-hand crank tends to reduce the effect of the blow. With excessive play of the boxes in the pedestals this pounding often sets up stresses which when added to the other stresses produce a sufficient resultant to cause a breakage of the right-hand frame.

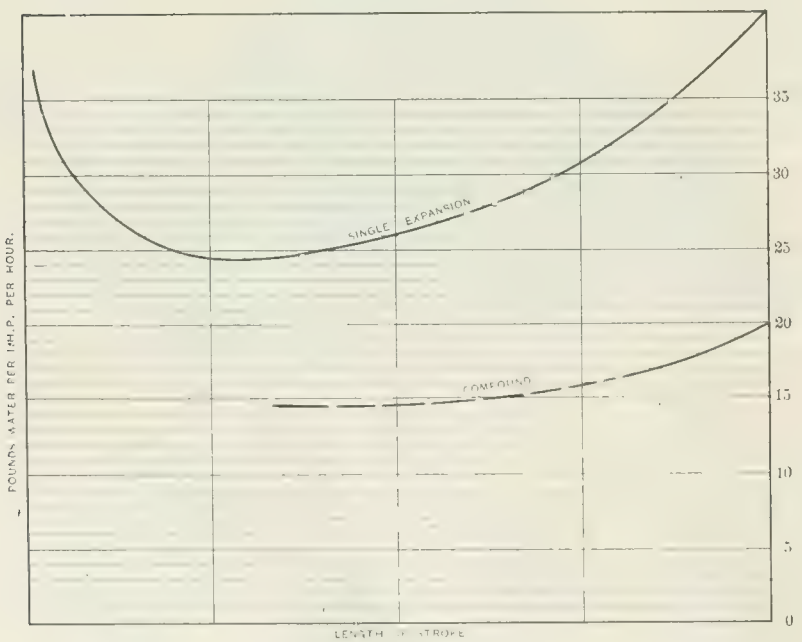
It is obvious that a balanced compound engine with pistons moving in opposite directions should be free from failures of this kind.

These engines have met with most favor for passenger service when the greater necessity for perfect balance exists. It has been shown by experiment that a balanced engine does not affect a bridge

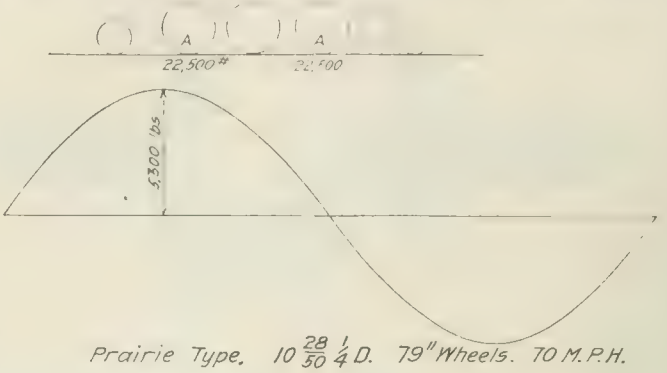


Horsepower Speed Curve of Compound Locomotive.

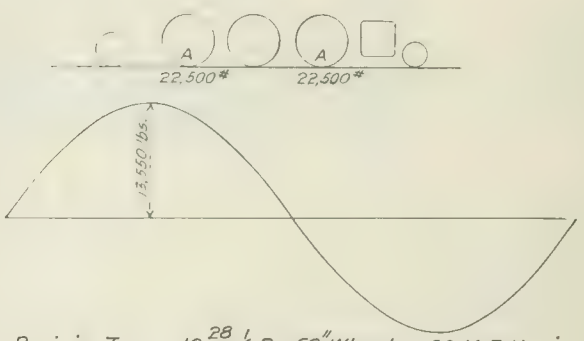
WATER RATE CURVES OF
COMPOUND AND SINGLE EXPANSION LOCOMOTIVES.



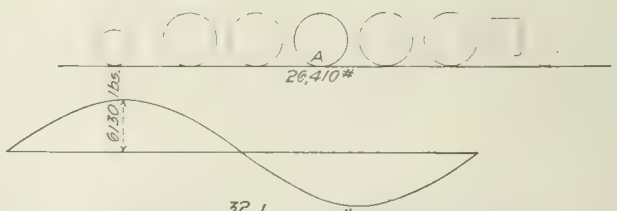
Water Rate Diagram.



Prairie Type. $10\frac{28}{50}\frac{1}{4}$ D. 79" Wheels. 70 M.P.H.



Prairie Type. $10\frac{28}{50}\frac{1}{4}$ D. 69" Wheels. 60 M.P.H.



Santa Fe Type. $14\frac{32}{58}\frac{1}{4}$ F. 57" Wheels. 25 M.P.H.

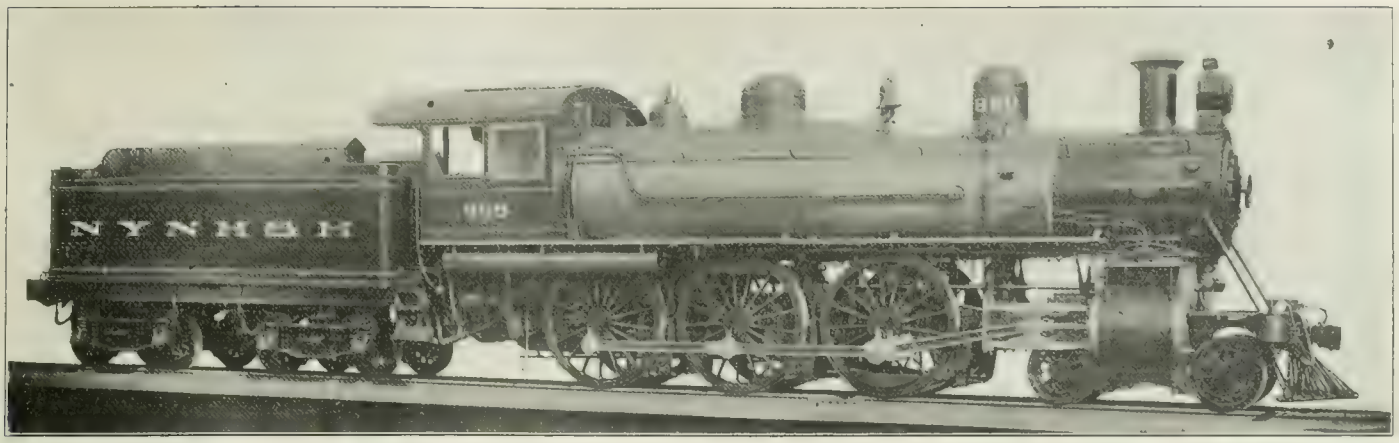


Pacific Type. 12-$38\frac{1}{4}$ D. 79" Wheels. 70 M.P.H.



Balanced Compound Atlantic Type. $10\frac{24}{44}\frac{1}{4}$ C.
73" Wheels. No Disturbing Effect from Counterbalance.

Vertical Throw of Counterbalance Excess.

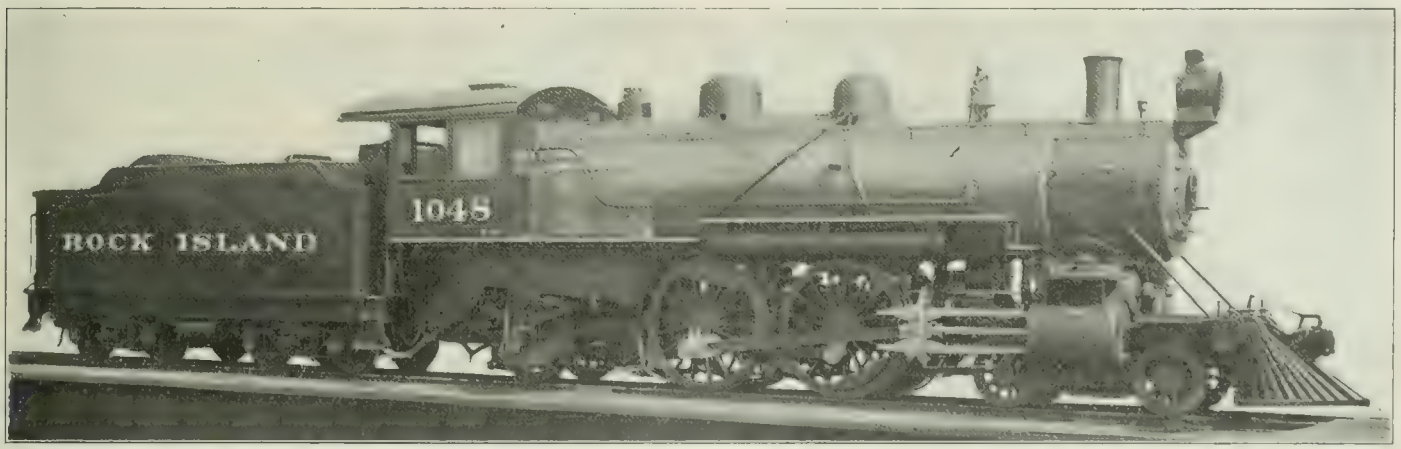


80-Ton, Ten-Wheel Vauclain Balanced Compound.

span any more than a car of equal weight, nor is it possible to determine the position of the balance when passing over the span. Engineers of the Maintenance of Way Department recognize this feature by rating these engines on the same basis as single-expansion engines of 20 per cent. less weight in all tables and charts of allowable wheel base.

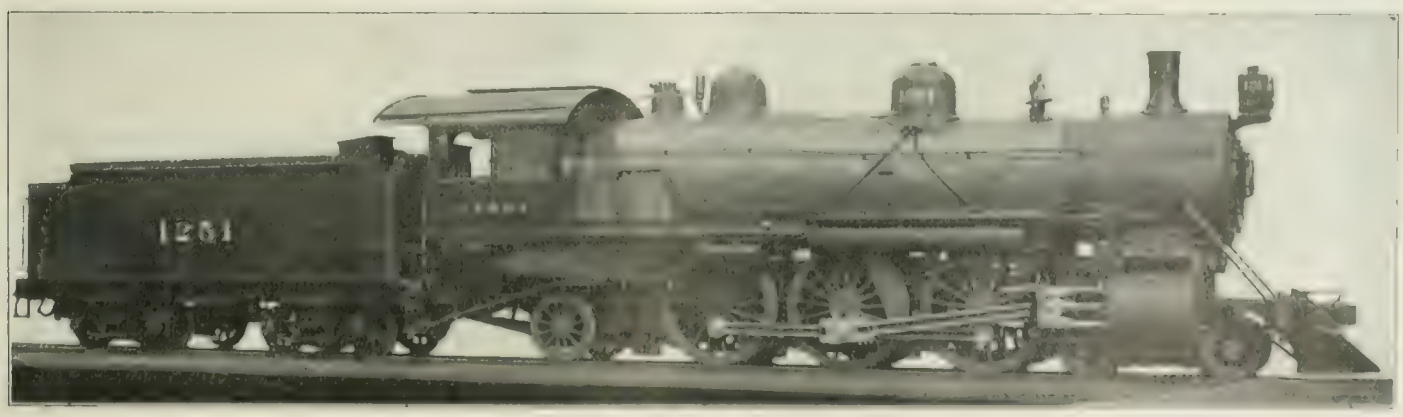
The perfect balancing of the balanced compound type of engine recommends it particularly for passenger service, but its value in this service is enhanced by greater speed which it is able to maintain because of the wider port opening both during the period of exhaust and admission. This difference is graphically shown in the diagrams. It will be noted that the maximum port opening of the single expansion engine is ⅜ in. in comparison with ⅝ in. for the compound locomotive, and there is about the same relative difference in the exhaust opening. When we consider the great volume of steam which passes through a locomotive cylinder in an hour the advantage of the greater port opening following the use of four in place of two cylinders is apparent, as a modern high-speed locomotive consumes from 50,000 to 75,000 cubic feet of steam at 190 lbs. pressure per hour. It is a problem worthy of serious consideration to get this immense volume of steam into a cylinder, but a much more serious one to get it out again without undue back pressure, as the volume will have increased to 300,000 to 450,000 cubic feet. The effect of the larger port opening is shown in diagram 1,958, which shows a falling off in horse-power of the single expansion engine as the speed increases, but that the compound shows an increase in horse-power with each increase in speed. The economy resulting from compounding is best illustrated by the well-known water rate diagrams. The diagram was plotted from tests in freight service and not quite the same economy can be expected in passenger traffic.

The engines have been subjected to a number of service tests, the most recent being on the C., R. I. & P. The results of seven tests of a compound in comparison with a similar number of a single expansion engine of the same type and size showed the single expansion engine used 29.3 per cent. more coal and 33.0 per cent. more water than the compound in slow freight service. The Santa Fe has made some remarkable runs with them hauling 17-car passenger trains out of Kansas City. The C., B. & Q. is hauling 13-car passenger trains up the McCook-Akron grade with an Atlantic type balanced compound, whereas a large Pacific type single expansion engine tried the run without success.



100-Ton, Atlantic Type Vauclain Balanced Compound.

These engines are the result of an evolution and they stand today as the highest type which men who have devoted their energies to the problem have been able to produce. They are meeting the conditions for which they were designed and the next decade will undoubtedly see their rapid increase in favor. They present one of the best solutions for the demands for heavy power and high speed, and they have passed their experimental stage and are now in the hands of their critics



Pacific Type Vauclain Balanced Compound.

Chesapeake & Ohio Double Tracking.

The great increase during the last two or three years in the traffic—particularly coal traffic—of the Chesapeake & Ohio has made necessary extensive improvements to the line. For a number of years double tracking has been under way, and at present is being especially actively prosecuted. The following statement published on May 4th in the Railroad Construction column of the *Railroad Gazette* shows the extent of the work:

	Miles.
Placed in operation since July 1, 1905	
Winifrede to Charleston	13.0
Russell to Riverton	7.8
Total	20.8
Under Construction	
Allegheny to Tuckahoe	1.5
Charleston to St. Albans	11.9
Dayton to Silver Grove	.7
Walker to Norge	11.2
Sewell Bridge	0.8
Lynchburg to Tyro	3.2
Total	34.3
Contracts Just Let:	
Grove to Morrison	15.8
Norge to Williamsburg	7.6
Greenway to Riverville	4.0
Jerry's Run to Lewis Tunnel	1.1
Hawk's Nest to Cotton Hill	1.2
Gauley to Mt. Carbon	8.1
Maysville to Lawrence Creek	5.4
St. Albans to Barboursville	29.2
Total	77.7
Bids Wanted:	
Concord to Crooked Creek	10.3
Total of last two groups	88.0

On the 50 miles of double track to be finished this year there are several miles of high solid rock cutting, one of the embankments being 215 ft. high. From Lewis to Barboursville, West Virginia, the double-tracking is accompanied with a change of the line of the road through a heavy region and a reduction of grades to $^{3}/_{10}$ of 1 per cent. and the elimination of all curvature sharper than 3 degrees.

Of the whole length of the main line from Newport News to Cincinnati, 192 miles consists of two parallel roads between Richmond and Clifton Forge; one a continuance of the low grade through freight route; the other used for through passenger business. This much, therefore, of the through route may be said to have the advantages of a double track with the additional advantage of commanding the local traffic of separated sections of country. In a somewhat similar way, when the 88 miles of new double track for which contracts have just been let or bids are wanted mentioned in the statement are completed, there will be brought into use by means of bridging New River 11 miles of parallel line already built on the opposite bank of the river, making two tracks that will be used for through business under double track methods. When the 88 miles of new work is done, the situation will be that the main stem of the Chesapeake & Ohio from Newport News to Cincinnati, 655 miles, will consist of 343 miles of straight double track, 203 miles of parallel roads, affording equivalent advantages to double track and something more, and 109 miles of single track (not paralleled). The double track is not continuous, but including the parallel roads mentioned, it will be almost so on completion of the work in progress.

For this information we are indebted to Mr. Decatur Axtell, Vice-President, and Mr. Henry Pierce, Engineer of Construction.

New York Central Electric Locomotives.

BY REGINALD GORDON.

For the electrical operation of through trains of the New York Central between Grand Central Station and Croton, N. Y., 35 electric locomotives are now being built by the General Electric Company and the American Locomotive Company at their Schenectady shops. The first electric locomotive, New York Central No. 6,000, shown in Fig. 1, and brought out about 18 months ago, has been given a thorough test since it came from the builders, and its performance has been so satisfactory that in those which are being built the original design has been modified only in details. A general description of locomotive No. 6,000 was published in the *Railroad Gazette*, June 3, 1904, and Nov. 18, 1904, and the account of a series of speed and acceleration tests with a 500-ton train in comparison with a Pacific type New York Central steam locomotive was published May 26, 1905. As these new electric locomotives will be put in regular service in a few months, a somewhat more detailed description of them is presented herewith. The locomotive as shown by Figs. 1 and 2 is mounted on four driving axles and has a two wheel pony truck at each end. It is propelled by four gearless motors, shown in Figs. 7 and 8, an armature being secured on each driving axle; and the current for the motors being obtained through shoes sliding on a third rail. There is also a trolley on top of the locomotive to make contact with an overhead wire in places such as road crossings where it is not practicable to have a third rail. While the armature is secured to the driving axle, the field coils of the motor are attached to transverse castings that connect the side frames. The cab, mounted on top of the frames, contains the controllers, rheostats, reversing and main switches, air compressor, boiler for train heating, air-brake apparatus, ammeters, etc., necessary for the operation of the locomotive, and is not only spacious, but so arranged that all appliances, both electric and pneumatic, are accessible for inspection and repairs. (See Figs. 3 and 4.)

The side frames are of cast-steel, locomotive type, with outside bearings for the driving axles, and have the boxes fitted in pedestal jaws in the usual manner. The end frames or bumpers are heavy steel castings (Fig. 5) bolted to the side frames and having pockets cast in them for the coupler drawbar and the platform side springs, as at each end a standard Gould platform is fitted to match that on a passenger car. To provide lateral stiffness, as well as to support the field magnets of the motors, there are five transverse steel castings, or crossties (Fig. 6), fitted and bolted to the side frames and having the field magnet cores cast

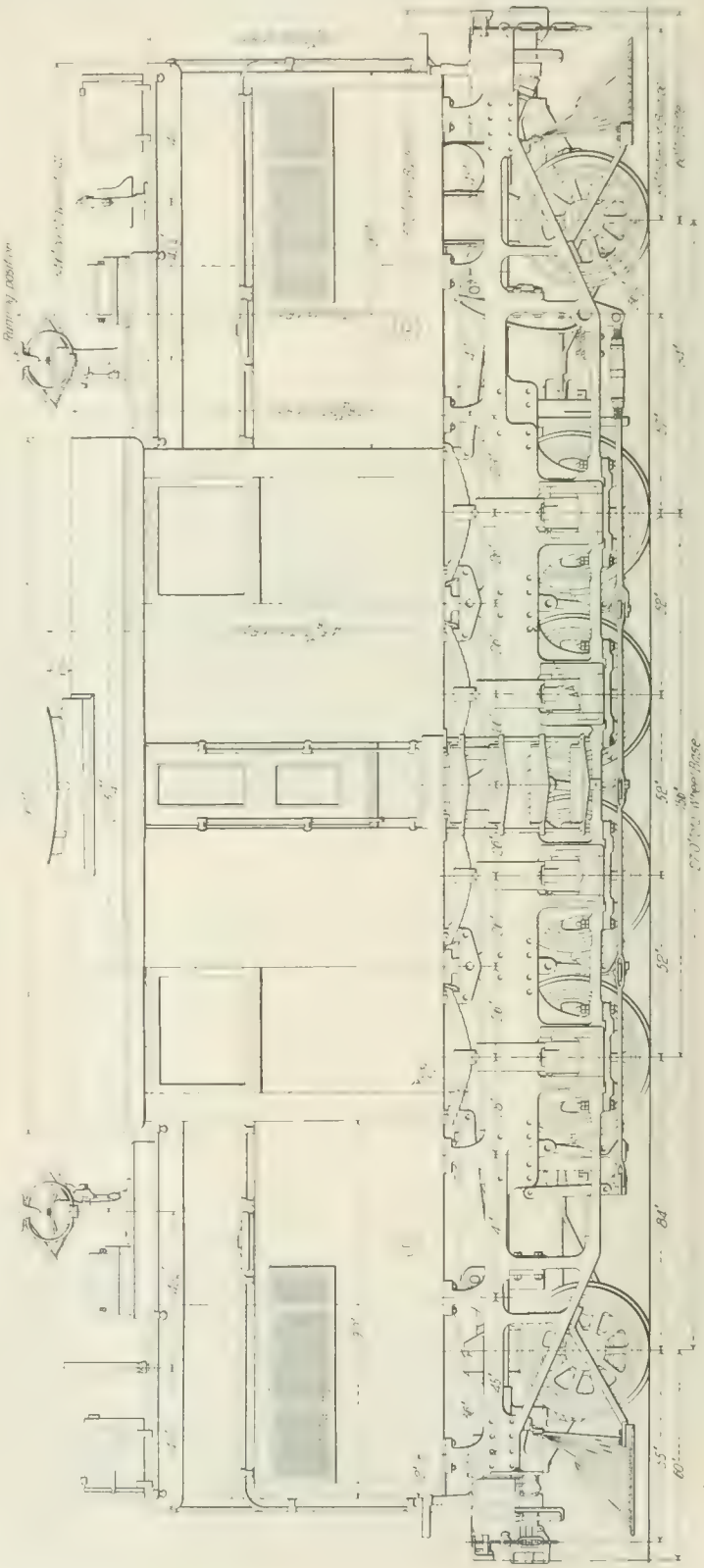


Fig. 2—Side Elevation.

with them. Above the crossties two longitudinal steel pieces of about 36 sq. in. cross-section are secured, forming not only part of the magnetic circuit of the motors, but being so located with reference to the center line of the locomotive that they cause a uniform distribution of weight, since the motors are slightly offset from the center line of the whole machine.

The springs and equalizing beams are placed above the frames, a half elliptic spring resting by means of a saddle on top of each driving box; and the first and second drivers reckoning from either end being equalized together and with the pony truck at that end. There is this difference, however, in the equalization of weight at the two ends, and partially shown in Fig. 12, that at one end the equalizers between the driving springs and the truck center pin are fulcrumed on short links bolted to the frame cross-tie, while at the other end the two equalizers are themselves connected by a short, transverse equalizer, thus forming a system that gives a three-point support for the locomotive. As the wear on the driving boxes will be more uniform than on those of a steam locomotive, no wedges are necessary, and the pedestal jaws are made parallel and have a shoe between box and pedestal on each side of the box. The driving axles have no end collars, all end thrust being taken between a bronze hub plate and the inside face of the box. The driving wheels shown in Fig. 9 are 44 in. diameter, the tires being held by retaining rings bolted on.

The motors (Figs. 7 and 8) are two-pole, direct-current, series wound, and rated at 550 h.p. each, thus furnishing a total of 2,200 h.p., and are built with ¼ in. clearance or air gap between armature and pole faces. They are built to run on a 50 per cent. over-

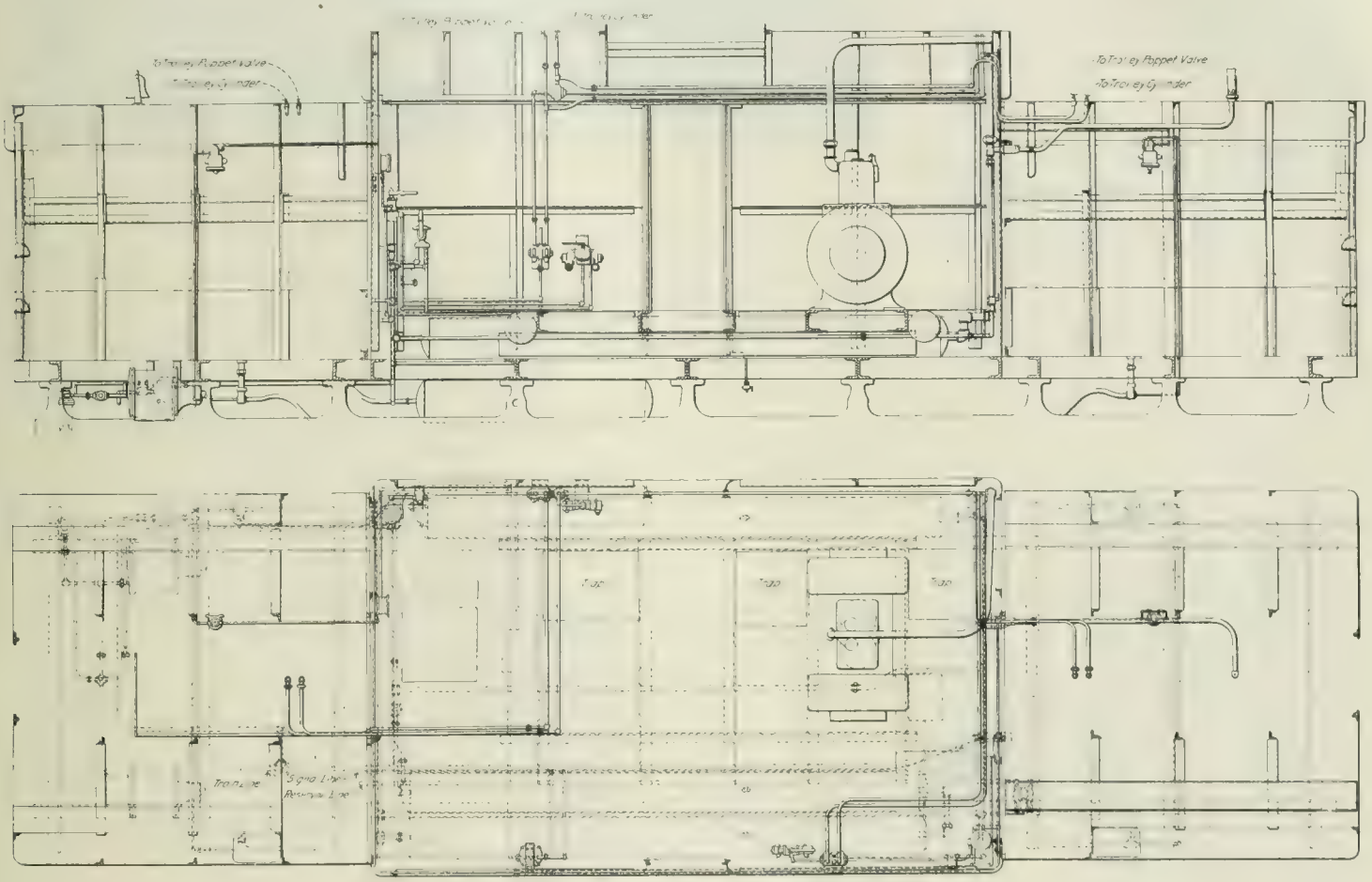


Fig. 3—Plan and Longitudinal View of Air Piping.

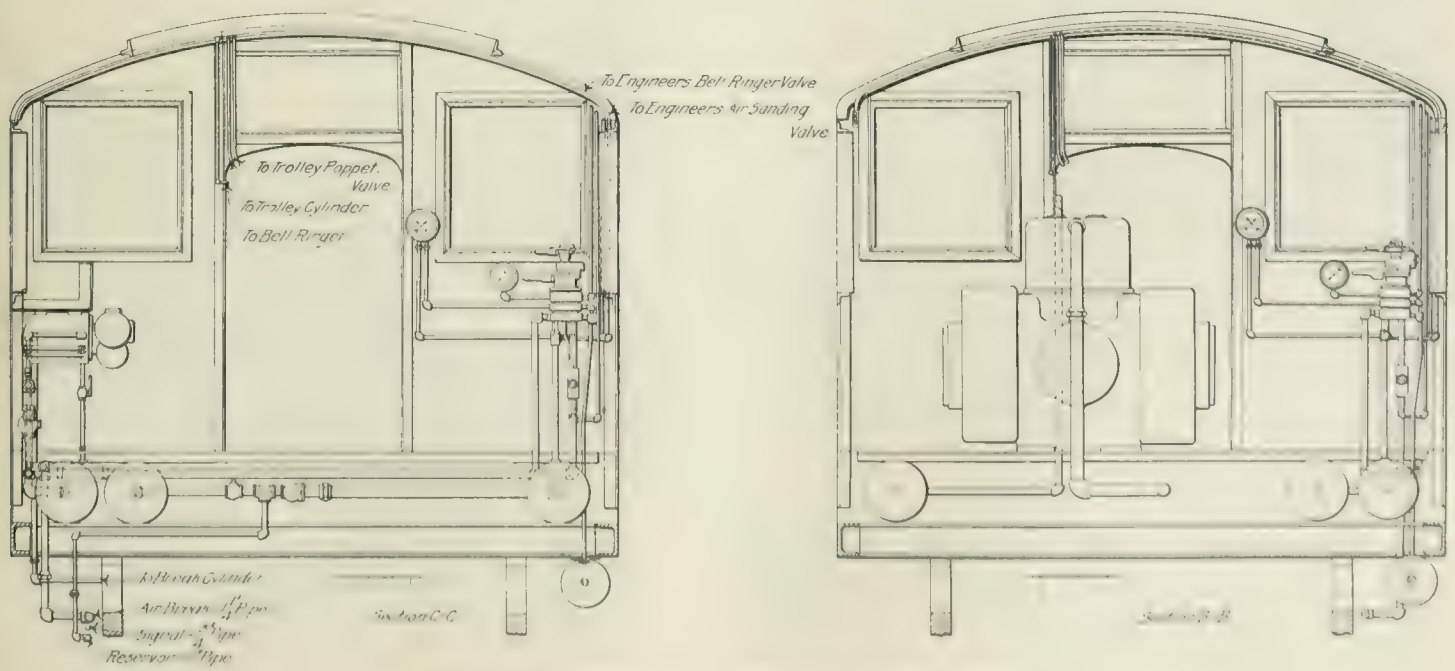


Fig. 4—Air Brake and Auxiliary Piping; End Views.

load for one hour with a rise of temperature not to exceed 75 deg. Fahr. As the armature is mounted nearer one side of the locomotive than the other, the steel bars on top of the frame forming part of the magnetic circuit are placed to one side of the central axis, as heretofore mentioned. The brush holders, which can be seen in Figs. 7 and 8, are mounted on insulated supports secured to a lug cast on the frame cross-ties, and are so arranged as to allow a vertical adjustment of 1¼ in. The motor field coils are rectangular in shape and held in place by bolts passing through the transoms of the frame. They are armored by a heavy brass casing outside of the windings, and over all a thick coating of asphalt paint is applied to exclude dust and moisture. As there are four motors, each with two field magnets, and five transverse frame castings to which the field coils are attached, the second, third and fourth transoms are cast with a magnet core on each face, while the first and fifth have



Fig. 1—Experimental Locomotive Built in 1904.

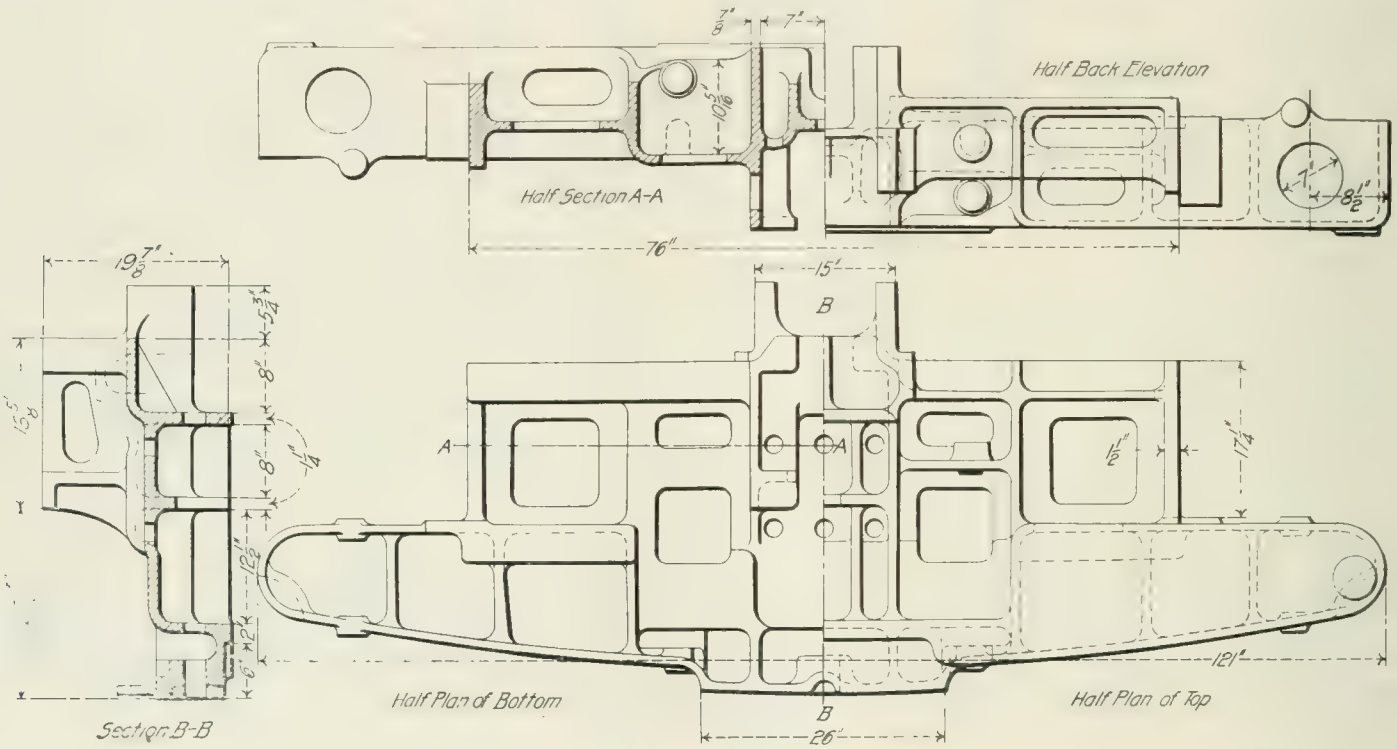


Fig. 5—End Frame.

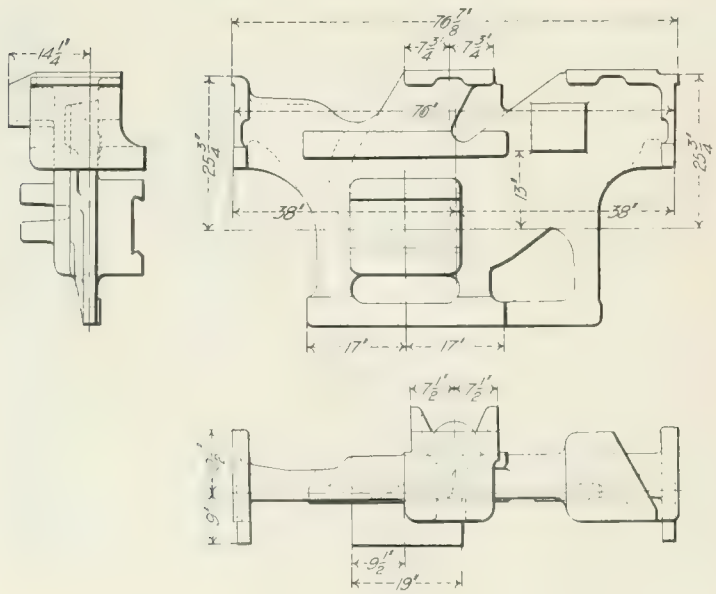


Fig. 6—End Transom.

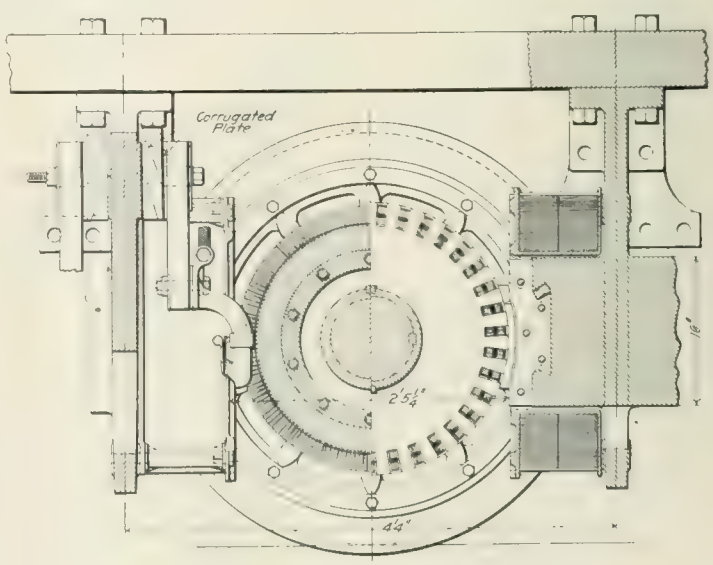


Fig. 7—Motor; Transverse Section.

a magnet core on one face and a lug on the other for the pin of the truck radius bar. The laminated pole faces of the field magnets, made up of thin soft iron plates, are dovetailed into the end of the magnet cores and held in position by the field coils.

For the control of 2,000 to 2,500 h.p. developed by such a locomotive as this, and to enable two such machines to be run together if necessary, the Sprague General Electric multiple unit system of control has been adopted. Naturally, the safe and reliable operation and application of such an amount of energy necessitates the use of large auxiliary apparatus, and for this purpose the cab is none too large. The central portion of the cab (Figs. 2, 3 and 4,) is occupied by the motorman's controller and air-brake valve, one at each end, the air compressor and train heating boiler; also ammeters and voltmeters, air gages, whistle cord and electro-pneumatic switch for sander and bell ringer. From this central portion an aisle or alley leads to a door at either end, and on each side of the alley way are placed the rheostats and contactors for controlling the amount of electricity supplied to the motors. In the same locality there is also the main switch, by means of which the current from the third rail is connected to or disconnected from all the apparatus on the locomotive, and the reversing switch, for reversing the direction in which the motors will run. There are also small switches for turning on the headlights, lamps in the cab, sander and bell ringer, etc., etc. Referring now to the rheostats and contactors, it should be borne in mind that when a direct-current motor is to be started it must always have some electrical resistance in series with it to prevent an excessive rush of current through its coils, and which resistance is diminished or cut out as the motor gains speed. For four motors, each rated at 550 h.p. each, it can be readily understood that a set of resistances capable of absorbing a large amount of energy must be provided. These resistances, or rheostats, are flat grids made of cast-iron, mounted in strong cast-iron frames, from which, of course, they are insulated, and connected by heavy copper bus bars to the switches or

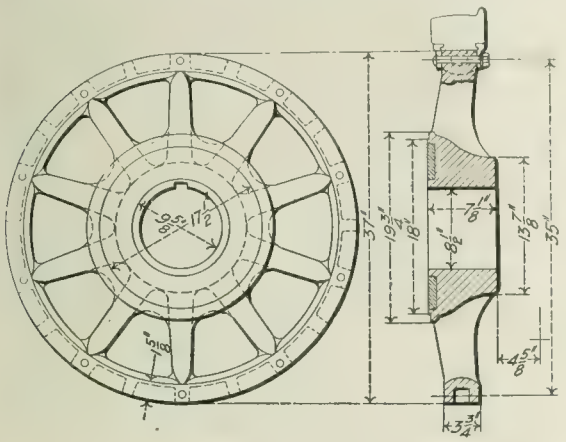


Fig. 9—Driving Wheel Center.

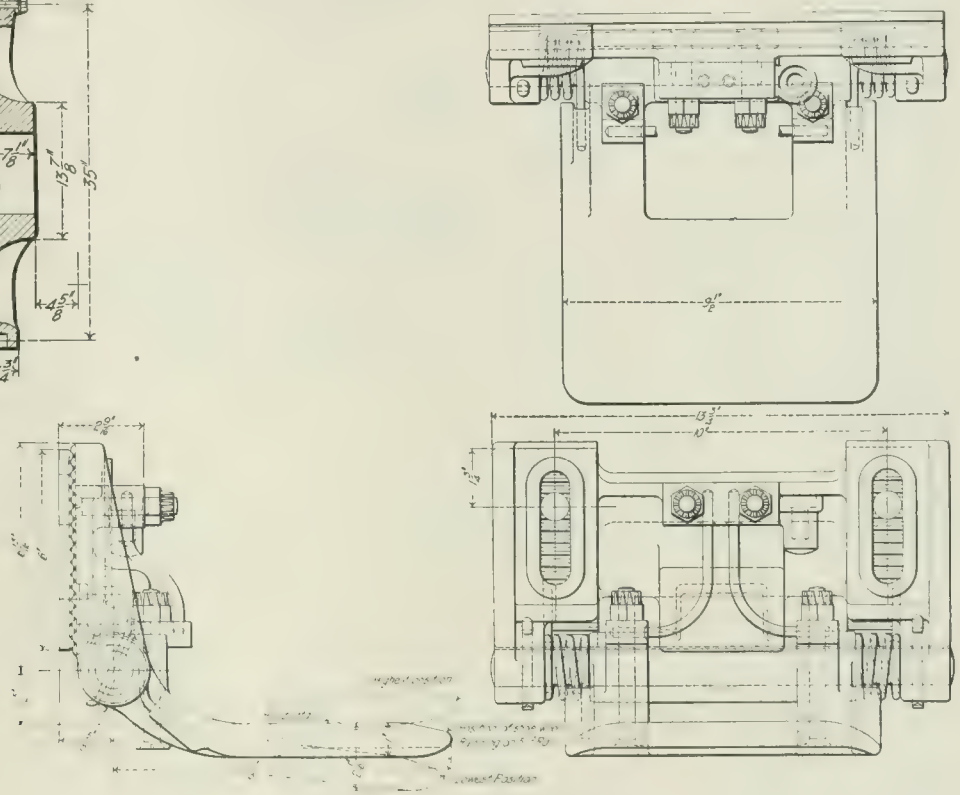


Fig. 10—Third Rail Shoe.

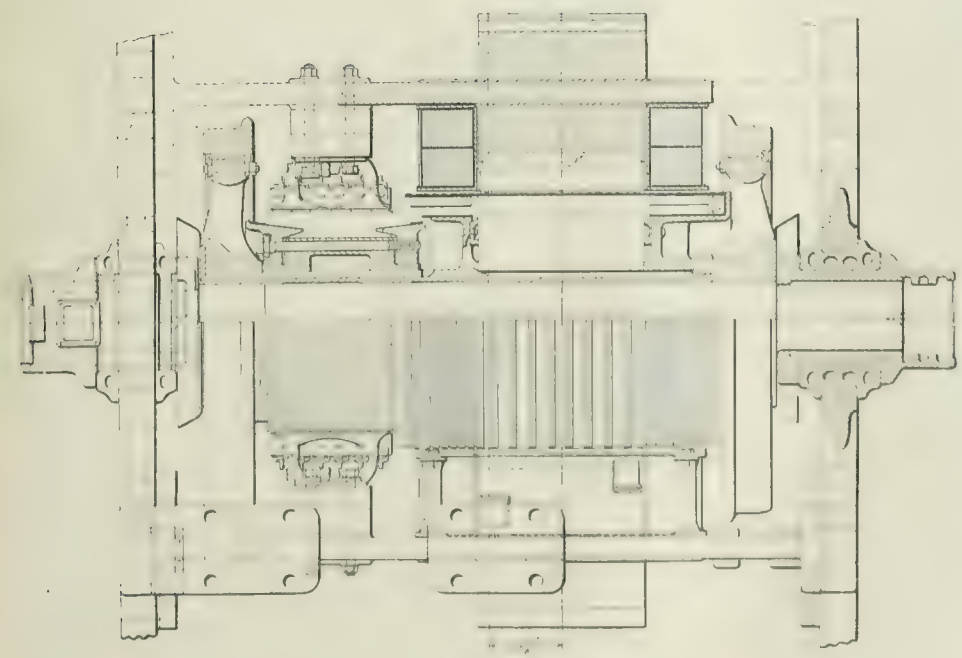


Fig. 8—Motor; Longitudinal Section.

contactors that correspond to notches on the motorman's controller. Cast-iron is used for the rheostats because it is strong, has a high specific resistance and can absorb enough energy to heat it to a dull red before any danger of short circuiting can occur; and since they are cast in the form of loops of flat, thin section, the rheostats have a large heat radiating surface in proportion to their mass. The current of electricity passing through any of the rheostats and the motors is varied in amount, or cut off by switches or contact surfaces called contactors, located above the rheostats in the cab. As it would be impracticable and dangerous to perform these functions in the controller directly operated by the motorman, his lever moves what is called a master controller, in which a small electric current not more than nine amperes, by being made and broken at the various points on the controller cylinder, operates the magnets of the contactors which thus make and break the currents to the motors. In starting a heavy train this electric locomotive has developed a drawbar pull of 32,000 lbs., and the ammeters showed that the four motors were absorbing energy at the rate of 1,600 amperes, about 1,500 h.p.

The controller has three sets of notches on it, with which the lever connecting a small throttle lever engages as it is pulled back, that is towards the motorman. The first set connects all four

motors in series and with the resistances which are gradually cut out as the controller handle is moved from notch to notch. the second controller position connects the motors in two pairs in series, the two sets each being connected parallel. While the third position puts all the motors in parallel and gives the maximum power available. In order to prevent the motorman from cutting out resistance too rapidly and so giving the motors an excessive amount of current before they get up to speed, an electro magnet is provided that locks the controller handle if more than a predetermined current for each position of the handle is exceeded.

The electric current is collected from the third rail by four shoes, one of which is shown in Fig. 10, which are in pairs, and spring supported from a longitudinal piece of wood that insulates them from the locomotive frame. The wooden piece is bolted to two brackets secured to the frame between the first driving box pedestal and the inclined bar of the frame. This is a modification of the design on the locomotive shown in Fig. 1, where it will be seen that the shoes were set farther from the ends of the frame and closer together. The shoes have a vertical play of about 2 in. to adapt them to make contact with either an under or overrunning third rail. As at highway crossings the third rail is continued as an overhead conductor, a pantagraph type of trolley is mounted on top of the locomotive and raised and lowered by air pressure controlled by an automatic electric control device.

For the air-brake and other pneumatic devices, a double-cylinder compressor driven by two General Electric 600-volt series motors is mounted in the cab. It is controlled by an automatic electric governor that starts or stops it at such times that the main reservoir pressure is maintained between 125 and 135 lbs. per square inch. This motor-driven compressor is shown in Figs. 3 and 4 as it stands in the cab, and in section by Fig. 11. It has two air cylinders, each 7¾ in. diameter by 8 in. stroke.

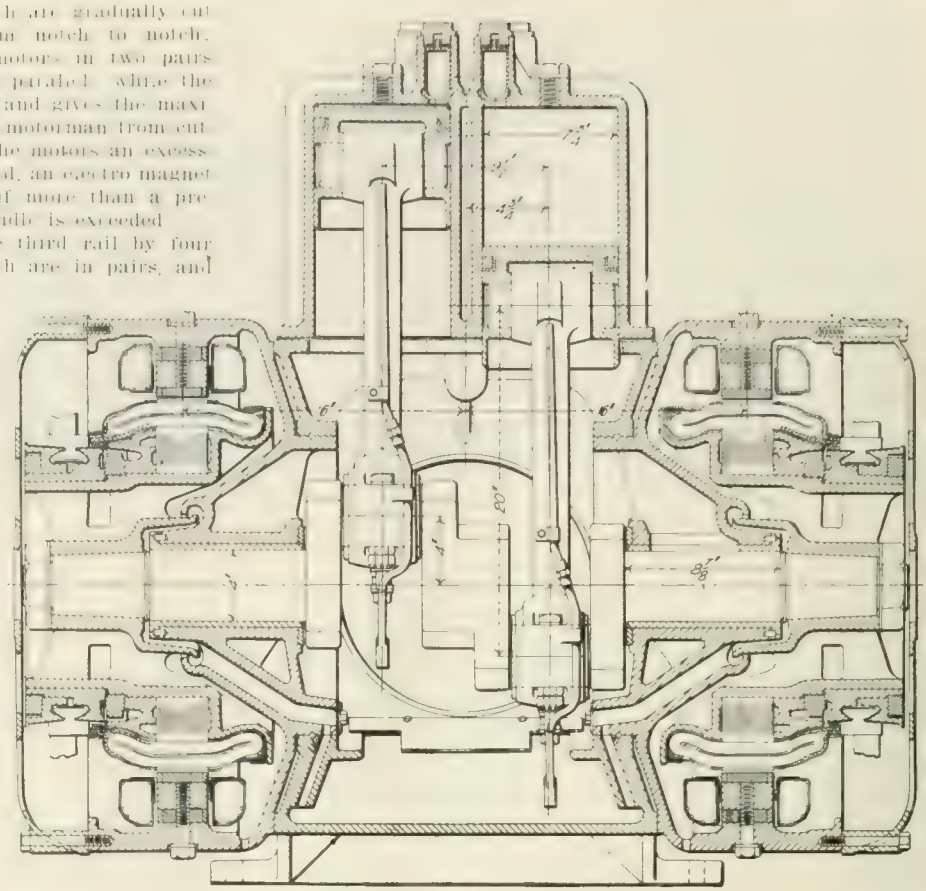


Fig. 11—Air Compressor.

This type of locomotive has proved itself capable of handling heavy, fast trains in a satisfactory manner; it starts easily, accelerates rapidly, and owing to the multiple unit system of control, a train may be double-headed by two of these engines. In addition to this, arrangements have been provided for controlling the air compressor of one locomotive from the other, and for supplying the main reservoir of one by the compressor of the other, should the occasion arise for doing so. The results of operation on the experimental track near Schenectady have shown that for the first 25,000 miles run, the cost for repairs and maintenance has been 1.7 cents per engine mile. The locomotive is now undergoing its second 25,000 mile test.

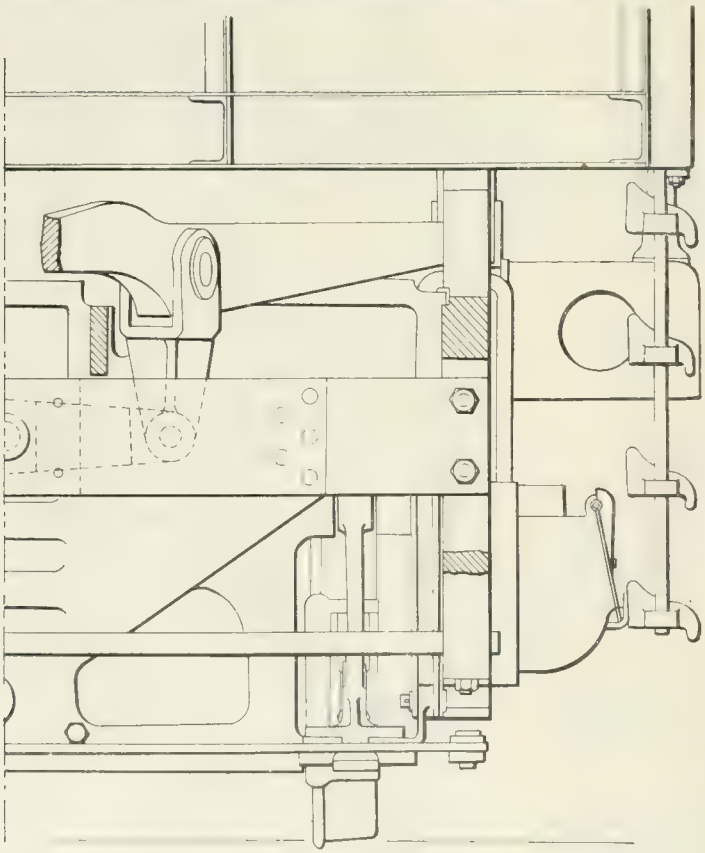


Fig. 12—Cross Equalization System at One End.

One of the most noticeable things about these large electric engines is their steadiness at high speeds. This is apparent at once by anyone who has ever ridden on a steam locomotive. There is no "nosing" or "hunting," and they take curves with the greatest ease. The runners of the steam locomotives find it difficult to realize the speed that can be attained and the load that can be pulled by the "electrics." The mystery that always surrounds anything operated by electricity only sharpens the curiosity of these men; and they appear to be making every effort to equip themselves to be able to understand driving these new machines.

A table of weights and dimensions is added:

Total weight	190,000 lbs.
Weight on driving wheels	140,000 "
Total length of locomotive	37 ft
Total wheel base	27 "
Rigid wheel base	13 "
Diameter of driving wheels	44 in.
Diameter of truck wheels	36½ "

Gasolene Motor Cars.

BY W. R. M'KEEN, JR.
Superintendent Motive Power and Machinery, Union Pacific Railroad.

Although we see large flocks of sheep and herds of cattle with their main supply of water entirely dependent upon the successful performance from hour to hour of a gasolene engine; although we see large coaling and pumping stations on important trunk line railroads, the uninterrupted service of which is dependent upon the performance of the gasolene engine; and see automobile engines running sometimes eight or nine months, without any attention save oiling, we know that the development of the internal explosion engine is in its infancy; that our experience with these engines is more or less limited, as compared with other means of developing power, and that the future use of these engines will be enormous as compared with the present day.

The introduction of the gasolene engine as a transportation power for motor cars fills a long-felt want by all railroads, namely, a self-propelled car, permitting of frequent service, at a reasonable cost to operate, on an established steam railroad system, and afford the same frequency of service as given by the electric lines.

In picking up passengers on branch lines and in delivering passengers at connecting points for through trains, the service of these motor cars will be exceedingly lucrative. The matter of giving the branch line patrons of any steam road increased service, with

more frequent trips per diem, is very much appreciated by the local community, and their good will is beneficial.

The present Union Pacific motor cars, with the limited horsepower engines, are particularly adapted to branch line service; they maintain readily a speed of 40 miles an hour, and can develop this speed hour after hour at a minimum cost. These cars can average easily three miles per gallon of gasolene, and frequently making four, and in some cases five, miles per gallon. The cost of operating these cars is largely dependent upon local conditions and methods of operating. It is safe to say that the performance will not be less than three miles per gallon; therefore, if gasolene can be purchased (in wholesale lots) at 9 cents a gallon, the cost for fuel would be 3 cents per mile.

With an experienced force to take care of repairs, and operators of reasonable skill, the cost of repairs to these cars will be in the neighborhood of 3 to 5 cents per mile (estimated). It is necessary, of course, to have one man, called the "motorman," in the engine room to operate the car. This man should be held responsible for the entire car, the movement of same, and light repairs to machinery, as well as the adjustments on the gasolene engine. On lines through sparsely settled country, an assistant to take up the tickets, shut the doors and assist motorman generally would be all that is necessary. In other places it might be necessary to have a conductor, as on interurban lines, who would take up tickets, use telephone (to receive orders, etc.) and work with the motorman. The cost of operating cars is largely dependent upon the wages paid these men.

It is of the utmost importance that the motorman be made the man in charge of the car, and that his wages should be commensurate with his duties, since it is more important to have men of ability in the engine room than in the passenger end of car.

The first gasolene motor car built by the Union Pacific Railroad, and designated as motor car No. 1, was turned out of the company's Omaha shop in March, 1905. This car, built to the railroad company's designs, was essentially an experimental car, and demonstrated in tests and regular service the practicability of gasolene power as a transportation medium.

Motor car No. 1 is 31 ft. long, mounted on a single four-wheel truck, wheels being 42 in. in diameter. The weight of the car is a trifle over 20 tons.

In testing, car No. 1 was coupled to two passenger cars, a standard mail car and a standard coach, totaling 112,000 lbs. in weight. These cars were successfully started and accelerated, both on a descending and on a one-third per cent. ascending grade, the motor thus starting a total load of 152,000 lbs.

Pulling the standard mail car, weighing 52,000 lbs., motor car No. 1 ascended a 1.6 per cent. grade at a rate of 11 miles per hour, the total load pulled being 92,000 lbs. In another test on a coal chute trestle, motor car No. 1 easily ascended a grade of 7.8 per cent., or about 400 ft. to the mile, the car being stopped and started repeatedly on the grade.

On April 2, 1905, the car was given its initial long-distance test, and made the round trip between Omaha and Valley, Neb., on the main line of the Union Pacific Railroad, a total distance of 70 miles, when the schedule for passenger trains was easily maintained. Leaving Omaha April 16, 1905, car No. 1 made the trip entirely under its own power from Omaha, via Denver, to Portland, Ore., and return. Leaving Cheyenne, the ascent of Sherman Hill, the summit of the Rocky Mountains, was made, the 27 miles of steep grade being accomplished without difficulty. On August 21, 1905, motor car No. 1 went into regular service between Kearney and Callaway, Neb., distance 65 miles, making one round trip daily.

Motor car No. 2, the second Union Pacific gasolene motor car, is an all-steel car, and is the standard design for all cars built subsequent to car No. 1. This and subsequent cars have two four-wheel all-steel trucks; driving wheels are 42 in. in diameter, other wheels 33 in. Car No. 2 is 55 ft. long, with seating capacity of 57. Weight of car is 28 tons. This car embraces all the features of motor car construction in the way of ventilation, sanitation, heating, lighting, etc. On its initial long-distance test, September 14, 1905, the car averaged 37 miles per hour between Valley and Omaha, a distance of 35 miles. A maximum speed of 52 miles per hour was attained on this run.

On September 22 a second trip was made to Valley and an average speed of 39.4 miles per hour was made on the westbound trip. On the eastbound trip the car made the 25 miles from Valley to Gilmore in 30 minutes, or an average speed of 50 miles per hour. Several miles were covered in 57 seconds, or 63.2 miles per hour, and mile after mile was accomplished at better than a mile a minute.

Since October 6, 1905, motor car No. 2 has been in regular service between Kearney and Callaway, making one round trip, or 130 miles, daily.

Motor cars Nos. 3 and 4 are of the same general design and description as car No. 2, except that these cars have baggage compartment. Car No. 3 left Omaha November 10, 1905, making the trip under its own power to Houston, Texas, and is now in regular service on line of Southern Pacific Company between Houston and Galveston. Motor car No. 4, upon completion, made trip to the Chicago & Alton road under its own power, and was in service on that line out of Bloomington for several days under test. The car was afterwards in temporary service on the Kearney branch; then it was sent to Portland, Ore., under its own power, and is now in service on line of the Oregon Railroad & Navigation Co. out of that city.

Motor car No. 5 left Omaha January 12, and reached Los Angeles January 23, 1905, having made the entire trip under its own power. The run from Salt Lake to Los Angeles, a distance of 778 miles, was made in a little less than four days, running about eight hours per day. After being tested on various lines of the Southern Pacific Company out of Los Angeles, the car was placed in regular service.

Motor car No. 6, since February 6, 1906, has been in regular service on branch line of the Union Pacific between Leavenworth and Lawrence, Kan., making the round trip of 68 miles daily. Train consists of motor car No. 6 and trailer, and is operated on regular schedule, displacing a steam train formerly operated on this branch, consisting of locomotive, combination baggage, mail and express car and coach.

Motor car No. 7, which is the latest car turned out of the Omaha shop, is 55 ft. long; the engine room and operator's compartment occupies 12 ft. 8 in. at front end of car, and the passenger compartment is 41 ft. 10⅝ in. long, with a total seating capacity of 75. The seats are built-up veneered wood seats, with seating capacity of three people each. The semi-circular seat at rear of car has seating capacity of 11. While this car is of the same general design as previous cars, it embraces some new features. The square design of window has been done away with, and an air, water and dust proof round window sash substituted. This sash is similar to the porthole of a vessel, and keeps out all elements, which the double sash in the finest Pullman cars is unable to do. Car No. 7 has side entrances, the doors being located at center of car.

The roof of motor car No. 7 is 9 in. lower than in other motor cars, notwithstanding which the ventilation is entirely adequate. The roof of Car No. 2 is 15 in. lower than an ordinary passenger car, so that the roof of car No. 7 is 2 ft. lower than the ordinary passenger coach. The interior of this car is finished in English oak, and its weight is 58,000 lbs.

On April 4 motor car No. 7 made its first trial trip from Omaha to Valley, 35 miles, and return. This was for the purpose of limbering up the machinery, and no special time was made, on account of the large number of passenger and freight trains to be met; the car, however, made close meeting points, like any other train, always exceeding the orders. On this trip a maximum speed of 45 miles per hour was attained.

The car was given its first long-distance trial April 14 and 15. On April 14 it left Omaha as the second section of train No. 1, the "Overland Limited." The motor car gained on No. 1 to such an extent that at Fremont, 46 miles from Omaha, the motor car was held on the block six minutes. Car No. 7 ran as second No. 1 from Fremont to Grand Island, but owing to a heavy wind and meeting trains from this point on, some time was lost on No. 1's schedule. However, the total time of motor car from Omaha to Grand Island was 5 hrs. 12 min., with a delay of 40 min. on account of orders, meeting trains, etc., the actual running time for the 153.6 miles being 4 hrs. 32 min., or 34 miles per hour. There was no delay whatever on account of the motor car, and the machinery was in almost constant motion from Omaha to Grand Island.

On the return trip, April 15, a speed run was not attempted and car was delayed over three hours for orders, meeting, trains, etc., in addition to a slight delay on account of a hot bearing. The actual running time from Grand Island to Omaha was 4 hrs. 10 min., or 36.3 miles per hour. From Elkhorn to South Omaha, 24.3 miles, the distance was covered in 36 minutes, which is at the rate of 42 miles per hour. A maximum speed of 53 miles per hour was attained on this trip.

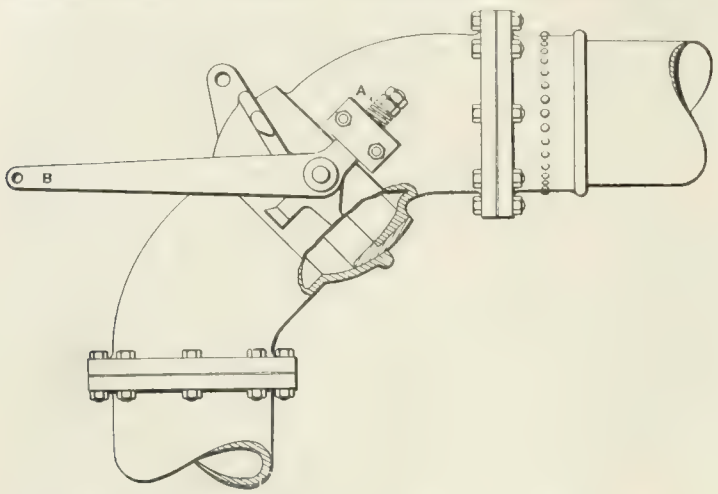
The same car left Omaha April 21 at 10 a. m., and ran under its own power to Grand Island, Neb., making the 153.6 miles in 8 hrs. 30 min. On April 22 it ran from Grand Island to Sterling, Colo., 276 miles, the trip being made in the daylight. Leaving Sterling the morning of April 23, it ran to Denver, 140 miles. After five days' service between Denver and Greeley, Colo., making a round trip of 103 miles daily, the car left Denver on the morning of May 1, and, running in daylight, reached Topeka, Kan., 573 miles away, at 7 p. m., May 3. The next day it ran from Topeka to Lawrence, Kan., and return, thence to Garrison, total distance 133 miles, and on May 5 ran from Garrison to Omaha, via the branch line, making the 209 miles by daylight.

On Friday, May 18, car No. 7 left Omaha for the trip to New York City, via the Chicago & North Western and the Erie. Leaving Omaha at 7 07 a. m., May 18, the car reached Belle Plaine, Iowa, at 5 30 p. m., distance 239 miles. May 19 it left Belle Plaine at 7 25 a. m. and arrived at Chicago 6 30 p. m., distance 254 miles.

On May 20 it ran from Chicago to Lima, 218 miles, between 7:15 a. m. and 5 30 p. m.

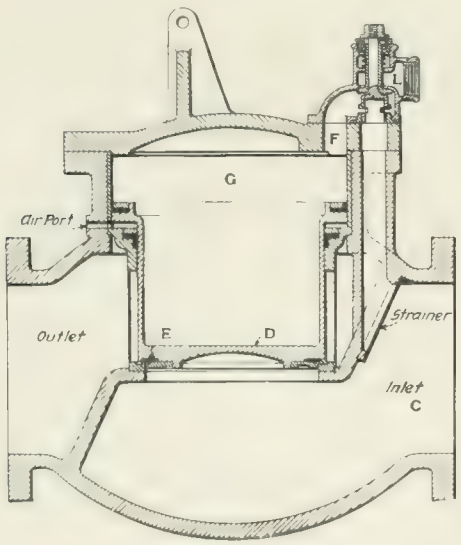
Anderson Automatic Valve and Water Column.

In the self-adjusting water column made by the Golden-Anderson Valve Specialty Company of Pittsburg, a flexible joint, whose construction is shown in the accompanying engraving, is used. The horizontal part of the pipe fits into a standpipe by means of a ball joint whose axis is at an angle of 45 deg. to the two parts, thus uniting them by an easy curve and securing a smoother flow of water than where a 90 deg. elbow is used. The two parts of the ball joint are held together by the stiff spring "A" on each side. This is, in turn, held down by a spring attached to the outer end of the lever "B." This lever also serves as a counterbalance for the horizontal pipe and spout. The counterbalance spring is encased in a piece of 3 in. wrought iron pipe with a plug at the top and bottom and a large bolt running through it, thus putting the spring in compression instead of in tension. By this arrangement there is protection against breakage or a drop of the spout, such as may happen where the springs are in tension.

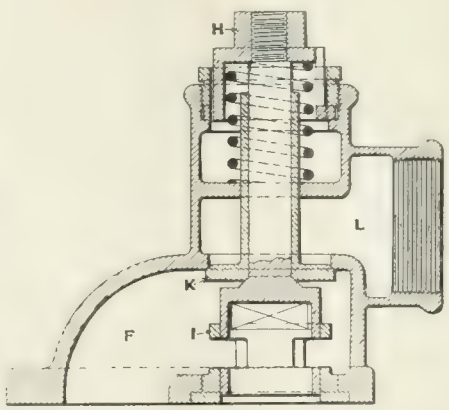


Self Adjusting Flexible Joint for Anderson Automatic Standpipe.

The bottom of the column is carried by a ball bearing, and has an automatic drain that can be thrown in or out of service at will simply by removing the shoe attached to the lug at the bottom of the column. .



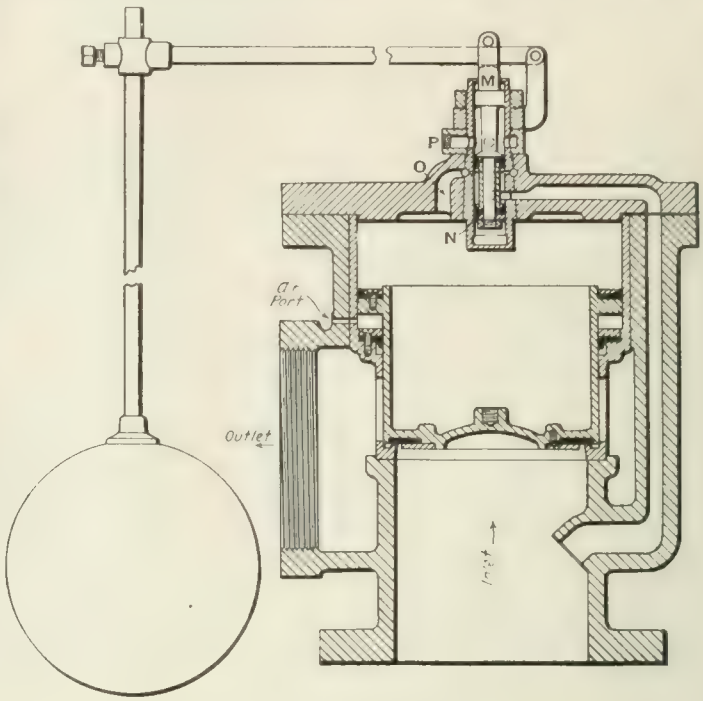
Section of the Anderson Automatic Standpipe Valve.



Section of Operating Valve of the Anderson Automatic Standpipe Valve.

The most important feature of the column is the valve shown in section in the two engravings herewith. Its construction and method of operation are as follows:

The whole is embraced in a substantial cast casing, with a connection to the source of supply at "C." The main or vertical part of the casing is bored to receive the differential piston "D," which has its larger diameter toward the top and with the two moving surfaces is packed with leather cup packings. When the valve is down in its normally closed position it rests on the soft packing "E," thus preventing leakage from the inlet to the outlet sides of the valve. Rising from the inlet side of the casing and protected by a strainer to prevent admission of foreign substances there is an auxiliary port that connects by way of the passage "F" with the space "G" above the differential piston. Under normal conditions this passage is open, and the water under its full head has free access to both sides of the piston. As the area of the top of the piston is the larger, it is forced down against its seat at the bottom and held closed by the pressure from above overbalancing that at the bottom. When the valve is to be opened for the flow of water, a movement of the hand lever, through its connections attached to the spindle at "H," pushes the valve "I" down to its seat. Just before it comes in contact the relief valve "K" is opened by being pushed down also, so that the water in the space "G" is free to escape to the waste by the outlet "L." The pressure above the differential piston being thus relieved, the pressure below forces it up and causes a flow out at the outlet through the valve. The piston is checked in its upward movement by choking the flow of water past the valve "K," and thus is prevented from slamming. At the same time it draws in air through the air port, and this serves a similar purpose when the piston comes down. It will thus be seen that the valve is automatic in its action, and that the stress on the operating lever to move the valves "I" and "K" is very slight. The adjustment of these two valves is made simply by turning the spindle "H" to the right or left.



Anderson Automatic Float Valve.

Another valve of the same character and working on the same principle is an automatic float valve. In this a float is made to open and close the passage from the source of supply to the space above the differential piston. When the float is down it rests on the spindle "M," to which the piston valve "N" is attached, and lowers it to such a point that water under pressure enters the central part between the cup packings and flows out through the holes in the side to the passage "O" leading to the space above the differential piston. As the float rises, it carries the piston valve with it until the port leading to the pressure main is cut off and the communication established between the passage "O" and the overflow "P," when, the pressure above the differential piston being relieved, the piston is forced up by the pressure below and communication between the inlet and outlet sides of the valve is established.

A bitter cry for coal comes from Russia, where it has reached unheard of prices, while at the same time the coal-producers of the Donez district, the Pennsylvania of Russia, declare that they are near bankruptcy, not because they cannot produce their coal, still less because they cannot sell it, but simply because they cannot get it carried away. The railroads supply them with only 35 per cent. of the cars they ask for to fill orders. The authorities promise no relief until they get back the rolling stock diverted to the Siberian Railroad on account of the war, and before that time there will be much freezing.

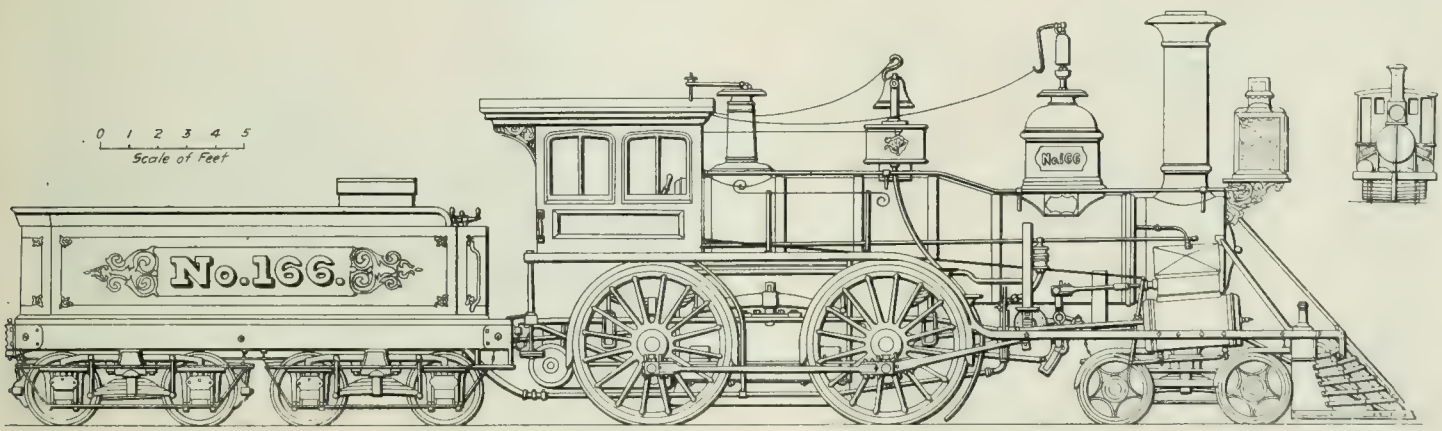
A Historic Locomotive.

BY C. H. CARUTHERS.

When His Royal Highness the Prince of Wales, now King Edward VII. of Great Britain, visited America in 1860 his trip eastward from Pittsburg over the Pennsylvania Railroad was made in the only private car then owned by the company, original number 60, built some time earlier for J. Edgar Thomson, then President of the company; and locomotive number 166 was selected to haul the train over the entire distance. This engine had a short time before been almost entirely rebuilt at the Altoona shops and had been changed from a wood burner to a smoke-consuming coal-burner, having received an entirely new boiler with Gill & Co.'s patent firebox, and all the latest improvements of that period. It was one of the most complete and attractive, though not the most powerful, passenger engines then in service.

The principal dimensions of No. 166 were as follows: Cylinders, 16 in. by 20 in.; drivers, 66 in. diameter; firebox, 35 in. by 68 in.; weight on drivers, 33,200 lbs.; total weight, 55,200 lbs. The steam-chests were perculiarly set, with quite a sharp pitch transversely from the smoke-box as well as with the same longitudinal pitch as the cylinders, in order, it is said, to give greater length of ports without having the steam-chests extend too far beyond the outside of the cylinders.

The painting was of the Altoona standard of that day; vermilion wheels, number plate, dome-base and centre panel of tender in vermilion; sand-box and outer portion of tender cistern, burnt umber; tender guard, chrome yellow; and all lettering and striping in gold leaf, with arabesques in colors. The frames were painted dark green without stripes. The cab was of black walnut, polished and varnished. The boiler, cylinders, steam-chests, dome and column for safety-valves, were jacketed with Russia iron; and all of these except the cylinder and steam chests, were fitted with bands, cornices and bases of polished brass. The driving wheels also had discs of polished brass, bearing the builder's name, attached to their centres.



Pennsylvania Railroad Locomotive Which Hauled the Train of the Prince of Wales in 1860.

Originally the engine was built at the Lancaster Locomotive Works of J. Brandt, in October, 1853, for the Columbia & Philadelphia Railroad, which belonged to the state of Pennsylvania, and was named Wheatland, after the homestead of the Hon. James Buchanan near Lancaster. It was then a wood-burner, with large balloon smokestack of the French and Baird type then in general use. The boiler was of the ordinary wagon-type pattern, with two 24 in. domes, one on the roof-sheet and close to the cab front, the other near the centre of the straight portion of the barrel. A round sandbox of polished brass with base and cornice of cast iron was placed between the domes, and the bell was about 30 in. behind the centre of the smokestack. Both domes were cased with polished brass. The trucks of the tender were of the Bissell inside journal type, nothing whatever being on the outside of the wheels, thus giving them the neat appearance of an engine truck. This arrangement was changed to the standard outside type at the rebuilding, but all other parts of the engine except the boiler and stack remained as originally built. In 1857 the Wheatland became the property of the Pennsylvania Railroad, through the purchase by that company of the state improvements, its name was dropped and the consecutive number of the company, 166, substituted.

This engine was again altered somewhat in appearance in 1866, six years after the Prince's trip, by the removal of the dome from the barrel to the crown-sheet in the position previously occupied by the safety-valve column; the placing of a round sand box with base and cornice, on the former position of the dome, and the fastening of the bell to the base which had supported the square sandbox. The safety-valves were then put on the dome cover, and a balloon stack of J. P. Laird's design, which had been substituted for the straight one shown, in 1863, was retained in this last remodeling.

The engine continued thus without any further important change until consigned to the scrap heap in 1873.

When one remembers that this engine was built in 1853 the close resemblance of the valve-gear and many other parts to modern practice is especially noticeable.

Management of Railroad Mechanical Department Employees.

BY J. E. MUHLFELD,
General Superintendent of Motive Power, Baltimore & Ohio.

The universal demand for safe, fast and regular train service at low rates, and the urgency for railroads to realize their great responsibility in the safeguarding of the lives and property entrusted to their care, as well as for the interests of the shareholders, brings with it the necessity for more thorough organization.

There are no employees in the general railroad service who are more concerned in the accomplishment of the desired transportation result than those engaged in the direct operation, care and maintenance of the motive power and rolling equipment. As the total wages paid to this class of employees, together with the cost for the material which they use, approximates one-half of the entire railroad operating expense, this item of the service, contributing as largely as it does to the general welfare or disorganization of the property, is entitled to the foremost consideration. The intelligent inspection, care, handling, distribution and use of the usually large amounts of expensive equipment and material entrusted to the manipulation and operation of mechanical department employees will result in net returns that can be duplicated in no other way.

The primary essential in a railroad organization is efficient men in control, and these can only be produced by the education and encouragement of the employees who constitute the rank and file.

Organization to be complete and effective must be composed of members of executive ability who have practical and progressive ideas and a strong and systematic control of generalties and details. Therefore, to insure competent labor an attractive apprenticeship system, which will give each such employee every opportunity for his moral, mental and physical training and development, must be provided.

In the promulgation of such an apprenticeship system young men who are willing to prepare themselves for and to follow locomotive and electrical engineering as a vocation should be entitled to the shop and road education, instruction and consideration necessary to enable them to intelligently and promptly learn the practical requirements for promotion, providing their qualifications and conduct may merit continued employment.

There is a universal desire for the benefit that can be derived from a higher educational standard of the mechanic and an apprenticeship system to accomplish this result, and to be truly valuable must combine the practical with the intellectual instruction. Furthermore, the result to be accomplished will depend largely upon the efforts put forth by the management, and for the successful inauguration of a given system such methods must be adopted as will best meet the different local conditions and individual interests, all of which will necessarily involve considerable labor and expense.

Given a young man, say 16 years of age, who has received a good home and common school education, and has health, energy, ambition and a desire to enter railroad mechanical department employment, he should be started to work as a wiper in a locomotive classified repair shop and advanced successively to regular appren

ticeship work in the carpenter pattern, foundry, blacksmith, boiler machine and erecting shops, finishing his trade at the latter work. He should then be given the opportunity of inspecting and testing material and equipment and to do mechanic's work at engine houses and fire road locomotives.

During the apprenticeship course he should, on his own time, receive the benefit of the company's athletic and gymnastic associations, as well as of its educational facilities for mechanical drawing and practical mechanics. A system of progressive examinations should be in effect to determine how each young man's time has been occupied, and a record of these examinations should be kept in a proper manner.

After applying himself for five years at such employment a young man entering his majority should be in a position to decide as to his future special line of work and to qualify himself for a supervising position. But it is when the apprenticeship training has terminated and he must hammer out a place for himself in the world, that the care for his welfare must be given even more consideration by the management.

While a collegiate technical education is undoubtedly an advantage to those who will diligently apply themselves and fully embrace the opportunity offered by the information and knowledge gained in the use of books and instruments; it is not a necessity, and many college-bred men fail, because of their indisposition to go through the probationary period of practical mechanics and thereby learn how to secure the respect of and to supervise men, and convey information in a manner that will produce results, where the more practical and industrious man will succeed.

Even where a college course is afforded, the summer vacation periods should be spent in practical work under the regular, and not special, apprenticeship courses and rates of pay, in order to combine to the fullest extent the technical, theoretical and practical schooling with the actual shop operation and experience.

It is most desirable that railroad employees should receive instruction in railroad economics, such as organization, regulation, extension, improvement, condition, construction, operation, engineering and politics, from the school of experience, to properly equip them for administrative positions and to prepare them to handle details intelligently and to analyze difficult problems promptly and correctly. They should be taught to work with their own minds and to observe intelligently and not mechanically; to use books, reason clearly, become accurate, economize in time and money and to be mentally and morally honest and look facts squarely in the face.

Subordination is the first principle of good railroading, and, in connection with impartial and considerate treatment and a disposition on both sides to squarely meet the issues, will produce the greatest benefit from collective work. The young men should also be impressed with a respect for law and order, a love of chivalry and fairmindedness, with high purposes and ambitions.

Nothing will contribute more to railroad progress than a general characteristic of all engaged in the work to give the benefit of their experience to others and to receive from others and determine for themselves ideas which may be labor-saving. Such a desirable trait should be fostered and encouraged so that rapid advancement and improvement in railroad service and management may develop.

A systematic and departmental intercourse between employees of different departments should be stimulated, more especially as regards the use of technical and practical knowledge, with respect to design, construction and operation pertaining to the railroad as a whole, and a resolute effort should be made to secure brevity in the time required to make decisions. The necessary individual authority to act should be given and encouraged, while fiscal restrictions should be uniform and as simple as may be consistent with accuracy and safety and not interfere with the executive discretion.

In the adoption of methods and processes for labor and machine performance, each detail not absolutely indispensable should be eliminated, and the existence of any standard custom or practice should be no reason for its continuance when a better mode is offered.

Railroads, even more than industrial companies, require mechanical and electrical engineers of broad and sane intelligence, with a thorough grasp of general principles, and if competent men are to be secured and retained it will be necessary not only to give more consideration to rates of wage but also to provide the good treatment, careful instruction, counsel and vacations that competent men desire. Recognition should also be given to the deserving rank and file in filling new positions and those made vacant by regular promotion. The wages should be commensurate with the character and market value of the work performed and should be uniform for similar classes of service rendered in all departments. This will insure a strict enforcement of accounting for the property and the inauguration of practical, precise and intelligent methods for handling work to the best interest of the railroad as a whole rather than as a personal, divisional or departmental proposition.

Ash-Handling Plant of the Santa Fe at Argentine.

The yard at Argentine, Kan., across from Kansas City, is one of the largest on the Atchison, Topeka & Santa Fe, and the number of locomotives to be cared for approximates 150 daily. The ash pit facilities for these locomotives heretofore have been the usual shovel-cleaned type. Some more expeditious and cheaper method became necessary, however, and a mechanical plant has recently been completed, a photographic view of which is shown herewith.

There are four concrete pits, each 135 ft. long, 3 ft. 6 in. wide, under as many tracks leading to the roundhouse. In the bottom of each pit is a track of 12-lb. rails, on which run four trucks with removable buckets. When a locomotive is to be cleaned, one or more of these trucks is run under the ash-pan and its contents dumped into the bucket.

Spanning the four pits, midway of their length, is an overhead I-beam track with a trolley and hoisting block. The trolley may be stopped over any one of the four pits, and the instant it stops the block will descend. The loaded bucket is conveyed to the top of the circular bin at one side of the tracks. This bin is built entirely of reinforced concrete, and is lined with brick. The construction obviates all danger from fire, and the brick lining takes up the wear on the bottom.

The bin has a capacity of 75 tons, and is hoppered to the center.



75-Ton Reinforced Concrete Cinder Bin, A. T. & S. F.

The accumulated cinders are dumped through a gate in the bin bottom into railroad cars on a track beneath. Several carloads are handled every 24 hours.

The plant is electrically operated, the trolley being moved by a 10-h.p. Lidgerwood electric hoist in a small frame house back of the bin. The inclined trolley track obviates the use of a locking trolley, thereby greatly simplifying the mechanism. The buckets dump into the bin automatically. The complete operation of securing, dumping and returning a bucket to the farthest pit requires about two minutes. One man operates the plant. One of the pit men attaches the block-hook to the bucket bail, of course. The plant is understood to be giving entire satisfaction. It was designed and built by Roberts & Schaefer Co., Chicago.

Foreign Railroad Notes.

The American tramp must look out for his laurels in the matter of stealing rides. A Roumanian recently succeeded in lodging himself on the pipes underneath a dining-car of the Orient express at Costanza, on the Black Sea, said pipes affording a sort of shelf about 20 in. wide. He left this bed in Paris 53 hours later. It is remarked that at the end of the journey he was very dusty, hungry and thirsty, and possessed a capital amounting to 5 cents.

At the opening of the new railroad from the Red Sea at Port Sudan (a little north of Suakin) to the Nile at Berber, October 15, Lord Cromer congratulated the builders because they had been able to build the 325 miles through a waterless country in 14 months, and further because in that desert they had made it cost only £1,400,000, which is less than $21,000 a mile.

Various syndicates, native and foreign, have sought a concession for a railroad over the caravan route from Pekin northwest to the gate in the great wall at Kalgan, on the most direct route to Lake Balkan and Irkutsk, over which from time immemorial "caravan tea" has been carried to Siberia and Russia. The Chinese government has rejected them all, declaring that it will build this railroad itself, perhaps convinced by recent events that it will do well to keep in its own hands all approaches from adjacent countries.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS, WESTMINSTER, LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

The June Convention 657
The New Hill Line 657
The Missouri Report 657
The Railroads of the World 658
Master Car Builders' Convention 658
May Accidents 659
The Whistle Nuisance 659

ILLUSTRATED:

The El Paso Union Station 661
Master Mechanics' Reports 673
Westinghouse Electric Motors 684
Combination Wood and Steel Passenger Car for the Southern Railway 686
Standard All-Steel 60-ft. Postal Car for the Harriman Lines 687

MISCELLANEOUS:

Working Hours of Engineers and Firemen in France 660
Single-Phase Equipment for Richmond & Chesapeake Bay Railway Company 660
The Cape-to-Cairo Project (Note) 660
Foreign Railroad Notes:
French Railroad Earnings 661
Swiss State Railroads 661
Master Car Builders' Convention 662
Topical Discussions 667
Professor Hatt's Address 670
Address of Secretary Moseley 670
Addt'l Exhibits, Atlantic City Convention 671
New Atlantic City-Camden Record Run 672
The Year's Record of the Penn. Special 672
The Coal Traffic Inquiry 683
Details of the Penn. R.R. French Loan 684
Manhattan Elevated Damage Suits 686
Train Accidents in the U. S. in May 688

GENERAL NEWS SECTION:

Notes 177
Obituary 178
Elections and Appointments 178
Locomotive Building 180
Car Building 180
Railroad Structures 181
Railroad Construction 181
Railroad Corporation News 182

VOL. XL., No. 25. FRIDAY, JUNE 22, 1906.

In point of total attendance and number and size of exhibits, this year's conventions of the Master Car Builders' and American Railway Master Mechanics' associations established a new record; but it seems to us unwise to hold these important meetings at any place that affords so little chance for concentration as does Atlantic City. The primary end sought in holding the conventions is the opportunity afforded the members of the two associations to attend to the prescribed business of the sessions; but fully as much is accomplished by the private discussions among railroad officers, and between railroad officers and makers of appliances. As these discussions must take place outside the meeting hall, it is vital to the best interests of all concerned that a place be selected that affords facilities for easy concentration. There is, of course, at present no place quite as good as Saratoga Springs, and it is to be hoped that the attitude of the hotels of that village will be such as to make it advisable to again hold the convention there. We know that the two associations would gladly return to Saratoga next year if met in the proper spirit by those who should be most anxious to have them. This year's exhibits in the aggregate formed a miniature fair of railroad appliances. They were sufficiently complete to warrant a trip to Atlantic City; but most of them were in exposed places on the Steel Pier, and had to be covered at times to protect them from rain when they should have been open to view. This, together with the overwhelming attendance of men, women and children whose only interest in the exhibits was gathering souvenirs, was a poor return for an investment of several thousands of dollars.

Mr. J. J. Hill has announced that for the 1,300 miles of new road which he plans in Canada there is no intention to issue any bonds, and that the stock issue will cover only actual cost of construction. If one did not take Mr. Hill himself into the reckoning this would be a remarkable announcement, but parts of the road he built south of the boundary are covered by no mortgage debt. From the example of the Great Northern can be judged with considerable accuracy the probable success of the new Canadian line. The Great Northern, built through an uninhabited country, in competition with at least five other transcontinental lines, and built purely on the faith of its promoter, more than any other important railroad stands to-day capitalized at its actual construction cost. High finance and graft had no part in the building of this youngest transcontinental. To quote a remark of the *Wall Street Journal*, "The Great Northern was built to carry freight. Some other roads were built to carry bonds. Its engineers were ordered to make the cheapest freight route across the continent. They did it." As a consequence, the Great Northern's operating ratio is to-day less than 50 per cent. and Great Northern stock is paying 7 per cent. and selling at a far more than correspondingly high figure. Mr. Hill says that through the Great Northern, funds will be provided for the 1,300 miles of new Canadian line. That he will have no difficulty in persuading his shareholders to embark with him on the new venture is clear from his previous record of success. The list of holders of Northern Securities stock, which was published at the time of the dissolution of the company, showed that some of the largest holdings in the Hill group were those of members of the royal family and nobility of Great Britain. That in particular these Englishmen, after their large profits in previous enterprises under his pilotage, will be especially ready to take stock in a company to operate on Canadian soil under Mr. Hill's guidance is obvious. The fact of the matter is that most of us who have heard something of the wheat fields of the Canadian Northwest would not be averse to going in as partners in his new Canadian enterprise with the man who made the Great Northern.

The statistical and other contents of the thirtieth annual report, lately received, of the Railroad and Warehouse Commissioners of Missouri, suggest impressively the vast and ramified interests with which some of the older commissions of large western states have to deal. It reminds one also how Missouri, not unlike Illinois, has now become geographically a kind of great railroad "hub" with the metaphor only impaired by the fact that she has two railroad feet—St. Louis and Kansas City—instead of one. The interests directly or indirectly covered by her commission are immense.

Thirty-six railroad corporations make reports which, inside and outside the state, had for the last fiscal year 44,686 miles of road—7,819 miles in Missouri—with the enormous sum of $2,532,288,707 in stock and debt and gross earnings of $347,317,909. The railroad corporations paid taxes in the state amounting to $1,565,330. Turning from these absolute measures of railroad magnitudes to the powers of the commission itself, one finds that, besides purview of freights and fares—with a list of some 8,000 commodities in the official freight classification—it reaches out to the express companies and like the commissions in some other western states has also supervision and regulation of warehouses and warehouse charges. The state statutes and the rules of the commission bearing on these subjects, as well as on railroad construction, organization, consolidation and the like, fill 170 closely printed pages, not including 228 pages of schedules. Upon a board of three commissioners salaried at $3,000 a year each, and certainly not undercharged with duties, the Missouri legislature considerately has not followed the precedent of other states and imposed the duties of a tax commission also. In looking over the work of the commission for the year one finds—besides one case relating to the grading of red wheat, which went to the courts, 27 complaints of overcharges ranging from 10 cents to $254.91 and involving a total of $561.68. We annex as a sample of microscopic analysis the official record of the 10 cent refund:

> May 4, 1905. The American Laundry Co., Louisiana, Mo., complained of overcharge on a shipment of laundry by express. The Board ordered a reduction to a correct basis and refund of 10 cents was promptly made.

Which we reprint not in irony, but to indicate how the powers of these western railroad commissions span the gulf between great and small things. Was not, indeed, John Hampden's ship money tax, which went so far in bringing the head of an English king to the block, a matter of only twenty shillings!

THE RAILROADS OF THE WORLD.

The statistics of the railroads of the world, compiled by the *Archiv für Eisenbahnwesen*, indicate an increase of 16,751 miles, or 3.1 per cent., from 1903 to 1904, which is the largest addition reported for years, though but little more than in 1901, the new mileage in each of the six years down to 1904 having been:

1899	13,533	1901	16,328	1903	13,135
1900	10,800	1902	13,335	1904	16,751

This shows an increase of 83,882 miles since 1898 and of 59,549 miles since 1900, making a total in 1904 of 550,735 miles, of which a little more than half is on the American continent, 44¾ per cent. in North America, and 39 per cent. in the United States.

The mileage in each of the grand divisions of the world was:

Europe	189,774	North America	249,717
Asia	47,974	South America	30,258
Africa	16,202	Australasia	16,810
Old World	253,950	New World	296,785

Of the additions made in the last year reported, 16,751 miles, nearly two-thirds was in America and not one-fifth in Europe, the new mileage for that year in each continent having been:

Europe	3,050	America	11,160
Asia	1,653	Australia	205
Africa	643		

The average yearly increase in Europe has not varied greatly for some years. In Asia the only additions of importance in the last year were 609 miles in British India, 498 miles in Korea, 289 in Japan, 82 in Turkey, and 52 in China. Russia opened no new railroad in Asia from 1901 to 1904, but it has opened one line more than a thousand miles long in Central Asia since 1904. In Africa nearly all the new road was in Egypt (281 miles) and the German colonies (260 miles). Since 1904 there has been considerable building, especially in British South Africa and in Egypt and Algiers.

Of the new mileage in America something more than half was built in the United States; but the most notable growth was in Mexico, where 1,720 miles were opened, and more than the total of the four previous years. Canada is credited with but 533 miles. In South America, out of a total addition of 2,855 miles, 1,611 miles were in Argentina and 1,039 in Brazil. Ecuador makes its appearance for the first time, with 37 miles of the railroad from the post of Guayaquil up to the Andes plateau.

While Great Britain has less than one-twelfth of the railroad mileage in Europe, and one-fourteenth of that in America, it has four-sevenths of the Asiatic railroads, nearly two-thirds of the African, and substantially all the Australasian lines, making a total of 98,150 miles in Great Britain and its colonies, which, with the 213,904 miles in the United States, gives 312,054 miles, or nearly 57 per cent. of the railroads of the world, in the hands of the English-speaking peoples.

The *Archiv* gives statistics of the capital invested in railroads, so far as possible. About 95 per cent. of the European railroads have cost $20,017,888,000, or at the average rate of $112,777 per mile. The statistics for the rest of the world cover seven-eighths of the mileage, whose aggregate cost has been $17,463,250,000, and the average per mile $57,991. The average for the United States was $50,963.

The total railroad investment of the world, providing the mileage not reported is of the average cost, was about $21,000,000,000 in Europe and likewise $21,000,000,000 in the rest of the world, but this goodly sum of 42,000 millions of dollars amounts to less than $28 per inhabitant, according to the latest estimates of the population of the earth.

MASTER CAR BUILDERS' CONVENTION.

The fortieth convention of the Master Car Builders' Association, held last week at Atlantic City, was a notable one. The attendance was larger than ever before, and the interest manifested in the committee reports and topical discussions was quite up to the standard of previous years. Several of the subjects considered and the action taken thereon will have a marked effect on the future condition of car equipment. Most of the committee reports were carefully and thoroughly prepared, and the information contained in them was evidently the result of painstaking work on the part of all the members of the committees. There has generally been displayed a spirit of fearlessness in treating the subjects assigned, and no attempt made to cover up or handle with gloves any of the delicate questions of comparison of different devices. This is as it should be. The Master Car Builders' Association has had, above all things, a reputation for honesty, integrity and square dealing, and its widespread influence to-day depends largely upon that reputation, which it has taken years to build up.

An example of this fearlessness of opinion is the report of the committee on automatic connectors for steam heat, air brake and air signal pipes. There are two distinct types of such devices, which differ so essentially in their construction that they cannot be made to interchange. On account of the patent situation, which, it is claimed, restricts the manufacture of such devices, the committee recommended that it be continued, with explicit instructions to prepare standard dimensions for connectors, considering only the type in which the parting is made on a line at right angles to the center line of track. It appeared from the discussion in the convention following the reading of the report that there was some misunderstanding with regard to the patent situation, and that the committee was possibly a little premature in recommending that it confine its labors in the matter of standardization to one type only, of which there are a number of modifications. The situation promises to become interesting within the next year or two, for already there is a bill before Congress to compel the adoption of some such device. The Master Car Builders' Association will have to face the same problem which confronted it twenty years ago when it adopted the present coupler contour lines and the principle of a vertical plane coupler. The need of some such device is apparent. All that portion of the Safety Appliance act referring to automatic couplers is intended to compel the application and maintenance of a device for coupling cars which will not make it necessary for a trainman to go between the cars when coupling or uncoupling them. It is, however, absolutely necessary at the present time to go between the cars to couple and uncouple steam, air brake and air signal hose, and in so doing to get down on the track in such a position that in case the cars were started the trainman would almost certainly be ground under the wheels. However, the application of a number of different connectors which would not interchange with each other would be far worse than the use of the present hand coupling, for it would result in endless delay and possibly serious accidents in attempting to use makeshift non-automatic coupling devices. The expression of several of the members of the association on this point will be found in the abstract of the proceedings. Next year the association may have a chance to show how strong it is in making its decision.

One of the best and most valuable reports which has been presented to the association in years was that of the committee on brake beams. The condition of brake beams generally has been

notoriously bad. Many of the beams in use are weak, and their maintenance has been sadly neglected. The committee began at the bottom and went into an exhaustive investigation of the causes of failure, the necessary requirements of service and the actual strength of many of the beams now in use. After explaining the weak points of the present brake beams, the committee makes a number of recommendations which, if followed out, will do much to improve the deplorable conditions which apparently exist on many roads. The report includes full details of all of the tests made, and compares the various brake beams submitted in their order of merit as regards meeting certain requirements as to strength, deflection, weight, etc. There is no fear or favor shown to the good or bad, and a careful study of the data presented cannot help but pave the way for a gradual weeding out of some of the beams in use which obviously are unfit for use under high capacity cars. The proposed specifications laid down by the committee in their report should accomplish much good if they are carefully followed.

The report of the committee on air brake hose specifications is almost as complete as that of the committee on brake beams, and it is equally non-partisan. Such reports are of value to the railroads and to the makers. The railroads usually know what they are buying and the makers know what they are selling. It is well, however, once in a while to make sure of the quality and condition of the product in an impartial manner. The report brings out strongly a condition of affairs which should be discouraged. The Master Car Builders' Association has adopted as standard certain specifications for air brake hose. The tests made at Purdue show that 78 per cent. of the total number of hose tested passed the M. C. B. specifications for bursting test, but that only 32 per cent. of the total number of hose tested passed the M. C. B. specifications for the friction test, and but 4 per cent. passed the stretching test. So long as the specifications are the standard of the association, they should be lived up to. All hose used on cars in interchange must be labeled M. C. B. standard, and that label presumably indicates that such hose has been tested according to the specifications, and, having passed the test, been accepted. The tests made show that much of the hose in use will not stand the prescribed tests.

The report of the committee on brake shoes discloses a point which should be given more than passing attention. The present specifications for brake shoes provide for a minimum coefficient of friction, but they do not fix a maximum. The minimum requirement is 20, and while only two of the 15 shoes tested fell below this requirement, two at least of the shoes exceeded it by 75 per cent. or more. A high coefficient of friction is desirable in a brake shoe, but in stopping a train it is necessary for safety and convenience to have some uniformity in the braking effect under each car. Triple valves, cylinder travel, brake leverage, etc., are carefully adjusted to give uniform action throughout a train. With equal pressure on the brake shoes, the retarding effect varies directly as the coefficient of friction. If the coefficient of friction on one car equipped with one kind of brake shoe is 37 and the coefficient of friction on the next adjoining car equipped with a different type of brake shoe is 20 (the standard required), the first car will be retarded with almost double the amount of force that the second car has acting upon it, and if these conditions are interspersed throughout a train the surging due to braking may become very severe. It would seem to be almost imperative that some maximum limit be adopted.

May Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of May, printed in another column, contains accounts of 15 collisions, 16 derailments, and four other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

June.	Place.	Killed.	Injured.
4th	Clover Creek Junction, Pa.	10	33
7th	Camden, N. J.	0	14
11th	Lynchburg, Va.	1	1
19th	Pearre, Md.	5	15
23d	Charleston, W. Va.	2	16
28th	Louisville, Ky.	8	22

Throughout the 33 years that we have recorded the train accidents of the country this column has been sadly deficient in humor; partly because of the dulness of the editor's mind and partly, no doubt, on account of the sadness of the subject. But with the abounding prosperity of the daily papers which is now so all pervasive, the reporter of genius and wit is found everywhere, and so we have at last a humorous train accident; to wit, the derailment at Mankato, Kansas, May 25, when Madame Sarah Bernhardt was a passenger on the train. "The escape of the train was miraculous," we are told; but it was scarcely less miraculous than the alertness of Madame Bernhardt's press agent, who had half a column of copy ready for the Associated Press in less than no time. And how nicely he arranged it! Bath rooms in cars are not particularly plentiful in the arid wastes of Kansas, but there was one on this train, all right; and the actress was in it!

"Mme. Bernhardt was taking a bath when the crash came, but within a minute she had donned clothes sufficient to appear in public and was out on the track gesticulating and talking at her best speed. She ran up to the engine and addressed the engineer in French and English. She then turned to the conductor. It was found that she regarded the locomotive as hoodooed, and she had expected a wreck on that account. She also decided that a new engine must be supplied immediately, as she would not ride behind the old one again. The tender was rerailed, and everything made ready to go. But Mme. Bernhardt refused to move, and demanded that the train be brought back to Mankato until another locomotive could be found for her. . . .

As we received no tickets to the show we shall print no more, though the exchange of notes between the actress and a business men's excursion, held up by the wreck, and, later, her appeal to the superintendent for a freight engine, make exciting reading. The incident was a record performance in many respects. That an actress can dress in one minute may not be so very startling, in view of the small quantity and simple character of the clothes that actresses sometimes wear; but the tout ensemble was so studded with artistic features that we have no doubt that the passenger department of the Rock Island road will reap golden benefits from the incident for years to come.

The two most serious accidents this month, Clover Creek Junction and Louisville, have already been reported in the *Railroad Gazette*. The moral of the first mentioned is the need of the block system. While it is true that in 99 per cent. or more of the accidents which appear in the records the cause is unmistakably seen to be one that is susceptible of decided reduction, if not entire abolition, by simple and well-known expedients in discipline, or methods, or selection of men, it is nevertheless fair to say that in this case we have typical conditions on one of the best roads—and yet we have the collision. Much could be said in connection with this case concerning the care with which men are selected, the intelligence with which the code of rules is prepared and administered, the fair treatment of the men, and of the valuable experience and acceptable record of the man who in this particular case was at fault—and yet we have the collision.

The moral of the Louisville case is the need of impartial and thorough investigation of accidents by a public authority. The first reports said that the derailment was due to the breaking of the flange of a wheel, but as the car jumped the track at or very near a switch, there is room for the claim that a loose switch point caused the breakage of the wheel. In cases like this, the car department always strenuously claims that the fault was with the switch, while the roadway department with equal persistency denies the claim. In such a situation, the public should have the opinion of an impartial expert.

The number of electric car accidents reported in the newspapers of the United States in the month of May was 21, 10 persons killed, 192 injured.

One of the electric car accidents was of a kind which will rarely occur on a standard railroad—a fire due to running into an automobile. In Cincinnati, on the 30th, two street cars collided with an automobile and demolished it. The gasolene tank at once burst into flame and nearly roasted to death the four persons in the vehicle who had been entangled in the wreckage; and the flame burst into and through the street cars, crowded with passengers, so quickly that a dozen of the occupants were burned or were trampled in the panic and struggle to get out of the cars. The combustible parts of the two cars and of the automobile were destroyed by the fire in ten minutes.

The Whistle Nuisance.

History is constantly repeating itself—or else it is not of much account as history; and reforms many times fade out and have to be done over again. This is the common experience of veterans. At least 30 years ago, if not 40, locomotive whistling became a great nuisance in the region of Boston, and, after the usual amount of annoyance, complaint and agitation, it was quite effectually suppressed; but now the same problem seems to have come up anew. The Massachusetts State Railroad Commissioners have received petitions from people in Dorchester, Quincy, Leominster and Hingham, asking for an order to stop the whistling of locomotives, and 40 or more people were on hand at the hearing to rehearse their grievance. But the Commission granted all the petitions without a word from anybody, and the railroad company—the New York, New Haven & Hartford—made no objection. The Superintendent said that he was glad enough to stop the whistling provided he could have the order of the commissioners to do so. Continuing, the report says:

"Chairman Jackson, at the opening of the hearing, stated that

the whistling at crossings was due to a recent Connecticut case in which the bell signals only had been used, and an accident resulted. The company thereupon ordered its engineers to blow the whistle at crossings, this being a signal which could not be mistaken, whereas there was a conflict of testimony regarding the ringing of the bell. The order was made to apply to the whole system. The Railroad Commissioners, however, had absolute power to prohibit whistling at crossings, after a hearing upon petition. There was no necessity of presenting testimony, as the board had sent its own inspectors to all these points, and had reports on the conditions in each case. He then made the statement that in all cases where crossings are guarded by flagmen, gates or bells, unless exceptional conditions exist, the board will issue orders immediately, upon petition, to stop whistling.

"Mr. Field, of Dorchester, asked what the position of the board was in regard to night whistling of switching engines. He was inclined to think that some engineers whistled maliciously, and Chairman Jackson told him that a specific appeal to the board would lie in such cases. The board has no authority to prohibit whistling in yards at night, but it recommends to the railroads that they cut down their whistling to the minimum, and the companies have issued orders to their engineers to this effect. If these orders are disregarded the company, as well as the board, would like to know it."

For furnishing grist for the lawyers' mill the highway crossing is almost as prolific as railroad spine—and sometimes, of course, the crossing and the "spine" co-operate. Probably that Connecticut case was one in which no gate, flagman or bell was concerned; but the presence or absence of gates or watchmen seems to make little difference in the total number of damage suits. The number of pedestrians and carriages crossing the railroad at guarded crossings is so much larger than at those which are unguarded that, while the proportion of casualties to the number of persons passing over is probably smaller at the large crossings than at the small ones, the number killed or injured per crossing probably is as great in the city as in the country. If a warning is worth having at the crossing at all, either man-operated or automatic, surely we ought to be able to make it thoroughly satisfactory without depending on any noise from the engine whatever. Having made sure that every approaching train shall energize the bell, or awaken the attendant, which can be done without disturbing the residents in the houses, it is unscientific to continue the use of the barbarous whistle. But why use such a barbarous instrument in ordinary service at all, even at unwatched and unsignaled crossings? The law of Massachusetts, if we mistake not, requires either a whistle or a bell, but not both. It says, in effect, that if a railroad manager is energetic enough to manage his bells efficiently he need not use the whistle. To continue the general use of the whistle in Massachusetts is to perpetuate a custom suitable only for wild and thinly settled countries where trains are few and noise is appreciated as a relief from the everlasting silence. A bell gives ample warning to careful horsemen and to the great majority of the careless. The small number who are so heedless that they do not collect their thoughts until they get within 10 ft. of the track will, in a majority of cases, continue their heedless course in spite of a whistle—and then swear that the whistle was not sounded. At all events these have few rights as compared with the thousands of more sensitive and sensible people whom the whistles disturb. Some states have approved, by statute law, the principle that every wayfarer approaching a railroad should stop, look and listen; and to persons who carry out this reasonable rule, or even half carry it out, the bell is a more than sufficient warning.

Another incident at the Boston hearing illustrates the fact that the noise problem is at least 40 years old—and yet continues young. The Dorchester man thought that the yard enginemen who had disturbed him at night did so maliciously. 'Twas always thus. A healthy man switching freight cars, and a nervous poet trying to sleep, are in such different mental states that they will never see alike. The only way out, if the railroad company is going to be at peace with poets, invalids and other critical people, is to have the yard engineman, in the matter of noise, ruled *entirely* by some authority other than his own judgment

Chairman Jackson's reply to Mr. Field calls to mind still another perennial difficulty in the relations between railroads and the public, and reminds us that to rule a yard engineman, as we have suggested, may be easier said than done. The chairman told the complainant that if enginemen disobeyed the whistle prohibitions the railroad company would be glad to know it. But why doesn't the company find out about such misconduct before any outsider can have time to send in a complaint?

Working Hours of Engineers and Firemen in France.

The Minister of Public Works of France has recently issued a revision of the regulations bearing upon the duration of the hours of labor of locomotive engineers and firemen. It requires, in part, that the average day's work shall include 10 hours of effective labor, at the most, and at least 10 hours of entire rest, so that in any nine consecutive days there should not be more than 90 hours of effective work or less than the same amount of rest. For road engineers and firemen there should be a period of 30 consecutive hours of rest on an average of once every 10 days. These rest days may be counted, less 20 hours, in the period of rest previously called for. When, however, the service is such that the men are not required to sleep away from home, these hours of rest may be reduced to 15. It will only be considered that the men are not obliged to sleep from home when they can have at least 10 consecutive hours there every day between 6 p. m. and noon of the following day. For engineers and firemen engaged in switching service, there must be a 30 hour period of rest every 15 days on an average, or 24 hours every 10 days when the engineer is assisted by a fireman. But where he works alone there must be a 30-hour rest every 12 days, or one of 24 hours on the average every eight days. These rest days can be counted in the total of the 90 hours already called for, for their full value less 20 or 14 hours, according to circumstances. The lapse of time needed by engineer and fireman for preparation of the locomotive, as well as that actually spent on the road, is to be counted in the period of work.—*Le Journal des Transports.*

Single-Phase Equipment for Richmond & Chesapeake Bay Railway Company.

The Richmond & Chesapeake Bay Railway Company has been incorporated to build a single-phase electric line, about 15 miles, from Richmond to Ashland, paralleling the Richmond, Fredericksburg & Potomac. It is planned to reach ultimately from Richmond to the Chesapeake Bay. The contracts for the equipment of the 15-mile section have been let to the General Electric Company. The catenary method of suspension will be used, adapted for a trolley potential of 6,600 volts. Each of the cars will be equipped with four G.E.A.-603 (125) A.C. single-phase motors, with multiple unit control. The air-brake system will be of the combined straight and automatic type with C.P.A.-52 motor compressors.

Power for the operation of the new road will be furnished by the Virginia Passenger & Power Company, and the arrangements for furnishing the single-phase current are of especial interest. Two generating sets will be furnished, both to be operated ordinarily by water power but arranged for electrical drive when that is necessary. The first unit will consist of a 750-kilowatt, 6,600-volt, three-phase, 25-cycle generator, mounted on the same shaft with a 750-kilowatt, 2,300-volt, 60-cycle, three-phase generator, the shaft being extended at one end for connection with a water wheel of sufficient power to drive both generators at their rated output.

The second set will be made up of a 25-cycle, 6,600-volt generator, a duplicate of the first, but instead of being mounted with a 60-cycle machine, this generator will be mounted on the same shaft with a 750-kilowatt, 550-volt, direct-current machine. When there is sufficient water to operate all of the water-wheel generators in the station, these sets will be driven by the water-wheels; if at any time there is sufficient water to drive the generators or flood conditions render it advisable to close the gate valves, the sets will be disconnected from the wheels and operated as straight motor generator units. In their respective cases, the 60-cycle generator will run as a 60-cycle synchronous motor and the 550-volt machine will operate as a direct-current motor. Power for driving the motor and of the 25-cycle sets in this way will be obtained from the engine driven units of the Virginia Passenger & Power Company already installed. When the motor generator units are operated as water-wheel driven machines, the 60-cycle generator will be operated in parallel with the present 60-cycle machines, and the 550-volt machine in the other set will run in multiple with the present 550-volt machines. The 750-kilowatt, 25-cycle generators in each set will for the present be operated as single-phase machines and will supply current directly to the trolley of Richmond & Chesapeake road at 6,600 volts.

There will be a lighting station at Ashland. This will consist of a 100-kilowatt, 2,300-volt, 60-cycle, three-phase generator mounted upon a common base with a 150-h.p., 440-volt, 25-cycle, single-phase induction motor. This set will be operated from the 6,600-volt trolley through a 150-kilowatt, single-phase, oil-cooled transformer. The motor generator set will be provided with a direct-connected exciter mounted on an extension of the shaft. The voltage will be controlled by a Tirrill automatic regulator, made by the General Electric Company, which will insure a uniform voltage at the generator end of the lighting service regardless of the fluctuating trolley voltage.

Late news from the Cape-to-Cairo Railroad is that the track is laid to the Kafue river, 258 miles northeast of the Victoria Falls, and the roadbed is graded 70 miles further. By June it is expected to open the line to the Broken Hill zinc and lead mines, 375 miles northeast of the Falls. The further extension will probably be due northward to the border of the Congo Free State, nearly 200 miles north of the mines.

The El Paso Union Station.

The new union station at El Paso, Texas, has recently been completed and opened to service. The two views of it which are reproduced herewith show that it can justly claim to be one of the finest stations in the Southwest. A detailed description of the structure from the architects' plans was published in these columns before work was begun on it (July 8, 1904). Prior to the completion of this station the several roads into El Paso had each its individual station except the Santa Fe and Mexican Central, which were joint occupants. All roads now use the union station. It is at the corner of Crosby and San Francisco streets, about three-quarters of a mile from the business center of the city.

The main building is two stories, with a clerestory. The tower is 130 ft. high. The building is 143 ft. 3 in. x 103 ft. 3 in. and has a one-story wing 61 ft. 1 in. wide extending back parallel to the tracks 247 ft. This wing contains the dining and lunch room and kitchen, the baggage room, and several smaller compartments for customs, trainmen's boxes and Pullman quarters. The main waiting room, shown in one of the views, is approximately 60 ft. x 100 ft., and its ceiling is 44 ft. 9 in. above the floor. It has a mosaic tile floor and plaster walls and ceiling. The roof supporting columns are expanded metal and plaster, 28 ft. high and 20 ft. on centers. The building is heated by steam and lighted by electricity. In the exterior view the absence of train sheds will be noted. The dry, mild climate of El Paso makes such protection unnecessary.



The New Union Station at El Paso, Texas.



Main Waiting Room of the El Paso Union Station.

The Board of Directors of the Union Depot Company is made up of a representative officer from each road and a representative for the citizens of El Paso. Mr. J. E. Hurley, General Manager of the Santa Fe, is President. The architects for the station were D. H. Burnham & Co., Chicago, and Frank Powers, El Paso, was the contractor.

Foreign Railroad Notes.

The French railroads earned gross 4 per cent. more in 1905 than in 1904. In 1904 the gain was less than 1 per cent.

The German fireman tried because he did not report that his engineman was drunk, so six weeks in prison, said engineman causing a collision which cost him his life.

The Swiss State Railroad earned gross 6 per cent. more in 1905 than in 1904, and, contrary to the estimates, the net earnings increased about $440,000, instead of the decrease of $160,000 which the management expected a year ago. The Gotthard Railroad, also (which is not yet a state railroad), had an increase of 6 per cent. in gross and of 8½ per cent. in net earnings.

The Master Car Builders' Convention.

The 40th annual convention of the Master Car Builders' Association was held in the sun parlor of the Steel Pier at Atlantic City, N. J., June 13, 14 and 15. It was the largest and most successful convention the association has had, the attendance being about 25 per cent. greater than ever before. The meeting was called to order promptly at 9:30 a. m. by President Joseph E. Buker (Ill. Cent.). After an invocation by Rev. N. W. Caldwell, Mayor Stoy of Atlantic City welcomed the members. Hon. George A. Post responded on behalf of the Association. Following this, President Buker delivered his address, which was in part as follows:

PRESIDENT'S ADDRESS.

From that little gathering in Springfield, Mass., in May, 1867, at which time there were 39,000 miles of railroad in the United States, with 268 engines, 16,135 freight cars and 220 passenger cars, the Master Car Builders' Association has grown until to-day we make the claim of being the greatest association of this kind in the world, with a membership of 629, having jurisdiction over 2,047,327 freight cars, valued at approximately $1,037,341,800, which compose the vehicles which move 1,277,771,573 tons of freight, producing a revenue of $1,374,102,275, and 41,981 passenger cars, valued at approximately $251,886,000, handling 716,244,858 passengers, producing a revenue of approximately $456,343,380 and operating over 293,937.42 miles of railroad—this not including cars owned by individuals or private companies; the value of such freight cars was on June 30, 1904, $72,000,000, and of cars operated by the Pullman Company $51,000,000, or a total of $123,000,000, making a grand total of $1,412,227,800, approximate valuation of passenger and freight cars.

Passenger engines have increased in tractive power in the last 20 years from about 10,000 to 12,000 lbs. to about 30,000 lbs., and freight engines from about 18,000 to 20,000 to 40,000 and 50,000 lbs., several types of engines having 70,000 to 80,000 lbs. tractive power; and, while these figures indicate the pace of the motive power officers of recent years, the car builders have kept abreast in a phenomenal record of improved car design and construction, until to-day the American railroads have an equipment which surpasses any other in the world.

One of the important subjects to railroad men in the operating department is the evolution of motor cars for suburban, interurban and branch line service, and on the mechanical department will devolve the duty of working out, both theoretically and by actual practice, the type of car and method of generating and applying power most suitable for this new departure. I believe that a permanently increasing demand will have to be met for such cars for railroad companies.

The enormous increase in the tractive power of engines above mentioned is in itself a warning to all who have to do with the design, construction or maintenance of cars, of any and all types and classes, that the construction must be such as to stand the buffing and pulling shocks of engines weighing 300,000 lbs. and with a tractive power of 40,000 to 80,000 lbs. Friction draft gear, and all forms of both pulling and compression devices, and the individual parts thereof, should receive most careful consideration from you.

I also wish to impress upon your minds the necessity of having brought to the attention of the management of the railroads, through the proper channels, full information in respect to damage and destruction of freight equipment by means beyond the control of mechanical department officers, and against the effects of which engineering skill, scientific research, practical experience, modern design or excellence of materials afford neither protection nor relief; this being controlled only by the transportation branch of the operating department.

The introduction of steel in car construction seems so eminently proper from all standpoints that there should be no hesitation in preparing the way for its more complete and permanent substitution for wood.

The rules of interchange have served our purpose so well during the past year, as evidenced by the heavy volume of business handled at interchange points without friction or delay that I urge that you make only such changes in these rules as new conditions may warrant, or to afford either relief or protection from any ambiguity that may exist. The referring of only about a dozen cases in dispute to the Arbitration Committee further evidences the fact that the present rules are very satisfactory. The report of the Arbitration Committee I commend to you. Although a good many changes are proposed, the committee has been very conservative in approving their adoption.

In the matter of a standard coupler I desire to impress upon you the inconsistency of our position, in that there are still in use a variety of car couplers, with a multiplicity of unlike parts, all coming within the M. C. B. requirements, which should through the committees assigned yield to a process of elimination resulting in one single standard M. C. B. coupler, as the term literally implies, and one that fully meets all requirements of the Interstate Commerce Commission's safety appliance act. In this connection I would call your attention to the report of the special Committee on Composite Design of Coupler. It would seem that the instructions given the committee at the last convention that a "design of composite coupler be agreed upon which shall contain, as far as possible, the desirable features of the best couplers as now designed" cannot be complied with for reasons which it states. It is suggested that the second recommendation of the coupler committee in its report last year—namely, "that the gradual improvement of the M. C. B. standard coupler, and the elimination of poorly designed and weak couplers be carried on by making the requirements to be met by the M. C. B. couplers more and more rigid"—be reaffirmed to the end that the large variety of couplers be reduced to a minimum.

I also ask your attention to and thoughtful consideration of any other committee reports on matters pertaining to safety devices.

It is proper that special mention should be made of the matter of "An Automatic Steam and Air Hose Connector" between cars, which is the subject of a committee report. The work by this committee should be carried on, to the end that a standard device, reasonable in cost, practical for all conditions of service, and free from any features that would mitigate against perfect interchangeability of parts, or satisfactory connection, in every case, of cars with M. C. B. couplers, coupled by impact as prescribed by law, be agreed upon, if within the range of possibilities.

Our progress in these matters should leave no doubt of our desire to cheerfully co-operate with the Interstate Commerce Commission, not only in the proper observance of present laws and instructions, but by a pronounced effort to assist in providing adequate remedies for any new conditions that now exist, or may arise in future.

The electrification of steam railroads in certain parts of the country has brought into prominence the necessity of proper clearances for passenger, freight and locomotive equipment which will operate over such roads. It would seem to me that the development of this question has reached the point where some action is desirable, and I would suggest the appointment of a committee to consider the matter of clearances for electrical equipment.

The report of the Secretary showed a total present membership of 631, divided as follows: Active, 356; representative, 243; associate, 13; life, 19. The number of cars represented in the association is 2,047,327. Four active members have died within the year.

The Treasurer's report showed a balance on hand of $5,104.

The following changes in the constitution, which were proposed last year and, in accordance with constitutional provision, laid over one year, were adopted:

Section 2 of Article III on eligibility to active membership was made to read as follows:

"Section 2. Any person holding the position of Superintendent of the Car Department, Master Car Builder, Assistant Mechanical Superintendent, Mechanical Engineer, Assistant Mechanical Engineer, Assistant Engineer of Motive Power, Chief Draughtsman, foreman of a railroad car shop, Joint Car Inspector or one representative from each car manufacturing company or other company owning or operating over 1,000 cars which are not in process of purchase by other parties, may become an active member by paying his dues for one year."

On motion, this was amended to include Assistant Master Car Builders. The balance of the section remains as at present.

Section 5 of Article II, regarding life membership, was modified so that either active or representative members who have been in good standing 20 years may become life members on the recommendation of the Executive Committee.

Mr. Godfrey W. Rhodes was elected to life membership in the association.

The following resolution by the Executive Committee was submitted to the convention:

"The 77th General Assembly of the State of Ohio, in 1906, passed House Bill No. 242. Section No. 3 of this bill reads as follows:

" 'That it shall be unlawful for any such common carrier to haul or permit to be hauled or used on its line any locomotive, car, tender or similar vehicle used in moving State traffic not provided with secure grab-irons or hand-holds in the sides of ends thereof; each and every car used in the movement of State traffic shall be provided with secure sill steps on each end of each side thereof.'

"Whereas, The Master Car Builders' Association has earnestly labored for more than a generation to bring about uniformity in car equipment, and has been aided therein by national legislation, which the Interstate Commerce Commission is directed to execute and enforce, and, in conformity with the rules of the Master Car Builders' Association, the Interstate Commerce Commission has adopted a system of inspection based on those rules; and,

"Whereas, The 77th General Assembly of the State of Ohio, in 1906, passed House Bill No. 242, which, among other things, requires the application of extra sill steps not required by national legislation, the application of which will destroy the uniformity in equipment which is so necessary for the safety of trainmen and the proper interchange of cars; therefore,

"Be it resolved, That the enforcement of such legislation will

be subversive of the work of the Master Car Builders' Association, destructive of the uniformity which alone has enabled the traffic of the country to be handled from one end to the other regardless of the ownership of the cars, and, therefore, the Master Car Builders' Association earnestly protests against the enactment or enforcement of legislation by any State which is calculated to destroy the uniformity of equipment so necessary to safety and the expeditious interchange of cars."

Members pointed out in detail the bad results that would ensue from compliance with this legislation in increased liability of danger to trainmen, and thought these points should be brought to the attention of the legislators. Mr. W. E. Fowler (C. P. R.), of the Executive Committee, said that all of this ground had been gone over by the committee in considering the matter, but it was thought the resolution would be more effective in the form submitted, with the details omitted; that the resolution as presented will, if it is brought to the attention of the various State legislators, impress upon them the inability of men not experienced in railroad devices to pass suitable legislation covering them, and they ought to be satisfied to leave the matter in the hands of the persons to whom it belongs—the railroad companies and the Interstate Commerce Commission.

The resolution was adopted.

Mr. Edward A. Moseley, Secretary of the Interstate Commerce Commission, next addressed the convention. An abstract of this address will be found in another column. Before reading his remarks, however, Mr. Moseley referred to the matter covered in the foregoing resolution, saying that the Commission desired to see no legislation which would conflict with the views and rules of the Master Car Builders, and that he would be glad to see any State pass a law that the rules and regulations of the Master Car Builders' Association should be law until such time as the Master Car Builders' Association in its wisdom sees fit to change them.

DISCUSSION OF REPORTS.

Revision of Standards and Recommended Practice.—In its report the committee made reference to all of the standards and recommended practice of the association, noting such changes as had been proposed and making recommendations. The report was read by sections to give opportunity for discussion on each. Before reading the report Mr. C. A. Schroyer (C. & N. W.), chairman of the committee, read a letter from Mr. O. C. Cromwell, of the B. & O., suggesting certain changes in the present standard 5½-in. x 10-in. journal axle. These changes consist of substituting a ¾-in. for a ⅛-in. radius between the wheel-fit and the rough collar adjoining the inside hub of the wheel, and also increasing the size of the radius between the dust-guard and the wheel-fit from ⅛ in. to ¼ in.

A blueprint showing the proposed changes was exhibited. On motion, the recommendation was received and referred to letter ballot.

Under "Height of Couplers" the recommendations of the committee were approved and the matter referred to the Executive Committee to appoint a committee on the subject, to report at the next convention.

"Archbar and Column Bolt for 80,000-lb. Capacity Cars." Motion to appoint a special committee to report at the 1907 convention in accordance with the recommendation in the report carried.

"Passenger Car Journal Box and Contained Parts." The recommendation was adopted and referred to the Executive Committee.

The recommendation of the committee under "Handholds," "Pedestal and Journal Box for Passenger Cars" and "Storing Line Cars on Foreign Roads" were referred to letter ballot.

Tests of Master Car Builders' Couplers.—The secretary was instructed to incorporate in the Proceedings the changes recommended by this committee. The committee was instructed regarding action for the ensuing year in accordance with the recommendation thereon in its report.

Composite Design of Coupler.—The report was received without discussion and the committee discharged.

Cast Iron Wheels.—The report, which was read from the manuscript by the chairman of the committee, Mr. William Garstang (Big Four), was as follows:

A conference was arranged with the American Railway Association through a committee appointed by President Fish, with Mr. G. L. Peck as chairman, the instructions to Mr. Peck's committee being to consider a standard cast iron wheel and rail section. The personnel of this committee was as follows:

Mr. J. T. Richards, C. E., Pennsylvania Railroad.

Mr. J. Kruttschnitt, Director of Maintenance and Operation, Southern Pacific.

W. J. Wilgus, Vice-president, New York Central.

R. Montfort, Consulting Engineer, Louisville & Nashville.

E. C. Carter, C. E., Chicago & North-Western.

William Garstang, Superintendent Motive Power, Big Four.

R. L. Ettenger, Consulting Mechanical Engineer, Southern.

W. E. Fowler, Master Car Builder, Canadian Pacific.

This committee held a meeting on April 24 at Chicago and another meeting on June 12 at Atlantic City. At the Chicago meeting the present Master Car Builders' standard wheel was presented with the flange increased, the increase amounting to ⅛ in. on the inside.

The maintenance of way members, after taking the matter under advisement, reported at the Atlantic City meeting that the thickness of flange might be used with present track conditions without detriment to frogs or crossings, and to put the opinion of his committee before the Master Car Builders' Association, so that some action can be taken at this convention, Mr. G. L. Peck, chairman, has handed us the following letter:

"The question as to whether the proposed increase of ⅛ in. in the thickness of flange of cast iron wheel would make it necessary to increase the clearance at frogs and guard rails was considered by the Committee on Standard Rail and Wheel Sections of the American Railway Association at its meeting in Atlantic City to-day.

"The committee decided unanimously that a wheel of the section submitted by your committee could be run through the present clearances without difficulty, for, while the increase in thickness amounts to ⅛ in. at the point where you measure the flange, we find that the increased thickness at the point of gage for track is not more than 1/32 in., or an amount almost negligible.

"The committee, of course, will not be prepared to adopt or recommend a standard cast iron wheel in all its features until after hearing from the Master Car Builders, but in view of the fact that the flange matter may be considered somewhat of an emergency, the committee will be prepared to recommend an increase in the thickness of the flange to the American Railway Association, so that action may be taken by that body at its meeting in October next.

"(Signed) G. L. PECK, Chairman."

The committee, therefore, asks that action be taken during this convention that will enable the American Railway Association to have our recommendations before them at their October meeting, and submits for approval the following changes in the present standard wheel: An increase of ⅛ in. on the flange, and a change in the taper of the tread from 1 in 25 to 1 in 20. The reason for asking for the change in the taper is due to experiments that have recently been made, which indicate less flange wear and a longer life to the wheel on this account.

Also that the specifications be changed so that the minimum weight be 600, 650 and 700 lbs. This is necessary because the increase in the flange will add about 15 lbs. to the present standard wheel. The committee feels that these are the only changes to recommend in the present wheel, and, if allowed, will result in a design that will very largely eliminate flange failures.

Should the action of the committee meet with the approval of the association, we call attention to the necessity of revising the present mounting gages to suit the increased wheel flange, and would suggest that this be taken up by a committee during the present year.

Mr. Garstang explained that the committee had received the instructions (1) to consider a guarantee for cast iron wheels as outlined in its report last year; (2) to consider the entire subject of wheel contour, including increasing the thickness of the flange; (3) to confer with the American Railway Association and other associations having the matter of track under consideration.

A drawing to illustrate the committee's recommendation for change of contour and increased flange thickness was exhibited and explained. Beginning at the upper part of the back of the flange, the increased thickness extended upward, having its maximum at the fillet joining rim to plate. It was pointed out that, measured on a line outside the rail, the increase is less than 1/16 in.; and when the natural radius on the edge of the rail is taken into consideration it is a little over 1/32 in. at the point at which the flange would strike in going through a crossing. At the point where the flange naturally does strike it is less than ⅛ in., and enlarges to ¼ in. at the furthest point. It is the opinion of a majority of the wheel makers that a larger body of soft iron in behind the flange will give a stronger wheel. It was said that this design has met the approval of all the wheel makers.

The taper was 1 in 25. Some railroads have been experimenting on a little greater taper—enough to keep the wheel between the rails and a little more, and take the wear off the flange. To a certain extent they find that 1 in 20 has given better results than 1 in 25. That is not much in 2 in.—a little over ⅛ in. It has been recommended and highly indorsed to make that change. In the opinion of the committee there is no reason for not doing it, and we think also that it would be an improvement.

Also as to the change of the radius in back of the rim. It is ¼ in. on the present section. It sometimes chips off. The larger radius shown will obviate that.

Mr. F. H. Stark (Pitts. Coal Co.)—I would like to ask the committee whether they know of any action on the part of the American Railway Association or the engineers of maintenance of way with a view of increasing the throat clearance of frog points and road crossings, guard rails, etc., so that in the course of four or five years the thickness of the flange may be increased again.

Mr. C. A. Schroyer (C. & N. W.)—I am of the opinion that the question of the wheel section belongs more properly to the engineering department than it does to the Master Car Builders. The latter

want to strengthen the iron wheel to meet the requirements of the 80,000 and 100,000 lbs. car. The committee proposes to strengthen the wheel at the flange point, which has been the weak point of cast iron wheels, to meet these increased requirements. It proposes to do that by placing the iron as indicated on the drawing. We would naturally suppose the increasing of that iron would increase the strength of that point. The difficulty in wheels has been that they wear at the flange very rapidly, and in the large number of failures of the heavy wheel we find there is a chill crack in the wheel at that point [throat of flange], and when the break occurs it goes right through there [from throat of flange to outside rim fillet]. That has caused a number of breaks on our road. If you increase that, you want to increase the radius of the throat of the flange. I think that the increasing of the radius is for the purpose of giving more chilling surface. Why do you want more chilling surface? To arrest the carbon in the chilling process, to get the deeper chill in the throat of the flange. The greater the radius at that point the more liability there is for the wheel to climb the rail. We have a great many derailments to-day because in rounding a curve the preponderance of weight is transferred to the wheel outside of the rail, and the result is that the outside wheel of the truck goes off the track; it climbs the rail because you make it easier by increasing the size of the radius of that flange.

You say: Let us change the taper; let us make it 1 in 20 instead of 1 in 25. That means the taper should be 1 in 20 in., instead of 1 in 25 in. in width—25 per cent. more taper than we have had. The result of that taper would be that it will ease up on the flange, but it gives us a constant outward pressure on our rail heads, and it would be more proper for the engineering department, through a committee of our association, to take this up and see what should be done as regards that matter than to leave it to the body of the association to say what shall be done on this, and then have the body of the Railway Association to say what shall be done on something else.

Mr. W. E. Fowler (C. P. R.)—The very thing that Mr. Schroyer thinks ought to be done has been done. We have been in conference with members of the American Railway Association and the Maintenance of Way Association, and the thing has been considered from the engineering and maintenance of way standpoint. The chairman of the committee stated that it was imperative that the Master Car Builders' Associaion give them something definite to work upon. The matter of the increase in the radius of the throat of the flange was gone into carefully. The statement was made in the committee, and some engineers claim, that the radical increase of the radius in the throat of the flange would result in more frequent derailment, and on that account we thought it better to be extremely moderate in recommending any increase in that radius. With regard to the coning of the tread, that also had its consideration, and we want to say that the members of the Maintenance of Way Association and the American Railway Association so far agree with us that they expect to take up in committee and in their associations the advisability of tilting the rail-head so that the rail will take the additional coning of the tread. That, I believe, is standard practice on the Continent of Europe and in England now, and it did not seem to be inadvisable to the members of the committee present.

Mr. Stark made the inquiry as to what would be the attitude of the American Railway Association or Maintenance of Way Association toward a still further increase. I think that if we can prove that this changed section has resulted in some improvement in broken wheel flanges we will have no difficulty in securing from them a promise of still further widening the clearances between the guard rail and main rail.

Mr. J. F. Walsh (C. & O.)—The necessity for improvement in the cast iron wheel is very great. It has been such a source of trouble with railroads which haul 50-ton capacity cars that we are going into the pressed steel wheel at an immense increase in the cost of the wheel. I believe we are to some extent responsible for some of the failures that we have had in the wheel, due to the fact that we insist upon too high a guarantee, too long a guarantee, from the wheel makers, and they, in turn, to protect themselves, have deepened the chill to the furthest possible point. That, in connection with the very heavily loaded cars, has resulted in many breakages which could have been avoided if the railroads had been more lenient with them in the matter of guarantee.

Mr. Schroyer—I believe that the engineering department is better capable of saying what should be done as regards the shape of the tread of the wheel than we are.

Mr. Garstang—The American Railway Association has appointed a committee to get up a standard cast iron wheel and a standard rail section. Three members of this association are on that committee. If we cannot agree here as to the best style or pattern of the wheel, the American Railway Association is going to agree for us.

It was moved to submit the recommendations of the committee to letter ballot as recommended practice.

Triple Valve Tests.—The report was received without discussion, and the committee's recommendations adopted regarding the redesigning of the test rack at Purdue University to accommodate 100 cars, and the formulation of a new code of tests for trains of this number of cars.

Brake Shoes.—Prof. Goss, chairman of the committee, presented the report.

Mr. R. P. C. Sanderson (S. A. L.)—There is one rather serious omission in this report. There is nothing said of the actual character of the shoes that have been tested. I think it would have been a great advantage if the character of the body of the shoe whether soft cast iron, hard cast iron, semi-steel or what had been mentioned, and what the true nature of the inserts were. I would like to ask the committee whether they could not make an investigation into that matter.

Prof. Goss—I have no doubt that would add to the value of the report. It would involve considerable expense. In the yearly reports of the Brake Shoe Committee an attempt has been made for several years to determine and to describe the characteristics of the shoes. Inserts have been drilled, and we have attempted to determine the hardness. We have tried to specify whether of cast iron, chilled iron, etc., but we have found that such descriptions are not always accurate, and so it seemed to be wise to omit them entirely, bearing in mind the fact that every shoe which has ever been tested by the Brake Shoe Committee, whether in Altoona or Purdue, is on file at Purdue and can be had by any member of the association when called for. It will be entirely feasible, however, to have an analysis made of the various parts of the several shoes tested, and have the results included as an appendix to this report, although it will be somewhat expensive.

Mr. T. W. Demarest (P. L. W. P.)—The most important thing in this matter seems to be the endeavor of the committee to determine the maximum coefficient of friction for any brake shoe. The point made by the committee is that it is necessary to state the maximum coefficient of friction. After we have got through with the entire brake apparatus, we are dependent at last on the efficiency of the brake shoe for stopping the train. I think that at this time it would be wrong for the association to endeavor to set a maximum limit on the coefficient of friction unless it can be shown practically that bad results in train service are apt to follow.

Mr. F. H. Clark (C. B. & Q.)—I think Mr. Demarest is right. We have a minimum coefficient, but we know there is a very wide variation in the friction of brake shoes above that minimum. It is no doubt desirable that there be a maximum coefficient specified. I would move that the committee be instructed to investigate that phase of the question and report on a desirable maximum coefficient friction, and also, if they think it desirable, to recommend any modifications in the minimum coefficient or the coefficient at a point 15 ft. from the end of the stop.

The motion was carried.

Mr. W. E. Fowler (C. P. R.)—There has been no action taken with regard to the recommendation in Appendix No. 2. Prof. Goss asks that the association assume the expense of fitting up such a machine. I think we should take steps to comply with the recommendation, and I would move that this matter be referred to the Executive Committee for such action as may be desirable, with the recommendation that the apparatus be provided.

Motion carried.

Brake Beams.—The chairman of the committee, Mr. A. E. Mitchell, presented the report. Before doing so he said: "Since this report was sent out the committee has received several communications from manufacturers of beams objecting to the committee not having made tests of some of the beams now in the market—in fact, of all the beams now in the market—so as to show comparative results of the beams now in the market. I wish to call the attention of the manufacturers to the fact that this is not a test of existing brake beams to show a relative comparison of one beam with another. It is simply a report to enable us to prepare a specification for brake beams."

At the conclusion of the presentation of the report Mr. Mitchell stated that the committee had decided to eliminate Table III (Summary of Direct Tests; Order of Merit) and Table IV, for the reason that these figures should not have been included in this report, as the committee was not comparing existing beams.

Mr. W. E. Fowler (C. P. R.)—We found in experimenting that when the brake hangers were attached to the brake head just back of the central brake-shoe lug that the brake beam had a tendency to tip over, and that the top of the shoe dragged against the wheel. The committee to remedy that recommend that all brake beams shall have suspension hangers applied, which would do away with that trouble; but I should like to have seen some kind of a recommendation from the committee that would have enabled all brake beams in service to have had an attachment of that kind applied to them.

Mr. N. H. Davis (Davis Pressed Steel Co.).—There are two important points on the beam question that have not been brought into the specification. The question of what kind of steel to use in brake beams; whether to allow more than one class of steel or not. We are using open hearth steel exclusively in the manufacture of our brake beams; some Bessemer steel is used in some others. The

question in your recommendation that the proof load should be the capacity of the beam is another point. You can always load 50 per cent. to 100 per cent. beyond the load; 50 per cent. beyond the capacity should be taken for proof load so as to eliminate all lost motion and set.

No. 7 of the specifications requires a maximum of 9½ in. from the center of the pin-hole to the back of the beam. Our beam measures 10 in. and we cannot get it lower than that. Otherwise the specifications would be acceptable to us in furnishing brake beams.

Prof. Hibbard (Cornell Univ.) illustrated with a rough wooden model the importance of having sufficient distance between the lever pin and front of brake shoe. Where the distance was small there was a great tendency for the beam to flop over sideways. This was overcome when the distance was increased sufficiently. He said: "When it goes over a little the weakness of the beam is shown by its buckling sideways. It is an exceedingly important point whether the pin-hole is a little distance in front of the face of the brake-shoe or whether it is a great distance in front of the brake-shoe, and in examining the report I find that some of the brake beams with a little distance do not last very long. Some of them buckle sideways, whereas the brake beams with sufficient distance show a very high strength on the pull and do not buckle sideways.

There was some objection raised to the specification providing for a maximum distance of 9½ in. from lever pin-hole to extreme back of beam on the ground that a number of manufacturers had said their beams would be excluded under this provision.

On motion all of the specifications were referred to the Committee on Standards.

Mr. A. E. Mitchell.—We recommend in No. 3, "That brake hangers shall be attached to the brake-head at the center, and just back of the central brake-shoe lug." Would it not be advisable to add, "Or alternate location as shown on Fig. 7, page 16?" That permits us on I-beam sections and solid sections to put the brake hanger 2½ in. above the center line.

On motion this addition was made.

Mr. J. J. Hennessey (C., M. & St. P.).—It is very important that we have a standard brake beam. If we are going to allow the dimensions of the level pin-hole from the face of the brake-shoe to vary every time we want to use a different make of metal brake beam we are compelled to change the beam rod. I think the brake beam question should be handled the same as the M. C. B. coupler was handled years ago; decide upon certain dimensions and say to the brake beam manufacturers that they must meet these requirements. If we had not done that on the question of the contour lines of the coupler, I doubt whether we would have to-day had any coupler that would interchange, and I am fully of the opinion that if the same course is pursued with reference to the brake beams—not confining ourselves to any one beam, but covering just as many as need be, only let them all get together and confine their beams within certain limits—we will have equally as satisfactory results as we had in the case of the coupler. If you do not do that, you will always be compelled to carry three or four dozen different kinds of brake beam rods on your repair tracks.

Axle Limits.—The report was presented by the chairman of the committee, Mr. E. D. Nelson (P. R. R.).

Mr. A. W. Gibbs (Pennsylvania).—This association should do something to reconcile the interchange rules and recommended sizes for axles. There is a discrepancy between our recommended sizes of axles and the rules of interchange. We have tanks of a certain capacity. The weight per gallon of that material might run anywhere from 5 lbs. in the case of light liquids to as much as 15 lbs. for sulphuric acid. If we put in the recommended axles anybody can take that car and put in interchange axles. We cannot consistently require them to put in the recommended size and then hold them up, when anybody has, under the interchange rules, a right to take out that size and put in what will do under the interchange rules. We ought to have our practice conform with our interchange rules. As I see the thing, it does not change the conditions in any way. Those who wish to mark their capacity are still governed by the interchange rules. It is only where they wish to avail themselves of the extra carrying capacity of the axles and mark the car with the maximum that any change would be made.

Mr. Samuel King (C. P. R.).—We should go very slowly in making changes in our standards. I move therefore that this matter be referred to the Committee on Standards.

Mr. Nelson. The committee in the report tried to make it clear that this does not go into application on a railroad unless the company desires to have it so. In other words, a car is not marked with its maximum capacity until it has under it the axle of proper diameter. It might have three axles which will conform to the maximum rate limit, and one axle under the present Rule 23 limit. You would not mark that car until you had the axles conforming to the new limit. I think what the committee suggests could be carried out without hardship. It would be entirely in the hands of the companies and would be a very simple way of getting the thing on a proper basis.

Mr. F. H. Stark. I would like to ask the committee how to guard against wrong repairs. If a car marked maximum capacity "C" is removed to a foreign road they may apply an axle below the limit belonging to that particular class of car. The car arrives home and it has a wrong diameter axle under it. Nobody wants to father the wrong repairs and the owner has no redress that I can see against an axle being applied less in diameter than the axle belonging to that particular class of car. We have cars repaired all over the country. Our ordinary car repair man would naturally take a pair of wheels with an axle that would conform to the old standard, judging by the journal boxes he finds on the car. Of course, it would be a matter of education, but you would have axles applied that are not up to the standard according to the new marking.

The report of the committee was adopted.

Arbitration Committee Report.—The decisions of the committee since the last convention were indorsed, and the report in reference to proposed revisions of the rules of interchange adopted.

Prices for Repairs to Steel Cars.—The report was presented by Mr. R. F. McKenna, member of the committee. The report was adopted.

Revision of Passenger Car Rules.—The report of the committee was adopted, following which a motion to adopt the Rules of Interchange as a whole, as amended, was carried.

Revision of Rules for Loading Long Materials.—The report was presented by Mr. A. Kearney (N. & W.), Chairman of the committee.

Mr. L. H. Turner (P. & L. E.).—I want to offer an objection to the report of the committee so far as it refers to the restriction as to the height of superimposed loads. I have taken pains to procure a list of 1,000 loads showing the point loaded, the number of the car, the initials of the car, and the destination. I also corresponded with the different lines in regard to loading these cars. I have been unable to find a single instance where any damage occurred from the cars being too high. There are some cases where it is conceded that there was trouble owing to rough handling. It will probably be claimed that the majority of those loads were within the restricted height. Possibly that is true. I hope it is. At the same time there are many loads that run above that height. The equipment of the companies to-day is not in condition to stand that restriction. There is no question but that the restriction is a step in the right direction, but we are not ready for it.

Mr. W. F. Bentley (B. & O.).—Concerning the height of the load—fixing it at 9 ft. 3 in.—if the rule is passed as is here proposed it would certainly affect the furnishing of cars in the Pittsburg district that carry their capacity of loading, and would affect the business of a good many railroads that handle the business that comes from that district. The B. & O., and I believe some other lines, would not be able to meet the requirements of the business at that point, and of course if we could not furnish the cars for the shippers the roads over which the shipments were routed to which the B. & O. would deliver would be affected in a proportionate degree. I would make an amendment to the motion that the clause restricting the height of the loading to 9 ft. 3 in. be cut out.

Mr. G. W. Wildin (Erie).—If you establish this limit these railroads would have to take 4,000 cars out of business. We cannot afford to do it. We have taken all the cars Mr. Turner has offered or interchanged with the loading as he has stated. In one single instance during the past two years has there been any question as to the loading of the cars. In that case it was finally decided that the trouble was the result of rough usage and not of the loading. I would very much dislike to see this 9 ft. 3 in. limit adopted for the loading.

Mr. W. F. Kiesel, Jr. (Penn.).—The 9 ft. 3 in. limit would give 7 ft. from the top of the rail or the top of the cars; 6 ft. has been recognized as the limit of safety. This is 1 ft. above the old recognized limit of safety. I think that the 9 ft. 3 in. limit should be retained to avoid accidents on the road and possible wrecks.

Mr. John J. Tatum (B. & O.).—I would like to know how many accidents we have had due to loading over 9 ft. 3 in.

Mr. R. L. Kleine (P. R. R.).—In addition to cases already cited, we have had two on the Southwest System of the Pennsylvania Lines where superimposed loads which were above the 9 ft. 3 in. limit have turned over, and one very nearly resulted in a very serious accident to a passenger train. We also had some on the P. R. R. Our experience has induced us to limit the superimposed loads. I might also say that I looked into this question very carefully, measured up a good many loads right in the Pittsburg district, and I find that there are very few loads on the top and sides of gondola cars that exceed this 9 ft. 3 in. limit.

Furthermore, the center of gravity of the load must be considered. We now figure on 6 ft. for center of gravity of our cars when loaded. The superimposed load to half the marked capacity of the car and the weight of the car when the load is 9 ft. 3 in. makes the center of gravity above the rail 7 ft. We have some 1 ft. above our limit, and I do not think we can stretch it any further.

Mr. F. M. Whyte (N. Y. C.).—I think we can get a lesson on this from locomotive practice. It is a very common thing to place the center of a boiler higher than this 9 ft. 3 in. limit above the track. It is also demonstrated that the higher the center of gravity, the easier the locomotive will ride. The easier it will take

curves. The lower the center of gravity, the harder it is on the rail, and I presume on the load, too. If we go to the lower extreme and assume that the center of gravity is at the top of the rail, we will find that the rail is soon knocked out if we are making any speed on it. The higher the center of gravity the further it must be thrown from the center line to come to the tipping over point.

The report of the committee was finally adopted after cutting out the clause relative to the 9 ft. 3 in. limit and substituting the old clause on this height limit.

Location of Temporary Stake Pockets.—Mr. Kearney, chairman, presented this report also. He said: This is nothing but an opinion. We do not hand you this as a recommended practice, nor as a commercial standard. I do not think it would fit many conditions.

Mr. L. H. Turner (P. & L. E.)—I happen to know that these stake pockets will suit all the large pipe manufacturers of the country, and that spacing should also suit the lumbermen. I will offer the motion that it be referred to letter ballot and recommended for adoption as recommended practice. (Carried.)

Air Brake Hose Specification.—Mr. C. A. Seley read the report.

Mr. R. P. C. Sanderson.—The committee is of the opinion that the physical tests now prescribed are of little value and that a bursting pressure test and a chemical test of the rubber composing the inner tube would be all-sufficient. How would the question of proper manufacture of the hose made of the very best materials be established by such a specification? How could you tell whether the tube was properly secured to the canvas, whether the friction was good or whether the tube was of proper thickness? A very thin tube, as long as the quality was good, might stand a chemical analysis, but not be sufficiently thick for good service. The thoroughness with which the hose was built should be covered in some way by the specifications.

Mr. F. H. Clark.—The committee may be of the opinion that the bursting test and the frictional qualities of the hose have some connection and that in order to get a high bursting test the hose must have good frictional qualities. This may explain the idea that the frictional test is of little value.

Professor W. F. M. Goss.—The committee feels that the present specifications serve well in determining the value of the hose as a structure, but they do not serve as the basis of determining how long the hose will last. The durability of the hose seems to depend upon the quality of the rubber and it is for that reason that the committee believes we should look ahead to a more intimate knowledge of the quality of the materials entering into the construction of the hose.

Mr. W. E. Fowler (C. P. R.)—Would the committee recommend that we revert to a guarantee as a means of protection under present conditions. The present specifications do not provide for any guarantee, and if we cannot tell much about what kind of service we are going to get out of the hose, should we not also, in addition to the specification and test, ask for a guarantee from the manufacturers?

Mr. R. P. C. Sanderson.—In going over the scrap hose we find the percentage very high of hose that have been damaged from outside causes that have nothing to do with the quality of the hose. I have found as high as 95 per cent. Such being the case, how much value would a guarantee be? Nothing. You could only consider 5 per cent. of the hose on the scrap pile in connection with the guarantee.

Mr. C. A. Seley.—The committee does not believe that the present specification is entirely valueless, but that it is not conclusive and not perhaps the best and ultimate form of specification. This is a report of progress. We believe that the present specifications should be strictly adhered to until we can arrive at the best possible specifications.

On motion the report was accepted and the committee continued.

High Speed Brakes.—Mr. F. M. Gilbert read the report. On motion the report was accepted and the committee continued for another year.

Height of Brake Staff.—The secretary explained that no report had been received from the committee.

E. A. Miller (N. Y. C. & St. L.)—The Railway General Managers' Association appointed a committee last year to determine on the height of the brake-staff, and through the chairman of that committee, the Master Car Builders' Association was requested to settle definitely on that matter. That committee has been holding its report for a year in order to have that question settled in the Master Car Builders' Convention at this time. In justice to the General Managers' Committee that is waiting for a report, something should be done through this Association in regard to the height of brake-staffs.

A motion to appoint a special committee to consider this question and report before final adjournment was lost. A motion to appoint a committee of three to work in conjunction with the special committee of the General Managers' Association and report next year on height of brake-staffs was carried.

Clearances of the Third Rail System.—Mr. F. M. Whyte (N. Y. C.) made an oral report as follows: The proper location of the third rail depends upon several things. So far as the locomotive is concerned, the farther out the third rail the better, but for various reasons it can be located too far for successful operation. At switches and cross-overs there is necessarily a gap in the third rail; that is, there is either a "dead point" or overhead construction is provided to carry the equipment over the gap. The farther the third rail is from the running rail, the longer these gaps, and at places the gaps are too long for the length of locomotive which is now used or we are preparing to use, and in some cases even longer than the ordinary suburban train would extend. On this account it is desirable to keep the third rail reasonably close to the running rail. Also, there are many truss bridges on the right of way, and the gusset plates for these are so located that the third rail might interfere with them if placed beyond the present limits, 28 or 30 inches. The passenger station platforms also would be affected. If the third rail is moved farther out the shoes on the trucks must be carried out, and it is best that these shoes should not project any further than is really necessary. Vertically, it is desirable to keep the rail as low as possible, and if it were possible the top of the third rail should be located flush with the top of the running rail. There are two kinds of third rail, one the over-running, with the shoe on top of the rail, the other the under-running, with the shoe beneath the rail, and with the over-running rail there is a pressure which carries the shoe down. As the shoe runs off the third rail, the pressure still carries the shoe somewhat lower, so that it is necessary to keep the third rail a sufficient distance above the running rail to allow for this additional depression of the shoe and still permit the shoe to cross frogs and turn-outs, and switches, etc. With the under-running rail the shoe would rise up on leaving the third rail, and clear these other rails better, but there must be clearance, of course, between the top of the track rail and the inside of the third rail, for the thickness of the shoe. The difference in height is 3½ inches, and that is not great, considering allowances for the spring motion of the shoe itself. These are the conditions which locate the third rail vertically.

That part of the clearance diagram relating to the third rail must be considered in a different light from the remaining part of the clearance diagram. The third rail is located the same distance from the running rail on curves as on tangents. The shoes are on the trucks, and therefore do not offset with the curvature, so that in car and locomotive work we must keep far enough inside the third rail diagram to allow for curvature. The rest of the diagram is provided for by the engineering department—that is, above the third rail. If there are obstructions at curves, they are set back far enough to allow for the offset of cars; but in third rail work that is impossible, or considered so thus far. The distance which truss rod bearers, battery boxes and other attachments to passenger cars and freight cars should be carried in from the third rail clearances will depend upon the wheel base of the car, or the distance between truck centers. With a 56-ft. truck center, the offset on a 20-deg. curve is about 17 in. I speak of a 20-deg. curve because that is the sharpest curve which the New York Central expects to use in their through yard as distinguished from the suburban yard.

A motion to incorporate the report in the printed proceedings was carried.

Automatic Connectors.—Mr. F. M. Whyte read the report of the committee, which was signed by all the members except Mr. Fildes, who refused to sign the report.

Mr. A. L. Humphrey (Westinghouse Air Brake Co.)—There is no patent covering either type of coupler. The first patent covering the automatic coupler was taken out in 1883. That covered the butt port coupler, so that it makes that form of coupler public property, as it has been for the last four or five years. The first patent on the side port coupler was taken out in 1885, so that that is also public property. So far as the patent situation is concerned, there is nothing to be given to the association that is not altogether public property. Any concern can manufacture either form of coupler.

If you accept the report of the committee you will discourage experimenting with any type of coupler except the butt port type. Estimating the number of couplers in use of a side port type, we have about 2,000 couplers known as the Westinghouse automatic steam and air coupler. They have been in use five years. A large amount of money has been spent in experimenting with and perfecting this coupler. The butt port coupler manufacturers have spent perhaps an equal amount. For this association to say that it is going to discourage any particular form of coupler at the present time is unwise.

The situation is this: The Westinghouse Air Brake Company holds the patents on certain specific features of the side port coupler, not the principle. The manufacturers of the butt type coupler have no idea of giving up any of their patents that they own on these specific features under which their particular type of coupler is being manufactured. So far as the patent situation is concerned, they both stand identically on the same ground.

Mr. F. M. Whyte—The committee did not act hastily in this.

EXHIBITS AT ATLANTIC CITY CONVENTIONS OF THE MASTER CAR BUILDERS AND MASTER MECHANICS' ASSOCIATIONS, JUN

















Groups of Exhibits on West Side of Pier.







Birdseye View of Steel Pier from the "Chalfonte" and Group of Exhibits in and Near the Ball Room.

EXHIBITS AT ATLANTIC CITY CONVENTIONS OF THE MASTER CAR BUILDERS AND MASTER MECHANICS' ASSOCIATIONS, JUNE, 1906.



Birdseye View of Steel Pier from the "Chalfonte" and Group of Exhibits in and Near the Ball Room.

















Groups of Exhibits on East Side of Pier.

There was only one company making the side port connectors, and there were several companies making the butt connectors, or straight port connectors. The company making the side port connector stated verbally that their understanding was that their patent would prevent any other company making the side port connector. In view of that and the action of the association heretofore in not adopting as standard an article which would put the whole of a certain business in the hands of one company, the committee thought they could not recommend the side port connector.

Mr. C. A. Schroyer—It seems to me that it is ill advised for this association to take the time and go to the expense necessarily involved in investigating these patents that are now existing, because unless they are waived we cannot adopt them or even recommend them for use, as I understand it. If we are going to adopt the automatic connector, we must have one type. One that abuts at the square cannot connect with one that abuts at the side, and in a short time we will have horizontal and angle and all other kinds. The coupler we should recommend should be one that could be used on both freight and passenger cars. We should have more injuries to our men if we have one kind on passenger cars and a different kind on the freight.

Mr. Sanderson—This is the old struggle between the couplers that existed years ago when we adopted the M. C. B. coupler lines. We must take it in our own hands and decide on something which will line the work of the different manufacturers up in some one direction. We ought to have the courage to do it. This committee should be continued, and next year get their arrangements with the manufacturers in such shape that they can consistently recommend to this association some principle similar to the recommendation of the contour lines of the M. C. B. coupler that we can act on next year.

Mr. G. W. Wildin (Erie)—The committee is appointed to investigate the matter and determine which is the best kind of automatic connector. The committee should not confine itself to one particular type of coupler unless that is best. The committee was appointed to find out which is best.

A motion that the report of the committee be received and the committee instructed to continue its work to prepare standard dimensions for automatic couplings for steam heat, air brake and air signal, also to fix the relative locations and dimensions of the different parts, so that as cars are equipped from time to time with such automatic couplings the various makes will be interchangeable, one with another, and that the committee report at the next convention, was carried.

Location of Side and End Ladders on Box and Stock Cars.—The report was read by Mr. F. H. Clark.

Mr. R. P. C. Sanderson—The recommended location of the grab-irons on the roof would compel the attachment of grab-irons to the roof boards only, because if placed in that exact location the purlins would not be there on the old cars already constructed. I doubt if it is wise to adopt that location without looking into the matter further.

Mr. F. H. Clark—The committee believed that the limits recommended are safe and proper. It is a better location to have the grab-irons placed within the limits of 12 or 15 in. from the edge of the car. There will be no important mechanical difficulties in locating the grab-irons as recommended.

Mr. R. P. C. Sanderson—The manner in which the grab-irons are now located, by having them secured to the top edge of the side plate of the car, brings the iron so close to the edge of the car that when a man is descending he is liable to trip over the grab-iron before he can turn around to descend. If the iron is put back 15 in. a man has a chance to catch hold of the iron before he descends; but now he must catch hold of the edge of the roof. That forms an element of danger as the grab-iron is now located according to our standards. By locating it anywhere from 12 to 15 in. from the edge of the car we get a much better position. A better plan is to have one fastened to the side plate and one to the end plate, when the ladder is on the side; and when the ladder is on the end, to have one end secured to the end plate and one end to the purlins. A large number of cars constructed to-day have purlins on which this grab-iron could be located, and it is only a question of the labor involved to make the change.

Mr. J. F. Walsh (C. & O.)—The location of the grab-iron on the top of the car should indicate the location of the ladder. If the ladder is on the side of the car, the grab-iron on top should run parallel with the length of the car, and if the ladder is on the end of the car the grab-iron should run parallel with the width of the car. We had within the past six months a very serious accident due to the fact that one of our switchmen mistook the location of the ladder on account of the wrong location of the grab-iron, and, grabbing the iron, threw himself over the side of the car, expecting to find the ladder, and fell between the cars.

Mr. F. H. Clark—If we provide that these grab-irons shall be placed 12 or 15 in. from the edge of the car, of a length suitable to the construction of the car, that will make it possible to attach one end of the grab-iron to the end plate and the other end to the first purlin. In the case of cars with end ladders it will be possible to make the roof grab-iron of such a length as to extend, say, from the side plate to the first purlin, or from the first purlin to the second purlin, depending on the length of the ladder on the end of the car.

A motion that the report of the committee be received, and the last recommendation be changed to read "car on which the ladders are located, these grab-irons to be placed not less than 15 in. from the edge of the car, and of a length to suit the construction of the car," and that this recommendation be referred to letter ballot, was carried.

Tank Cars.—Mr. Gibbs presented the report, and also said: The original requirements of some of the roads required friction draft gear. There is a difference of opinion in the committee and among the officers who met to consider this general question, and therefore the requirement of a friction draft gear has been omitted.

The railroads are issuing requirements for tank cars. There is a wide tank car ownership with wide differences in the constructions. No one road by its requirements can possibly keep up with these, and must change its requirements as the character of the construction of the cars change. If tank cars could be examined by their home road and marked in some way that they comply with the requirements of the association in being at least as strong as the requirements contemplated, then such cars would not be held up for examination at inspection points over the road. We have found that our own inspectors have held up cars at one point which have been accepted by our inspectors at another point. We think these tank cars, which are nearly always individual cars, should be examined and stencilled by the home road as having passed the inspection. That would be a certificate which would prevent these cars from being held up on technicalities, and I would like to add that as a continuation to the report for the consideration of the association. There has been a good deal of hardship in some cases in holding up cars. Some of the manufacturers met the requirements long ago, some of them just tried to meet the minimum requirements, and some have done nothing. I think those who have done little or nothing are kicking very strongly.

There are also cars which are divided into compartments to carry different grades of oil. It has been the practice to apply safety valves to only one compartment, and the other has been bottled up ready to explode when any occasion justified it, and we have had some accidents of that kind. We have recommended that every compartment have its own safety valve.

Mr. R. L. Kleine (Pennsylvania)—I would like to add an amendment to Mr. Gibbs' motion that the committee prepare the necessary stencil so that it can be submitted at the same time the matter is submitted to letter ballot. Also the location of the stencil on the cars.

A motion that the report of the committee be accepted and the recommendations be referred to letter ballot as suggested by Mr. Gibbs and Mr. Kleine was carried.

Subjects.—Mr. Sanderson read the report, and on motion it was referred to the Executive Committee.

The Secretary read the report of the Committee on Correspondence and Resolutions.

The following officers were elected for the coming year: President, W. E. Fowler, Canadian Pacific; Vice-President, G. N. Dow, L. S. & M. S.; Second Vice-President, R. F. McKenna, Lackawanna; Third Vice-President, R. W. Burnett, Erie; Treasurer, John Kirby. To fill the vacancies on the Executive Committee occurring this year, J. F. Walsh, F. N. Hibbits, F. T. Hyndman.

The meeting then adjourned.

Topical Discussions.

The topical discussion on "Circumferential Variation Allowable in Mating Wheels" was opened by Mr. G. L. Fowler, who said that, theoretically, both wheels should be of exactly the same diameter, if the rails are of the same length, but, unfortunately, the rails even on straight lines are not exactly the same length, so that the wheels running on them would naturally crowd over to one side. It is therefore suggested that the variation should at least be as little as possible. He asked a wheel-maker recently what variations are allowed in pressing on wheels, and the latter had said he had lately had a call from an electric road for an allowance of $^{1}/_{32}$ in. variation in pressing on the wheels. He said it was absurd, but they were willing to pay for it, and it was none of his business. Others say they can allow $^{1}/_{8}$ in. or more. In the reading of the tape there is a variation whether it should be read to the nearest mark, or to the one immediately below. Of course, the actual variation allowed by this reading would be practically the same whether the nearest reading or the reading immediately below was taken. What I found in my investigation of these sharp flanges, from the data I accumulated, was that if I eliminated part of it I could prove anything I pleased. That is, ordinarily we expect that the small wheel will run sharp. As a matter of fact, in this particular investigation I found that the thing was pretty evenly divided; in fact, I found sharp flanges on large wheels $1^{1}/_{4}$ in. larger than their mates on the other side.

The sharp flange is caused by axles not being in parallel and by wheels not equally pressed on. If the wheels are not pressed

on equally so as to be at the same distance from the ends of the journal, it is pretty sure you will have sharp flanges. I found that to be the case in this particular instance. I went over the trucks and found running on straight line, trucks, taking them haphazard, which would not square on a tangent. I found trucks running for two or three miles over a perfectly straight piece of track that were $\frac{3}{8}$ in. out of square when they got to the end of the tangent. I spoke to Prof. Dudley regarding the matter and he said it was one of the commonest experiences with his dynagraph car; that it was almost impossible to get his trucks to square. From a number of investigations I made with cars down on the side bearings, the trucks will very seldom square up perfectly true until they strike another curve running in the opposite direction, and are brought around by the rails.

The shape of the tread is said to have a very great influence on the running of sharp flanges, and the matter brought up this morning of increasing the taper from 1 in 25 to 1 in 20 is a move in the right direction. Roads that have made that change find there is a very remarkable decrease in the amount of sharp flanges.

I have also found that the shape of the rail, in electrical work particularly, has an influence; a rail with a tapering side with a very decided flare to the head causes less wear on the flange, and less flanges to run sharp than where there is a sharp corner to the side of the rail, and the rail comes down square and straight. This matter I have not been able to corroborate, but the indications are it is a fact. The result of what I have been able to find by my inquiries among the members of the association and my own investigation is that it is pretty difficult to tell exactly what amount of variation can be allowed in the mismating, or in the mating of wheels.

I found in this particular case that the trouble with sharp flanges was not mismating of wheels, not bad curves or trucks, or anything to do with the car, but merely bad pressing on. I found the wheels were set all the way from $\frac{3}{16}$ to $\frac{3}{8}$ in. nearer one end of the axle than the other, and the wheel closest to the end of the axle was the one with the sharp flange.

Mr. E. W. Pratt (C. & N.-W.).—In turning up steel-tired wheels with sharp flanges we have for some time, as many others have done, made the sharp wheel slightly different in diameter, about $\frac{1}{32}$ in., and that would be approximately $\frac{3}{32}$ in., and our men returning these tires say it is not one time in 20 that they get the sharp flange on the same wheel.

Piece-Work on Freight Car Repairs.

Mr. L. G. Parish (L. S. & M. S.).—First, and most important, is the increased car-service. If we figure the earnings of freight cars, at a reasonable rate per day, the saving on this item alone will nearly pay the total labor charge, as the time on the repair tracks for heavy repairs is reduced nearly one-half. By practically doubling the capacity of the repair tracks, the need for increased track facilities, and the congestion under day work system are relieved, and it naturally follows that the cost is reduced and earnings of the men increased, bringing about a desirable labor condition. This system automatically betters the shop organization in general, brings about better methods of store keeping, improving the design of equipment, calling attention to lack of proper shop and repair track facilities, and, in fact, is the only true measure of shop output.

What has been said of freight car repairs is equally true of passenger car repairs. Too much cannot be said in favor of this system in the various departments of car shops. In order to bring about these conditions, however, it is necessary to have experienced piece-work supervision when the system is introduced.

Mr. F. H. Stark (Pitts. Coal Co.).—I believe that the heads of car departments might well look into the question of piecework for various reasons. One is that it is difficult to get the wages of men increased; that is, their hourly rate. Piecework increases the earnings of a man while his daily rate remains as it was previously. In most districts it is almost impossible to get men to work at the present rates allowed by railroads for car repair men. The same men working at piecework will increase their earnings from 25 to 50 per cent., and surely it is a godsend to some men who have to do with freight car repairs.

Then, too, it measures up a man's ability according to the amount of output that he is capable of producing; it makes a distinction between a poor man and good man, which, and alone, is a matter worthy of consideration. We have all our heavy car repairs done on piecework and we find it a decided advantage. Instead of the foreman pressing the men, the men are pressing the foreman. It is a question of getting the material out for them, and taking it as a whole, for heavy repairs at least, there is no question but that it is a success.

Should not the uncoupling chains of passenger equipment be so arranged as to guard against the uncoupling of cars in transit by passengers who may be on the platforms?

Mr. E. F. Chaffee opened the discussion. He described three different arrangements they had had for uncoupling passenger cars, the third being a staff with an offset of about 6 in. at the bottom, to which is attached the uncoupling chain. This staff is equipped at the top with a drop handle to operate the uncoupling arrangement.

"The chains on all of these devices are permanently fastened to the staff, or lever, and there is a hook on the opposite end for attaching to locking block. When the chain is not in use it is disconnected from the locking block and hung into an eye-bolt placed under the platform end timber for this purpose. In case it is desired to make a cut between cars, the trainmen are obliged to go between them to connect the hook to the locking block. This we have always considered dangerous and I would recommend that the chain be reversed; that is, that the chain be fastened permanently to the locking block, with the hook and eye-bolt to the outside. By this arrangement the hook could be fastened to the shaft or lever or placed in the eye-bolt without the trainmen going between cars. I am of the opinion that it would be advisable to do away with the lever and staff with wheel on top, as the wheel comes in contact with diaphragm face plate on vestibule cars, and with the lever we cannot, in many cases, get sufficient movement to operate the locking block.

"The staff with offset at bottom and with drop handle and chain permanently attached to locking block, with a hook at the other end that can be placed in the link on the uncoupling shaft when it is desired to operate the locking block, or, when it is not needed, the hook can be placed in eye-bolt under platform timber, I consider is the safer for trainmen and will also prevent cars being uncoupled by passengers who may be riding on the platform."

Mr. T. H. Curtis (L. & N.).—Instead of a chain I have placed a rod on all cars, extending to the outside, which will permit the coupler to go any distance in and out. It is fastened with a cotter pin, thereby making it necessary to have the thing coupled and operative at all times, so that any trainman going up there can uncouple a car without going into the vestibule or coupling up any chain. For instance, a train will come into the station quickly and you want to cut off a dining car. The trainman comes up, pulls the lever out and the dining car is loose. If there is a chain there, it is necessary for him to get in between the car to uncouple the chain before he can uncouple the dining car, and perhaps to get up into the vestibule to operate the drop handle, wheel, or whatever may be there. By having this hook on the under side of the platform the passengers never meddle with it while they are in the vestibule, and it is adaptable to all kinds of platforms, whether vestibule or non-vestibule.

Advisability of splicing center sills on cars of 50,000 lbs. or less capacity, in order to perpetuate the cars for two or three years longer, with the least possible expense.

Mr. F. H. Stark (Pitts. Coal Co.).—To enjoy the full benefits of this bold movement it would be necessary to splice both center sills at the same end of the car. In a large majority of the cases when center sills are damaged both sills are damaged simultaneously, and if we renew one sill full length there would be little or no saving. I would also call attention to certain cars which are built without longitudinal truss rods. Many of the box cars have no longitudinal truss rods, and it is questionable whether it would be good practice to splice even one center sill. Cars equipped with two or more longitudinal truss rods, with the center sills spliced in accordance with the manner suggested by the Arbitration Committee, are perfectly safe, and such cars have been in service for two years with satisfactory results.

President Buker.—Is there any further discussion on this matter, gentlemen? We would like to bring out the sense of this meeting here.

Mr. J. H. Manning (D. & H.).—I believe it would be unwise for the association to permit the splicing of center sills in 50,000 lbs. capacity cars. They are old cars and are going out of service. If we want to perpetuate them and want to splice the sills, let us keep them at home and we can put the splices where we want. These cars can be used in cinder service and in construction work, but we should keep them at home, and not give them to other roads to mix up with their 100,000 lbs. capacity cars.

Mr. G. W. West (N. Y., O. & W.).—I think it has been demonstrated that a spliced sill is as good as a solid one. Those of us who have had spliced passenger car sills have been convinced that the spliced sill will stand up with the single sill. We have a line of coaches built in 1883 which have spliced sills. When we take them out we find that the sills are cracked over the body bolster, but the spliced sill is in perfect condition.

Mr. J. J. Hennessey (C., M. & St. P.).—I agree with Mr. West that a spliced sill is as good as a solid sill. We repair all our sleeping car equipment and we find the sills which have been spliced in every bit as good condition as the solid sills, and the cars which have the spliced sill are in as good condition as the cars which have the solid sills in them. These cars in which it is proposed to splice the sills will soon be out of service. I think we will save a great deal of money by following this practice if the splice is properly made.

Mr. Stark.—The Lake Shore has made some exhaustive tests and finds that the splicing of center sills is perfectly satisfactory. The Pennsylvania introduced several methods of reinforcing center sills.

One practice was the reinforcing of the center sill with a steel plate extending from the end sill back to a point beyond a fracture in the sill. There is no question but that a splice 3 ft. back of the body bolster is absolutely safe. To enjoy the full benefits of splicing center sills we must splice both of them. The rules permit the splicing of one. We all realize that it is almost a hardship to procure Southern pine at this time. In the Pittsburg district Southern pine costs from $40 to $44 a thousand. Then, too, in splicing the center sills we reduce the cost of labor by half and it is a matter of economy.

Desirability of Adjusting Brake Pressure to Light and Loaded Trains.—Mr. West opened the discussion as follows:

There are more and stronger reasons against the desirability of adjusting brake pressures to light and loaded trains than in its favor. When the question of adjusting air-brake pressures to light or loaded trains was first raised, there was more reason for it than now. Then only a small percentage of the cars were equipped with air, and frequently trains made up of air and hand-brakes ran away going down long grades, our road having quite a number of very expensive wrecks. Now with 75 per cent. or more cars in all trains equipped with air, we never have a runaway train. It is safe to say 90 per cent. of slid flat wheels are removed from one or two cars in trains, often at extreme ends of the same train, proving the defect is in the brake apparatus on one or two particular cars, and not in the present efficient brake when in order.

Second, our cars are all equipped with the retaining valve feature, and experience proves that even this feature of the present brake is not being used as intended or desirable. It is difficult to get the men to turn the handles all up or all down as occasion requires, and unless it is done, the cars using the extra pressure will have hot and broken wheels at the foot of the long grades. Until somebody provides a means of operating the retaining valve from the engine they will never be used as intended, and if used for the purpose they were intended, they will take care of any train down any grade.

If it were possible to have all loaded or all empty cars in trains, it might be desirable to adjust brakes to suit the conditions, but we know this is not possible on a great majority of roads and is only practiced on ore and coal trains.

Some of us can recall the efforts made to have the driver brake operate independent of the train brake when the air-brake was first applied to passenger equipment. I recall two cases on the West Shore, while Master Mechanic at Buffalo, 1883-86, when the order was issued by Mr. Soule, then Superintendent of Motive Power, that the driver brake should be connected up with the train brake. I made a strong plea with Mr. Soule to allow two of our engineers having regular engines on our best trains to retain the cut-out feature on these engines. He consented, but told me I would regret encouraging it, which was true, for in less than 30 days the one engineer who had made the strongest appeal to have the cut-out cock left on his engine, had occasion to cut loose from his train at Rochester station, and in backing down on the train again some one neglected to cut in brakes. When he applied brakes at the first junction stop he had no use of them, and ran off derailing switch. Investigation proved that he forgot all about his cut-in valves, and had no use of the driver brake. We shortly after had another similar derailment, and since that time have been a strong advocate of braking all wheels possible at the same time. These cases are mentioned to show you that we can never depend on our trainmen or inspectors cutting in or out brakes to suit light or loaded cars, and there is no real necessity for it.

A paper read before the Western Railroad Club by Mr. S. W. Dudley, of the Westinghouse Company, on "What Stops a Moving Train?" in my opinion, is a strong argument against adjusting brakes to light or loaded trains. Mr. Dudley has shown us that as much depends on the friction between the rail and the wheel as between the wheel and the brake-shoes, and that a brake-shoe pressure that would retard a moving train running 60 miles per hour without injury to the wheels would be very damaging to wheels at a speed of ten miles per hour.

It was my good fortune to witness one of the first tests of the high-speed brakes made by the Westinghouse Company, and was on the train equipped with the quick action brake. Both trains were run side by side for a long distance or until they were both going at the same speed, when the brakes were applied simultaneously by a device along the track. The train with the high speed brake shot by our train as if it had been unbraked, and ran a long distance past our train before stopped, caused by every wheel under the car being slid flat, proving what Mr. Dudley said in his paper, that the best results in brake practice are obtained by preventing wheels from sliding.

It is no uncommon occurrence at the present time on our best railroads to hear wheel sliding on down grades in wet places, such as tunnels, and in dry places, making station stops, in the last few feet the train has to run, showing we are braking our present equipment now with present devices about as near the safe limit as desirable.

We have the emergency feature of the air-brake now to use when needed, and at such times, if all wheels, including the drivers, are slid flat in an attempt at stopping, no one would find fault with the engine or trainmen, but we do object to the emergency being used as frequently as it is for service stops. Experiments and practice have proved that present air-brakes are capable of stopping a train, passenger or freight, when kept in order, in much less space than is ordinarily used, showing that more depends on the condition of the apparatus than the kind used.

There are two very distinct and opposite views to be taken of this subject. One is from the viewpoint of long and heavy trains down steep and long grades. The other, that of making short stops in the least time. The condition required to make a quick stop would be a dangerous means of handling the heavy trains down long and steep grades. It is not a question any longer how much pressure we can apply to our freight trains, but how little and uniform a pressure can be maintained, and it appears to me the more care required to operate or maintain the brakes the less general efficiency will be obtained.

The condition of the air-brake apparatus on many cars at the present time can be greatly improved, and until such time as the railroads can afford, or will better maintain, the present very efficient brake, do not think it desirable to undertake to adjust the brake pressure to light and loaded cars.

There was no discussion.

Better Fitting up of Couplers Even to the Point of Machining, or at Least Drilling the Pivot Pin Hole Through Coupler Lugs and Knuckle, with Knuckle in Place and Tail of Knuckle Forced Against Lock and Proper Contour Preserved Under This Condition.

Mr. F. W. Brazier opened the discussion.

I am in favor of the better fitting up of couplers. The fitting up and maintenance of couplers, however, is a commercial proposition, and any scheme which proposes to fit them up by assembling the knuckle in its coupler while the holes in the coupler lugs and knuckle are being drilled is impracticable. Such a scheme would tend to individualize the knuckles rather than make them interchangeable with other couplers of the same make, and the only useful purpose served would be to start the coupler out with its contour lines correct.

Incorrect contour lines are due to a variety of causes. These causes may be subdivided into "inherent defects" and "developed defects." Inherent defects are those existing when the coupler leaves the manufacturer, such as failure to conform to contour lines, incapacity to maintain the lines they are sent out with, defects of assembling and defects of design. Developed defects are those that come from service, and they are too numerous to mention.

The knuckles, knuckle pins and coupler lugs are the parts that are the most punished in service. From the interchangeable conditions imposed on these parts they cannot be strengthened by increasing their dimensions, except vertically. There seem to be but two other ways of increasing their strength. One is by using better material and the other by using better workmanship in the assembling of the component parts so that the stress may be distributed over the material in such a way as to give us the full benefit of same.

With the steel couplers, steel knuckle pins and steel knuckles of to-day, we seem to have reached the limit as regards improvement of material. We must therefore so assemble the parts that we may get the full value of the material therein. I am of the opinion that in order to start the coupler out to proper contour lines, hold it to these lines as long as possible, and insure the distribution of the stress over the entire available material, we would be justified in going to the expense of drilling the pinholes in the coupler lugs and knuckles and also in the coupler shanks for the pocket rivets. These should, however, be drilled to jigs and templates and not by assembling the individual couplers for drilling.

Statement of inspection of scrap couplers for 60 days ending June 11, 1906.

Defect	Steel	Malleable	Total
Top lug broken off	382	1,168	1,550
Bottom lug broken off	80	268	348
Face split	1,662	2,811	4,473
Guard arm broken off	1,633	8,378	10,011
Head broken off	51	611	662
Both lugs broken off	161	468	629
Broken off at rivet holes	91	87	178
Shank bent or broken	95	183	278
Split through center of lug	14	9	23
Back face broken	92	114	206
Split through lock hole	9	6	15
Broken at neck	8	183	191
Back face split	256	256	512
Worn pin hole	100		100
Total	7,014	15,116	22,130

Professor Hatt's Address to the M. C. B. Convention.

Prof. W. K. Hatt, of Purdue University, in charge of timber testing for the Forest Service, United States Department of Agriculture, addressed the Master Car Builders' convention on Thursday regarding the work of this department. He spoke as follows:

It is a privilege to be able to take a few minutes to-day to interest you in the work of the United States Government in its Forest Service in determining the mechanical properties of timber. The activities of the Purdue laboratory are not limited to the elements of railroad equipment, such as brake-beams, draft rigging and bolsters, but we do a large amount of work in reinforced concrete, and particularly in testing timber. It is the headquarters of the timber work of the Forest Service, and I am here to-day as the representative of the Forest Service to draw your attention to these matters. I think those who are familiar with the situation realize that in the next 10 or 15 years we are going to feel the pinch of a timber famine. The quality of timber is getting poorer every day and the price is rising. Furthermore, in spite of the accumulation of substitutes for timber which are now on the market, the consumption is increasing, and one of these substitutes, reinforced concrete, creates a new drain on our timber resources in the form of wooden moulds. The present supply of timber is mainly in the hands of private holders, but there is a very large portion of timber on the forest preserves and mountain ranges of the west which are operated and administered by the Forest Service, by the United States Department of Agriculture. As a matter of fact, one-fortieth of the area of this country is under forest reservation. In addition to the work of administering these forest reserves the Forest Service would interest the private holder in the process of conservative forest management; that is to say, to try to induce him to hold his land for a second crop.

Also the Forest Service is investigating the mechanical properties of timber so as to find substitutes for what is now becoming scarce, as the hickory in the vehicle industry; and in promoting the perfection of specifications and also in determining the best uses to which forest preserve timber and all timber may be put. In pursuance of that plan we operate a number of laboratories throughout the country and will publish the results of those tests, and I want to say to the members of the convention that if they will write to the Forest Service they can obtain these publications. We have, for instance, a large amount of data on the strength of structural timber for car sills and bridge stringers, particularly Douglas fir and western timbers, which are now finding their way to the eastern market.

Address of Secretary Moseley.

The condition of safety appliances in all parts of the country is better to-day than at any time since the enactment of the safety appliance law. This is in measure due to the action of the courts in clearly defining the statute, so as to remove doubt regarding its application. The most important factor in this result, however, has been the action of leading carriers, under the influence of members of this association, in taking a firm stand in the matter of receiving and delivering cars at interchange points.

The chief joint inspector at a large railroad center, where there is a monthly interchange of more than 70,000 cars, gave us the following record of cars returned to delivering roads because of defective safety appliances during the first four months of 1906:

January	464 cars.
February	279 cars.
March	202 cars.
April	141 cars.

This record is a correct indication of the improved condition of cars offered in interchange, and does not mean that inspection is growing careless.

The number of cars under inspection last year was 44,000 greater than in the previous year, but the total number of defects noted were 8,000 fewer than in the year before. The percentage of defective cars to the number of cars inspected was 22.59 last year as against 31.31 in the year 1904. The present year will show a still further decrease in percentage.

In many parts of the country better arrangements could be made for the handling of bad order cars. Many complaints have reached the commission concerning the handling of cars without drawbars, chained together in trains. Where a drawbar is pulled out of a car between terminals there may be some excuse for chaining that car up and taking it to the nearest repair point, but there is no excuse for hauling a car through or away from a terminal or repair point in that condition. Under the decision of Judge Humphrey, in the case of the United States vs. Southern Railway Company, cars with couplers in such defective condition that they will not couple automatically by impact, making it necessary for men to go between the ends of the cars to couple or uncouple them, must not be *used*. This prohibition is absolute, and cannot be modified or abrogated by any order or ruling of the commission. When the drawbar has been pulled out of a car in service, that car may not lawfully be chained up and moved in interstate commerce. Carriers making a practice of chaining such cars together and moving them in trains to terminals or repair points, on the assumption that the law permits that to be done, are laboring under a wrong impression. The law does not permit the handling of cars in that condition under any circumstances. Such cars cannot lawfully be moved until their drawbars have been repaired so as to permit them to couple automatically by impact, and without the necessity for men to go between the ends of the cars.

The operation of couplers on sharp curves demands attention. The M. C. B. couplers in use are not sufficiently flexible to meet the conditions of curvature frequently found in large terminals or yards, special devices having to be used in such places, such as links and pins, bars and pins, or auxiliary coupler heads. The use of any special device which renders it necessary for men to go between the cars to couple them together, or to uncouple them, is a violation of the law, and I would suggest the advisability of a standard for automatic couplers that will cover all the requirements of the service.

One of the most difficult problems with which we have to deal is the existence of defects caused by the application of improperly made repair parts, such as knuckles, lock-blocks, etc. Such defects are not visible, and are in most cases only discovered when it is sought to operate the coupler in the usual and ordinary way. It is then found that the coupler is totally inoperative, due to the fact that knuckles or lock-blocks of improper dimension or contour have been substituted for the parts belonging to the coupler. This makes it necessary for a man to go between the cars to perform the operation of coupling, or to adjust the improperly constructed part so that it will perform its intended function, thus subjecting employees to unnecessary danger and placing carriers in the attitude of violators of the law. The evil has grown to such an extent recently that some action should be taken by this association to put a stop to it. It does not appear that there can possibly be any economy in purchasing improper parts, even though their first cost per pound may be slightly less than that charged by coupler manufacturers for the proper parts, as the danger and delay caused by the attempt to operate the improper parts are matters that must be considered, and when the liability to prosecution for using inoperative couplers is taken into consideration it will clearly be seen that it is to the best interest of the carriers to demand and secure repair parts that will fit the couplers to which they are applied. This matter is of more than ordinary importance from the fact that the Employer's Liability bill, doing away with the defence of contributory negligence, in personal injury cases where gross negligence or disobedience of the law on the part of the employer is shown, has passed both Houses of Congress.

The order of the commission increasing the minimum of air-brakes in service to 75 per cent. goes into effect on August 1. From the reports of our inspectors it would appear that the companies generally are in good condition to meet the requirements of this order, as our reports show that most trains are now run with from 80 to 100 per cent. of air-brakes in service. The new rule, taken in connection with the further requirement of law that all power-braked cars associated together with the minimum must also have their brakes used and operated, practically means 100 per cent. air, and will demand strict attention to the matter of air-brake maintenance. That better attention is paid to maintenance is shown by the fact that the air-brake defects reported in 1905 numbered more than 3,000 less than those reported in 1904, though the number of cars inspected was 44,000 greater. The number of air-brake defects per 1,000 cars inspected was 95.07 in 1905, as against 169.60 in 1904, thus indicating a very considerable and general improvement in air-brake conditions.

Something should be done to reduce the number of cars having brakes cut out with no card attached showing defects. Our inspectors found more than 7,000 such cars last year. It is true that this number was nearly 3,000 less than the number found the previous year, thus indicating considerable improvement; still there are a great many more of these cut out cars than there should be. The great evil in this condition lies in the fact that in most cases these cut out cars have nothing whatever the matter with their brakes, and the carriers are thus deprived of the use of many brakes which will be needed more than ever when the increased minimum order goes into effect. In most cases these cars are cut out through the carelessness of trainmen. Desiring to set a car out on a side track at some point along the road, a brakeman cuts it out of the train line and leaves it cut out after it is placed on the sidetrack. When the car is picked up by some other crew the brake is found cut out, and it is assumed to be defective and runs in this condition sometimes for months before anyone thinks to cut the car in and find out what is the matter with it. The car finally arrives in a yard where there is a testing plant, and an inspector cuts it in for the purpose of discovering wherein the brake is defective, finding that it is all right. Many roads have issued stringent orders forbidding employees to cut out air-brake cars without attaching cards

showing defects. Such orders should be more general, and discipline should be enforced for their disobedience, as it is of the highest importance that every effective brake should be in condition for use at all times.

Something should also be done to improve the condition of retainers. It frequently happens that cars are used on level roads for many months. The retainers on such cars are not put in service, and as no attention is paid to their condition they deteriorate to such an extent that when the car finally finds its way to a road having heavy grades, and it is sought to use the retainer, the device is found to be inoperative. A requirement for the testing and oiling of retainers at regular intervals, similar to the regulation affecting the care of triples, would undoubtedly improve the condition of retainers.

Additional Exhibits at the Atlantic City Convention.

[WITH INSET.]

The following list of exhibits at the Atlantic City Convention completes the partial list printed in our last week's issue on pages 639 and 640:

Acme Ball Bearing Co., Chappaqua, N. Y. Acme ball-bearing jacks and Acme ball-bearing casters.

Adreon & Co., St. Louis, Mo. Simplicity bell ringer; Adreon brake shoe; key-bolt fastening; and the Adreon Morse ratchet-wrench, with drill socket and brace.

Allis-Chalmers Co., Milwaukee.—Electric motor and steam turbine, showing section.

American Car & Foundry Co., New York. Track exhibit of fire-proof steel suburban passenger car for the New York Central Lines.

American File & Sharpener Co., New York.—American file sharpening machine; "Carbotlynt" for sharpening files; Fulton friction tapping machine; and the Hercules folding steel ladder.

American Lock Nut Co., Boston, Mass. Burrows' patent lock nuts.

American Palace Car Co., New York. Track exhibit of combined sleeping and parlor car; also booth on Steel Pier in which photographs of car are shown.

American Water Softener Co., Philadelphia.—Complete working model of an American water softener; also photographs of installations.

Anglo-American Varnish Co., Newark, N. J.—Varnishes.

Ajax Metal Co., The. Ajax plastic bronze bearings.

Asbestos, Slate & Sheathing Co., Ambler, Pa. Asbestos; "Century" shingles; asbestos building lumber; asbestos reinforced corrugated sheathing; and asbestos smoke jacks.

Ashton Valve Co., Boston, Mass.—Muffler and open pop safety valves; steam gages; duplex air gages; gage testers and chime whistles.

Baldwin Locomotive Works, Philadelphia, Pa. Track exhibit of Atlantic type balanced compound locomotive for the Union Pacific, and a Pacific type locomotive for the Great Northern.

Baldwin Steel Co., New York.—Hudson high-speed steel tools for locomotive shop use.

Baltimore Journal Box Co., Baltimore, Md.—Self-oiling journal box.

Belle City Malleable Iron Co., Racine, Wis.—The "Belle City" adjustable draft plate and the "L. & S." anti-rail creeper.

Best, W. N., American Calorific Co., New York. Oil furnaces for annealing, brazing, heating, etc.; also oil burners and safety regulator cocks.

Bliss Electric Car Lighting Co., Milwaukee, Wis. The Bliss electric train lighting system.

Boker & Co., Herman, New York.—"Novo" patent section tool steel and cutters.

Border Bolt & Nut Lock Co., The, Richmond, Ind. The "Border" nut lock.

Boston Belting Co., Boston, Mass. Air brake hose and other rubber goods for railroad use.

Bowser, S. F., & Co., Ft. Wayne, Ind. Oil house equipments, including lubricating oil tanks, self-measuring oil tanks, power pumps, etc.

Bradford Draft Gear Co., Chicago. Four-spring and three-spring draft gears.

Brown Hoisting Machine Co., Cleveland, Ohio. Photographs of the "Brown hoist" locomotive coaling cranes and of coal and ore handling machinery.

Buffalo Brake-Beam Co., Buffalo, N. Y. The Buffalo and Vanderbilt brake beams.

Bullard Automatic Wrench Co., Providence, R. I.—The Bullard automatic wrench.

Burgess, B., Danville, Ill. The Burgess rail anchor and the Schott incline jack for replacing locomotive and car brasses while on the road.

Camel Co., Chicago.—Car door fixtures; ball-bearing center plates and side bearings and Chaffee hose clamps.

Carborundum Co., The, Niagara Falls, N. Y. Carborundum products; carborundum wheels; stones and carborundum fire sand for lining brass furnaces.

Celluloid Co., The, New York City. Samples of "Texoderm" for upholstering and car curtains.

Chase Grain Door Co., Chicago. Chase grain door.

Chisholm & Moore Mfg. Co., Cleveland, O. Chain hoists.

Clark Automatic Nut Lock Co., New York. The Clark automatic nut lock.

Cleveland Car Specialty Co., Cleveland, O. Pressed steel carlines and pressed steel spring planks.

Cling Surface Co., Buffalo, N. Y. Device for demonstrating the difference in efficiency between a belt treated with "Cling Surface" and running slack as compared to a belt untreated running tight.

Coburn Trolley Track Mfg. Co., Holyoke, Mass. Freight car door and shop trolley tracks and fixtures.

Coe, W. H., Manufacturing Co., Providence, R. I. Coe's gilding wheels and ribbon gold leaf.

Crocker Wheeler Co., Ampere, N. J. Photographs showing application of motor drives to machine tools; also several sizes of its type "L" motor.

Dahlstrom Metallic Door Co., Jamestown, N. Y. The "Dahlstrom" metallic door.

Davis Expansion Boring Tool Co., St. Louis, Mo. The Davis expansion boring tool for car wheels.

Dearborn Paint Co., Chicago. Fire-proof and water-proof compounds, specimens of canvas car roofing and sheet iron treated with Dearborn paint, etc.

Detroit Lubricator Co., Detroit, Mich. Locomotive lubricators having three, four and five feeds.

Diamond Machine Co., Providence, R. I.—Motor driven disc grinders and polishers; also special device for grinding lathe centers.

Draper Mfg. Co., Port Huron, Mich.—McGrath pneumatic flue welder; McGrath turntable motors and Draver valve-facing tools; also a Rockwell flue-welding oil furnace.

G. Drouve Co., The, Bridgeport, Conn.—The Lovell window opening device and the "Anti-Pluvius" skylight system.

Duff Mfg. Co., Pittsburg, Pa.—Various types of Barrett and Duff track and car jacks.

Duquesne Steel Foundry Co., Pittsburg, Pa. Duquesne rolled steel car wheels.

Fairbanks, Morse & Co., Chicago. Reception booth and model of gasolene gang car.

Farlow Draft Gear Co., Baltimore, Md.—The Farlow draft gear as applied on cars of the Great Northern, Hocking Valley and the Coal & Coke Railroads, and on Seaboard Air Line locomotives and Atlantic Coast Line cars in connection with the Westinghouse friction barrel.

Featherstone Foundry & Machine Co., Chicago. Illustrations of the Featherstone pneumatic forging machine and specimens of work done on the same.

Forsyth Bros. Co., Chicago.—Forsyth track-actuated draft and buffing mechanism, applied to a steel passenger car exhibited by the American Car & Foundry Co.; also a Stucki radial drawbar centering device on a full-sized freight model.

Frazer Specialty Co., Detroit, Mich. Frazer locomotive joint and boiler front cement and front end paint.

Galena-Signal Oil Co., Franklin, Pa. Reception room on pier.

Garlock Packing Co., Palmyra, N. Y. Full line of fibrous and metallic packings for locomotive and general railroad use.

G. & B. Paint Co., The, Port Allegheny, Pa. Water and acid proof paints.

Goldschmidt Thermit Co., New York.—Samples of steel welded by the Goldschmidt process; also samples of metal and different designs of patterns, molds and flasks used in making welds.

Graves, N. Z., Co., Philadelphia, Pa.—Paints and varnishes; white lead; and railroad specialties.

Greenway Co., Detroit, Mich.—Steam and oil separators; compressed air separators and cast iron exhaust heads and steam traps.

Hammet, M. C., Troy, N. Y.—Trojan Packing; Sansom bell ringer; and balance slide valves.

Hanlon Locomotive Sander Co., Winchester, Mass. The Hanlon pneumatic locomotive sander in operation.

Harrison Dust Guard Co., Toledo, O. The Harrison dust guards and the Williams Harrison vestibule journal boxes.

Harrison Williams Co., Toledo, O. Harrison car journal lubricator and cellars.

Holcomb Steel Co., Syracuse, N. Y. Sabin high-speed tool steel.

Hurley Machine Co., Chicago. "Little Giant" floor scraper.

Illinois Malleable Iron Co., Chicago. Model of the Bruyn automatic swinging smoke jack; "Imico" combination brass and malleable iron non-corrosive unions and malleable iron pipe fittings.

International Correspondence Schools, Scranton, Pa. Air brake instruction car.

Invisible Roll Screen Co., Brooklyn, N. Y. Invisible rolling screens for cars, hotels, office buildings, etc.

Janney, E. H., Alexandria, Va.—"The New Janney" coupler.

Jefferson Union Co., Lexington, Mass. Pipe unions.

Jenkins Brothers, New York.—Complete line of iron and brass valves; also packings and rubber specialties.

Joyce-Cridland Co., The. Hydraulic, lever, compound, lever and geared jacks.

Kalamazoo Railway Supply Co., Kalamazoo, Mich.—Pressed steel hand and push car wheels; Moore track drills; Root locomotive scraper and flanger, and Kalamazoo ratchet jacks.

Keystone Drop Forge Works, Philadelphia, Pa. Drop forgings for car and locomotive work, including Keystone connecting links, safety shackle hooks and crocodile wrenches.

Lawrence, V. O., & Co., Philadelphia, Pa. The Filion patent diagonal folding vestibule trap door.

Lawrenceville Bronze Co., Pittsburg, Pa.—Bronze and copper founders; "Corinthian" bronze; driving box brasses; rod brasses, and universal couplers and brass cocks.

Lincoln Electric Mfg. Co., Cleveland, O.—Lincoln variable speed motors.

Lord Co., Geo. W., Philadelphia, Pa.—Samples of boiler compounds.

Lucas, John, & Co., Philadelphia, Pa. Lucas coach and car colors; stains; fillers; varnishes, and the "Mirac" varnish and paint remover.

Luce & Co., E. F., Inc., Chicago.—Climax car doors and mlock drop end doors for box cars.

McGuire-Cummings Mfg. Co., Chicago. Cooke patent release grain door and various designs of burglar-proof door brackets for freight car doors.

Major, A., New York. Major's compartment water coolers for railroad use.

Merritt & Co., Philadelphia, Pa. Sheet and expanded metal lockers for machine shops.

Metal Plated Car & Lumber Co., New York. Full sized model of car window equipped with the Brown metallic window strip. Sections showing application.

Metallic Packing & Mfg. Co., The, Elyria, O. The "Twentieth Century" metallic packing for locomotives, etc.

Morse, Williams & Co., Philadelphia, Pa. Locomotive drop table and the Hindley worm gear.

National Mfg. & Supply Co., Chicago. National standard roofing canvas and diaphragms.

National Roofing Co., The, Tonawanda, N. Y. Security ready roofing.

New Jersey Tube Co., Newark, N. J. Patent spirally corrugated boiler tubes with reduced fire-box ends.

Oil Well Supply Co., Pittsburg, Pa. Railroad special globe valves.

Oliver Machinery Co., Grand Rapids, Mich. Photographs of wood-working machinery of all kinds, including universal saws, band saws, hand planers, wood face and gap lathes, disk sanders and wood trimmers.

Otley Mfg. Co., Chicago. Eureka cement for steam joints; also enamel for front ends and smoke jacks.

Pantasote Co., New York. Pantasote car curtains and seat fabrics.

Parker Anti-Freezing and Hot Water System, London, Ont. The Parker system of car heating.

Penn Steel Casting & Machine Co., Chester, Pa. Specimens of cast steel locomotive cylinders.

Perry Side Bearing Co., Chicago. The "Perry" roller side bearing.

Post, E. J., & Co., New York. Samples of Posts, Zero and Motor metals for journal bearings.

Power Specialty Co., New York. Sections of the Foster superheater and drawings of the Foster locomotive superheater; also Duval metallic packing.

Pressed Steel Car Co., New York. Track exhibit of steel passenger car built for the Southern Railway.

Protectus Co., The, Philadelphia, Pa. Reception booth.

Quincy, Manchester, Sargent Co., Chicago. Reception booth.

Rostent, Clement, Co., Philadelphia, Pa. Steam and hydraulic packing.

Robinson Co., Boston, Mass. Exhaust nozzle for locomotives, air strainers, automatic brake slack adjuster and track jacks.

Railway Lock Nut Co., Chicago. The "Bull Dog" lock nut.

Republic Railway Appliance Co., St. Louis. Brake shoes, the Jones post

tive nut lock; Hudson's improved plastic freight car roofing, and Republic front end and stack enamel.

Rushmore Dynamo Works, Plainfield, N. J. The Rushmore lens mirror searchlight for locomotive headlight and automobiles.

Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. Nuts and bolts for railroad use.

Republic Railway Appliance Co., St. Louis. Republic draft gear, car doors; Eureka nut locks, turnbuckles, etc.

Riverside Metal Co., Riverside, N. J. Phosphor bronze; German silver, and white metal ingots; also castings, sheets and rods.

Rostand Mfg. Co., The, Boston, Mass. The McCarthy basket racks for passenger cars. The N. Y. C. Lines suburban car on exhibition at the track is fitted with this rack.

Roth Jack & Tool Co., New York. Roth high pressure jacks.

Royal Ventilator & Mfg. Co., Philadelphia, Pa. Royal ventilators for engine houses, machine shops, etc.

Safety Car Heating & Lighting Co., New York. This company, in addition to its car heating system mentioned in our last week's issue, also has an exhibit of modern lamps for car lighting, including four-flame lamps, Pintsch mantle lamps and electric fixtures and storm-proof lanterns for buoy and beacon lighting.

Sauvage Safety Brake Co., New York.—The Sauvage air brake system.

Shuttle & Koerting Co., New York. The Koerting Universal double tube injector.

Sellers & Co., William, Philadelphia, Pa.—Sellers improved self-acting injector; Sellers check valves, etc.

Sight Feed Oil Pump Co., Milwaukee, Wis. Locomotive sight feed oil pumps.

Standard Coupler Co., New York.—Sessions Standard friction draft gear. Reception booth on Steel Pier.

Star Brass Mfg. Co., Boston, Mass.—Steam gages; pop safety valves; lubricators; renewable seat and disk globe valves, angle valves; blow off cocks; water gages; recording gages; patent cylinder relief and vacuum valves.

Strauss, M., & Sons, Newark, N. J.—Machine and hand buffed leather for car cushions.

Talmage Mfg. Co., Cleveland, O.—The Talmage system, including Talmage blow-off valves and Rubra boiler oil.

Thompson, C. A., St. Louis, Mo.—Acme flexible staybolts and the Acme pneumatic sledge.

Trojan Car Coupler Co., New York.—The Junior coupler.

Tyler Tube & Pipe Co., New York. Knobbled charcoal iron blooms, boiler tubes, showing sections as tested for beading, flanging, expanding and flattening both horizontally and longitudinally.

U. S. Automatic Heat Regulating & Ventilating Co., The, Newburgh, N. Y. —Combined system of automatic heat regulation and ventilation in operation on a N. Y., O. & W. passenger car.

United States Lighting & Heating Co., New York. Axle lighting equipment.

Vacuum Cleaner Co., New York. Car cleaning by the vacuum system.

Watters, J. H., Augusta, Ga. Pneumatic track sander.

Wellman & Street, Pittsburg, Pa. Track exhibit of a steel coal car.

White Enamel Refrigerator Co., St. Paul, Minn. Reception booth and blue prints showing the "Bohn Syphon System."

Williams, R. B., Margaretville, N. Y. Safety signal for car inspectors while inspecting cars.

New Atlantic City—Camden Record Run.

By invitation of Burnham, Williams & Co., on Tuesday, June 19, a party of 148 convention visitors left Atlantic City for Philadelphia in a special train over the Philadelphia & Reading (Atlantic City Railroad). On arrival in Philadelphia at 1:30 p. m. the party was driven in tally-ho coaches through the city to the Baldwin Locomotive Works. Here luncheon was served in a space in one of the shops which had been cleared and decorated. This was followed by a trip through the works, including the new electric truck shop at Eighteenth street recently completed and now being put in service. After an inspection of two finished examples of recent Baldwin construction—an Atlantic type locomotive for the Chicago & Alton and a Pacific type for the Southern Railway—the visitors returned to Atlantic City, reaching there shortly before six o'clock.

The special train was made up of six cars—three 8-wheel coaches and three 12-wheel Pullmans. The engine, No. 343, is a wide firebox, Wooten boiler, Atlantic type, weighing about 105 tons, built at the Reading shops of the Reading—one of the locomotives regularly used in the Atlantic City service. The distance between Atlantic City and Camden is 55½ miles. This was covered on the up trip in 45 minutes, an average rate of 74 miles an hour from start to stop, but on the return this was bettered by a minute and a half. The fastest time that has ever been recorded over this line is 42 min. 33 sec., made on May 14, 1905, with five cars (*Railroad Gazette*, June 2, 1905, page 597); though there is an unofficial statement that eastbound, Camden to Atlantic City, a regular train, behind time, has made the trip in 41 minutes. For a six-car train the present run establishes a new record. In view of this fact an unofficial but careful taken log of the return trip is given below. Although probably not accurate to a second in each instance, it checks up closely with the time recorded by other observers, and is to all intents and purposes an accurate record of the run. The whole distance, 55½ miles, was covered in 43½ minutes, an average rate from start to stop of 76.7 miles an hour. This includes a slow half mile at the start. Leaving out the first five and a half and last two miles, the 48 miles between mile posts 50 and 2 were run in 34 min. 5 sec., or at 84.7 miles an hour. From mile post 38 to mile post 2—36 miles—was run in 24½ minutes, or at 88.2 miles an hour. It will be observed that the 12 miles between mile posts 29 and 17 was covered in exactly eight minutes, or 90 miles an hour. The fastest miles—mile posts 27 to 26 and 19 to 18—were made in 38 seconds each, which is just under 95 miles an hour. The special train was furnished by the courtesy of the Philadelphia & Reading, through Mr. H. D. Taylor, Superintendent of Motive Power and Rolling Equipment, who accompanied the party.

The log of the run follows:

	June 19, 1906.		Seconds per mile	Miles per hour.
Left Camden		5 07 05		
Mile post	55	5 09 20	135 for ½ mile.	27
" "	54	5 10 30	70	51
" "	53	5 11 35	65	55
" "	52	5 12 35	60	60
" "	51	5 13 35	60	60
" "	50	5 14 35	60	60
" "	49	5 15 29	54	67
" "	48	5 16 20	51	71
" "	47	5 17 10	50	72
" "	46	5 18 00	50	72
" "	45	5 18 45	45	80
" "	44	5 19 30	45	80
" "	43	5 20 15	45	80
" "	42	5 21 00	45	80
" "	41	5 21 46	46	78
" "	40	5 22 38	52	69
" "	39	*	46½	78¼
" "	38	5 24 10	46¼	78¼
" "	37	*	43½	84¼
" "	36	*	43½	84¼
" "	35	5 26 20	43½	84¼
" "	34	5 27 03	43	84
" "	33	5 27 45	42	86
" "	32	*	40½	90¼
" "	31	*	40¼	90¼
" "	30	5 29 45	40¼	90¼
" "	29	5 30 30	45	80
" "	17	5 31 10	40	90
" "	26	5 31 50	40	90
" "	25	5 32 28	38	95
" "	24	5 33 08	40	90
" "	23	5 33 48	40	90
" "	22	5 34 28	40	90
" "	21	5 35 09	41	88
" "	20	5 35 50	41	88
" "	19	5 36 30	40	90
" "	18	5 37 12	42	86
" "	17	5 37 50	38	95
" "	16	5 38 30	40	90
" "	15	5 39 11	41	88
" "	14	5 39 52	41	88
" "	13	5 40 32	40	90
" "	12	5 41 14	42	86
" "	11	5 41 55	41	88
" "	10	5 42 35	40	90
" "	9	5 43 15	40	90
" "	8	5 43 55	40	90
" "	7	5 44 35	40	90
" "	6	5 45 15	40	90
" "	5	5 45 56	41	88
" "	4	5 46 35	39	92
" "	3	5 47 15	40	90
" "	2	5 47 57	42	86
" "	1	5 48 40	43	84
" "		5 49 15	35	103
Arr.	Atlantic City	5 50 35	80	72

* Mile posts hidden by cars.
† Average for the two or three miles.
‡ Brakes on top drawhead.

The Year's Record of the Pennsylvania Special.

An officer of the Pennsylvania Railroad has favored us with the following condensed record of the times of the "Pennsylvania Special" express trains between New York and Chicago for the first year of their existence. The distance traversed by these trains between Jersey City and Chicago is about 905 miles, and the time 17 hrs. 47 min. (18 hrs. between New York and Chicago, including the ferry between New York and Jersey City). No. 29 is the westbound train and No. 28 the eastbound.

Train No. 29, June 12, 1905, to June 11, 1906, Inclusive.

Month.	Days.	Ar. Chicago On time.	Late.	Percentage, On time.	Minutes late—Not more than 5	10	20	30	Over 30
June, 1905	20	18	2	90.0	0	1	0	0	1
July	31	31	0	100.0	0	0	0	0	0
August	31	30	1	96.8	0	1	0	0	0
September	30	29	1	96.7	0	0	0	0	1
October	31	28	3	90.3	0	2	0	1	0
November	30	28	2	93.3	2	0	0	0	0
December	31	27	4	87.1	0	2	1	1	0
January, 1906	31	23	8	74.2	1	2	2	0	3
February	28	19	9	67.9	0	1	1	1	6
March	31	28	3	90.3	0	1	0	1	1
April	30	28	2	93.3	1	0	0	1	0
May	31	29	2	93.5	0	0	0	1	1
June	10	10	0	100.0	0	0	0	0	0
Total	365	328	37	89.8	4	10	4	6	13

Of the 37 times that the train arrived late at Chicago, 14 times were due to the equipment of the train and 23 to various road causes.

Train No. 28, June 12, 1905, to June 11, 1906, Inclusive.

Month	Days	Ar. Jersey City On time.	Late.	Percentage On time.	Late.	Minutes late—Not more than 5	10	20	30	Over 30
June, 1905	20	17	3	85.0	15.0	0	0	0	0	3
July	31	26	5	83.9	16.1	0	1	2	1	1
August	31	26	5	83.9	16.1	1	2	0	0	2
September	30	27	3	90.0	10.0	0	0	0	1	2
October	31	26	5	83.9	16.1	0	1	1	0	3
November	30	27	3	90.0	10.0	0	0	1	0	2
December	31	23	8	74.2	25.8	3	2	1	0	2
January, 1906	31	28	3	90.3	9.7	0	2	0	0	1
February	28	21	7	75.0	25.0	0	2	0	0	5
March	31	25	6	80.6	19.4	0	0	2	0	4
April	30	27	3	90.0	10.0	1	0	2	0	0
May	31	30	1	96.8	3.2	0	1	0	0	0
June	10	8	2	80.0	20.0	0	1	1	0	0
Summary	365	311	54	85.2	14.8	5	12	10	2	25

Of the 54 times that the train arrived late at Jersey City, 17 times were due to the equipment of the train, and 37 times to various road causes.

Master Mechanics' Association Reports.

The committee reports of the Master Mechanics' Association this year are quite up to the standard of previous years. The most important one is that on Front Ends, which is reprinted almost in full. A number of individual papers presented at the convention are not reprinted here but will appear in subsequent issues.

SPECIFICATIONS FOR CAST-IRON TO BE USED IN CYLINDERS, CYLINDER BUSHINGS, CYLINDER HEADS, STEAM CHESTS, VALVE BUSHINGS AND PACKING RINGS.

Purchasing.—It is recommended that all purchases of pig iron be made by analysis. This necessarily implies penalties for nonconformity with specifications, and the amount of silicon is considered to be of prime importance as indicating the grade. High silicon irons—that is, low foundry numbers—are generally dearer than low silicon (high numbered) irons, and if the shipment does not contain the desired percentage of silicon, payment is made accordingly. For example, with some purchases a deficiency of silicon of from 10 to 20 per cent. subjects the shipment to a 4 per cent. reduction in the contract price; or, again, at other times the bill is settled as for the grade shown by the silicon contained. Sulphur is the element to be most carefully kept down to the limit and an excess of this substance will generally entail rejection under any grade.

When purchasing cylinders, valves, etc., analyses and test bars should be insisted upon, to demonstrate that the metal is in accordance with the desired specifications.

Specifications.—For coke pig iron, these are usually limited to the chemistry of the metal. The usual proportions are given as follows

Combined carbon	.40 to .70	per cent.
Manganese	.40 to .80	"
Phosphorus	.40 to .80	"
Sulphur, not over	.06	"

The grades are determined by the amount of silicon, in accordance with the attached schedule:

Grade No. 1, Silicon	3.00 to 2.50	per cent.
" " 2, "	2.50 to 2.00	"
" " 3, "	2.00 to 1.50	"
" " 4, "	1.50 to 1.00	"

The grade desired for cylinders is about No. 3.5, or say, silicon from 1.25 to 1.75 per cent. However, cylinders are seldom if ever cast from one grade of iron only, as there is usually a considerable proportion of scrap, sometimes as much as 50 or 60 per cent.

Inspection.—Various plans are followed for sampling and inspecting pig iron when received in carload lots. The American Society for Testing Materials has adopted certain rules (not reprinted).

The Baldwin Locomotive Works state that six pieces of pigs will be taken from different portions of the car, and if the analysis of their mixed drillings shows that the iron is outside of the specified analysis, it will be cause for its rejection.

The American Locomotive Company has prepared a specification in which they state that "Check analysis will be made for each car received at the foundries, from a mixture of equal amounts of drillings taken from freshly fractured ends of three pigs, one from each end and one from middle of car. If this analysis is not within the specification, drillings will be taken in the same manner from seven additional pigs." In other cases samples of 12 pigs are taken from each car, two from the top of each end, two from the middle and two from the bottom, the borings being mixed in equal quantities and the resultant sample taken to represent the shipment. Almost any of the above methods will be generally satisfactory if closely adhered to.

Charging.—In mixing the iron for the cupola it is necessary to know the chemistry of the metals charged and the desired analysis of the output, and the various brands must be thoroughly mixed in the cupola. The percentages of the various elements in the casting will be different from that in the average charge. The amount of phosphorus usually remains constant, while silicon diminishes, particularly when more than 1 per cent. is present. Part of the manganese is always oxidized—the greater the amount the greater the proportion—and sulphur is likely to be increased by absorption from the fuel. For this ingredient it is more necessary to watch the coke and the working of the cupola than the metals which are charged. The total carbon remains practically unchanged.

Fifteen or 20 points more silicon must be charged than expected in the casting, and this is really the most important element in the iron, as it determines the hardness of the product in an inverse ratio to its presence, that is, the more silicon the softer the iron. It also affects the strength, giving a maximum tensile resistance at about 1.60 per cent. Phosphorus and manganese act as hardeners and also cause the iron to flow readily and make a clean and sound casting, but if present in large quantities, brittleness is apt to ensue. When sulphur is excessive there is a greater tendency to crack, and it should not be allowed to rise above set limits. This is particularly true for complicated forms, like a locomotive cylinder. Some manufacturers, however, claim that there should be at least .07 per cent. sulphur in a cylinder casting to get the best results.

It is essential to carry on hand a liberal stock of irons of known analyses, so that the desired combination can always be secured.

Production.—A locomotive cylinder should combine strength and hardness—the former to prevent breakage, the latter to retard wear; however, it must not be brittle and must admit of machining. A cylinder may be made of tough iron and a hard bushing inserted to give the wearing qualities. In fact, we know of recent cases in which the cylinder shell has been a steel casting, with cast-iron bushings inserted in the piston and valve chambers. Shrinkage must also be considered, as when excessive there are apt to be cooling cracks present in the casting.

The committee recommends the following specifications for metal in locomotive cylinders:

Silicon	1.25 to 1.50	per cent.
Phosphorus	.50 to .80	"
Sulphur	.06 to .10	"
Manganese	.30 to .60	"
Combined Carbon	.50 to .70	"
Graphite Carbon	2.75 to 3.25	"

Tensile strength, 25,000 lbs. per sq. in. minimum.
Transverse strength, 3,000 lbs. minimum on $1\frac{1}{4}$-in. round bar, 12 in. between supports.
Deflection, .10-in. minimum on transverse test.
Shrinkage, $\frac{1}{8}$ in. in 1 ft. as a maximum.

Testing.—The American Society for Testing Materials has adopted a method for testing such castings, and the committee recommends it to the Association.

Uniformity.—The presence of scrap and other uncertain elements in the charging causes some irregularity in uniformity of the products, but with careful work satisfactory results can be obtained.

Owing to numerous causes a variation of 20 or 30 points is sometimes found in the silicon and perhaps 4 or 5 points in sulphur, due largely to the fuel, but as the former is apt to decrease and the latter to increase, careful charging will produce quite regular results, in spite of the variation between different taps.

Results.—The cylinders made in accordance with various formulæ or analyses (which are very similar), are reported as having good wearing qualities combined with strength, and this seems to be the case without regard to the particular brand of iron used, so long as the final analysis of the cylinder is satisfactory. The iron is harder, stronger and closer grained than the ordinary foundry output, but no trouble is experienced in machining with modern tool steels. If the silicon runs much above the limits specified, the cylinders will cut readily, as above demonstrated, or if below 1 per cent., they are subject to cracks. Some manufacturers mix charcoal and coke pig with good wearing results, but it is thought that cracks are more common with this method, as also when using cold blast irons. If sulphur runs high there is trouble in obtaining a perfect casting for such a complicated pattern.

From information gathered, it is evident that many foundries are still charging by fracture and furnace name and number, but as irons are so liable to vary in their analyses, depending upon the working of the furnace and variations in the ore and fuel, it is surprising that the method of mixing according to analyses has not been more generally adopted, especially as different localities must purchase iron where the haul will not be excessive.

General.—While the metal advocated is perfectly suitable for cylinder bushings, as well as cylinders (and we also think for valve bushings), a softer grade of iron is generally used for cylinder heads, steam chests, valve bushings and packing rings. This iron has a silicon content of from 1.60 to 1.80 per cent.; the other elements remaining about the same. As shown on page 215, Vol. 30, of the Proceedings of this Association, the greatest strength was obtained with silicon at 1.60 per cent., and for cylinder heads and steam chests strength is most important. In packing rings a softer iron is desired to save the cylinder bore, and the strength is also a very important factor to prevent breakage when springing over pistons or from water accumulating in the cylinder.

The report is signed by G. R. Henderson, E. D. Nelson, Max H. Wickhorst.

ENGINE HOUSE RUNNING REPAIR WORK ON LOCOMOTIVES.

The report is based on the assumption of a 50-stall house and that 150 engines have to be taken care of in 24 hours.

What is the best practice for doing running repairs on locomotives, handling reports, etc., made by foremen, engineers, road foremen and inspectors? A system as outlined below will give the maximum results with the minimum delay and expense. It is necessary to know what work has to be done on an engine before it arrives in the roundhouse, so that, if for the drop pit, it can be run there without delay, or, if any heavy repair work is necessary, it can be run in a stall convenient to machine shop, which will save time of machinists.

A system of engineers' work reports and engineers educated to report their work fully and intelligently is of value. These slips should be deposited in a box or other receptacle, located centrally and preferably close to the foreman's office, so that the man in charge of handling them, and distributing the work, can do so and keep in touch with the foreman.

A system of writing out the work on separate slips and giving it to the proper man, who signs and returns it to the gang foreman when work is done, has many advocates and enables a close check to be kept on improper repairs. Which ever system is used, it is absolutely necessary to know who has done the work, for future reference.

When an engine arrives in the roundhouse, the inspector should at once make an examination of it, reporting all the work found, on the regular engineers' slip, but signing his own name and adding the word "Inspector," so that a check can be kept on the engineers to see if they are looking over their engines properly.

If any repairs are necessary, the gang foreman should have his men ready to make them, so as to avoid any delay; if for washing out, the steam and water should be blown off into a proper receptacle and hot water used for washing out and filling up. Great care should be exercised so that machinists are not sent to an engine that is to be washed out, unless they can do their work without interruption. If it is necessary to grind in boiler checks, renew stay bolts, or do other work that can only be done when the water is out of the boiler, advantage should be taken of this opportunity.

On some roads the road foreman of engines uses a regular blank for reporting work that he finds while riding on engines. This report should be turned in so that it can have attention while the engine is out of service, and work reported by a road foreman should have particular attention paid to it, as his discipline is hurt to a great extent, and his usefulness impaired, if no notice is taken of his reports.

On some roads the water conditions are good, so that boiler work is almost unknown. On others, the amount of boiler work fixes the time an engine is out of service. On some roads, with poor coal, it is not unusual to change grates nearly every trip, while on others the coal is of such good quality that grate troubles are almost unknown.

The location of a roundhouse of the size being considered has to be taken into account. If in close proximity to the main shop, less machine tools may be necessary, but where entirely self-supporting, a proper outfit should be supplied to take care of anything that may come along.

In addition to the small tools owned and carried by the various mechanics, the committee recommends the following:

1 48x48 in. by 8-ft. planer.
1 24-in. lathe.
1 40 in. heavy drill press.
1 20-in. drill press.
1 emery wheel.
1 16 in. bolt lathe.
1 22 in. shaper.
1 bolt-cutter to take up to 2-in.
1 36-in. boring mill.
1 hydraulic or screw press for driving box brasses, rod bushings, etc.

Suitable cranes around engines and drop pits, either supported by posts or roof, so as to take care of air pumps, steam chests, front end doors, driving boxes and other heavy parts. The lifting on and off of cabs is something that should not be overlooked.

A driving wheel drop pit capable of taking care of at least two engines at a time.
1 engine truck drop pit capable of taking care of at least 2 engines at a time.
1 tender truck drop pit, if trucks are suitable for wheels to be dropped.
2 gasolene or oil tire heaters, with proper sized hoods and burners can be used for straightening frames, etc.
1 rotary valve seat planer of sufficient size to take the largest sized seats.
1 boring bar for piston valve bushings.
1 cylinder boring bar.
4 piston-rod pullers, various sizes.
12 differential chain hoists.
4 ½ in. grab chains.
4 ⅝-in. grab chains.
12 pinch bars.
12 heavy capacity jacks, 35 or 40 ton, hydraulic or lever.
12 screw jacks for holding up work.
4 lever journal jacks.
2 lever jacks for pilot and tank work.
2 air hammers made out of pipe or old hydraulic jacks for driving out rod and frame bolts.
6 air motors, various sizes, two to be end motors for close work.
4 crosshead lifters.
2 spring pullers.
3 close chisel bars.
6 long chisel bars.
4 two-wheel trucks for moving material.
1 blacksmith forge.
1 set ratchets and rollers for valve setting.
2 4-wheel rod trucks.
1 portable arrangement for hydrostatic test.
1 steam gage tester.
1 complete set of twist drills, ¼-in. to 2-in.
1 small breast drill.
1 complete set standard reamers, ¾-in. to 2 in.
1 pipe vise.
1 complete set of standard taps, ¼-in. to 2-in.

Cold chisels, as many as necessary.

1 complete set of pipe cutters, dies, and taps, from ⅛-in to 3-in; sufficient adjustable pipe wrenches to accommodate the force of men that the work requires.
6 each, open wrenches, ⅜x5⅜-in. to 1¼x1¼ inches.
2 each, large-size open wrenches, up to largest size nut on locomotives.
6 mauls, various weights, 8 to 16 lbs.
12 handle punches, ¾ to 1¼ in.
2 pneumatic hammers for boilermakers, chipping, etc., caulking tools, etc.
1 complete set stay-bolt reamers and taps; in fact, complete outfit for stay bolt, fire and grate work.

Sufficient chisels, gages, hack saws, files, scrapers, straight edges, etc., to accommodate the force maintained at each roundhouse in order that one man may not be held up on a job waiting for another man to get through with some small tool.

Each roundhouse should have a separate tool room of its own, with a man in charge, both day and night, to handle the tools on a check system; otherwise it will be impossible to maintain roundhouse tools.

The following suggestions are endorsed by the committee:

The use of a floating or hospital gang in roundhouse, to which gang will be turned over the heavier jobs so as to get engines into service quickly, instead of having the work drag along with various men being put on and taken off according to the exigencies of the service. This system will often enable an engine to be kept out of back shop and increase the mileage between shoppings.

A long master wedge for drawing piston rods into crossheads before the regular wedge is applied.

A small bolt lathe mounted on a truck and run by electric or air motor, for use around an engine where new rod, truck or cylinder bolts are being fitted, to save running back and forth to machine shop.

Always keep one engine on blocks undergoing moderately heavy repairs so that machinists can be kept busy at all times when work in the roundhouse falls off temporarily. It is claimed that work done in this manner costs more, but where business fluctuates it is a good proposition.

The neglect of running repairs causes engine failures to increase and also decreases the life of an engine between shoppings.

A hydraulic press operated by a screw, for forcing out rod bolts, etc., saves bolts from being upset when hit by a sledge.

An inverted "Y," with the upright leg slotted, which is used for removing heavy cylinder heads, the method of operating being to stand the "Y" against cylinder head, with feet on floor and stud through slot, the nut being put on and tightened so that when cylinder-head nuts are removed head can be "walked" away and stood ready for application.

The report is signed by H. T. Bentley, P. Maher, F. T. Hyndman.

PENNSYLVANIA RAILROAD LOCOMOTIVE TESTS AT ST. LOUIS.

The committee, appointed in 1903, reports that it has finished its work and asks to be discharged. It gives a brief history of the enterprise in its report and, as an appendix, the summary of tests and results reprinted from the official publication of the Pennsylvania Railroad.

The report is signed by F. H. Clark, C. H. Quereau and H. H. Vaughan.

TIRE SHRINKAGE AND DESIGN OF WHEEL CENTERS.

General.—The dimensions, design and weight of wheel centers should, in a general way, be of suitable proportions to the weight and power of the locomotive. These recommendations, therefore, will be found somewhat too heavy for locomotives of moderate weight, and will be understood as applying to large, heavy, modern engines of proportions such as are used at the present time.

Spokes.—In order to properly support the rim and to resist the tire shrinkage, the spokes should be placed from 12 to 13 in. apart

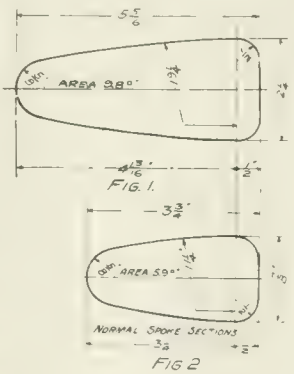
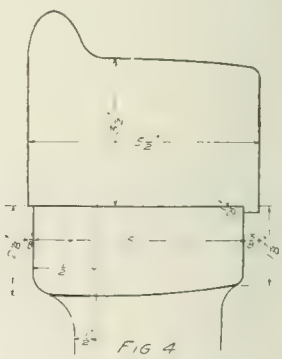


FIG. 1.

FIG 2


FIG 4

from center to center, measured on the outer circumference of the wheel center. The committee recommends the following approximate rule:

Number of spokes to equal the diameter of center divided by 4. If the remainder is one-half or over, use one additional spoke. The exact spacing of the spokes according to this rule would be 3.1416 × 4 = 12.56.

Wheel centers arranged in this manner would have the following number of spokes:

Size of center.	No. of spokes.	Size of center.	No. of spokes.	Size of center.	No. of spokes.
38	10	62	16	76	19
44	11	66	17	78	19
50	13	72	18	80	20
56	14	74	19		

Among patternmakers and foundrymen there is an impression that an uneven number of spokes should be used, so as to avoid getting two spokes directly opposite each other in a straight line. The following table has been made up on this basis:

		Recommended				Recommended	
Diam.	Circumference	Spokes.	Pitch.	Diam.	Circumference.	Spokes.	Pitch.
44	138.23	11	12.5	66	207.3	15	13.8
48	150.8	11	13.6	68	213.6	17	12.5
50	157.0	13	12.6	70	220.0	17	12.9
54	169.65	13	13.0	72	226.2	17	13.3
56	176.0	13	13.5	74	232.5	17	13.6
60	188.5	15	12.6	76	238.76	19	12.6
62	194.8	15	13.0	78	245.0	19	12.9

In the above table, the pitch of spokes, measured on the outside of rim, is 12.5 to 13.8.

Spokes at crank hub should not be located at center line of wheel, but on either side, so as not to bring a short spoke directly in line with crank pin hub. Sections of spoke to be from 9 to 10

sq. in. in area, with form as shown in Fig. 1, for the big end. Section at small end to have an area of from 5¾ to 6 sq. in., with form as shown in Fig. 2. These sections are taken at the base of the fillets uniting the spoke to the hub and rims, as shown in Fig. 3 at AA and BB. The metal in these sections is distributed so as to give the maximum amount of resistance to the shrinkage of the tires, and with this end in view the section is much heavier directly underneath the part of the tread which bears directly upon the rail head.

Rims.—Cast-steel driving wheel centers should be preferably

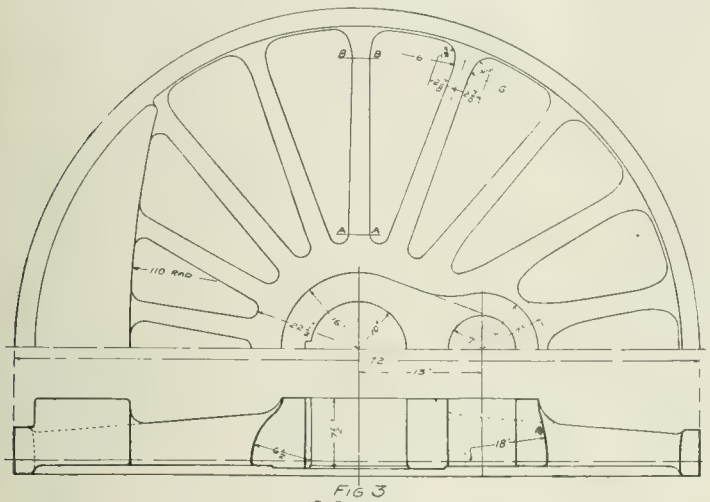


FIG 3
18 SPOKES

cast with the rims uncut and shrinkage slots omitted whenever steel foundries will guarantee satisfactory castings. The Pennsylvania Railroad has been obtaining wheel centers with uncut rims for the last two years or more. A number of cast-steel foundries are now ready to make wheel centers in this manner.

For wheel centers 60 in. and over, where the permissible total weight of the engine will permit, the rims should preferably be cast solid without cores, so as to obtain the maximum section and have full bearing of tires. The section in square inches should be approximately .45 of the sectional area of the tires when new; for instance, a 5½ by 3½ in. flanged tire has a sectional area of 20.2 sq. in. This would require a rim with 9 sq. in. of metal. A 3 by 5½ in. flanged tire has a sectional area of 17.5 sq. in., requiring a rim of approximately 7.9 sq. in. In our opinion, it is not necessary to consider the increased area of flat tires.

It is difficult to get sufficient counterbalance in centers smaller than 60 in. in diameter, so that it will be found very desirable to core out the rims to obtain the maximum lightness on the side next to the crank pin, and in some cases on the counterbalance side, in order to fill in with lead where necessary. The committee would recommend a rim section as shown in Fig. 4 for wheel centers without retaining rings. The tire is secured from having the center forced through it by a lip on the outside ⅜ in. wide and about ⅛ in. high, the tire being left rough at this point. The exact height of the lip therefore depends upon the amount of finish left on the interior of the tire.

Retaining Rings.—The committee does not recommend any particular form.

Shrinkage Slots.—It is becoming more and more the practice

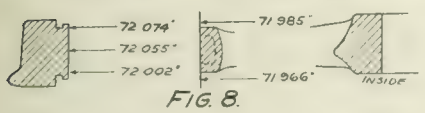


FIG. 8.

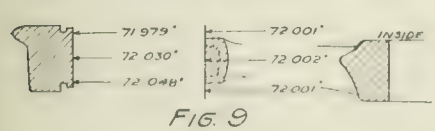


FIG. 9

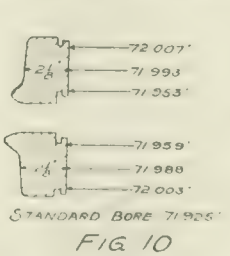


FIG. 10

of steel foundries to cast rims without shrinkage slots and several of them are now prepared to guarantee satisfactory results. The committee recommends the adoption of this practice whenever foundry methods will permit, as the rim of the wheel is stronger and better adapted to resist the strains to which it is subjected when the rim is left uncut. The extent to which this practice may be used depends entirely upon the attitude of steel manufacturers. It is well known that the shrinkage strains can be taken care of and that cast-steel wheel centers of all diameters required for locomotives have been made successfully in this manner for several years.

Hubs. In order to prevent an excessive dish to the spokes the committee recommends that a standard distance of 55 in. between hubs be adopted. This permits of the use of a practically straight spoke without dish on the inside.

In boring out the tires and in turning off wheel centers, a wide-nosed tool should be used and care taken that the surface of the finishing cut is not left in ridges. It has been observed that when ridges are left they soon wear flat and decrease the original shrinkage.

Accurate measurements of tires after they have been in service for some time, especially when less than 2½ in. in thickness, show that a rolling out or stretching of the tire occurs, and for reasonably heavy centers these figures would account more for loose tires than any permanent set in the driving-wheel center.

In Fig. 8 is shown the exact caliper dimensions of the wheel centers and tires which were reported loose on Atlantic engines having about 104,000 lbs. weight on drivers. These tires had been previously shimmed, and contained liners between the tire and center .068 in. on the left and .050 in. on the right for the entire circumference.

Fig. 9 shows diameter of tires 2⅛ in. thick, which had been removed from a similar engine. These dimensions appear to confirm the statement that considerable rolling out and stretching occurs when the tire becomes reduced in thickness, and it is especially noticeable that this rolling action of the wheel is most apparent on the outside of the tire where the wear of the rail would be greatest.

The report is signed by F. J. Cole, J. E. Muhlfeld, A. S. Vogt, W. A. Nettleton.

SUBJECTS.

For Noon-Hour Topical Discussion, Convention of 1906.

1. Is not a boiler pressure of 185 lbs. better than 200 lbs. for locomotives?
Opened by Dr. W. F. M. Goss.
2. The necessity of proportioning brake pressure to wheel loads.
Opened by G. L. Fowler.
3. Is it practical to use the Prosser tool in roundhouse running repairs?
Opened by F. R. Cooper.
4. Grease vs. oil in driving box cellars.
Opened by F. H. Clark.
5. (a) Relation of roundhouse to shop and road.
(b) The best roundhouse organization for properly taking care of locomotives.
Opened by S. W. Miller.
6. Distortion of wheel centers and tires out of round due to heavy counterbalance on 100-ton engines.
Opened by George W. West.
7. To what extent should an engine be repaired in the main shop and what class of repairs could be made to advantage in the roundhouse?
Opened by C. A. Seley.
8. Relative advantage of the piston valve as compared with the slide valve.
Opened by E. A. Miller.
9. Is the Walschaert valve gear an improvement over the Stephenson link movement?
Opened by George W. West.

Committee Reports, 1907 Convention.

1. The comparative arrangement for coaling stations.
F. F. Hildreth, F. H. Clark, J. B. Barnes.
2. Submit a blank form for use at terminals to give history of the movement of every locomotive from the time it leaves its train until it takes its next train. Object: To secure closer co-operation between the mechanical and operating departments.
G. M. Basford, R. D. Smith, R. P. C. Sanderson.
3. What thickness of tires is the most practical for locomotive driving wheels—3 in., 3½ in. or 4 in. thick? Why?
W. T. Fitzgerald, John Howard, H. F. Bentley.
4. Results of different valve gears on locomotives.
C. A. Seley, A. S. Vogt, G. H. Haselton, Robert Quayle.
5. Proper allowance for fitting axles and crank pins to driving wheel centers and method of registering the pressure.
S. W. Miller, L. R. Pomeroy, S. M. Dolan.
6. Pay for shop and roundhouse labor and comparative merits of day work, piece work, bonus or other systems.
David Van Alstyne, J. F. Deems, W. R. McKeen, Jr.
7. The proper spacing of flues in high pressure boilers.
Charles E. Fuller, H. J. Small, F. J. Cole.
8. Supervision in larger locomotive repair shops.
G. W. Wildin, H. H. Vaughan, J. B. Kilpatrick.
9. Boiler shop area in square feet, per pit of erecting shop, including cranes, machine and tool equipment.
T. Rumney, A. C. Deverell, A. E. Manchester.

Individual Papers, 1907 Convention.

1. Locomotive failures, records and results of keeping them.
Paper by W. E. Dunham.
2. Superheating and compounding from a standpoint of locomotive economy.
Paper by T. A. Foque.
3. Shop cost systems and effect of shop schedule on output and cost of locomotive repairs.
Paper by A. Lovell.

4. Causes for leaky flues.

Paper by M. E. Weeks.

The report is signed by R. D. Smith, G. W. Wildin, C. H. Quereau.

MECHANICAL STOKERS.

The committee has obtained data from several sources regarding automatic stokers for locomotives, but this data, in the opinion of the committee, is not sufficiently conclusive to submit to the Association, at the present time.

Since the last convention there has been little progress made in the development of the automatic stoker for locomotives, as in addition to continued trials of the stoker mentioned in the Proceedings of the 1905 convention, the committee has advice of trials of but one other stoker. This stoker had in connection with it, apparatus for conveying the coal from the tender to the stoker hopper above the fire door. The types of locomotives, nature of service and kinds of coal used by the various railroads, make it difficult, at the present time, to make any valuable comparisons of the performance of the various types of stokers.

The report is signed by W. Garstang, D. F. Crawford, J. F. Walsh.

LOCOMOTIVE FRONT ENDS.

In 1901 the *American Engineer and Railroad Journal* undertook a series of experiments on locomotive front ends, using the experimental locomotive and testing plant at Purdue University. The results of these tests were made public in 1902 and general equations for use in designing front end arrangements were evolved by the use of which it was assumed that the stack for any engine might be correctly proportioned. These experiments, however, were made on a locomotive having a boiler only 52 in. in diameter, much less than that of the modern locomotive, and they were chiefly concerned with the problem of the outside stack. There was a desire to have the experiments repeated upon a locomotive of large size and to have the study extended to include the draft pipe problem, the effect of inside stacks and of false tops in the smoke arch. The Association in June, 1902, appointed the present committee. Seventy-four railroad companies and two locomotive building companies made contributions of money to meet necessary expenses. The New York Central Lines contributed the use of a locomotive for a period of five months.

Outside Stacks.—The tests of outside stacks involved two different heights, namely, 29 in. and 47 in. The 29-in. height only is practicable for road conditions upon the locomotive under test. Stacks of each of these heights were supplied in diameters ranging from 15 in. to 21 in. by 2-in. steps and as the work proceeded it seemed desirable to extend the range with the result that in the 29-in. height, stacks of 23 in. and 25 in. diameter respectively were added to the series. In these tests no draft pipes or netting were employed in the front end; the diaphragm and exhaust pipe were the only details present. Under these conditions, with a 29-in. height, the best diameter was found to be 23 in., though this was not much better than that of 21 in. With a 47-in. height the best diameter is 21 in. Assuming a plain outside stack 29 in. high to be used, its diameter for the best results is 23 in.

Comparison of Results Obtained from a Large Locomotive with Those Previously Obtained from a Smaller Locomotive.—Among the more important conclusions drawn from the *American Engineer's* tests of 1903, the following are of especial interest in connection with the present discussion:

1. That for a tapered stack, the diameter for best results does not change with changes in height.

2. That the diameter of stack is somewhat affected by the height of the exhaust tip, the diameter for the best results being greater as the nozzle tip is lowered.

3. That, calling d the diameter of the stack at its smallest part, and D the diameter of the front end, the relation between the diameter of stack and front end when the exhaust tip is at the center of the boiler is

$$d = .25D.$$

4. That the diameter of stack must, for best results, be increased .16 in. for each inch that the exhaust tip is below the center line of the boiler; that is, calling h the distance between the center line and the tip,

$$d = .25D + .16h.$$

5. That a variation of an inch or less from the diameters given by the equation will produce no unfavorable results.

In view of the publicity that has been given these statements, it is important to determine the extent to which their truth is affected by the experiments of the present year.

As to the necessity for varying the diameter with the height of stack, the work of the past year is far less elaborate than that of 1903, but two heights of stack having been employed, namely, those of 29 in. and 47 in. respectively. Comparing draft values obtained from stacks of each of these heights under a uniform back pressure of 3.5 pounds it appears that the best diameter for the 29-in. stack is 23 in. The best results from the 47-in. stack were obtained by use of the largest diameter experimented upon (21 in.). Curves plotted through the several points show this diameter to approach that for the maximum draft, but it does not equal it. The indication is that if a diameter of 23 in. had been employed it would have been found right for the 47-in. height as well as for the 29-in. height. There is in fact nothing in the experiments of the present year to invalidate the conclusion derived from the preceding work. So far as outside stacks are concerned, therefore, the diameter does not need to be varied when the height is changed.

As to the effect upon the proportion of stack resulting from changes in the height of the exhaust tip, it must be noted that the work of the present year has involved one height of tip only and hence gives no information upon this question. The validity of the conclusion already stated, however, has never been called in question and it may be assumed to stand.

Concerning the actual size of the stack for best results, the work of the present year points to the desirability of using diameters which are somewhat larger than those given by the equation of 1903. This equation is,

$$d = .25D + .16h,$$

which when applied to the N. Y. C. locomotive experimented upon gives

$$d = .25 \times 74 + .16 \times 12.5 = 18.5 + 2.0 = 20.5$$

whereas, with a stack 29 in. high the best results were actually obtained when the diameter was 23 in. The difference of 2.5 in. is not great, especially in view of the fact that it has been distinctly noted that variation of an inch or even more is not important. The difference is to be accounted for also by the fact that in reviewing the results of 1903 there was a common feeling on the part of the members of the advisory committee that the experiments pointed to dimensions which, for service conditions, were excessive. Because of this view, the equation was framed as a conservative expression of the experimental results. The data obtained during the present year might, for like reasons, be similarly treated, in which case the discrepancy of 2.5 in. would be diminished or even be eliminated. Since, therefore, the only element of doubt concerning the results of 1903 has found expression in beliefs that they gave diameters which were too large, it is the feeling of your committee that the work of the present year may be accepted as a full confirmation of the earlier work. It will be shown that, however well the plain outside stack may be proportioned, the demands of service require it to give way to a more highly articulated device.

Inside Stacks.—The experiments included inside stacks of four different diameters ranging from 15 in. to 21 in., a constant outside height of 29 in. and a penetration into the smoke box of 12 in., 24 in. and 36 in., respectively. The best proportions of this form of stack are: Diameter is 21 in. and penetration (P) into the smoke box is 12 in. Results of nearly the same value were, however, obtained with stacks of smaller diameter having greater penetration. This may well be seen by reviewing the draft values obtained in return for a back pressure of 3.5 pounds. Thus, 21 in. diameter, 12 in. penetration gave a draft of 4.71; 19 in. diameter, 24 in. penetration gave a draft of 4.55, and 17 in. diameter, 26 in. penetration gave a draft of 4.32. From values thus presented it appears that as the degree of penetration increases the diameter of stack should be reduced. The effect is, in fact, of the same nature and degree as that which results from raising the exhaust tip. It is noteworthy also that these values for the plain inside stack are not materially better than those for the plain outside stack, a fact which was formulated as a conclusion resulting from the work of 1903.

Inside Stack, with False Top.—It had been planned to fit the front end with three different false tops located at 12 in., 24 in. and 36 in. respectively from the top of smoke box, but the presence of the steam pipes made it difficult to fit the 12-in. top and as a consequence only the 24-in. and 36-in. drops were experimented upon. In each case stacks of different diameters were used, the outside height being always 29 in. The best results were obtained with a stack 17 in. in diameter having a penetration of 24 in. In all cases with the false top the 17-in. stacks gave best results. A comparison of these results with those quoted for plain outside stack and for plain inside stack show material improvement in draft values.

Substitutes for False Top.—The false top necessarily interferes with free access into the front end which fact makes it desirable that a way be found in which to secure the results derived from it by means which are more simple. It was suggested that experiments be made to determine the effect upon the plain inside stack of an annular ring or flange which might be considered as representing a portion of the false top. Responding to this suggestion rings of two diameters were used on 17-in. and 19-in. stacks having a penetration of 24 in. It was found that certain proportions gave substantially the same results as those obtained with the best arrangement of false top. Believing that the results thus obtained pointed to the desirability of having a broader curve at the base of the stack and that when the proper proportions were understood

the best results would be obtained from such a curved surface, the 17-in. stack was fitted with a bell to which, for purposes of experimentation, flanges of various widths were afterward added. The best draft with the false top was 5.06; with the ring 5.05, and with the bell 4.98—that is, these three arrangements are practically on an equality. No other arrangements were experimented upon which gave higher draft values than these.

Single Draft Pipes.—Draft pipes of various diameters, adjusted to many different vertical positions, were tested in connection with plain stacks of the several diameters available. The elaboration of this phase of the work was very extensive. It was found that for the best results the presence of a draft pipe requires a smaller stack than would be used without it, but, that no possible combination of single draft pipe and stack could be found which gave a better draft than could be obtained by the use of a properly proportioned stack without the draft pipe. While the presence of a draft pipe will improve the draft when the stack is small, it will not do so when the stack is sufficiently large to serve without it.

Double Draft Pipes.—Double draft pipes of various diameters and lengths, and having many different positions within the front ends, all in combination with stacks of different diameters, were included in the experiments with results which justify a conclusion similar to that reached with reference to single draft pipes. Double draft pipes make a small stack workable. They cannot serve to give a draft equal to that which may be obtained without them, provided the plain stack is suitably proportioned.

The Length of Front End.—The experiments involving different lengths of front end only, appear to be inconclusive. The range of these experiments included the length of the front end normal to the locomotive which is 65.75 in., with successive reductions therefrom of 4½ in., $8^{7}/_{16}$ in. and 20 in., respectively, obtained in each case by fitting in a false front. The fitting was well done, the work being made practically tight, notwithstanding which fact it was found that the longest and shortest ends experimented with gave practically identical results, while the lengths between these limits gave results which were somewhat inferior. The peculiar character of the results as first obtained led to a complete duplication of the work after a considerable interval had elapsed, with results which were identical with those first obtained. So far as the experimental results give a solution to this problem, they point to a length of 66 in. or 46 in. as equally satisfactory, and suggest that intermediate lengths are to be avoided.

Suggestion as to a Standard Front End is presented which, with the following equations referring thereto, may be accepted as a summary of the conclusions to be drawn from all experiments made. (See Fig. 9.)

For best results, make H and h as great as practicable.

Also make

d = .21D + .16h.
b = 2d or .5D.
P = .32D.
p = .22D.
L = (not well established).
= .6D or .9D, but not of intermediate values.

While the drawing is a simple one, to be put forth as a result of so elaborate a series of experiments, it goes without saying that the latter have been valuable quite as much for the things they prove useless as for the proportions of details which they serve to define. For example, it will be seen that the suggested standard does not include draft pipes, and that it includes a stack of comparatively large diameter having a bell at the lower end of dimensions quite beyond those now common in American practice.

The New York Central & Hudson River Railroad Company's locomotive No. 3929 used in the tests, is of the Atlantic type. It was built by the Schenectady Works of the American Locomotive Company. Its principal dimensions are as follows:

Weight in working order	176,000 lbs
Normal weight on drivers	95,000 "
Weight on truck	42,000 "
Weight on trailing wheels	38,400 "
Diameter of cylinders	21 in.
Stroke of pistons	26 "
Type of valve	Piston
Diameter of valves	12 in.
Boiler pressure	200 lbs.
Diameter of boiler, first ring	72 in.
No. of tubes	396
Outside diameter of tubes	2 in.
Length of tubes	16 ft.
Length of firebox	96⅛ in.
Width of firebox	75⅜ "
Depth of firebox: Forward end...80¼ in.: Back end...69	"
Area of heating surface in tubes	3,298.08 sq. ft.
Area of heating surface in firebox	180.0 "
Area of surface in arch firebox tubes	27.09 "
Total heating surface	3,505.17 "
Area of grate	50.32 "
Diameter of smokebox	74 in.
Length of smokebox	65¾ "
Height of stack above smokebox	29 "
Diameter of stack at choke	18 "
Diameter of exhaust tip	5 11-16 "
Height of exhaust tip above bottom of front end	25 "

Oil was used as fuel to secure constant conditions at the grate. The equipment for handling the oil was the same as that employed in previous stack tests conducted at Purdue University.

In the preparation of the firebox for oil, a curved floor was substituted for the usual grate. This was supported by six 1 x 5-in. wrought-iron bars extending across the firebox and bolted to the mud-ring. Over this was fitted a covering of ⅛-in. plate strengthened where necessary by angle irons. Upon this metal floor two courses of fire brick were laid in grout. Side walls also were constructed between this floor and the line of the arch tubes, all as shown. The floor of the firebox thus described was pierced by three ports for the admission of air, the dimensions of which are well shown upon the drawings. As it was essential that the degree of freedom with which air was allowed to enter the firebox should remain constant throughout the tests, great pains were taken to make all parts of this special construction secure. Angle irons were used under the side walls and around all openings and the brickwork was put in with such care that it remained throughout the tests in excellent condition. To protect the frames and axles from reflected heat through the ports, a supplemental shield of brickwork on a metal foundation occupied a place similar to that of the usual ash pan. Fuel oil was delivered by a single burner inserted under the mud-ring in a manner made possible by the curved form of the floor of the firebox.

The report is signed by H. H. Vaughan, F. H. Clark, Robert Quayle, A. W. Gibbs, W. F. M. Goss, G. M. Basford.

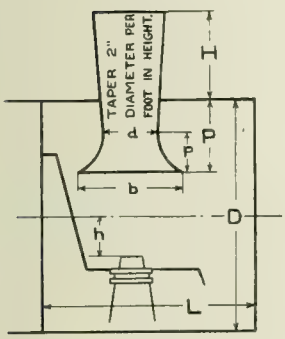
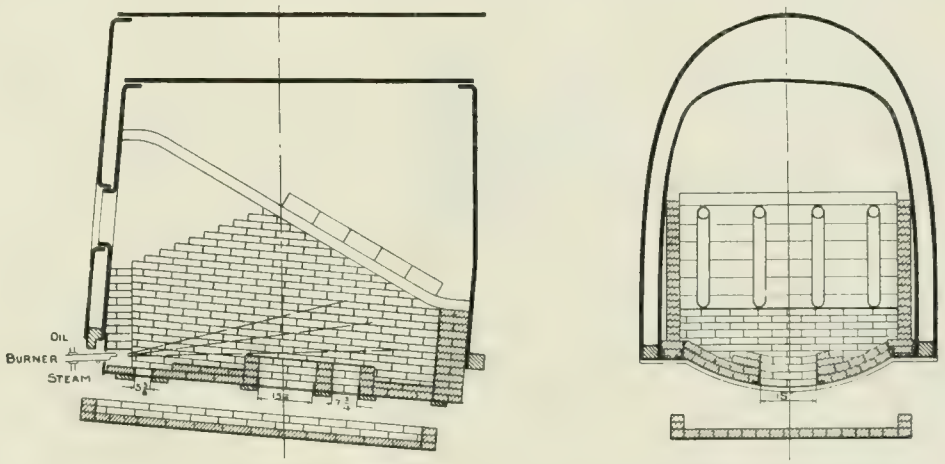


Fig. 9.



Arrangement of Fire Box for Burning Oil.

ELECTRICITY ON STEAM RAILROADS

The instructions of your Committee on Electricity on Steam Railroads read as follows: The committee to consider and present to the Association the relative advantages of the different systems of electric traction now in use as applied to interurban and suburban lines; also, as far as possible the relative cost of operating such lines by electricity and steam. The committee is also instructed to include in its investigations the different systems of gasolene, gasolene-electric and steam motor cars.

This commission is almost the first recognition in this Association of other motive power than the steam locomotive and your committee doubts its ability to cover the whole ground of its instruction in a perfectly satisfactory and comprehensive manner for the reason that the factors in each railroad proposition vary from its neighbor even as men vary in their personal characteristics.

We understand that main line operation is not to be considered, but that branch lines, suburban and interurban lines which are feeders to main lines are to be discussed. We understand, also,

that the question relates mainly to passenger traffic on account of the expression "now in use," as electric traction of freight is carried on to a limited extent only at the present time. Mail, baggage and express are being handled, but these are generally considered in connection with or a part of the passenger traffic.

In early electric street railway traction several attempts were made to utilize an electric locomotive, but these were generally abandoned, although it is customary now on some roads to have trail cars attached to leading motor cars. The latest and most advanced practice is to have all cars equipped with motors controlled from the leading car. The development in electric cars has been marked not only by their increase in size and carrying capacity but also in the size of motors employed. The earlier cars had 15 or 20 horse-power equipment, but it was soon found that these were inadequate to properly accelerate loaded cars, and now many heavy suburban cars are equipped with four 75 h.p. motors, each, and in some cars the motor equipment totals 400 h.p.

We have, therefore, available for comparison the steam railroad train, consisting of a locomotive with as many cars as the service demands, running at infrequent intervals, and covering perhaps 200 miles per day, as against the same road operated with individual electric cars, obtaining power from a general source, running at frequent intervals and fairly equivalent mileage.

The travel which is contemplated is the local, short runs, which in many cases has been taken from steam railroads by competing electric lines, this proving that the more frequent service and general convenience of the trolley line is more attractive. Absence of smoke and cinders, open cars in season, connections with city lines, all add to the popularity of the trolley and give a business that can be profitably carried at lower rates, which, after all, is the main inducement.

Relative Costs of Operating by Electricity and Steam.

The relative costs of operation with electricity and steam are difficult to state as there is very little accurate information of value. The results obtained by attempting to draw comparisons from hypothetical roads would depend entirely upon the assumptions which were made. For instance, a set of conditions could be assumed which would show a much lower cost of operation by electricity than by steam; another set could be assumed which would show practically equal cost, and a third set which would show that steam operation would be the most economical. In view of the fact that the assumptions would govern the results, it is believed that information of this nature would not be of value to the Association and might lead to erroneous assumptions and misunderstanding.

A number of electrifications are under way at the present time, employing various systems of distribution, and a considerable amount of data will no doubt be available in the near future.

Relative subjects which would be of interest and value to this Association are the character of the shops, shop equipment and apparatus necessary for the maintenance and repair of electric equipment; also the power houses and their equipment.

Gasolene, Gasolene-Electric and Steam Motor Cars.

Some time prior to the development of electric interurban railways the steam motor car or dummy, in many cases hauling a trailer, was used to a moderate extent, but at the present time few of these remain. In response to a demand from railroad managers for a motor car to operate on branch lines and special situations there has been recently a development of motor cars employing gasolene in an internal combustion engine, this engine either directly driving the car or driving a dynamo to generate current to be used for driving motors in the trucks. Some builders interpose batteries between generator and motors to store the current when it is not all needed for propulsion, and to assist in starting on grades when the generator capacity may be insufficient. There is very great flexibility and convenience in this combination, but it is attained at very considerable expense and complication, and requires unusually skilled attendance not commonly available in railroad service.

The examples of the gasolene engine, electric generator, battery and motor types are the cars of the St. Joseph Valley Traction Company's line, built by F. M. Hicks, and the Strang car that lately made a successful run from New York to Kansas City. The gasolene engine on these types is set to run at a constant speed, and this characteristic is essential for the best economy of the internal combustion engine. The size of the engine used may be proportioned to the average power required for normal operation, and the speed variation and excess of power above normal requirements may be supplied by the battery equipment, which also comes into play for lighting and short movements and would also be available to bring the car in in case of a breakdown of the engine or generator.

The gasolene-electric type not employing batteries is illustrated by the D. & H. car recently built by the General Electric Company. The generator on this type of car has to be equal to the maximum requirements, and in order to vary the current for the conditions to be met, the field excitation is handled by a separate exciter, chain-driven from the main generator. The controller is semi-automatic and can be set for any predetermined maximum acceleration, and the speed of the car is governed by varying the field strength of the generator. The speed of the engine remains constant after acceleration. This application is very ingenious and effective, and we understand that the car has been put into regular service between Schenectady and Saratoga.

The Union Pacific motor car, representing the direct mechanical drive application of gasolene power, is driven by a six-cylinder reversible gasolene engine, with crank shaft at right angles to the length of car; a sprocket mounted on same, driving a special chain, transmits the power direct to the driving axle through a second sprocket attached to the axle. The chain easily shows a transmission of power with an efficiency of 97 per cent., which clearly demonstrates that this method of transmission is very close to the maximum efficiency possible.

For the initial start of car, or putting it in motion, a reducing gear is used, and, until the car attains a speed of six or seven miles per hour the economy of this transmission is somewhat reduced; but, as the use of the gears is only temporary and lasts only a few seconds, it can almost be left out of consideration.

The first cars—55 ft. long, seating capacity 75, and with an engine of 100 h.p.—are particularly adapted for branch line service, where the traffic is insufficient to support a steam service or anything like electric service.

Interest in the steam car is also being revived, as, for example, the Ganz cars imported from Budapest by the Florida East Coast Railways; the Erie and the Canadian Pacific are also experimenting with a steam car equipped with a Scotch marine type of boiler, using a superheater and oil fuel. It is believed that some one may undertake to make a so-called flash boiler that will be applicable to this service.

Service and Utility of Motor Cars.

It is recognized that the so-called motor car, one carrying its own motive power plant, whether gasolene, gasolene-electric or steam, occupies a distinct field of usefulness. Many branch lines, now existing, where travel is light, and on new extensions into unsettled country where the business will not return a profit on steam train service, it would have to be run at a loss until a sufficient business was induced or built up by the travel facilities afforded. These situations are the distinct field of the motor car, which can be operated for less per car-mile than by regular steam train or electric methods until the volume of business will warrant the regular transportation methods.

The use of motor cars on the Union Pacific in picking up passengers on branch lines and in delivering passengers at connecting points for through trains, is exceedingly lucrative. The matter of giving the branch line patrons of any steam road increased service, with more frequent trips per diem, is very much appreciated by the local community, and their good will is beneficial.

On the hypothesis of the same density of traffic, with the same class of service as would be encountered on one of the ordinary branch lines of the territory west of the Missouri river, the cost per mile for local train service, equipment consisting of two cars and a locomotive, would be about 24 cents, including repairs, fuel, oil, labor, cleaning, etc.; this for passenger, as well as baggage, mail and express service.

Electric service equipment, consisting of one car and trailer, figuring that the density of traffic is sufficiently regular to support same seven days in a week, is estimated at about 18 cents a mile.

The gasolene service (mechanical-drive only considered), consisting of one car and trailer, with baggage, mail and express service, would cost 15 cents per mile. The latter, of course, would be independent of whether service was six days or seven days per week, the cost simply depending upon the service rendered.

Railroads, therefore, have a choice of the systems proposed, and a study of the conditions to be met and facilities afforded, both in the way of care and maintenance, as well as the train service proposed, will give the elements by which each situation will have to be studied. The Motive Power Departments will be called upon to participate more and more in advising as to these questions, and in order to be qualified to undertake such work it is very desirable to introduce information and discussion of these subjects in this Association.

The report is signed by C. A. Seley, W. R. McKeen, Jr., L. R. Pomeroy, C. F. Street, F. J. Cole.

LOCOMOTIVE LUBRICATION.

A Proper Lubricant for High Steam Pressure and Superheated Steam.

For locomotives with steam pressures as high as 225 lbs., or those using superheated steam, the temperature of which is as high as 600 deg. F., the ordinary valve oil has been found by experience to be quite satisfactory. The problem is to deliver the oil in proper quantities, to the place where needed.

Economy in Internal Lubrication.

In order that the engine parts may perform their work properly and without undue wear or heating, lubrication should not be stinted. Dry valves and cylinders mean rapid wear of the surfaces of contact in the steam chest and cylinders, besides excessive trouble with the valve motion parts. An attempt to get at the minimum of oil used for internal lubrication is apt to result in hot or slipped eccentrics, and broken eccentrics, eccentric straps, links, transmis-

sion bars, rockers, valve stems, and connection pins, in addition to the trouble just mentioned. Aside from increased machine friction, the performance of the engine is affected. Hard running valves cause a derangement in steam distribution; and worn packing in valve chambers, cylinders, or at rods, causes a loss due to leakage.

With the slide valve locomotives, there is not so much danger of these troubles becoming excessive, because the jar of the reverse lever is such an annoyance to the engineer that he at once exerts his energy to seeing that the valves are properly lubricated.

With piston valve locomotives, the internal lubrication may be

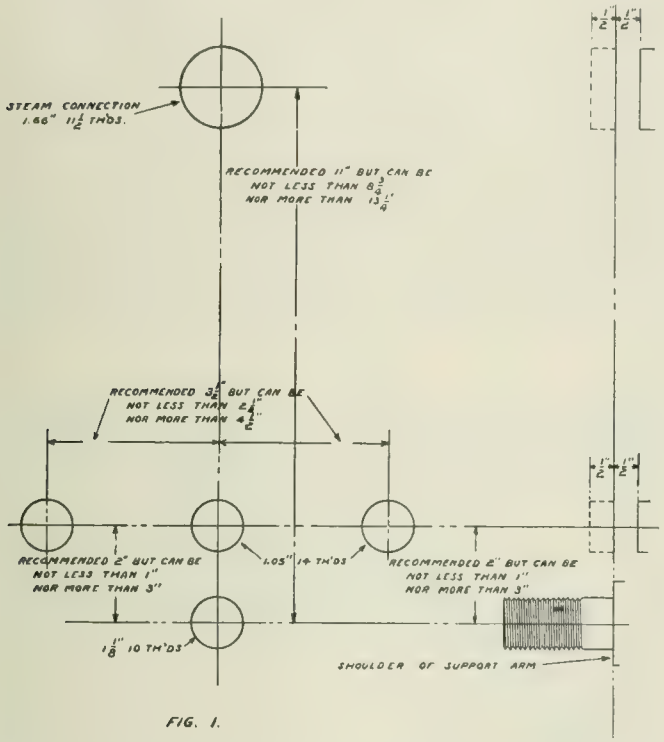


FIG. 1.

much below that required without any indication from the reverse lever. Under these conditions the annoyance comes to the man responsible for maintaining the locomotives and the cause of the trouble may have been operating a long time before being discovered, or indeed may be lost sight of altogether. In other words, with slide valve engines, when the oil allowance is just sufficient or only a little in excess of what is needed, the engineer is more apt to keep the valves supplied with enough oil to prevent hard service to the machine; while, with the piston valve engines he is not so able to tell that the valves need oil, and no one knows that the parts have been running too dry until trouble comes through heated bearings, or worn and broken parts.

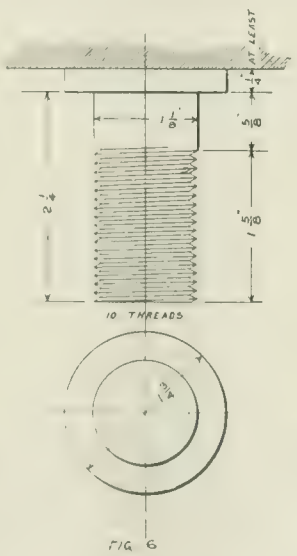


FIG. 6

For internal lubrication, 70 miles per pint for large freight locomotives and 80 miles per pint for large passenger locomotives, would seem to be the amount needed to lubricate properly. The amount to each class depending upon the speed at which the locomotive is running. In bad water districts, the oil allowance should be increased about 25 per cent.

Economy in External Lubrication.

The use of grease on crank pins and driving axles seems to offer the best solution of how to decrease the cost of external lubrication, and at the same time secure the better results.

Information from four years' experience with 203 locomotives, fully equipped for grease lubrication during all or part of that time, would indicate that to lubricate pins and driving axles with grease instead of oil reduces the cost of external lubrication. Along with the reduction in cost there has been a decided decrease in engine failures due to hot bearings. Journals lubricated with grease are less apt to be cut, and cut journals require turning. Hence grease lubrication increases the mileage between turning of axles and pins. The action of a grease lubrication system applied to driving boxes is practically automatic. On this account, its action is independent of whim or neglect of the engineer, and it applies lubricant at the time it is needed in approximately the right quantities. Some objection has been raised to the use of grease as a lubricant on account of increased machine friction. Within the experience of the committee it has never been found necessary to reduce the tonnage rating of a locomotive on account of changing from oil to grease. It would seem therefore the reasonable conclusion that this effect is slight, and in view of the material advantages coming from the use of grease, need not be considered.

Grease as a lubricant on locomotives gives results about as follows:

(a) Reduces engine failure due to heated journals and pins.
(b) Reduces cost of lubrication.
(c) Reduces cost of labor incident to inspection, cleaning and renewals of lubrication packing.
(d) Reduces delays incident to oiling.
(e) Reduces cut journals incident to oil lubrication.
(f) Possibly produces a slight increase in machine friction.

Standard Fittings for Lubricators.

To facilitate the use of different lubricators on the same railroad the committee proposes a standard as to relative location of holding arm shoulder and oil and steam connection joint faces, and a system of standard fittings and joints for all connections. Fig. 1 illustrates the standard proposed for location for connection of joints and holding arm. This is thought to provide ample variation to the lubricator companies, and, at the same time, to bring the connections near enough together so that by bending the pipes slightly lubricators made to this recommendation shall be interchangeable. Figs. 2, 3, 4 and 5 illustrate the standard for pipe joints and fittings. Fig. 6 illustrates standard holding arm proposed.

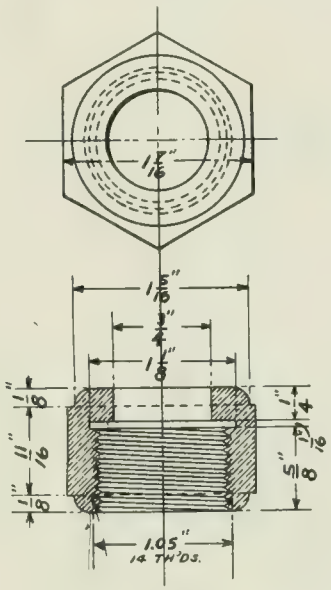


FIG. 2.

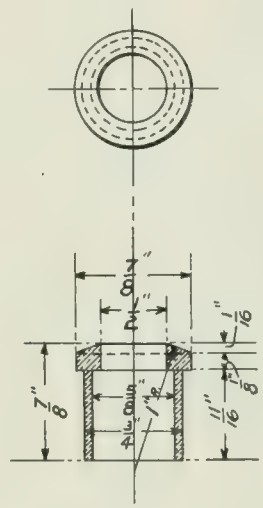


FIG. 3

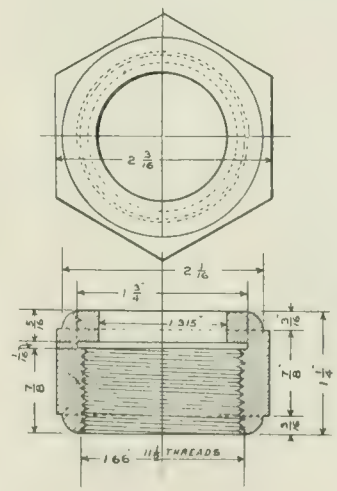


FIG. 4

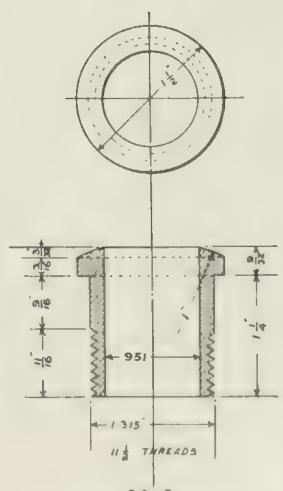


FIG. 5

Lubricators Versus Pumps.

Data collected from 12 different systems would seem to indicate that pump lubricators of whatever description are still in a state of imperfection, and that quite as good results have been obtained by using the ordinary sight feed lubricator, even on superheated steam locomotives.

The committee suggests that the recommendations on standard fittings be referred to letter ballot for adoption as standard.

The report is signed by E. D. Bronner, R. F. Kilpatrick, C. Kyle, R. D. Smith.

WATER SOFTENING FOR LOCOMOTIVE USE.

The committee gives below a series of reports of the saving obtained by treating water, both before feeding it into a locomotive boiler and treating it in the boiler.

Continuous Process.—The following is a brief report of the results obtained by a railroad, purifying water by means of a continuous process. There are ten plants in operation and the following figures give the cost of treatment, together with the results obtained. In connection with the treatment of water is an elaborate system of blowing off and washing with hot water:

	Total gallons pumped.	Pumping, cost per 1,000 gals., labor, fuel, etc.	Treating, cost. 1,000 gals., labor, chemicals, etc	Total per 1,000 gals.
A*	128,900,000	4.00 cts.	1.80 cts.	5.80 cts.
B	48,085,000	2.16 "	1.27 "	3.42 "
C	38,000,000	2.11 "	1.48 "	3.59 "
D	47,360,000	1.3 "	1.18 "	2.48 "
E	47,200,000	1.1 "	1.24 "	2.34 "
F	200,300,000	0.6 "	1.07 "	1.67 "
G	44,690,000	0.7 "	2.03 "	2.73 "
H	18,290,000	3.52 "	3.26 "	6.78 "
I	28,630,000	2.93 "	2.53 "	5.46 "
K*	22,700,000	7.00 "	4.02 "	11.02 "
Total	624,155,000			

*Water is purchased at 4 and 7 cts. per 1,000 gallons, respectively.

	Average cost.
Pumping, including cost of fuel, labor, etc. (no interest on investment and no allowance for deterioration) per 1,000 gals.	2.037 cts.
Treatment, including labor, chemicals, etc. (no interest on investment and no allowance for deterioration), per 1,000 galls.	1.589
Total, of water per 1,000 gals. pumped, treated and delivered to storage tanks.	3.626 cts.

Trains Given Up.

August, 1902	27
November, 1905	None

Engines Setting Off Cars Account of Leaking.

August, 1902	13
November, 1905.	None

Engines Cut Off Through Trains Account Leaking.

August, 1902	45
November 1905	5

Engines Having Tubes Caulked.

August, 1902	803
November, 1905	469

Boilers Washed.

August, 1902	466
November, 1905	146

Boilermakers' Wages.

August, 1902	$401.50
November, 1905	210.90

Boilerwashers' Wages.

August, 1902.	$485.00
November, 1905	399.75

Life of Tubes, August, 1902

20x26-in. cyl. consoldatd. 11 to 12 mos.
21x30-in. cyl. consoldatd. 8 to 10 mos.

Life of Tubes, November, 1905.

20x26-in. consoldated..... 27½ mos.
21x26-in. consolidated..... 13½ mos.

About 10 per cent. less engines handled in 1905 than in 1902; 20 by 26-in. engines in somewhat lighter service in 1905 than in 1902. Other engine service the same.

The water is treated for carbonate of lime, sulphate of lime and sulphuric acid by the use of lime and soda ash, applied through the continuous system. The treatment of water causes some boilers to foam; this is taken care of by the water-changing devices which enable the complete discharge of the contents of a boiler containing 2,500 gallons and fill it and have the engine ready for service in 32 minutes without dumping the fire.

The report of comparative cost of boiler washing with and without treated water, includes the cost of water changing.

Fireboxes that were scheduled to be renewed one year ago are in service and doing well. The life of the tubes has been materially increased. The greatest benefit derived from water purification is the ability to keep locomotives in more constant service, with a great reduction of engine failures.

Intermittent Process.—The following is a report from a railroad using an intermittent process of water purification:

The water is mixed with chemicals and allowed to flow into a settling tank. After the sediment has settled the water is pumped into service tanks, two or three settling tanks being used at one plant. Through the use of purified water, 35 boilermakers at $10.40 per hour and 42 boilermaker helpers at $7.09 per hour in 1902, have been reduced in 1904 to 23 boilermakers, costing $7.71 per hour, and 35 boilermaker helpers, costing $6.70 per hour. This shows a decrease in the cost of boilermakers of 21.4 per cent. and a decrease in boilermakers' force of 56 per cent. The greater proportion of skilled help used in 1905 than in 1902 accounts for the discrepancy between the saving and cost and reduction of force. The tabulated statement gives the reduction in number of boiler failures through the use of purified water:

	August, 1902, to and including June, 1903.	August, 1903, to and including June, 1904.
Leaky flues	544	99
Leaky fireboxes	33	20
Leaky arch tubes	6	1
Total	583	120

There has been a reduction of 80 per cent. in boiler failures in 1903 over 1902, and the reduced number of failures was made with an increased tonnage. In 1902 there were 2,934,930,377 ton-miles handled with 28.7 lbs. coal per 100 ton-miles; in 1903, 3,154,484,507 ton-miles were handled with 27.5 lbs. coal per 100 ton-miles.

In 1902 159 engines were used and in 1903 154 engines were used with 6.6 per cent. increase in ton-miles, with a saving of 4 per cent. in the number of engines.

The above figures show that the boilermakers' force was reduced 56 per cent., the cost of boilermakers 21.4 per cent., engine failures decreased 80 per cent., and the tonnage increased 6.6 per cent., with a decrease of number of engines used of 4 per cent.

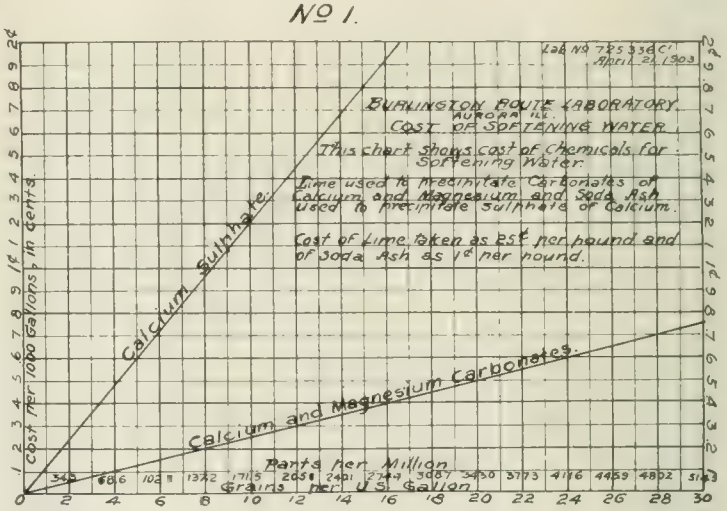
Engines that formerly had their flues reset and heavy repairs to fireboxes, are now taken in for repairs to machinery and resetting a portion of the flues only, and from six to eight months' additional service is obtained.

Mechanical Process.—The following is a report from a railroad using a process for purifying water after it is fed into the boiler:

The device used consists of a system of perforated pipes and blow-off cocks. The water is purified by a special oil introduced into the boiler. The success of this device depends upon absolutely living up to the blowing-out instructions. The results obtained are as follows:

	Per cent.
1. Decrease in the times locomotives have their boilers washed which amounts to	83.9
2. Increase in service of flues between resetting of	24.82
3. Increase in average mileage per engine between engine failures.	147.0
4. Increase in mileage of engines between resetting and removing of flues of	7.35

The fireboxes are kept comparatively free from scale, which reduces the amount of boiler work necessary and increases the life of firebox. This system of purification shows a decrease in the cost of operation of $1,323.03, or equal to 41.7 per cent. For less number of times boiler washing has been calculated on $15 per day for engine, and for the period of one month will amount to $2,025. The saving in wear and tear to machinery is estimated at $25 per engine per year, and amounts to $400. These figures added to the



decrease of operation, $1,323.03, will make the total saving for one month of $3,748.03, or a saving for a period of one year of $44,976.36.

Below is detailed statement of above figures:

	Treatment — Chemical.	Mechanical, with oil
Number of times boilers washed	1,117	192
Cost of operating chemical plant	$454.29	.....
Cost of washing boilers	2,721.51	$490.77
Cost oil used in oil treatment	.....	1,362.00
Total	$3,175.80	$1,852.77
Decrease in cost	.....	1,323.03
Per cent. in decrease in cost	.....	41.7

In addition to the above, the following estimated saving is effected:

Saving in time due to washing 925 additional times at 3 hrs. 30 mins. each, equals 130 days at $15 per day for engine hire.	$2,025.00
Saving in wear on machinery per month, on basis of $25 per engine per year, cylinder and valve work only.	400.00
Total saving	$3,748.03
Percentage of saving	118 per cent.

Engines equipped with mechanical device, washed once a month.
Engines when using chemically treated, washed on an average of every five days.

The above performance is based on washing engine once a month, and while this can be done, conditions must be favorable. There are, however, times when conditions are such that require washing of engine twice monthly, and in these cases we would arrive at the following figures:

	Treatment — Chemical.	Mechanical, with oil
Cost of operating chemical plant	$454.29	.....
Cost of washing boilers	2,721.51	$981.54
Cost of oil used in oil treatment	.....	1,362.90
Total	$3,175.80	$2,344.44
Decrease in cost	.....	831.36
Per cent. saving	.....	26

Continuous and Intermittent Process.—This railroad is using a number of different devices for water purification, the continuous process and the intermittent process of treatment before the water is fed to the boiler and also treatment in the boiler.

On 206 miles of main line there are five water stations furnishing purified water, four of them being continuous process and one intermittent.

The flue failures causing a delay of more than five minutes on

the divisions using this water have decreased as per following table, which includes freight and passenger:

Year.	No. failures.	Year.	No. failures.
1901	805	1904	169
1902	395	1905	135
1903	352		

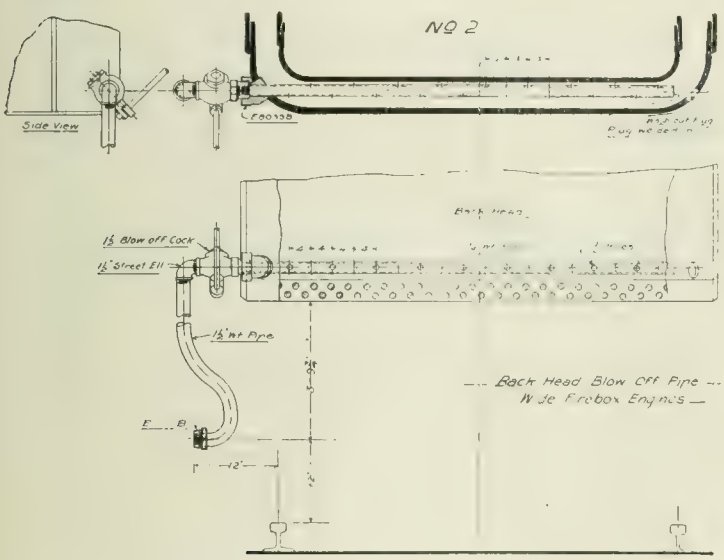
NOTE.—No purified water in 1901, part purified in 1902-1903, and all water supply purified in 1904-1905.

During 1904, 1905 and for the four months in 1906, there have been no delays to passenger trains on the 206 miles using purified water, on account of leaky flues.

One division has been equipped for feeding from two to five grains per gallon to the suction pipe of the pump delivering the water to the supply tubs. The record of flue failures for 13 months is as follows:

Year.	Month.	Failures.	Year.	Month.	Failures.
1905	January	11	1905	August	1
"	February	18	"	September	1
"	March	1	"	October	1
"	April	1	"	November	0
"	May	1	"	December	0
"	June	3	1906	January	0
"	July	4			

Engines using this treated water are equipped with a single perforated blow-off pipe in the back water leg of the firebox. It has been found that the mud works toward the back water leg and frequent systematic blowing off will keep the mud down to a minimum.



The following statement shows the saving made, due to treatment as above outlined:

Failures Due to Leaky Flues.

	No. failures.	Total mileage.	Miles per failure.
Nov. and Dec., 1904, and Jan., 1905	27	567,115	21,004
Nov. and Dec., 1905, and Jan., 1906	1	605,196	605,196

	Staybolts replaced.	No. men in roundhouse.
Nov. and Dec., 1904, and Jan., 1905	498	5 boilermakrs, 2 helpers.
Nov. and Dec., 1905, and Jan., 1906	103	2 boilermakrs, 2 helpers.

	Boilers washed	
	No. times washed.	Miles per washing.
Nov. and Dec., 1904, and Jan., 1905	389	1,432
Nov. and Dec., 1905, and Jan., 1906	325	1,862
January, 1905	107	1,620
January, 1906	63	3,175

The cost of treatment for chemicals is shown in diagram No. 1. Lime quoted at ¼ cent per pound, and soda ash at 1 cent per pound.

Waters containing over three grains of calcium sulphate or magnesium carbonate, whether there is other scale-forming material or not, should be treated. The treatment will not remove all of the scale-forming matter, but will convert the sulphate into carbonate, which produces scale to a much less degree than does calcium sulphate. Water containing over six grains of total incrustating solids, a part of which is sulphate, should be treated. Water containing eight grains of incrustating solids, all of which are carbonate, should be treated. Any trace of free acid should be neutralized before the water is fed into the boiler.

There is no known method of treatment for alkali, and the only way to overcome its bad effects is to blow out the boiler systematically and thereby prevent the concentration of alkali, which will produce foaming. Systematic blowing off is necessary in any method of treatment and will do great good, even if no purifier is used.

An arrangement of perforated blow-off pipe placed at the bottom of the back water leg of a firebox is shown on diagram No. 2. This arrangement has been used on the C., B. & Q. R. R. for some time and has given most excellent results, keeping the boiler as free from mud as a much more complicated system of blow-off cocks would accomplish. A floating outlet pipe in the supply tank will be found of great benefit with muddy water, whether purified or not.

The report is signed by J. A. Carney, L. H. Turner, R. Quayle, C. E. Fuller, J. F. Dunn, J. G. Neuffer.

CLASSIFICATION OF LOCOMOTIVE REPAIRS.

This subject comprises the following three separate questions:

1. A classification distinguishing between those engines which are in service and those which are under repair.

2. A classification distinguishing between those engines which are under running repairs and those which are under shop repairs.

3. A classification distinguishing between the various classes of shop repairs.

It has become customary to establish some limit to discriminate between those engines from which it should be expected to obtain service and those which, although not actually shopped, are held at the roundhouse for a sufficiently long time to make it unreasonable to include them in calculating the average daily mileage. As it is recognized that engines must receive small repairs from time to time, it is evidently simply a matter of agreement as to where the prescribed line should be drawn, but in view of the comparisons that are frequently made between one road and another as to the percentage of their power that is available for service, a uniform definition of this limit is important if such comparisons are to be of any value.

The distinction between running and shop repairs is largely a question of individual preference. Several roads have, however, already arranged their locomotive performance sheets to show the costs of these two divisions separately, and as this is of considerable importance in statements attempting any accurate comparison, it would be of advantage if uniformity could be secured.

The distinction between the various classes of shop repairs is made for two purposes—first to indicate in a general way the nature and extent of the repairs made to an engine, and secondly to allow of a rough measure being obtained of the output of a repair shop. In neither of these cases is a close definition possible without more complication than is either practicable or desirable. The detail repairs vary to such an extent on engines between which differences cannot be specified in any classification having a reasonable number of headings that, for the purpose of accurate comparison, either of one shop with itself, or of the various shops on a system, the costs or times required for specific operations must be dealt with, and not those of the accumulation of a number of those operations which may not correspond within wide limits even on engines which, as closely as possible, would be said to receive the same class of repairs. There would thus be but little advantage in the use of a uniform classification of shop repairs, and the object of this report is consequently to discuss the various systems employed and point out their respective advantages.

(1) A classification distinguishing between those engines which are in service and those which are under repairs.

An examination of the replies received to the circular of inquiry shows a very general agreement that engines not ready for service within 24 hours of the time they arrived at the roundhouse should be considered out of service or under repairs. There is evidently a wide variation in this respect, one road considering an engine under repairs if not ready when called, while others do not consider an engine out of service unless it is shopped. The latter system would be objected to on many roads, while the former, if rigorously followed, would certainly lead to large numbers of engines being cut out for short periods at busy seasons when power is called for as quickly as it can be turned, and while, perhaps, logically correct, would seem to defeat its object by rendering it difficult to draw the line between good and bad service. The majority of roads keep records showing the time in which each engine is turned and compile reports showing the daily performance at each roundhouse, so that a time limit above which an engine is considered out of service is also a time limit below which an engine is included on the time turned report. This division also separates those engines which will be turned without special delay from those which are held for a considerable time, and which it may be possible to return more quickly to service by personal attention on the part of the Master Mechanic. Hence on the one hand it is not advisable to set the time limit too high, as the turning report becomes unduly complicated and the Superintendent is charged with power which he is unable to use, while, on the contrary, if set too low, engines which would be shortly dispatched are included with those seriously delayed and attention is not thus properly directed to them. It is thus practically necessary to establish a reasonable limit, and as your committee considers that of 24 hours meets the requirements outlined above most closely, and it also agrees with very general existing practice, they would recommend it for adoption. Such a limit should, however, not apply to [illegible] engines which are ready in turn for their run, or to helper or switching engines in 24 hours' service which must evidently be considered as [illegible] engines not ready for their run, if held for repairs when required, and the committee would therefore recommend as follows:

Engines should be considered as under repairs if not ready for service within 24 hours of their time of arrival at the roundhouse

or in the case of engines assigned to regular runs or in helper or switching service, if not ready for their run.

(2) A classification distinguishing between those engines which are under running repairs and those which are under shop repair.

The replies show very little agreement with reference to the distinction between running and shop repairs, and illustrate, what has previously been mentioned, that this is very largely a question of individual preference. In its broadest sense the division should be made by terming those repairs which are incidental to the maintenance of an engine in service and the amount of which is approximately proportional to the miles run by the engine, running repairs, and those in which a number of the parts of an engine are repaired or renewed and place it in condition for making a further number of miles, shop repairs. The amount of the shop repairs is evidently independent of the miles run in the month during which they occur, and its nature is that of an occasional as against a continual maintenance charge. A further condition must also be observed, that repairs of sufficient magnitude to be individually worth analysis should be considered shop repairs, as running repairs are very generally reported as a total monthly sum and no record kept of the cost of each shopping. On some roads this represents simply the difference between work done in the shop and in the roundhouse, while on others, where main shops are conveniently situated, it is quite usual to do repairs in them that are essentially running repairs, while in many cases also work of considerable magnitude is handled in the roundhouse; and to obtain uniformity some more definite limit than this must be established.

When an engine is reported under repairs it is at the same time reported as under shop or running repairs, as the judgment of the foreman may determine, and the cost of the work booked accordingly. On this account there is also an advantage in basing the limit on the value of the labor expended, in place of on the total of material and labor, as it can in general be more closely estimated, and in repairs of this nature the cost of the labor is also a better indication of the extent of the repairs effected than is the total cost of material and labor. On this basis the committee considers it may be stated that repairs on which the labor is under $50 might safely be described as running repairs, while those on which it is over $100 would certainly be of sufficient importance to warrant them being individually reported and considered as shop repairs; and in view of the constantly increasing size of locomotives and the desirability of avoiding unnecessary complication it would select the higher limit as preferable.

Running repairs are those, whether made in shop or roundhouse, in which the estimated labor does not exceed $100.

(3) A classification distinguishing between the various classes of shop repairs.

The system in use for classifying shop repairs varies with each road or group of roads reporting. What may be termed the money system is in extended use, in which the class of repairs is graduated by their cost, varying frequently with the size of the engine. It is difficult to see what object is served by a classification of this nature, as it affords no information as to the work done on the engine and the shop output can only be measured by the total sum expended.

The simplest and what may be termed the most primitive method is that where repairs are classified as light, general and heavy, but it is evident that such a classification does not afford specific information with regard to the work done, whether tires were turned, tubes reset, and the extent to which the machinery and boiler was repaired. It has therefore been developed by increasing the number of classes up to six or eight, each class defining such combinations of repairs as are found to usually accompany each other. A good example of this system, which may be termed the numerical, and which is representative of that used by many roads, is herewith presented:

Class 1 repairs contemplate a new boiler, and all necessary work in addition thereto.

Class 2 repairs cover new firebox, tires turned or renewed if necessary, and all necessary machinery repairs.

Class 3 repairs—all flues reset or renewed, tires turned or renewed, and necessary machinery repairs.

Class 4 repairs—flues reset or renewed, either full or part set, and necessary repairs to machinery.

Class 4a repairs—one-third or less flues reset or renewed, tires turned or renewed, and necessary machinery repairs.

Class 5 repairs—tires turned or renewed, and such machinery repairs as are necessary.

Class 5a repairs—any repairs which are not included in the above classes, except accident repairs. Class 5a repair is generally machinery repairs of which the labor cost amounts to more than $10.

Class 6 repairs—repairs which are due to accident, and for which the motive power department is not responsible.

This type of classification has the objection that in spite of the number of classes of repairs, the information obtained is quite indefinite. No distinction is made between an engine having side sheets and front tube sheet removed and one in which no firebox work is done, and it would certainly appear that such differences should be recognized in any classification for the purpose of obtaining definite information. A further objection is that Classes 4 and 5 are the only ones in which any distinction is made as to the extent of the machinery repairs, as in those classes tires are not turned or renewed, but otherwise no information is obtained as to whether machinery repairs are light or heavy, and in view of the common practice of giving engines intermediate repairs to machinery it would certainly be an advantage to indicate what was done. If this were done there would then be ten classes of repairs, without including those required if the firebox work were more closely specified, and the tabulation of those to present any intelligent comparison of shop output would certainly be exceedingly difficult.

An inspection of the various elements included in such a classification shows that they may be divided into three divisions—machinery, tubes and firebox, as follows:

Machinery repairs—
1. General repairs to machinery with tire turning.
2. Light repairs to machinery with tire turning.
3. Light repairs to machinery without tire turning.

Flue repairs—
1. All reset.
2. Part reset.

Firebox repairs—
1. One sheet.
2. Two sheets.
3. Three sheets.
4. Four sheets.
5. Five sheets.

On the divisional system, in place of specifying certain combinations of these elements and assigning a number to each combination, the class of machinery tubes and firebox repairs effected are mentioned separately, as, for instance, an engine having a general repair to machinery, all tubes reset and two firebox sheets renewed is said to have a No. 1 machinery, No. 1 tube and No. 2 firebox repair. This may be abbreviated to M. 1, T. 1, F. 2, or more simply to 1-1-2, providing zero is understood to mean no repairs, and the class of repairs received by an engine within the limits of definition included in the list of elements is thus concisely and clearly determined. It is evident that this system does not attempt any closer definition of the class of repairs received than does the numerical, but it states them in a more convenient way, and also enables reports to be more closely arranged.

The heading required for reporting engines receiving repairs at any station is as follows:

Engine Number.	Class of Repairs.			Other Information as Required.
	M.	T.	F.	
1000	1	1	2	....

The statement of engines turned out at various points during any period is as follows:

Shop.	Machinery			Tubes.		No. of Firebox Sheets.	Other information as to days or under repairs, running repairs, etc.
	1	2	3	1	2		
New York	17	12	8	22	10	12	

It will be noticed that the report of engines receiving repairs defines the work done to each engine, while the statement showing the repairs made at each shop does not connect the repairs made to each engine, but simply summarizes the amount of work turned out.

This summary does, however, show the number of general, intermediate and light machinery repairs each period, the number of tubes reset or part set and the total number of firebox sheets applied, and thus affords as clear a statement of shop output as can be obtained without going into greater detail, and also, when totaled for all shops in a district, enables a fairly close estimate to be made as to whether the required amount of shop work on the system is being obtained.

It may be objected to, and with good reason, that a classification of this nature does not define the repairs received with sufficient accuracy to allow of fair comparisons to be drawn; as, for instance, one engine receiving No. 1 machinery repairs may require a new driving axle, a new pair of cylinders and frame taken down, while another receiving the same class of repairs may not require any of those especial items, or that a firebox sheet may mean a flue sheet on one engine and a side sheet on another; but the only answer can be that any system going into such details would become so complicated as to defeat its object, and that such information must be obtained from the work report and not from the statement of shop repairs.

The latter is and should be a general summary, and the explanation of the amount of work performed can safely be left to the man whose output is not fairly allowed for.

One important point to consider is the allowance that should be made for the size of the engines repaired, as it is obviously true that

the large and heavy locomotives now being used cannot be either repaired or maintained for the same amount as smaller engines. From the point of view of the shop alone probably the best comparative unit for this purpose would be the weight of the engine, as this determines the amount of material it is composed of and is consequently a measure of its cost and also of the cost of the labor necessary to repair it. There are, however, many reasons for using a unit for repairs which is also to be used for general purposes, and your committee feels that, while not strictly included in this subject, reference may be made to the tractive power mile introduced by Mr. A. A. Goodchild, when Auditor of Statistics on the Canadian Pacific Railway, which has many advantageous features. On that road the tractive power is expressed in the usual way as a percentage, an engine shown as 100 per cent. having a draw-bar pull of 20,000 lbs. calculated at 85 per cent. of the boiler pressure. An engine having a tractive power of 30,000 lbs. is shown as making 1.5 100 per cent. miles for each mile it runs, and the cost of repairs is calculated both for the locomotive mile and the 100 per cent. locomotive mile. This unit is also used in a number of other ways, but the above example will illustrate its principle. The test of two or more units is their approximation to the truth, and in comparing those suggested for the comparison of locomotive repairs, the miles, the engine ton-mile and the tractive power, or, as it may be called, the 100 per cent. mile, the mile may be first eliminated, since with engines varying in weight in the ratio of three to one it is evidently inaccurate. Considering the 100 per cent. mile as against the engine ton-mile, if two engines weigh the same, but one is a consolidation, the other a ten-wheeler, the consolidation will cost more to repair. On the engine ton-mile basis the allowance would be the same; on the 100 per cent. mile basis the consolidation will obtain a greater allowance, which will to a certain extent compensate for its greater cost of upkeep. If, again, two engines of equal weight are compared, one passenger and one freight, the freight engine will cost the larger sum per mile. On the 100 per cent. mile basis this is partly compensated for by the increased tractive power, and this unit may therefore be said to be the closer. The committee does not consider it necessary to define the tractive power which constitutes 100 per cent., as that is unimportant, provided it is known and allowed for; but in view of the merits of the tractive power or 100 per cent. mile as a unit it would recommend that the same unit be used in allowing for the output of a shop. By including this factor the statement of engines actually receiving Nos. 1, 2 and 3 machinery repairs, etc., would show the equivalent number of 100 per cent. engines receiving such repairs and a 50 per cent. engine counting as 0.5 and a 150 per cent. engine as 1.5 100 per cent. engines turned out, and so on, and the committee then considers that the output of the various shops would be measured as closely as is practicable without objectionable complication.

The report is signed by H. H. Vaughan, A. E. Mitchell, R. Quayle and D. Van Alstyne.

The Coal Traffic Inquiry.*

At Philadelphia, June 6, Joseph Boyer, Chief Clerk of the Superintendent of Motive Power at Altoona, receiving a salary of $2,700 a year, testified to having received within the last three years $11,000 in coal stocks and $46,000 in cash from companies selling coal to the Pennsylvania Railroad, Boyer being the one to decide on purchases. M. K. Reeves, Assistant to Vice-President Pugh, testified to owning $40,000 of coal mine stock received as a gift from George W. Huff. Boyer said that the Graff Coal Co. gave him 5 cents a ton on what he bought, other companies 4 cents and 3 cents, and others gifts of sums not named. Asked as to the reason for these gifts, he quoted one of the givers as saying that these commissions had been paid to his predecessor, and so it was desired to pay them to him. Mr. Reeves had known Colonel Huff from boyhood and said that the gift was one of friendship as he, Reeves, could not render Huff any service.

Mr. Gibbs, Superintendent of Motive Power, testified that he knew nothing of the things Boyer had testified to, and Mr. Reeves said that Mr. Pugh knew nothing of his ownership of coal stocks.

J. E. Muhlfeld, of the Baltimore & Ohio, told of the agreement between his road and the H. C. Frick Coal Co., by which the coal company's cars were repaired by the road at prices more favorable than those charged other coal companies.

A day or two after the hearing, Boyer was dismissed from the service of the company, as was also J. K. Aiken, Chief Clerk in the Superintendent's office of the Monongahela division, who testified to ownership of large amounts of coal stocks and admitted having received gifts of cash.

On June 7, James McCrea, First Vice-President of the Pennsylvania Lines West of Pittsburg, testified. He owns some stock in the Westmoreland Coal Co. which he inherited from his father. Mr. McCrea also owns shares in a coal company on the Northern Michigan Railroad and in another situated in Virginia. Both of these interests he paid for. He testified to other holdings, all of which appear to have been acquired by regular purchase.

Mr. McCrea said that he was entirely unaware of the things concerning Pennsylvania officers east of Pittsburg which have been brought out by the present inquiry; and that on the lines in his charge—those west of Pittsburg—he had made an investigation and found that there was practically no holding of industrial stocks by officers or employees of the road. Asked if he did not think it harmful for officers to own stock in coal companies on the line of the road, he replied: "Certainly; officers should not hold such stocks."

Mr. McCrea said that for two years the officers of the Pennsylvania had been trying to find a way to get rid of the private cars east of Pittsburg. West of Pittsburg they have already been pretty nearly eliminated.

W. W. Patterson testified that his soft coal business at Meriden, W. Va., had been killed off by discrimination on the part of the Baltimore & Ohio in distributing cars. His plant had to be sold for less than half the value at which he appraised it. President Potter, of the Donohoe Coal & Coke Co., on the Alexandria branch of the Pennsylvania, said that the railroad company had arbitrarily rated the capacity of his mine below what it should be and had seriously damaged his business; but after writing to President Cassatt and threatening legal proceedings the rating of his mine was increased, in February, 1905, from 500 tons to 900 tons a day.

In trying to learn the rating of other mines, Mr. Potter once sent a detective to count the cars, but "they shot at him and he was afraid to go back."

The Committee of the Board of Directors of the Pennsylvania Railroad, which is investigating the conduct of officers and employees, has sent out a circular of inquiry, demanding an answer from each. President Cassatt promptly responded to the circular, and his reply was published June 11.

Mr. Cassatt says that he owns no stock in any coal company situated near the road or which ships over its lines. Until the beginning of this year he owned 160 shares in a company which did not pay well, but he, with other owners, sold out to the owners of adjoining land. This stock was acquired by him in 1872, when the company was formed. He now owns 333 shares of the common stock of the Union Switch & Signal Company, bought in 1884; 45 shares of stock of the United States Metallic Packing Company, bought in 1886; 2,296 shares of preferred stock of the Pennsylvania Steel Company, and 2,000 shares Cambria Steel Company. Of the stocks of these two steel companies the Pennsylvania Company owns a majority. Mr. Cassatt replies at length to the interrogatories as to what his dealings have been with shippers, or persons selling goods to the road, or in connection with the distribution of cars, etc., all in the negative; except that he has bought the locomotives and the rails for the company, and has directed the establishment of side tracks when authorized by the board of directors. He has no interest in the Keystone Coal & Coke Company, or the Henrietta; or the firm of Cassatt & Company; and never had any. He owned stock in the Berwind-White Coal Company when he was not an officer of the road.

At Washington, June 11, officers of the Baltimore & Ohio were heard. Charles E. Ways and L. R. Brockenbrough told of shares of coal mining stock owned by them.

In Philadelphia, June 13, testimony was given concerning the relations between the Pennsylvania Railroad and the Pressed Steel Car Company, orders for cars intended for coal operators having been given to the car company by or through the railroad company. One purpose of this arrangement appears to have been to secure a lower price for the cars than would have been given to the buyer of a smaller number of cars.

A coal operator testified that on going to the office of the General Manager of the Pennsylvania Railroad to sell coal he was informed that to succeed in his purpose he would have to pay to a certain clerk in the office two cents a ton. He reported the matter to Vice-President Pugh and obtained an order for coal without paying the commission. Later, an officer of the road brought before the commission certain witnesses claiming that no such demand for commission had been made at the General Manager's office.

Testimony of men connected with the Berwind-White Coal Company was taken to show the relation of that company to the Pennsylvania Railroad. Charles Berwind, founder of the company, got orders for coal from steamships in New York Harbor and thus built up the enormous coal traffic of the Pennsylvania Railroad at Harsimus Pier, Jersey City. In other words, the railroad was indebted to Mr. Berwind for giving it a great trade. For terminal expenses at Harsimus the road allows the B.-W. Company seven cents a ton, and the quantity handled monthly is about 70,000 tons. Figures were given which it was claimed would show that this was three cents a ton more than the cost of the service rendered by the B.-W. Company. Coal for other consignees goes to South Amboy, where the railroad company does the terminal work.

Coal for the Berwind-White Company has been carried by the railroad without weighing, the charges being made on estimated weights, but since the present hearing the General Manager of the road has ordered the coal weighed at Hollidaysburg.

*Previous reports in the issues of May 25, June 1 and June 8, pages 554 and 606.

Details of the Pennsylvania French Loan.

It is announced that Kuhn, Loeb & Co. have taken the entire Pennsylvania loan of 250,000,000 francs, 12-15 year, 3¾ per cent., guaranteed, principal and interest, by the Pennsylvania Railroad Co., and that the loan has been placed with a French group under the management of the Banque de Paris et des Pays-Bas and the Credit Lyonnais. The issue price will be in the neighborhood of par. Payment will be made in about equal monthly instalments divided over the balance of the present year or earlier, at the option of the French banks.

The cost to the Pennsylvania is estimated at 4½ per cent. The listing on the Paris Bourse required the approval of the French Ministers of Finance, of the Interior and of Foreign Affairs, but the Russian disturbances, so far from hindering negotiations, hastened matters, French investors displaying a tendency to favor American securities as safer. The French bankers pay the expenses incidental to listing the stock.

President Cassatt is quoted as saying that the proceeds of the French loan, together with the amounts that will be available from other resources of the company, will meet the payments for the 33,000 50-ton steel cars and 313 locomotives which are being built at a cost of $42,000,000 and also provide the money for the completion of the water supply system. The car trust certificates and water company certificates which it had been intended to sell, will therefore not now be placed upon the market, but will be held in the treasury of the Pennsylvania Company. The amount realized from the recent sale of $50,000,000 short notes is sufficient to fully complete all the improvements upon the main line and branches now authorized and also to carry on the construction of the New York tunnels and terminal station during the current year.

"The improvements now authorized and under contract include all the heavy work at present contemplated, with the exception of the additional relief lines referred to in the last annual report, and it will not be necessary to proceed with these for several years, except to secure the right of way, which is now being done. The company will not, therefore, as far as can now be foreseen, have to meet any large capital requirements for some years beyond what will be necessary to pay off the $50,000,000 of notes maturing November 1, 1907, and to provide the money needed after the close of this year to complete the New York terminals. This expenditure, which will be spread over the years 1907 and 1908, is estimated at $40,000,000.

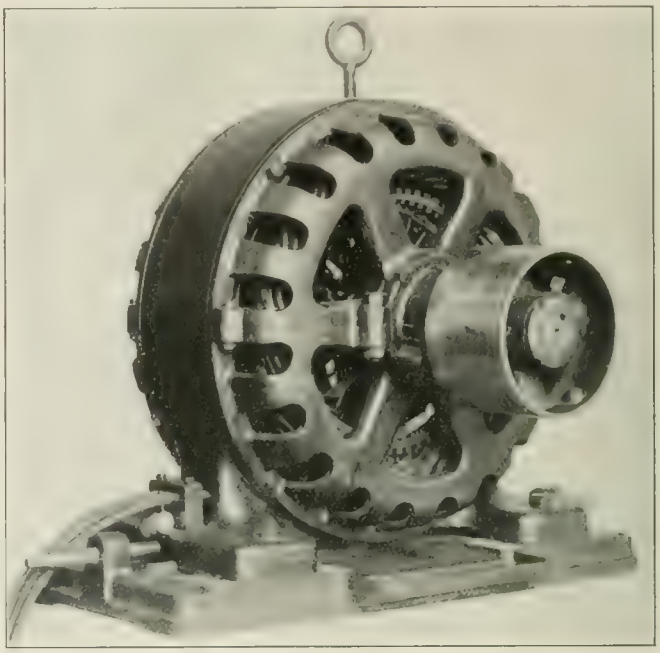
"It will, perhaps, not be considered out of place to refer in this connection to the large increases both in the capital stock and bonded indebtedness of the company, and to point out the results of the policy of liberal expenditures pursued by the management during the past six years.

"Since 1900 the capital stock of the Pennsylvania Railroad Co. has been increased from $129,000,000 to $303,000,000, an increase of $174,000,000. The bonded debt has been increased from $88,000,000 to $192,000,000, an increase of $104,000,000, but of this amount $13,000,000 is due to the assumption of the bonded debt of branch roads formerly controlled by the company through stock ownership, but which have now been absorbed, so that the actual net increase in the bonded debt is $91,000,000. The aggregate increase in bonds and stock, including premiums on latter, amounts to $300,000. Of the proceeds of these issues about $122,000,000 was expended on improvements and additions to property, which have been fully described in the annual reports of the Board of Directors, and all of which were absolutely necessary to the proper handling of the largely increased traffic and to the construction of the New York tunnel and terminals and the purchase of real estate connected therewith. About $140,000,000 has been invested in the stocks of other companies, which are yielding a satisfactory return, and which are worth much more than their original cost. The remainder appears in advances to subsidiary companies, in increased shop and roadway inventories, and in cash. As to the results obtained through these large expenditures: In the first place, the company is now in a position to fully perform its public duty, as its large traffic is being moved with an ease and regularity never before attained. The financial results are equally satisfactory, as will appear from the following brief statement of facts:

"In 1898 the gross income of the company was $71,000,000, the net income was $11,000,000, the dividend paid was 5 per cent. and the surplus, after paying dividends, was $4,000,000. In 1905 the gross income was $146,000,000, the net income was $30,000,000, the dividend on the largely increased capital stock was 6 per cent. and the surplus, after paying the dividend, was $11,700,000. In the six years from 1893 to 1898, inclusive, the yearly dividend was 5 per cent. and the average surplus, after paying the dividend, was $2,700,000 per annum. In the six years from 1900 to 1905, inclusive, the yearly dividend was 6 per cent. and the average surplus, after paying the dividend, was $11,400,000 per annum. From 1900 to 1905, inclusive, $70,000,000 was taken out of income and expended in improvements to the property. It should be stated, too, that at least $60,000,000 have been spent on additions and improvements, from which no return is yet being received on account of their not being completed and in use, though the interest upon the securities issued to pay for them has been a charge against income."

Westinghouse Electric Motors.

The eight motors here shown include types of power for a great variety of industrial plants and a wide range of large and small capacities. The induction motors are sparkless, and therefore especially desirable where highly inflammable or explosive



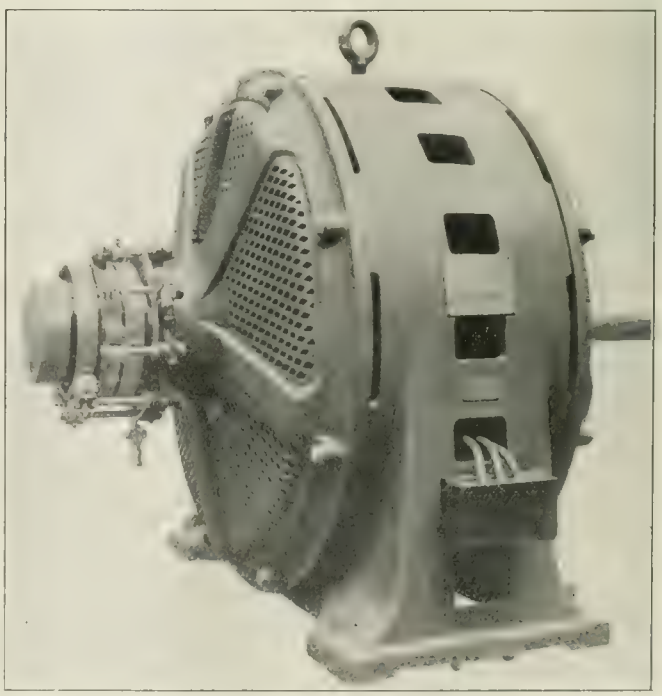
Polyphase Induction Motor.

material is about. In textile, flour, cement mills, and the like, they are so far safe. The direct current motors are adapted to driving machine tools, elevators and other work, both large and small.

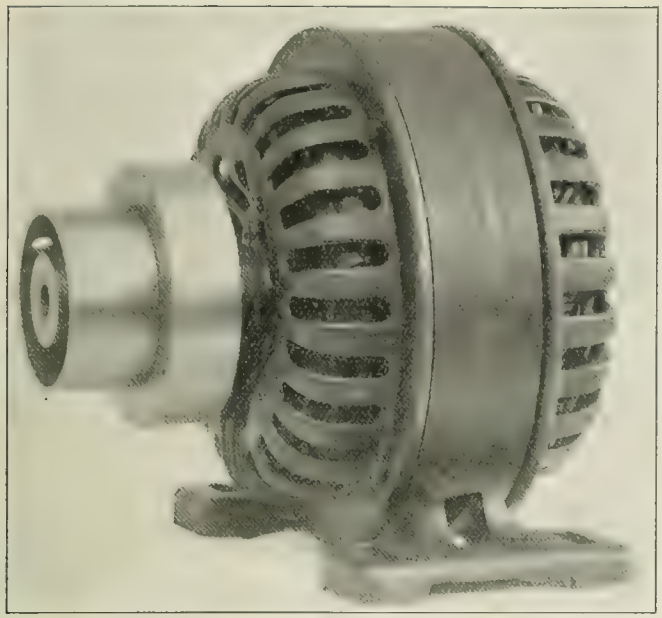
Polyphase induction motors are made in sizes from ½ h.p. to 75 h.p. The rotating element is carried by two bearings and there is a liberal air space between the stationary and rotating parts, so that the only wearing parts are the bearings.

Single-phase induction motors are made in sizes from ¼ h.p. to 10 h.p. It is adapted for localities where the polyphase current is not available, and seems to have all the mechanical advantages of the polyphase machine.

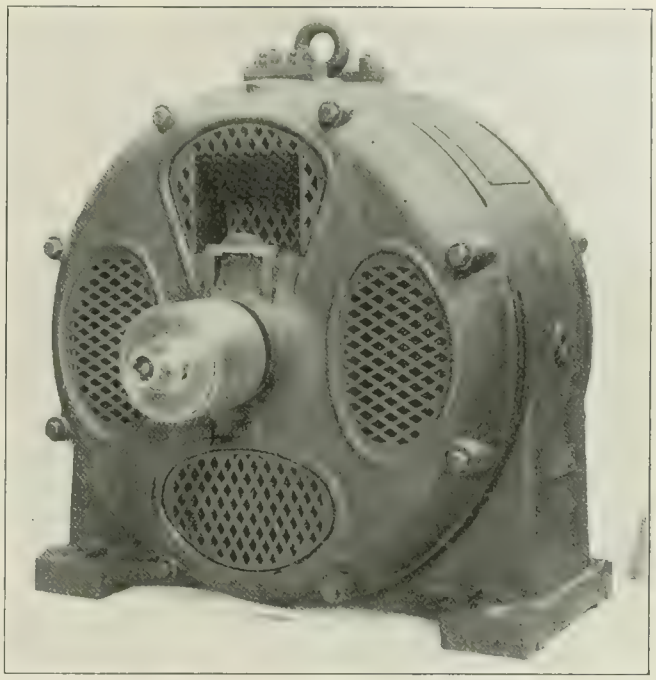
The variable speed induction motors are made in sizes from 1 h.p. to 500 h.p., and are designed to meet the requirements of



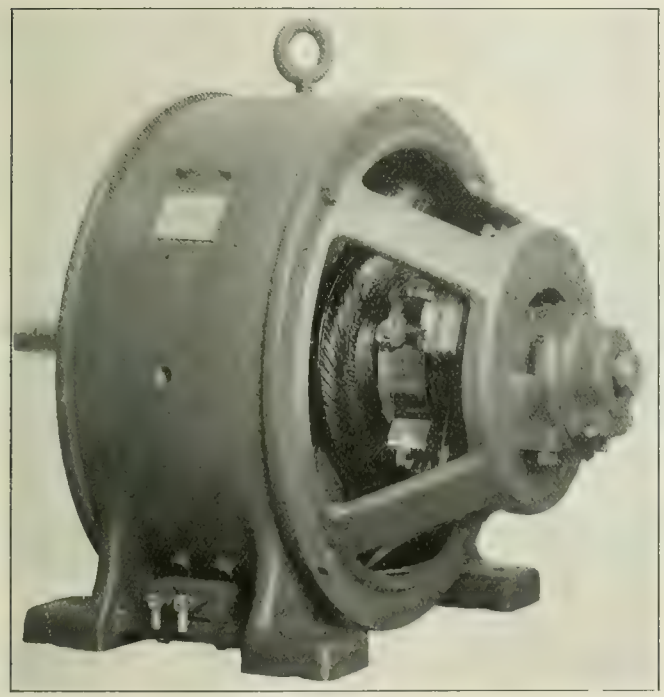
Variable Speed Induction Motor.



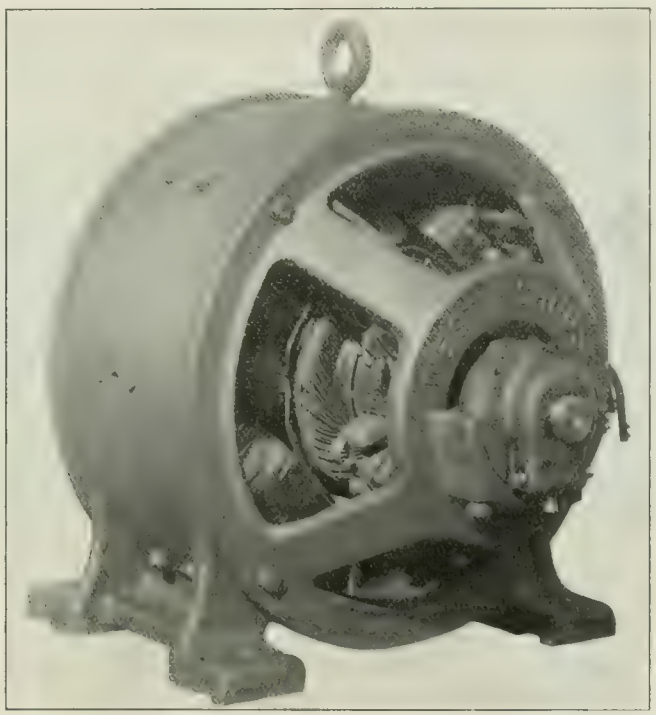
Single Phase Induction Motor.



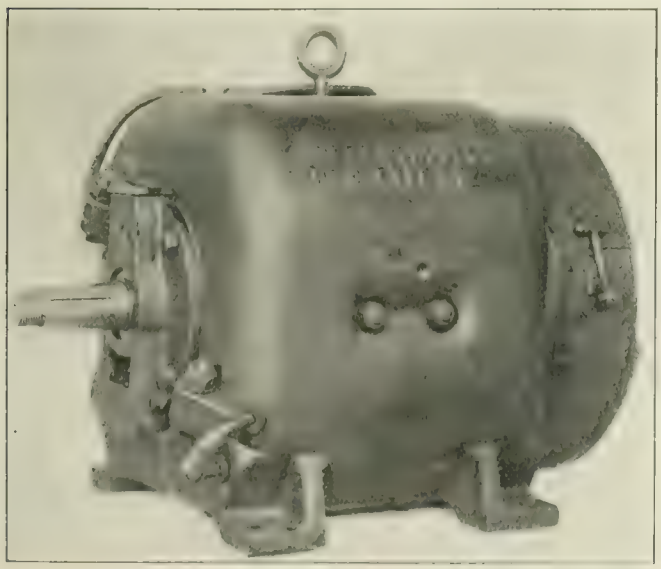
Constant Speed Induction Motor.



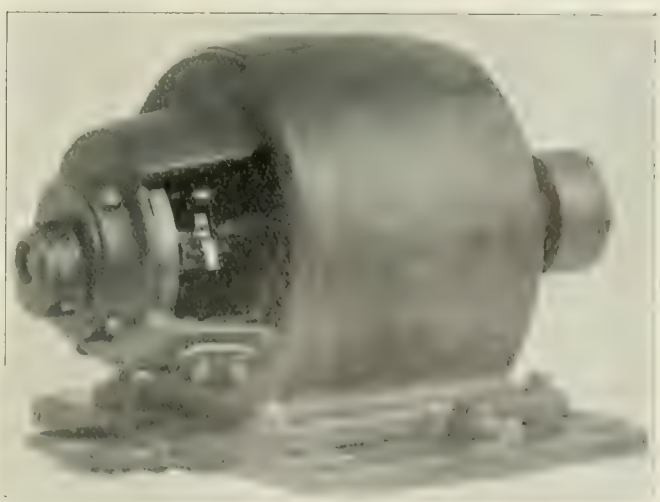
Direct Current Motor—Type S.



Direct Current Motor—Type S. A.



Direct Current Motor—Type K.



Direct Current Motor—Type R.

hoists, cranes, dredges, etc. They may also be used for fans, blowers and pumps.

Constant speed induction motors are made in sizes from 5 h.p. to 75 h.p., and are designed for service where the starting conditions are severe and where regulation is liable to be affected by sudden changes of load. This applies to work on lighting circuits. The motor is especially useful for line shafting and all forms of constant speed.

Type S direct current motors of from 1 h.p. to 110 h.p. are adapted to belt and gear connection. It is best known as a machine tool motor. A shunt winding prevents it from attaining an excessive speed. A modification of its winding adapts it to elevator work.

Type S A direct current motors have a variable speed through a range as high as 1 to 4; desirable for certain machine tools.

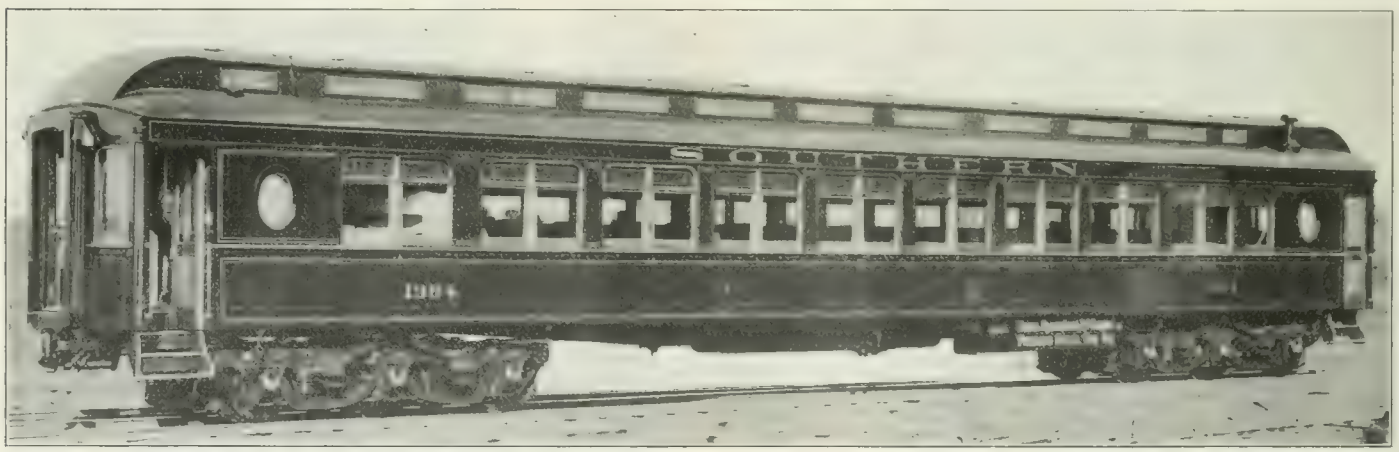
Type K direct current motors of from $3\frac{1}{2}$ h.p. to 40 h.p. are particularly designed for crane hoisting. The frames are enclosed so as to exclude dust and moisture. Nevertheless the working parts are readily accessible for inspection.

The interesting type R motor is designed for small power, from ⅛ h.p. to $1\frac{3}{4}$ h.p. It operates without spark between no load and an overload of 50 per cent. These have large use for printing presses, coffee grinders, ice cream freezers, shoe machinery, sewing machines, and, indeed, for any work where small power can be easily turned on or off.

Combination Wood and Steel Passenger Car for the Southern Railway.

The Pressed Steel Car Co. has under construction a number of all-steel and combination steel and wood passenger cars for electric and steam railroads, among which are three passenger coaches for the Southern Railway. One of these Southern cars was exhibited at the Master Mechanics' and Master Car Builders' Conventions at Atlantic City. The car has the following general dimensions:

Length over platforms	74 ft. 6¼ in.
Length over body end sills	66 " 0 "
Total inside length	65 " 3¼ "
Distance from center to center of trucks	50 " 0 "
Width over side sheets	9 " 10¼ "
Width inside between finish	8 " 10¼ "
Height from top of rail to top of body	14 " 2 "



Combination Wood and Steel Passenger Car for the Southern Railway.

The cars are of the same general size as the standard coaches of the Southern Railway, and the interior arrangement of seats, smoking room and saloons, as well as the general appearance of the car, is standard.

The underframe, superstructure, platforms, platform sills, body carlines and the side sheets of the cars on the outside below the windows are made of steel in the form of plates, pressed, rolled or built-up parts, according to the requirements and the adaptability of the material. The interior finish, doors, windows, window sash, upper part of floor, roof, and the outside above the window sills is made of wood.

The underframe is composed of two fish belly center sills built up of ⅜ in. plates, 22 in. deep at the center and 13½ in. over the bolsters. These plates are reinforced with angle irons and cover plates and extend throughout the length of the car between the platform sills.

The body bolsters, of which there are two at each end of the car, spaced to suit six-wheel trucks, consist of ⅜ in. plates 13½ in. deep near the center sills, tapering toward the sides and reinforced with T-irons and cover plates on top and bottom. The side bearings are supported on 8 in. I beams, secured between the bolsters.

The underframe consists also of two deep and eight shallow diaphragms on each side of the car between the bolsters. The deep diaphragms are made up of ¼ in. plates, 20½ in. deep at center sills, and are reinforced with T-irons and cover plates on top and bottom. The shallow diaphragms are made of 7-in. rolled channels. The side plates below the windows are ⅜ in. thick, cold rolled steel, reinforced with angle irons at bottom edge and with a special shape at the top edge under the window sill. Both these reinforcing members extend the whole length of the body.

The main posts consist of two angles spaced apart, and the intermediate posts consist of one T-shape. The main posts extend from bottom of side plate to roof, but the intermediate posts extend from roof to window sill only, at which point they are riveted to a reinforcing plate extending between the main posts inside of the side sheets.

The floor is composed of ⅛-in. steel plates upon which are laid two courses of wooden flooring each ¼ in. thick with ⅛ in. felt paper between. The top of the floor is covered with linoleum ⅛ in. thick. The framing at the ends consists of angles at the corners and of three channels reinforced with plates on each side of the door. The platforms are supported on the center sills and on 6-in. channels. The platform end sills are pressed of $^5/_{16}$-in. steel plate into channel shape and to suit vestibule fixtures.

All vertical lines of rivets on the outside of the car are covered with special drawn steel mouldings, which give the appearance of broad panels, as used on some wooden cars. On account of using the railroad company's standard six-wheel trucks with standard height of bolsters and center plates it was impossible to make the depth of center sills over the trucks sufficient to bring the center line of draw gear above the lower edges of center sills; the center line of draft gear is therefore below the sills.

The construction of these cars has been worked out by the Pressed Steel Car Company subject to the approval of important parts by Mechanical Superintendent A. Stewart and Consulting Mechanical Engineer R. L. Ettinger, of the Southern Railway, and while the construction as a whole, as well as in details, may be more or less changed in future similar cars, it shows a decided improvement in the right direction, namely, a car offering greater resistance to damage in accidents as well as minimizing danger to passengers in such emergency.

The Pressed Steel Car Company is now preparing drawings of still further advanced types of steel passenger coaches and steel trucks, these constructions to embody the use of non-inflammable or totally fireproof materials.

Manhattan Elevated Damage Suits.

The New York Court of Appeals has handed down a decision which it is estimated will save the Manhattan Elevated over $6,000,000, by holding that the statute of limitations shuts out unsettled damage claims. Upwards of 7,500 claims are still outstanding.

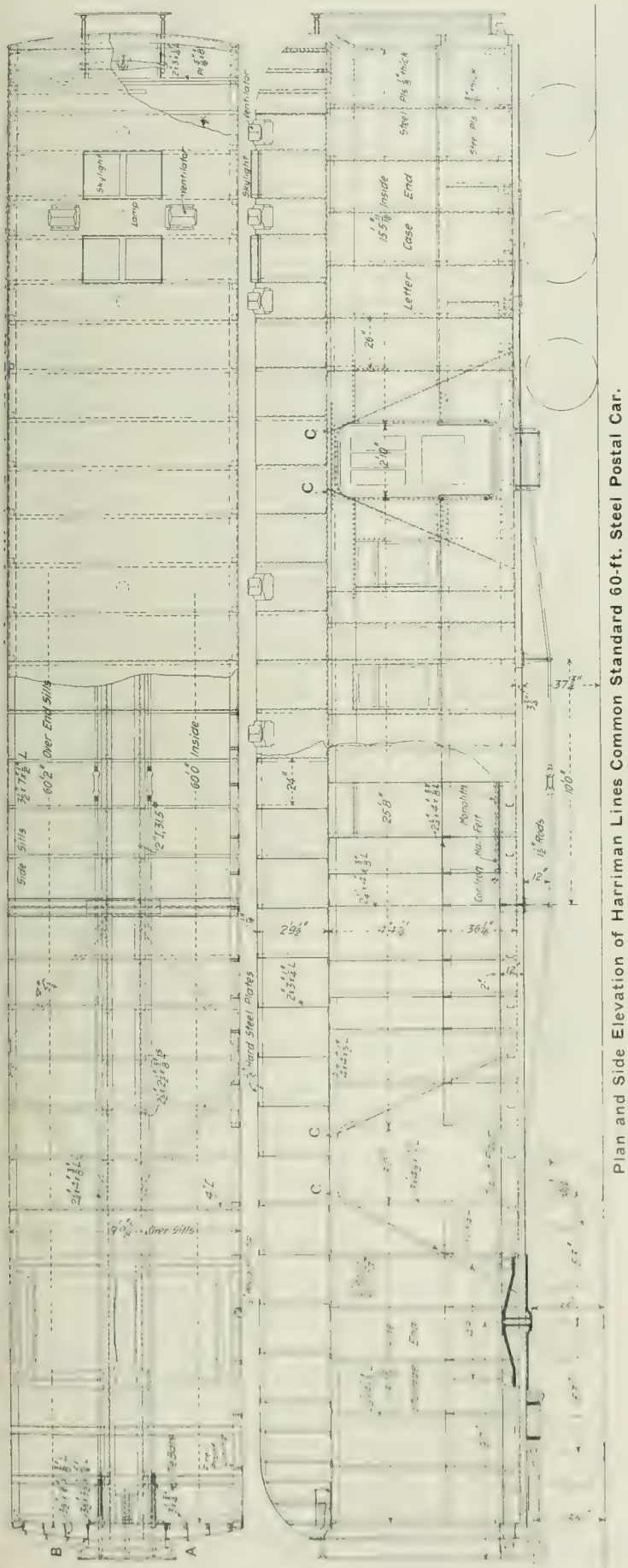
The case was that of Hindley against the Manhattan Elevated Railway Company, and has been contested since 1901.

Hindley, in brief, owned the property at No. 813 Sixth avenue, and brought suit against the company to recover damages to his property. The statute of limitations was pleaded by the company, but Justice Bischoff, in the Supreme Court, found judgment against the company for several thousand dollars. He held the statute of limitations did not bar the plaintiff. This deprived the defendants of the benefit of the twenty years' statute of limitations.

An appeal was taken to the Appellate Division in 1904, and that court affirmed the decision of Justice Bischoff. An appeal was again taken, and the Court of Appeals, in a decision written by Judge Vann, in which all the judges concur, has reversed the judgment of the Appellate Division and ordered a new trial.

Standard All-Steel 60-Ft. Postal Car for the Harriman Lines.

More than a year ago Mr. Julius Kruttschnitt, Director of Maintenance and Operation of the Harriman Lines, became convinced that the time had arrived for the change from wood to steel in the construction of the passenger equipment for that system. This conclusion was prompted not only by most of the operating and maintenance reasons that have made the similar change in freight equipment advantageous, but had as a primary motive the desire for greater safety in operation and of protection to passengers in the event of collisions or wrecks. The development of plans in accordance with his ideas has been in progress since that time, and the design for a standard 60-ft. postal car has lately been approved. The designs for day coach and baggage car have not yet been completed. The general drawings for the postal car are reproduced herewith. For them and the information which follows we are indebted to Mr. Kruttschnitt.

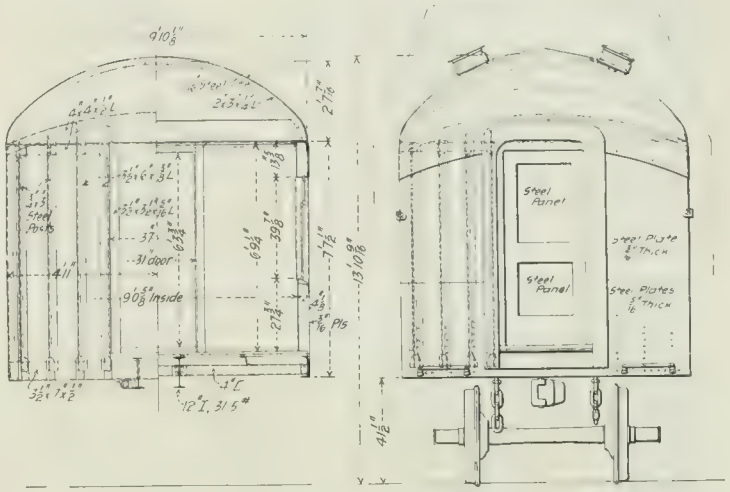


Plan and Side Elevation of Harriman Lines Common Standard 60-ft. Steel Postal Car.

The general dimensions are as follows:

Length of body over end sills	60 ft.	2 in.
Width of body over side sills	9 "	9⅝ "
Length over platforms coupled	63 "	3¼ "
Width of car over eaves	9 "	10⅛ "
Height from top of rail to top of eaves	9 "	7¼ "
" " " " " to top of roof sheets	13 "	10⅝ "
" " " " " to center of drawbar	2 "	11 "
Distance from center of bolster to end of body framing	8 ft.	
Distance from center to center of cross ties	10 "	
Width inside	9 ft.	5⅛ in.
Length inside	60 ft.	
Height, top of floor to ceiling inside	9 ft.	4⅝ in.
Height, top of floor to top of side plate	6 "	9¼ "
Light weight of car, estimated	107,000 lbs.	

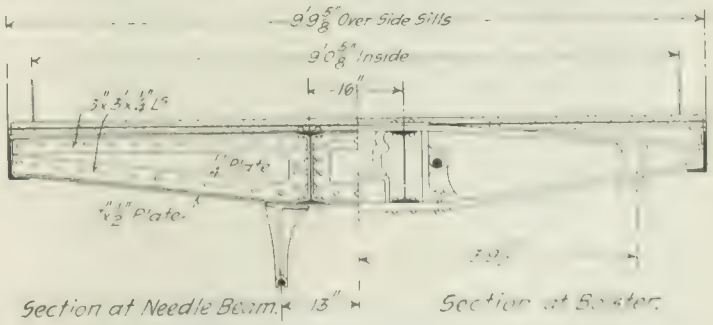
The framing and exterior is entirely of steel. The side posts



End Elevation and Cross-Section of Steel Postal Car.

are ⅜-in. x 2¼-in. x 4-in. angles which overlap a ½-in. x 3-in. x 7-in. side-sill angle and ½-in. x 4-in. x 4-in. side plate. The lower stretch exterior finish is 3/16-in. steel plate riveted with button-head rivets and joints butted. This construction forms a girder which carries the entire framing. Additional support is furnished by two built-up needle beams spaced 10 ft. apart at the middle of the car. The upper stretch is lined with ⅛-in. sheet steel and button riveted. Although truss rods are not used at the sides, the steel structure will carry over 60 per cent. more weight than an ordinary wooden car with truss rods.

The door posts for side and end doors are formed of angles, making a simple and effective detail. For securing the inside lining, paper boxes and other fixtures, fireproofed wooden posts 1⅛ in. thick are secure to side-post angles. The ends of the car are framed of angles which extend to the bottom of the buffer beam, forming a part of it, and continue up to the curved end plate. A ⅜-in. plate, 18 in. wide, extending across the car and riveted to both side plates,



Half Cross-Section Through Underframe.

forms the bottom of the vestibule mechanism casing, at the same time lending material support to the end framing at the top.

One of the principal features of the lower framing is two 12-in. I beams, weighing 31.5 lbs. per foot, extending through to the buffer beams. On account of their depth, platform sills or draft timbers will not be necessary, the draft gear being secured to the lower flange of the I beams. The flooring is composed of two courses of corrugated steel, corrugations laid crosswise of car. Between the

two courses hair felt is applied. To form a smooth floor surface, monolith is used.

The roof framing consists of $\frac{1}{4}$ in. x 2-in. x 3 in. angles bent to the shape of an ellipse, with a foot at each end which is riveted to the side plates. The outer roof lining is $\frac{1}{16}$ in. sheet steel, which extends down the side plate angle and is overlapped by the $\frac{1}{8}$-in. letter-board sheet. The inside roof sheet of $\frac{1}{10}$-in. steel is flanged on the edges and riveted through the angle iron carlines, forming panels 24 in. wide. Ventilation is provided for by Cottier ventilators placed radially on the roof.

The interior arrangement is standard for the sixth and eighth railway mail divisions. The entire side and end lining is of fireproof material, and the paper boxes and other wooden fixtures will be of fireproofed wood. It is intended to make the car absolutely fireproof. The trucks are the system's standard six-wheel design.

No cars from this design will be built immediately, as all 1906 equipment has been provided for. However, all future equipment of this sort will be built from these or revised plans.

Train Accidents in the United States in May.[1]

unf, 3d, Texas & Pacific, Sodus, La., passenger train No. 53 was derailed by running over a cow and the engine and first three cars fell down a bank. The engineman and fireman were killed and two passengers and two trainmen were injured.

†bc, 4th, 10.45 p.m., Pennsylvania road, Clover Creek Junction, Pa., butting collision between westbound passenger train No. 21 and eastbound passenger train No. 18, wrecking the engines of both trains and one passenger car and four mail cars in the eastbound train. Four passengers, four postal clerks, and two trainmen were killed, and 25 passengers, four postal clerks, and four trainmen were injured. Clover Creek Junction is on the Petersburg branch, and the trains in collision were through expresses diverted from the main line on account of an obstruction. The westbound train was in charge of a pilot, and the collision was due to the pilot's non-compliance with an order to wait at the end of the double-track for the eastbound train. This collision was reported in the *Railroad Gazette* of May 11 and May 18.

xc, 5th, Southern Railway, Salisbury, N. C., fast mail train No. 37 collided with a work train which was entering a side track but was not clear of the main line. A man walking along the track was killed and two mail clerks were injured.

xc, 7th, 8 p.m., Texas & Pacific, Wiles, Tex., collision between a freight train and a string of cars which had escaped from another freight and were running uncontrolled down a steep grade; 11 cars wrecked. One drover and one trainman were injured.

*7th, West Jersey & Seashore, Camden, N. J., a passenger train was derailed and one car was overturned; 14 passengers were injured. One of the cars in the wreck took fire and several passengers were somewhat burned.

bc, 8th, 2 a.m., Western Maryland, Avondale, Md., butting collision of freight trains due, it is said, to the non-delivery of a meeting order, wrecking both engines and several cars. Five trainmen were injured.

unx, 8th, St. Louis Southwestern, Red Water, Tex., the tender of the locomotive of a passenger train was derailed, and, with the first two cars, was wrecked. One mail clerk was injured.

rc, 9th, Atlantic Coast Line, Tunis, N. C., a freight train of the A. C. L. ran into the rear of a preceding freight of the Southern Railway, damaging the engine and two cars; two trainmen injured.

unx, 9th, Southern Pacific, Edenvale, Cal., a passenger train was derailed and several cars were ditched. One man was killed and four injured.

dr, 9th, Chesapeake & Ohio, Buena Vista, Ky., a passenger train was derailed by a broken rail and one sleeping car was ditched. Four passengers and three trainmen were injured.

rc, 11th, 4 a.m., Norfolk & Western, Lynchburg, Va., a westbound freight train propelled by three engines, one at the front and two at the rear, was run into at the rear by a following freight, and three engines were damaged. Four trainmen were killed and four injured. There was a dense fog at the time.

eq, 12th, Chesapeake & Ohio, Coaldale, Va., a freight train was derailed by a sudden stoppage due to the automatic application of the air-brakes, and several cars were wrecked. A man stealing a ride was killed.

dn, 12th, Pennsylvania road, Hunker, Pa., two freight cars which had escaped control while being switched ran uncontrolled down grade some distance and were derailed and overturned. Two trainmen were injured.

xc, 15th, Norfolk & Western, Burkeville, Va., a switching engine backed into the side of a moving passenger train, wrecking the engine and badly damaging the engine and cars of the passenger train. The engineman of the switching engine was killed.

xc, 16th, 2 a. m., New York Central & Hudson River, Black Rock, N. Y., collision between passenger train No. 1 of the Wabash Railroad and an empty engine of the New York Central, damaging both engines and three cars. One engineman was killed and three trainmen and 17 passengers were injured. The collision was due to a misunderstanding between signalmen.

dn, 16th, 3 a.m., Cincinnati, Chicago & Louisville, Fowlerton, Ind., a freight train was derailed at the derailing switch approaching the crossing of the Indiana & Eastern, and the engine was overturned. The engineman and one brakeman were killed and the fireman was injured.

bc, 17th, Central of Georgia, Macon, Ga., butting collision of switching engines, wrecking both engines and many cars. This collision is said to have been due to the hurry and confusion due to strenuous efforts to move cars out of the reach of a conflagration that was raging in the cotton yard. In spite of the efforts to save property, 2,000 bales of cotton and 50 loaded freight cars were burnt up.

o, 17th, Pennsylvania road, Herndon, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler, and three employees were killed.

xc, 19th, West Jersey and Sea Shore, May's Landing, N. J., collision between a passenger train and a freight; two trainmen and four passengers injured.

unf, 19th, Western Maryland, Pearre, Md., a work train consisting of two cars occupied by 20 laborers, with the engine at the rear, was derailed by a rock which had fallen on the track from a high bank, and the two cars fell into the Chesapeake & Ohio canal. Five employees were killed and 15 were injured.

o, 19th, Southern Pacific, Oakland, Cal., the locomotive of a passenger train was wrecked by the explosion of its boiler; engineman and fireman killed.

rc, 21st, 9 p.m., Central of Georgia, Rome, Ga., a freight train drawn by two engines ran into the rear of a preceding freight, wrecking the caboose and several cars and the first of the two engines. Five employees were injured.

eq, 23d, Toledo, St. Louis & Western, Bluffton, Ind., a freight train was derailed by a broken journal and several cars were wrecked. A man stealing a ride was killed and another was injured.

unx, 23d, Kanawha & Michigan, Charleston, W. Va., a work train was derailed and wrecked; engineman and fireman killed, 16 other employees injured.

rc, 24th, Baltimore & Ohio, Meyersdale, Pa., rear collision of freight trains, making a bad wreck. One engineman was killed and five other trainmen were injured.

unx, 25th, Chicago, Rock Island & Pacific, Mankato, Kan., the tender of the engine of a special train carrying a theatrical company was derailed and ran about 1,300 ft. on the sleepers, but without causing serious damage to the rest of the train.

unx, 26th, Atlanta, Birmingham & Atlantic, Oglethorpe, Ga., the locomotive of a work train was derailed and overturned; one employee killed and one injured.

o, 26th, Ultima Thule, Arkadelphia & Mississippi, Daleville, Ark., a locomotive which had just come out of the shops after being repaired was wrecked by the explosion of its boiler. The assistant master mechanic was killed and three other employees were injured.

rc, 27th, Chicago, Rock Island & Pacific, Geary, Okla., passenger train No. 4 ran into the rear of preceding passenger train No. 154; 13 passengers injured.

bc, 27th, Pennsylvania road, Monterey, Pa., butting collision of freight trains, making a bad wreck; one employee killed and six injured.

o, 27th, Missouri Pacific, Jefferson City, Mo., a freight train was struck by lightning. Several cars were slightly damaged and a brakeman was killed.

†28th, Louisville & Nashville, Louisville, Ky., a passenger train running at moderate speed was derailed in the yard and two passenger cars ran violently against some freight cars standing on a siding. Eight passengers were killed (four of whom were bridge carpenters employed by the road) and 22 passengers were injured. The derailment appears to have been due either to a defective switch or to the breaking of a flange of a wheel of one of the cars.

dn, 28th, 9 p.m., Duluth & Iron Range, Two Harbors, Minn., a freight train became uncontrollable on a steep descending grade and 34 loaded cars were derailed and wrecked. One employee was injured.

xc, 31st, Fort Worth & Denver, Wichita Falls, Tex., a passenger train collided with a freight car which had been blown out of a siding on to the main track, and the engineman and 10 passengers were injured, the engineman fatally.

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS, WESTMINSTER, LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Imprisonment for Rate Cutters. 689
- Change in the Law of Negligence..... 689
- Conventions, New and Old 690

ILLUSTRATED:
- Address of President Ball 702
- Sir Frederick Peel 704
- New York Central All-Electric Signaling at New York. 705
- Reinforced Concrete Trestle on the Burlington 713
- Pacific Locomotive for the Southern Ry.. 714
- The Kohn Insulated Rail-Joint. 716

CONTRIBUTIONS:
- Tests of Brake Beams 691

MISCELLANEOUS:
- The Master Mechanics' Convention 693
- Topical Discussions 699
- Railway Telegraph Superintendents 711
- Government Railroad Monopoly in Italy.. 712
- The Coal Traffic Inquiry 712
- American Society for Testing Materials... 714
- The Train Despatchers' Convention..... 714

GENERAL NEWS SECTION:
- Notes 183
- Trade Catalogues 185
- Elections and Appointments 187
- Locomotive Building 187
- Car Building 187
- Railroad Structures 187
- Railroad Construction 188
- Railroad Corporation News 190

VOL. XL., No. 26. FRIDAY, JUNE 29, 1906.

The sentence of two rate cutters to imprisonment, reported from Kansas City last week, has led to a great deal of comment by the newspapers and, according to Chicago reporters, to much introspection and humble resolving to reform on the part of railroad freight agents in that city. These agents have not learned so very much new about the law, but they have seen a new light concerning its enforcement. From the public standpoint the salient feature of the case is the imprisonment of the agents. Equally interesting is the question how the Government has suddenly found itself able to discover evidence of lawbreaking, and has so cunningly introduced the imprisonment penalty where it was supposed that the only allowable punishment was a fine. Imprisonment is made possible by proceeding, not under the Interstate Commerce law alone, but also under Section 5,440 of the Revised Statutes:

"If two or more persons conspire either to commit any offense against the United States, or to defraud the United States in any manner or for any purpose, and one or more of such parties do any act to effect the object of the conspiracy, all the parties to such conspiracy shall be liable to a penalty of not less than $100, and not more than $10,000, and to imprisonment for not more than two years."

This law was brought to notice last September when four officers of Schwarzschild & Sulzberger, Chicago packers, pleaded guilty to conspiracy and were fined $25,000. The only explanation that is forthcoming concerning the Government's present activity, after 18 years of indolence or futility, is the Attorney-General's circular of a few months ago to district attorneys throughout the country. The President ordered these officers of the law to abandon their policy of indifference and they abandoned it. As to the railroad men's part in this case, Messrs. Thomas and Taggart presumably received from the railroads just plain, straight commissions, as soliciting agents; and proof that in such a case the railroad officers conspired may have been difficult or impossible to find. A railroad officer who knows that one of his agents divides his commissions with a shipper or consignee is morally guilty of making illegal rates; but he may be able to avoid committing himself by any word or deed that will convict him. He is skating on very thin ice, however, for a Court of Equity will stand no fooling, once it is convinced that the officer knows what the money is used for.

CHANGE IN THE LAW OF NEGLIGENCE.

The law relating to injuries sustained by employees of common carriers approved June 11, 1906, imposes a liability for damages upon many carriers engaged in interstate commerce, from which they have been heretofore entirely exempt. By this Act Congress has changed one of the cardinal principles of the law of negligence as enforced in the federal courts and in the courts of most of the states. Except in a few states which have enacted statutes on the subject, the rule has always been that every employee on entering service took the risk of damage flowing from the negligence of a fellow servant, for which he could not seek indemnity from the common master. From the dawn of the law, a man has been held liable to outside parties for the consequences of his own conduct as well as for the consequences of the conduct of his servants while engaged on his business. But the policy of the law never favored making the master liable for injuries sustained by one servant for the carelessness of a fellow servant. As, however, some servants were far above others in intelligence and authority, an exceptance was grafted upon the general law, whereby the master was held to answer for the negligence of those superior employees who to a great extent assumed, in dealing with other employees, the functions of the master. With this exception the courts of this country have adhered to the doctrine that no employee could recover for the carelessness of another employee, however gross and however great the damage caused thereby.

The legislatures of some states have changed the rule by statute but for the most part in this country the courts have stood by this ancient principle and resisted any encroachment upon it.

Congress has at last taken a hand in the matter, and by the law recently enacted has provided that common carriers engaged in interstate and foreign commerce shall be liable under certain conditions for damages occasioned by the negligence of co-employees.

This liability runs first to the injured employee, in case of his death, to his personal representatives for the benefit of his widow and children, if any, if none, to his parents; if none, to his next of kin dependent upon him. It will be seen that the law is designed merely to protect the unfortunate employee personally, or if dead, his widow and children or parents, or kin dependent upon him. If no such persons are in existence, the liability of the carrier does not attach, as the conditions therefor do not exist.

But this may be matter of defense which if not set up by the carrier may not appear, and whatever does not appear in the law, may as well not be. These limitations upon the application of the law will doubtless afford the carrier an opportunity to escape liability in numerous instances. For there are many men in the service of railroads who have no domestic ties or near relationships and many who float from one employer to another, and in case of death from accident, leave behind them little information of their antecedents or connections. But while the limitation of liability in such cases will be substantial, yet, after allowing for that, the losses the carriers will have to face from the enactment of this law will be very heavy every year, and a wide new column in the expense account will have to be added in the bookkeeping of all the roads. For accidents happen in great numbers during the year, of the kind contemplated by this law, or which a jury at least will find are protected by the law, whatever the fact be. And as the law makes the jury the judge of the fact of negligence, one has no difficulty in reaching the conclusion that every accident will be found to be due to the negligence of some one except the unfortunate victim.

We may therefore judge from the statistics quite accurately what the railroads will have to pay each year in addition to fixed charges, if we can only approximate a fair allowance to apportion to each accident reported.

We are unwilling to say that this change in the law is not a development in the right direction. It has always seemed hard that the victim of carelessness other than his own should not have some substantial redress. The law has doubtless always given him a claim against the individual whose personal negligence caused the injury, but the poverty of the wrongdoer has quite invariably rendered this remedy of no practical advantage. The change in the law transfers this liability from an irresponsible servant to a responsible master and so wipes out the exception to the doctrine that what one does through another, he does himself. The negligence of the servant employed by the master is thus imputed to the master and the action of the servant is the action of the master, as to the fellow servant as well as to every one else.

To avoid, or at least to diminish, the heavy loss to which all the carriers will be subjected by this law, it will be necessary, first, to revise the rules for the prevention of accidents; next, to promulgate others more adequate; and then to see to the strict enforcement of them. This will tend inevitably to save life and limb, and to that extent at least the law will exercise a salutary influence and accomplish a world of good.

To soften the hardship of this new liability, the statute still allows the defense of contributory negligence of the injured employee to be interposed, but it makes a distinction between slight and gross negligence of this character, and provides that when the injured servant's contributory negligence was slight and that of the other was gross, it shall not bar recovery but the jury shall diminish the damages in proportion to the amount of damages attributable to the contributory negligence. This sounds well theoretically, but in the actual administration of justice it will be impossible for a jury of the ordinary kind to divide with any degree of accuracy the damages between slight and gross negligence, and knock from the damage to the victim, as required by the statute, just that particular sum which measures the slightness of his contributory negligence. This is too foggy to be enforceable, and too unjurylike to expect that they will pay, even if they could, the slightest respect to it.

Another provision of the law may prove less illusory. This permits the carrier to deduct from damages any sum it has contributed toward any insurance, relief benefit, or indemnity for injury or death that may have been paid to the injured employee or to his personal representative. To ascertain the sum may require some nice calculations in tracing what portion of the carrier's contribution to a general fund finds its way to the benefit of any particular employee, but the result, when reached, the carrier is surely entitled to claim, in reduction of the general damages.

A carrier may perhaps obviate liability under this law, if in every case he exacts from each employee on entering and renewing service a release from all damages accruing from the negligence of co-employees. And perhaps a more popular safeguard would be found in specifying a limit of liability, not exceeding a certain sum to be agreed on. But perhaps, again, the wisest and most far-seeing plan, after all, will be to accept in good faith this change in the law, as the development of a conservative public opinion, and provide for meeting its increased burdens as if it had come to stay.

CONVENTIONS, NEW AND OLD.

It would be difficult to exaggerate the importance to the technical and railroad world of the conventions of the Master Car Builders' and Master Mechanics' Associations that are held in June of each year. The days when they were looked upon askance by the managers and were little more than a junket have long since passed away, and in their stead we have a gathering that is noted for the steadfastness of its purpose and the high character of the work that is done. It is interesting to note in passing how the very influence that it was thought would act as a damper on the assembly has proven to be of inestimable value. A year ago, when it was proposed to hold the meeting of the International Railway Congress in Washington, it was thought that it would detract from those of the two associations that were to be held so soon afterwards at Manhattan Beach. Contrary to expectations, the Washington meeting served to show the managers and presidents what manner of men these were that were in the habit of coming together in June, and the exhibitors, realizing the advantages gained at Washington, gathered up their goods *en bloc* and showed them at Manhattan Beach, thus making that meeting a record-breaker, not only in point of attendance, but also in the space covered by the exhibits.

The success of the convention show of last year evidently had its effect, since the record this year, not only on the part of the supplymen but also on that of the members, was again broken with the unparalleled total attendance of more than 4,500 people. A big gathering is not all that is needed, however, to make the conventions the success that they should be and have been. Technical work of a high order is demanded, and that has been forthcoming to a marked degree in the reports submitted this month. The work of the Master Car Builders' Association was passed in partial review in the *Railroad Gazette* last week, and attention was called to the change in the methods of handling subjects from the old-time delicacy that refrained from "naming names," thus leaving the reader in absolute darkness as to the relative value of the articles discussed, to that of telling in open court all that is to be known on the subject. The increased value of reports under this new regime will, of course, be appreciated at once. In addition to these minor items and to the technical value of the other reports submitted, there was one that marked in a striking manner the changed conditions that have been brought about in the past 20 years.

Many remember the struggle that Mr. Rhodes had at the time of the Burlington brake tests in 1887, and the criticism to which he was subjected because he insisted that those tests should be made with trains 50 cars long. Events proved the soundness of Mr. Rhodes' position, and we have all been duly thankful for his firmness. This year, the committee on triple valves reports that, after having made all of its arrangements to test the new Westinghouse triple valve on the rack of the association at Purdue, the makers objected on the ground that a 50-car train did not represent present conditions, and that unless the work were to be done on a rack for 80 or 100 cars they would not submit it for trial. The committee promptly acknowledged the reasonableness of the objection and accepted the offer of the Westinghouse company of the use of its rack, and the work was done there. Once in a while we have a startling instance of the growth of modern power during the past quarter of a century, and surely this is one of those cases. Twenty years ago the whole railroad community, brake manufacturers included, was unanimous in declaring that 50 cars would constitute a train of needless length in order to show everything that could be shown in the action of continuous brakes, and such a train was in itself of a very unusual length. To-day, a brake company declares that a train of 50 cars is so short that it is absolutely worthless for full demonstration of the company's product, and the committee in charge of the work acknowledges that the company is right, without a word of argument.

In the Master Mechanics' Association the most notable report presented was probably that on the smokebox; a report that has really been in preparation for the past ten years, ever since the time when Prof. Goss first took up the investigation of the action of the blast upon the fire. Some previous work had been done in Germany, and the principle of the action of the exhaust was fairly well understood, though the details of the application to American

practice, involving the forcing of the boiler, remained for the present investigation to elucidate. While the report does not give empirical formulæ by which any and all types of engines can be arranged, it does lay down the fundamental principles upon which such work should be done; principles which can serve as a guide to the designer, who must also be guided by the conditions of the service that his engine is to be called upon to perform, as well as by the coal that will be burned.

As in the case of the Master Car Builders' convention, some reports were presented at the Master Mechanics' Association that indicated the advances that have been made and the change in the standpoint of the railroad towards matters that would not have been regarded within the pale of practical consideration a few years ago. Water softening, for example, is now regarded as a necessary part of the equipment of a road that is running through bad water districts. About ten years ago, a proposition was made to one of the trunk lines to equip with purifying apparatus its water tanks in a district where the water is as bad as it is anywhere in the country, under a guarantee as to cost and quality of the water delivered that would compare favorably with the best that is done to-day. The apparatus was not new, but had been in use in France for many years, and there was no reason for hesitation, except that the railroad management had not been educated up to appreciate the benefits to be derived from such an installation. The proposition was declined, and it was not until seven or eight years afterwards that water softening was introduced on this system. Now it is an every day matter, and it is taken for granted that water softening should be employed where the water is bad.

Similarly, the study of the Walschaert valve gear now comes to the front. This is a somewhat different proposition, to be sure, from that of water softening, in that the gear offers no economy of coal or steam in comparison with the Stephenson gear, but the exigencies of locomotive construction and the cramped spaces between the frames that now exist in the case of our large engines have driven the designer to the use of an outside gear. Consequently, everyone is anxious to obtain all the information on the subject that is available.

This does not exhaust the list of notable papers that were presented, but the ones mentioned serve best of all to place the stamp of contrast between present and past conditions. An objection might be made to this statement on the ground that the report on Electricity on Steam Railroads is a guide post to what may be expected in the near future. This may be true, but the present report handles the subject most gingerly, owing to lack of effective data from which the effects of electricity and the motor car can be definitely stated. We may look for another report along these lines in four or five years that will mark a new condition in railroad operation, greater perhaps than that indicated by any of the papers that have here been passed under review.

Aside from the technical features of the conventions, as embodied in the meetings and the proceedings, there is great value attached to the exhibits and to the intercourse of members and supplymen, outside the convention hall. The display this year was greater than ever before, and the time has come when railroad men do not have to be dragged out against their will to see what is shown, but go willingly, of their own accord. It is universally agreed that the exhibit at Atlantic City was unsurpassed in interest and in the attention that it attracted. The exhibitors, however, experienced a good deal of difficulty and inconvenience on account of the dampness of the atmosphere, and many were the complaints regarding the damage done by the rust. Machinery that would have remained bright and clean in the dry climate of the mountains, had to be smeared with oil in order to protect it, and many a soiled pair of gloves resulted from the wearer's inadvertently grasping the articles so covered.

Another criticism that was heard on all hands related to the difficulty of locating an individual with whom it was desired to come in contact. The lack of a hotel that could be regarded as the headquarters, where everyone would be sure to come, was apparent. With these two exceptions, the place and the surroundings seemed to be all that could be desired. The first difficulty can easily be remedied by holding the conventions in a dryer climate. The second question has become a serious one, on account of the large number of people that have to be accommodated. Taking care of 5,000 people is a very different matter from taking care of 1,000, and the limit has evidently not been reached.

One lesson taught by these gatherings that cannot be emphasized too often, is their value in bringing men together and leading them to an appreciation of each other's viewpoint. The days when business competitors were hardly on speaking terms have been relegated to oblivion, and now we find the stiffest rivals mingling socially on the most affable terms. The same thing holds true of the railroad man who was formerly so jealous of his position that he was unwilling to accept any innovation that did not originate with himself; so that, while he was content to discuss the matter with his fellows, he went home to follow the even tenor of his own way regardless of the experience and teachings of those with whom he had been brought into contact. Now each seems to be striving to get the best that the other has to offer and willingly follows the path that the majority point out as the best to follow. In no place is this more vividly shown than in the adoption of new and the revision of old standards. A committee investigates and reports; it recommends a reference to a letter ballot; the recommendation is accepted and acted upon and the standard adopted with almost no debate and certainly with no bitterness of feeling on either side. Place this action beside the adoption of the first M. C. B. standard axle and the contrast is startling. Certainly, aside from the great value of the meetings to the technical world, the achievement of such a condition of affairs as this places them high in the list of things that are worth while.

CONTRIBUTIONS

Tests of Brake-Beams.

New York, June 22, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

After a careful study of the report of the M. C. B. Committee on Brake-Beams, the writer has been moved to make certain calculations and from these results has compiled what he believes to be a true arrangement of Tables II. and III. of the committee's report, based on deflections, for the reasons hereinafter stated. Table III., which was printed in the advance copies of the report, was eliminated by the action of the Association when the report was adopted after discussion at the convention. In addition to the rearrange-

TABLE II.—SUMMARIZED DATA—DIRECT TEST.

Beams arranged in order of least net deflection at 15,000 lbs.

Lab. No.	Name.	Make up.	Weight.	Mark.	Loads and deflections: 7,500 Load.	7,500 Deflection.	7,500 Set.	7,500 Net def.	15,000 Load.	15,000 Deflection.	15,000 Set.	15,000 Net def.	At maximum load in lbs.	Lab. No.
	Beams under 110 lbs.													
1.	Davis	Truss.	94.75	B 1	7,500	.040	.005	.035	15,000	.086	.017	.069	42,000	1
44.	Creco	Truss.	91.5	None.	7,500	.040	.000	.040	15,000	.076	.002	.074	41,614	44
43.	Creco	Truss.	86.0	None.	7,500	.043	.002	.041	15,000	.089	.003	.086	38,000	43
48.	Pressed steel	Truss.	94.5	None.	7,500	.048	.000	.048	15,000	.110	.007	.103	28,000	48
14.	Waycott	Truss.	94.5	L 2	7,500	.063	.012	.051	15,000	.137	.033	.104	29,000	14
17.	Central	Solid.	80.75	P 1	7,500	.055	.000	.055	15,000	.117	.001	.116	32,000	17
13.	Vanderbilt	Solid.	105.0	D 1	7,500	.064	.000	.064	15,000	.128	.002	.126	33,000	13
42.	Creco	Truss.	68.5	None.	7,500	.070	.005	.065	15,000	.139	.009	.130	28,500	42
19.	Nat. Hol.	Truss.	74.0	Extra.	7,500	.070	.004	.066	15,000	.202	.066	.136	18,[illegible]	19.
16.	Nat. Hol.	Truss.	69.0	J 1	7,500	.082	.000	.082	15,000	.174	.033	.141	[illegible]	16
20.	Haskell & Barker.	Truss.	65.0	K 2	7,500	.100	.008	.092	15,000	.267	.115	.152	[illegible]	20
24.		Solid.	105.0	None.	7,500	.083	.000	.083	15,000	.160	.004	.156	[illegible]	24
6.	Pressed steel	Solid.	92.25	Extra.	7,500	.085	.000	.085	15,000	.172	.005	.167	31,575	6
7.	Pressed steel	Solid.	85.25	A 1	7,500	.100	.000	.100	15,000	.240	.054	.186	[illegible]	7
4.	Simplex	Solid.	95.0	C 2	7,500	.098	.000	.098	15,000	.188	.000	.188	[illegible]	4
11.	Marden	Solid.	91.0	Q 1	7,500	.110	.000	.110	15,000	.220	.004	.216	[illegible]	11
12.	Sterlingworth	Solid.	88.0	R 1	7,500	.110	.000	.110	15,000	.231	.015	.216	[illegible]	12
8.	Monarch	Solid.	82.5	S 1	7,500	.101	.000	.101	15,000	.1000	.766	.234	[illegible]	8
	Beams over 110 lbs.													
15.	Simplex	Truss.	137.75	G 1	7,500	.018	.000	.018	15,000	.063	.001	.034	50,000	15
18.	Simplex	Truss.	131.5	H 1	7,500	.022	.000	.022	15,000	.044	.003	.041	61,000	18
22.	Keystone	Truss.	115.0	None.	7,500	.038	.001	.037	15,000	.081	.041	.040	62,000	22
23.	Dia. Spec.	Truss.	157.5	E 2	7,500	.053	.000	.053	15,000	.085	.001	.084	56,800	23
21.	Atlas	Truss.	127.0	None.	7,500	.064	.008	.056	15,000	.115	.020	.095	41,000	21
10.	Buffalo.	Solid.	110.0	M 1	7,500	.048	.000	.048	15,000	.103	.000	.103	54,800	10
5.	Simplex	Solid.	124.0	F 2	7,500	.062	.000	.062	15,000	.135	.007	.128	52,500	5

ment of the M. C. B. tests two diagrams and the results of the tests made of two brake beams by the writer are included to support his contentions.

The elastic limits as given in the M. C. B. report appear to be misleading as the diagrams and tabulated results indicate that some of the beams had been loaded to from 20,000 lbs. to 28,000 lbs. before being received for test. This would cause these beams to show only a small set up to the point to which they were loaded before test and therefore the table of elastic limits as given in Table II. of the M. C. B. report has been omitted from the accompanying table compiled by the writer. Since the table of elastic limits is omitted, the table of resilience is also omitted.

A table of net deflections has been added, and in this table the beams have been listed in order of least deflection at 15,000 lbs. The reason for using net deflection as a basis is that the beams which were not loaded to from 20,000 lbs. to 28,000 lbs. before being tested are thereby placed on a parity with those that were so loaded. This is clearly shown in Fig. 1. The first loading takes nearly all the set out of the beam and the second loading gives a much smaller deflection and almost no permanent set. It is the writer's opinion that before testing brake-beams, the beam should be loaded in excess of the load as called for in the specifications. Such preliminary loading insures seating of all the malleable iron parts and therefore true results of deflection and set of the beam are obtained. A load of 20,000 lbs. for beams which are to be tested to 15,000 lbs., and of 37,500 lbs. for beams to be tested to 28,000 lbs., has proved to be quite satisfactory.

Fig. 2 illustrates the effect of such a proof load. This beam was loaded to 20,000 lbs. before testing, as the M. C. B. specifications require loading to 15,000 lbs. with not more than $^1/_{16}$ in. deflection for this class of beam. The diagram shows that a permanent set took place upon second loading to 20,000 lbs. It will also be seen that this occurs in Fig. 1 after a second loading and after a third loading to 15,000 lbs., but when a load of 30,000 lbs. was placed on this beam no set was obtained at 15,000 lbs. It therefore appears that the recommendation of the M. C. B. Committee on Brake-Beams, "that a load equal to the load to which the beam is to be tested shall be applied and released before making the test" is not sufficient to take all the permanent set out of the beam. And in the writer's opinion beams should be first loaded in excess of the load at which they are to be tested.

The table of strength per pound of weight of beam was not included in the table compiled by the writer for the reason that the struts and heads of the various beams are not of the same

TABLE II.—SUMMARIZED DATA—TRANSVERSE TEST.
Beams arranged in order of least deflection at 3,000 lbs.

Lab No	Name.	Make up	Weight.	Mark.	Loads and deflections: 1,500 Load.	1,500 Deflection.	1,500 Set.	1,500 Net def	3,000 Load	3,000 Deflection.	3,000 Set.	3,000 Net def.	At maximum: load in lbs.	Lab No.
					Beams under 110 lbs.									
29.	Buffalo	Solid.	108.5	M—2	1,500	.301	.017	.284	3,000	.621	.058	.563	8,400	29.
38.	Vanderbilt	Solid	103.0	D—2	1,500	.370	.080	.310	3,000	.740	.080	.660	8,400	38.
37.		Solid.	105.0	None.	1,500	.352	.018	.334	3,000	.800	.140	.660	5,470	37.
35.	Waycott	Truss.	95.0	L—1	1,500	.452	.040	.412	3,000	1.050	.260	.790	4,955	35.
34.	Central	Solid.	80.75	P—2	1,500	.435	.032	.403	3,000	.930	.120	.810	4,350	34.
27.	Davis	Truss.	96.5	None.	1,500	.459	.031	.428	3,000	1.275	.420	.855	3,800	27.
3.	Simplex	Solid.	94.5	C—1	1,500	.534	.017	.517	3,000	1.263	.260	1.003	6,250	3.
49.	Pressed steel	Truss.	95.0	None.	1,500	.597	.053	.544	3,000	1.514	.485	1.029	4,140	49.
30.	Marden	Solid.	94.5	Q—2	1,500	.602	.011	.591	3,000	2.410	1.380	1.030	3,225	30.
25.	Sterlingworth	Solid.	85.5	R—2	1,500	.785	.150	.635	3,000	2.110	.740	1.270	4,435	25.
26.	Monarch	Solid.	80.5	S—2	1,500	.645	.051	.594	3,000	2.475	1.040	1.435	4,200	26.
33.	Pressed steel	Solid.	94.75	A—2	1,500	.757	.062	.695	3,000	2.050	.550	1.500	5,000	33.
47.	Creco	Truss.	92.0	None.	1,500	.880	.272	.608	3,000	2.105	.475	1.630	5,550	47.
46.	Creco	Truss.	86.0	None.	1,500	1.237	.280	.957	3,000	2.569	.645	1.924	4,240	46.
45.	Creco	Truss.	68.0	None.	1,500	1,733	.154	1.579	3,000	3.935	1.010	2.925	3,220	45.
31.	Nat. Hol.	Truss.	69.0	J—2	1,500	.852	.325	.517	3,000	...	...	...	2,590	31.
32.	Haskell & Barker	Truss.	66.5	K—1	1,500	2.007	1.115	.892	3,000	...	...	...	2,700	32.
					Beams over 110 lbs.									
36.	Simplex.	Truss.	138.5	G—2	1,500	.195	.027	.168	3,000	.415	.065	.350	9,400	36.
28.	Simplex	Solid.	124.0	F—1	1,500	.205	.008	.197	3,000	.420	.030	.390	6,660	28.
40.	Simplex	Truss.	131.5	H—2	1,500	.343	.113	.230	3,000	.656	.223	.433	8,975	40.
39.	Keystone	Truss.	115.0	None.	1,500	.464	.041	.423	3,000	.879	.234	.645	5,380	39.
9.	Atlas	Truss.	127.0	None.	1,500	.542	.045	.497	3,000	1.095	.170	925	5,530	9.

TABLE III. SUMMARY OF DIRECT TESTS. TABLE II.

Beams arranged in order of Least Net Deflection at 15,000 lbs. Beams under 110 lbs. weight—Truss 9, Solid 9; Beams over 110 lbs. weight Truss 5, Solid 2.

Item No.	Item.	Truss Av'ge.	Truss Max.	Truss Min.	Solid Av'ge.	Solid Max.	Solid Min.	No. beams Truss.	No. beams Solid.
1.	Greatest load applied to beam, lbs.:								
	(a) Under 110 lbs.	30,236	42,000	18,325	21,580	27,400	15,575	9	9
			1	19		17	8		
	(b) Over 110 lbs.	56,558	62,600	50,000	25,175	27,850	22,500	5	2
			22	15		10	7		
2.	Net deflection at 7,500 lb. load, inches:								
	(a) Under 110 lbs.	0.0577	0.092	0.035	0.089	0.110	0.055	9	9
			20	1		11, 12	17		
	(b) Over 110 lbs.	0.037	0.056	0.018	0.055	0.062	0.048	5	2
			21	15		5	10		
3.	Net deflection at 15,000 lb. load, inches:								
	(a) Under 110 lbs.	0.1116	0.152	0.069	0.178	0.234	0.116	9	9
			20	1		8	17		
	(b) Over 110 lbs.	0.64	0.095	0.034	0.115	0.128	0.103	5	2
			21	15		5	10		

NOTE.—Subscripts indicate Laboratory Numbers in Table II.

TABLE III.—SUMMARY OF TRANSVERSE TESTS IN TABLE II.

Beams arranged in order of least net deflection at 3,000 lbs. Beams under 110 lbs., weight truss 8, solid 9; Beams over 110 lbs., weight truss 4, Solid 1. Note. Subscripts indicate laboratory Number in Table II.

Item No.	Item.	Truss Av'ge.	Truss Max.	Truss Min.	Solid Av'ge.	Solid Max.	Solid Min.	No. beams Truss.	No. beams Solid.
1.	Greatest load applied to beams								
	(a) Under 110 lbs.	3,899	5,550	2,590	5,525	8,400	3,225	8	9
			47	31		29.38	30		
	(b) Over 110 lbs.	7,321	9,400	5,380	6,660	6,660	6,660	4	1
			36	39		28	28		
2.	Net deflection at 1,500 lb. load, in.								
	(a) Under 110 lbs.	.742	.892	.403	.484	.695	.284	8	9
			32	34		33	29		
	(b) Over 110 lbs.	.325	.497	.168	.197	.197	.197	4	1
			9	36		28	28		
3.	Net deflection at 3,000 lb. load, in.:								
	(a) Under 110 lbs.	....	....	.810	.992	1.500	.563	8	9
				34		33	29		
	(b) Over 110 lbs.	.588	.925	.350	.390	.390	.390	4	1
			9	36		28	28		

ORDER OF MERIT—DIRECT TEST

Beams arranged in order of Least Net Deflection at 15,000 lbs

Items	No.	(a) Maximum strength.*	(b) Minimum net deflection Under 7,500 lbs.*	(c) Minimum net deflection Under 15,000 lbs.*
	1.	1	1	1
	2.	44	44	44
	3.	43	43	43
	4.	14	48	48
	5.	48	14	14
	6.	42	17	17
	7.	17	13	13
	8.	16	42	42
Beams. Under 110 lbs. weight	9.	6	19	19
	10.	12	16	16
	11.	13	24	20
	12.	4	6	24
	13.	7	20	6
	14.	24	4	7
	15.	20	7	4
	16.	19	8	11
	17.	11	11	12
	18.	8	12	8
	1	22	15	15
	2	18	18	18
	3	23	22	22
Beams. Over 110 lbs. weight	4	21	10	23
	5	15	23	21
	6	10	21	10
	7	5	5	5

*Numbers in the table Order of Merit indicate laboratory or test numbers.

ORDER OF MERIT TRANSVERSE TEST.

Beams arranged in order of least net deflection at 3,000 lbs.

Items	No.	(a) Maximum strength.*	(b) Minimum net deflection Under 7,500 lbs.*	(c) Minimum net deflection Under 15,000 lbs.*
	1.	29, 38	29	29
	2.	3	38	38
	3.	47	37	37
	4.	37	34	35
	5.	33	35	34
	6.	35	27	27
	7.	25	3	3
	8.	34	31	49
Beams. Under 110 lbs. weight	9.	46	49	30
	10.	26	30	35
	11.	49	26	26
	12.	27	47	33
	13.	30	25	47
	14	45	33	46
	15.	32	32	45
	16.	31	46	31
	17.	..	45	32
	1.	36	36	36
	2.	40	28	28
Beams: Over 110 lbs. weight	3.	28	40	40
	4.	9	39	39
	5.	39	9	9

*Numbers in table Order of Merit indicate laboratory or test numbers.

weight, therefore the table as given in the M. C. B. report does not fairly represent the strength per pound. In order to obtain a correct table of strength per pound of weight of beam the weight of the tension and compression members and their parts should be taken to which should be added an estimated weight for strut and brake heads, this estimated weight to be alike for all beams. As at this writing the weight of all the beams as computed in this manner was not available, this table could not be included.

Although the table of transverse tests accompanies this communication it does not give much information. It has been eliminated to all intents and purposes in the M. C. B. report by paragraph 7 of Prof. Hatt's report, which reads: "Inasmuch as transverse stiffness and strength are necessary in order to develop the direct strength of the beams, it would seem that the proper specifications for strength under direct loading will insure strength under transverse loading." However, attention is called to the fact that these tests are of no value since the distance from the center of the pin hole to the face of the brake head was not the same in all the beams tested.

The question of speed of loading to obtain the maximum strength of a beam is an important point, and in the judgment of the writer should be specified by the M. C. B. committee.

Another point which may be worthy of consideration is, shall the test beam, representing a lot of 500 beams, be required to hold the test load for a given length of time without a deflection greater than that called for by the M. C. B. specifications. ENGINEER.

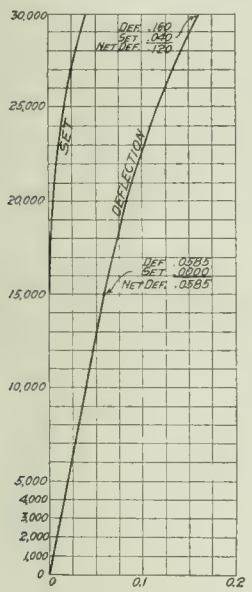


Fig. 2.

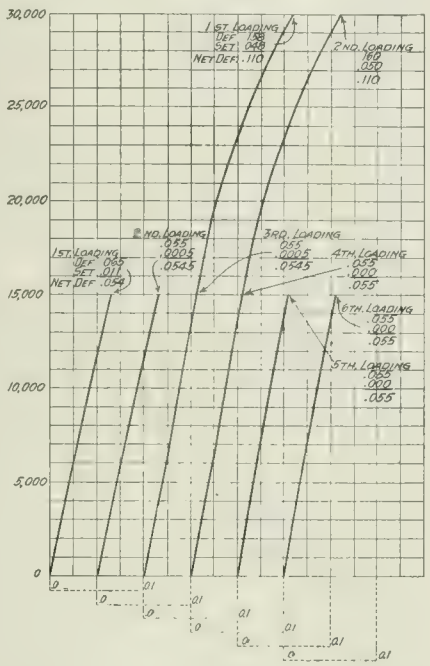


Fig. 1.

Note.—All lines show deflections.

DIRECT BENDING TEST.

Fig. 1. Beam Not Loaded Before Testing. Span, 60½ In. Heads in Place.

Results of Test.

Load.	Def.	Set.	Net def.	Def.	Set.	Net def.	Def.	Set.	Net def.
0	.0	...	...	.0	...	...	.0	...	...
1,000	.005	...	...	.005	...	...	.005	...	...
2,000	.009	...	...	.009	...	...	.009	...	...
3,000	.013	...	...	.013	...	...	.013	...	...
4,000	.0175	...	...	.016	...	...	.016	...	...
5,000	.022	...	...	.019	...	...	.019	...	...
6,000	.026	...	...	.023	...	...	.023	...	...
7,000	.030	...	...	.026	...	...	.026	...	...
8,000	.035	...	...	.030	...	...	.030	...	...
9,000	.039	...	...	.033	...	...	.033	...	...
10,000	.043	...	...	.037	...	...	.037	...	...
11,000	.047	...	...	.040	...	...	.040	...	...
12,000	.052	...	...	.044	...	...	.044	...	...
13,000	.056	...	...	.048	...	...	.048	...	...
14,000	.061	...	...	.051	...	...	.051	...	...
15,000	.065	.011	.054	.055	.0005	.0545	.055	.0005	.0545
16,000	...	...	...	...	...	...	.058	...	...
17,000	...	...	...	...	...	...	.063	...	...
18,000	...	...	...	...	...	...	.068	...	...
19,000	...	...	...	...	...	...	.073	...	...
20,000	...	...	...	...	...	...	.078	...	...
21,000	...	...	...	...	...	...	.084	...	...
22,000	...	...	...	...	...	...	.090	...	...
23,000	...	...	...	...	...	...	.097	...	...
24,000	...	...	...	...	...	...	.104	...	...
25,000	...	...	...	...	...	...	.112	...	...
26,000	...	...	...	...	...	...	.121	...	...
27,000	...	...	...	...	...	...	.130	...	...
28,000	...	...	...	...	...	...	.138	...	...
29,000	...	...	...	...	...	...	.148	...	...
30,000	...	...	...	...	...	...	.158	.048	.110
30,000	...	...	...	...	...	...	.160	.050	.110
15,000	...	...	...	...	...	...	.055	.0	.055
15,000	...	...	...	...	...	...	.055	.0	.055

Fig. 2. Beam Loaded at 20,000 Lbs. Before Testing. Span, 60½ In. Heads in Place.

Results of Test.

Load.	Def.	Set.	Net def.	Load.	Def.	Set.	Net def.
000	.0	...	...	12,000	.0475	...	...
1,000	.004	...	...	13,000	.051	...	...
2,000	.008	...	...	14,000	.055	...	...
3,000	.012	...	...	15,000	.0585	.000	.0585
4,000	.016	...	...	20,000	.083	.003	.080
5,000	.020	...	...	25,000	.115	.016	.099
6,000	.024	...	...	30,000	.160	.040	.120
7,000	.028	...	...	35,000	.302	.165	.137
8,000	.032	...	...	42,000	Compression member straight		
9,000	.036	...	...				
10,000	.040	...	...	52,700	Maximum load.		
11,000	.044	...	...				

NOTE. Speed 2½ In. per min. from 42,000 lbs. to maximum

The Master Mechanics' Convention.

The thirty-ninth convention of the American Railway Master Mechanics' Association was held at Atlantic City, N. J., June 18, 19 and 20, the sessions being held in the Sun Parlor of the Steel Pier. Like the Master Car Builders' convention, this was the largest meeting the Association has ever had, the attendance of members being 350, as against 260 last year. The meeting was called to order by the President, Mr. H. F. Ball (L. S. & M. S.), and prayer was offered by the Rev. Newton W. Caldwell. Mayor Stoy made an address of welcome, which was responded to by Mr. A. M. Waitt.

President Ball then read his address, which is printed in another column.

The Secretary's report showed the membership to be: Active members, 777; associate members, 17; honorary members, 40, a total of 834.

The Treasurer's report showed a balance on hand of $1,870.79.

Andrew J. Cromwell and F. M. Twombly were elected honorary members.

The following proposed changes in the constitution were read and laid over until next year for action:

Article VIII, Section 1, changed to read as follows: "The officers, excepting as otherwise herein provided, shall be elected at the regular meeting of the Association held in June of each year. A majority of all votes cast shall be necessary to an election, and elections shall not be postponed.

"The President, Vice-Presidents and Treasurer shall hold office for one year and executive members for two years, or until their successors are chosen, provided, however, that three executive members shall be elected for one year at the time of the adoption of this amendment. Three executive members shall be elected each year thereafter."

Section 2 of Article VIII to be eliminated.

Article IX, Section 1, a new paragraph added as follows:

"At the first session of the annual meeting, the President shall appoint a Nominating Committee of five members, who are not officers or associate members of the Association, and this committee shall present the names of nominees for officers of the Association for the ensuing year to the Secretary before the election of officers is in order, and they shall be announced by him as soon as received. The election shall not be held until the day after such announcement except by unanimous consent. Any other three members may nominate candidates for office."

A change was also proposed in the provision of the Constitution regarding the requirements for membership.

"Article III. Membership. Section 1. The following persons may become active members of the Association on being recommended by two members in good standing, signing an application for membership and agreement to conform to the requirements of the constitution and by-laws, or authorizing the Secretary to sign the constitution for them.

"1. Those having the rank of master mechanic, mechanical engineer, electrical engineer, superintendent of shops (when they are independent of the master mechanics), having charge of the design, construction or repair of railway rolling stock.

"2. Representatives from each locomotive and car building works.

"3. One representative member may be appointed by any railroad company to represent its interests in the Association. Such appointment shall be in writing, and shall emanate from the President, General Manager or General Superintendent, or other general officer in charge of the motive power department. Such member shall have all the privileges of an active member, including one vote on all questions, and, in addition thereto, shall, on all measures pertaining to the determination of what tests shall be conducted by the Association, the expenditure of money for conducting same, *or the adoption of standards*, have one additional vote for each full 100 engines which are in actual operation or are in process of purchase by the road or system which he represents. Such membership shall continue until notice is given the Association of his withdrawal or the appointment of his successor."

The second motion of Article III to be omitted.

Tire Shrinkage and Design of Wheel Centers.—The report was read by the Secretary.

Mr. Geo. L. Fowler: I would like to know whether there has been found to be any difference in the different makes of tires in the rolling out action referred to in the report. There is a wide differ-

ence in the amount of carbon and naturally in the hardness of the tire, in the tensile strength and natural elongation between the different makes. They run from about .055 carbon to .072 carbon. I speak of car wheel tires, and take it for granted that the same variation exists between the tires of locomotive wheels. If the tire is of the higher carbon it would naturally have less elongation and less liability to roll out, and the rolling out and stretching would undoubtedly be very much less than in the case of the softer tires. The question, therefore, arises, whether it would be better to raise the carbon points in the tires, so that you will have a harder tire and one less liable to this rolling-out action, than when you have the softer tire such as we have been using. I want to ask whether the committee made any measurements to find out what the stress on the tire is, after it is shrunk on. Of course, there must be some stretching to the tire, and I ask whether that tensile stress is ordinarily calculated to take up the whole of the shrinkage, and whether measurements have been taken to show what the depression of the center is by which the actual tensile stress on the tire, when finished, is somewhat less than it otherwise would be.

Mr. S. T. Park (Mich. Cent.): Two makes of tires were used in getting these dimensions, and both showed the rolling action. Although we did not make a chemical analysis we made a physical test of one of the tires, and it gave an ultimate strength of something over 100,000 lbs.

Mr. G. W. Wildin (Erie): We are abandoning retaining rings altogether, up to 76-in. driving wheels.

Mr. W. G. Menzel (Wis. Cent.): We don't need a retaining ring when we have tires 3½ in.; only when we get them down as low as 2½ in. It is a question whether it is best to put retaining rings on in order to get another ¼ or ½ in. wear on the tire. We don't need the retaining rings until a tire gets down to 2 in. Would it pay to put it on to get another ¼ in.? I don't think it would.

Mr. F. Slater (Chic. & N.-W.): With the projection used in the Pennsylvania form it would be difficult to shim the tire; but if the tires are fitted with an inside retaining ring, they could not shift, and an engine developing loose tires on the road could be brought to her home station and it would save the expense of sending men out on the line.

Mr. H. H. Vaughan (C. P. R.): We are using the lip shown in Fig. 6 on our tires and shimming them from the inside where necessary, and I don't believe we have any very serious difficulty. It accomplishes the same purpose as the retaining ring, and is an element of safety.

In regard to the design of the steel wheel, referring to Fig. 4: The center line is shown ½ in. inside of the spoke, and the center line of the tire is about another ½ in. on the outside. In Fig. 2, showing the spokes, you will see that the center of the thrust of the tire, tending to collapse the wheel center, is very near the inside end of the spoke which the committee has made considerably thicker than the outer end. We have gone a step farther than that. We have put the bulk of our metal in the spoke right under the line of the thrust of the tire, making a pear-shaped spoke and reduced the section very considerably on the outside. We started to make practically a T-shaped spoke and came to the pear-shaped spoke. The wheel-makers say the wheel is a very easy one to mould, and it appears to me correct, because it puts the bulk of the metal right under the thrust of the tires. I think that section is preferable to the one suggested by the committee.

I don't believe the rim section suggested by the committee is correct, either. We have a considerable number of engines with cast steel wheel centers, with a rim very similar to this, although perhaps not quite so heavy, and as the tires were thinner we found considerable trouble from loosening, and also we have had trouble from breakages. I charge that entirely to the bending of the rim, with a thin tire, between the spokes. In the old designs of cast iron wheel it was common to have a rim 3 to 3½ in. deep. That rim had plenty of strength. It would support a thinner tire, and it had strength to do it. Our rims now are all made with practically the same section as the old cast iron centers with the deep U-shaped rim. While it takes no more metal than the proposed rim, it gives a very large additional amount of strength to support a thinner tire. I believe that is better than the section shown here.

We have been making experiments to determine the amount the wheel center collapses when a tire is shrunk on. For instance, you apply a tire with a shrinkage of .001 in. to an inch. We happened to strike a design of tender wheel centers that were over size. We would normally have given them .030 in. shrinkage. They were .030 in. over size. We were astonished on measuring the tire, after being shrunk on, to find it had come down to within two-one-thousandths of its cold diameter. The wheel center had given away entirely. That type of wheel center is one on which we have considerable difficulty with loose tires, and I think that accounts for it. When you put on .020, or .030, or .040 shrinkage, if you measure the diameter after it is put on, you will find the centers have collapsed. Driving wheel centers collapse under .025 to .040. The tendency in the pear-shaped spoke with the metal in the direct line of the thrust of the tire is to hold the wheel out and not give away as much as the tire with the spoke with the section shown by the committee.

Another point is that where rims are cut they should be fitted with cast-iron spacers. We struck some engines turned out a year ago, where they were fitted with soft metal spacers. They took away the entire resistance of the rim to hold out against the shrinkage of the tire.

Mr. F. Slater (C. & N.-W.): We found no difficulty in shimming the tire with the lip without placing a jack under the engine or removing a rod. We merely put a jack under the crank-pin to take enough of the weight off to free the tire from the rail. It does not take much pressure. There is little strain on the pin. It merely raises the wheel off the rail enough to take the weight off the tire. Then a tire heater is put around the tire, and in a very few minutes it is warm enough to put in all around the wheel center, and the engine can then go out. It saves a lot of roundhouse work. We shim a tire that way out on the road or in the house. For work on the line we have a small portable tire heater and send two men out. They use the air from the locomotive, and in a very short time the engine can go on with its train.

Mr. P. Maher (T., St. L. & W.): I am experimenting now with a retaining ring the full diameter of the wheel, to be put on in sections. It acts more as a clamp. That leaves a place between each clamp for shimming.

Mr. D. J. Durrell (P. L. W. P.): The action of the brakes probably has the greatest tendency toward loosening the tires, especially upon thin tires. We have recently made some investigations as to the thickness tires should be run on Atlantic type engines before being taken out of service, and we have found that 2 in. should be the limit.

President Ball: What disposition do you wish to make of this report, gentlemen?

Mr. C. A. Seley (C., R. I. & P.): We have the matter before us now in the form of a tentative report from the committee, and I would make a motion to lay it over for one year before being submitted to letter ballot. (Carried.)

Flexible Staybolts.—The report was read by the Secretary. Mr. W. H. Newbury, of the motive power department of the Pennsylvania, was present to represent the chairman of the committee, Mr. R. M. Durborow.

Mr. H. H. Wickhorst (C., B. & Q.): In making these measurements of the movements of sheets, I would ask if the sheets were free from scale? Was the fire-box sheet new?

Mr. Newbury: No, not a new sheet.

Mr. Wickhorst: It strikes me that probably the main reason for large movements of such sheets is the forming of scale, or mud or other insulating material, on the fire-box sheet and staybolt. If the sheets and staybolts are free from scale, the temperature cannot be very much different from the temperature of the water. I made some temperature tests which indicated with a hot fire that a ½-in. sheet cannot be raised over the temperature of the water more than 40 or 50 deg. F.; but allow ⅛ in. of scale to form, and the temperature of the metal is going to rise above the temperature of the water by several hundred degrees. In fact, with a hot fire and ⅛ in. scale on the staybolts and sheets, the sheets can actually attain a low red heat. As the relative movement of the sheets is probably primarily a function of the difference of temperature more than any one thing, it will be seen that if the inside sheet is allowed to become materially raised in temperature, the movement is going to be greater, and I rather imagine that if the test had been made with scaled boiler sheets, that movements would have been found, as, for instance, by opening the fire-door, after a good hot fire. With the hot fire and the scaled sheet, with the temperature of the water, say 400 deg. or lower, the temperature of the fire-box sheet would easily be raised to 600, 800 or 1,000 deg., whereas if the sheet is perfectly clean the temperature of the fire-box sheet probably would not have been raised to over 450 deg.

Mr. G. R. Henderson: I do not notice anything in the report about the cost of staybolts, and that is an important item, particularly if you have side sheets, which only last a year or two in service. We can hardly afford to put in very extensive staybolts in those sheets.

Mr. J. F. Walsh (C. & O.): We commenced using the flexible staybolts about three years ago on our high-pressure engines. We had a class of consolidation engines, with long fire-boxes, carrying 200 lbs. of steam, which troubled us greatly. As we commenced the construction of the wide fire-box engines, we put the staybolts in the outside rows in the side sheets, butt sheets and additional ones up in the upper corners, and putting as many flexible staybolts in the throat sheets as we could get in there. We probably have, all told, 15,000 or 16,000 flexible staybolts in 210 or 215 engines, and up to a few days ago we had not a failure of the flexible staybolts. However, two days ago I got a report of 22 broken flexible staybolts removed from one of our engines, which had been in service about 23 months. That is the first failure we had out of the 15,000.

Mr. A. E. Mitchell: I have had experience with the flexible staybolt of the type shown in Fig. 7, which is the only type that I have used. All of my experience has been on the Wooten type of boilers. We have introduced about 40,000 of these bolts in the last two years, and in that period we have not had a failure of that type of bolt.

Previously we had a large number of failures of the rigid type in our throat sheets, and in one type of boiler we had failures freqeuntly; but where the flexible type of bolt is used we have entirely eliminated the trouble.

Mr. D. J. Durrell (P., L., W. P.): Incrustation has a great deal to do with the failure of flexible staybolts. Where we have water purifying plants, I do not think for two years we have had a failure of a flexible staybolt.

Mr. C. E. Fuller (C. & A.): We have had to educate our men who do the inspecting of flexible staybolts to learn the knack of finding out definitely whether it is a broken bolt or not. That is the only new feature we have had to take up in connection with the practical operation of these bolts. Bolts have been reported broken when they were not broken, and bolts have been reported solid when they were broken. Otherwise the flexible bolt has been very satisfactory.

Mr. Wm. McIntosh (C. R. R. of N. J.): Some five years ago we commenced supplying the bolt in Fig. 9, and have several thousand of them in service. We are using another type of bolt now to a considerable extent, and, desiring information about it, we undertook a vibratory test that, while I do not consider that it gives accurate information, probably gives information that will be of some value.

I will give a brief statement showing how the test was conducted. It consisted essentially of putting four bolts into sheets of fire-box steel, representing the inner and outer sheets of the boiler and fire-box. These are spaced 4 in. apart, as they would be in service, 4¼ in. between centers, the plates being of regular fire-box thickness. Between these plates we placed a spring with the equivalent power of the boiler pressure. This had a tendency to press the sheets apart in about the same ratio. We clamped these sheets, the outer sheet to a table, and the inner sheet to a beam that was arranged to be vibrated back and forth by power, with a total of 3/32 in. in either direction. The beam was moved by a ram, one end of it being held by a pin connection to the table of the machine, and the other driven by a connecting rod from a crank. This movement was kept up continuously until the bolts commenced to break and until there was only one remaining. The results seemed to show that the machine worked fairly uniformly on the various samples, and the fractures that developed were due entirely to the bending action. With solid bolts they averaged more uniformly than they did with flexible bolts. There were considerable variations in these, but this we attribute to the different pressure that was applied to them in screwing them into the sheets.

The results were decidedly surprising. The variation in breaking points between the flexible bolt and the rigid one ranged from 10,664 vibrations, as the largest number that the rigid bolt stood, to 41,300, as the largest number that the flexible bolts stood, under conditions as nearly the same as we could apply it. These were 1 1/6 in. bolts. We had no smaller flexible bolt to experiment with, but we made a number of other tests with rigid and hollow bolts of 1 in. diameter. Their breaking point ranged from 8,300 down to 3,400.

Mr. C. H. Doebler (Wabash): We were not led to the use of the flexible bolt from the breaking of the solid bolt, but to overcome the difficulty in the cracking of side sheets.

Mr. Frank Slater (C. & N.-W.): In view of all that has been stated and the fact that the flexible staybolt does break, and that its life does not appear to be very long, I believe that the most satisfactory staybolt is the rigid staybolt with the tell-tale hole.

Special Valve Gears for Locomotives.—This was an individual paper by Mr. C. J. Mellin, of the American Locomotive Company. The discussion opened with testimony from several members, having in service some of the gears described in the paper, regarding the performance of these gears.

Mr. Angus Sinclair (*Loco. Engineering*): I am surprised when our people are coming in for other improved gears that they have not paid more attention to the Joy. The most objectionable part about the Stephenson is the eccentric. The Joy gear does away with the eccentric. It is strange to me that American master mechanics and designers have not applied the Joy gear, because the distribution of steam is precisely the same, as far as I can make out, as with the Walschaert gear. There is the objection made that the gear is thrown out to some extent by the up and down movement of the axle-box. But I don't think that with the road beds we have now that that would be a serious objection. It is used largely in England. Nearly all the engines that go to Japan from British makers have the Joy gear, and I think it would be a good thing if our people would pay more attention to it, merely from the fact that they get rid of the eccentric.

There is something about a locomotive that is not well recognized in regard to the exhaust. The locomotive that throws out its exhaust like a shot always uses more fuel than one that lets the exhaust out more slowly. That is the difference between the British and the American locomotive in the economy of fuel, and I think that until that part is recognized—the parts relating to the exhaust of steam—we will not get down to the most economical method of operating the locomotive.

Mr. G. R. Henderson: The explanation of our beginning to use the Walschaert gear is: We think so much more of it now than 30 years ago, not because there has been no improvement in the steam distribution, but on account of the large bearing surfaces, and, especially with crank axles, the interior of the engine is so much taken up and the Walschaert gear lends itself to the outside. We are forced to use it now.

Locomotive Tests of the Pennsylvania Railroad.—The report was received and the committee discharged.

Water Softening for Locomotive Use.—In the absence of the chairman of the committee, the secretary read the report.

Mr. G. R. Henderson: I would like to call attention to the paragraph which states that there is no known method for the treatment of alkali. That is true probably in the sense of treatment, but I believe it is perfectly feasible under certain conditions to purify alkali water by distillation. There are distilling apparatus which will give anywhere from 30 to 60 lbs. of water per pound of coal and with coal at $1 per ton—it can be had for very much less on a great many of the railroads in the western part of the country—it is possible to distill water at a cost of approximately 10 to 12 cents a thousand gallons, and while that is considerably higher than the cost of chemical treatment, yet I think that any one who has experienced the great troubles of alkali water from foaming—when very often you have to shut the throttle before you can blow the whistle, greatly endangering cylinder heads and drawbars—I would like to simply call their attention to the fact that alkali water can be treated satisfactorily if they will go to the necessary care and expense.

Mr. A. E. Mitchell: I would like to hear Mr. Fuller tell us some of the results he is obtaining on the Alton with his boilers. I understand he has had remarkable success with a mechanical system.

Mr. Fuller: About 1900 the purification of water was taken up. Later on, the service not being satisfactory, owing to the water foaming to such an extent that it was almost impossible to pull trains over the road without washing the boilers at the end of every trip, the company went into a system using an oil device. In 1903 we were still treating water and using the oil system. Both were expensive luxuries, but with the water we have and the coal, it is absolutely necessary to do something. The subject was gone over carefully and the results watched. Some of the engines were put into localities where there was not any treated water and used simply the oil; others were using the oil and treated water together, until, finally it was decided to abandon one or the other. Canvassing the situation thoroughly resulted in our abandoning the treating process entirely in 1904 and using oil. Since that time we have equipped our heavy type engines from 19-in. cylinders up. If the Association remembers, in 1901 I believe the question came up relative to the service obtained from 20 ft. flues, on these engines. Our Pacific type engines, with 20 ft. flues were running between Chicago and Bloomington, and it was practically impossible to obtain over 35,000 miles for flues. On one of these engines the fire-box failed completely after having three patches on it, and two sets of flues, in nine months. We are now running the 20 ft. flues from 80,000 to 95,000 miles. The fire-box sheets are free from scale. It is no trouble whatever to keep them free from scale. We are extending the life of our fire-boxes to two and three years in place of eight and nine months, or a year. The system requires a good deal of attention and continual vigilance. If it is not given attention you had better not use it, because the oil will collect the scale forming matter and it will settle at the bottom, and if it is not blown out at the end of each trip it is only a question of time until damage will result. It also requires care from the engineers.

In 1904 we increased the tonnage 27 per cent. over 1902 for the same class of engines in the same territory, due to the fact that we stopped the foaming. It is a rare thing now to have an engine reported as foaming. We reduced our engine failures on account of leakages more than one-half.

Mr. G. R. Henderson: I would like to ask Mr. Fuller about two points: What are the ingredients in the water to which he refers where this oil has been successfully used; and has there been any appearance of blisters or pockets on the fire-boxes, or other parts of the sheets. In stationary plants they are very particular about allowing no oil from the cylinders to get into the boilers and they practically throw away enormous amounts of money every year in waste water and heat to prevent oil from getting into the boiler.

Mr. Fuller: When we went into this the statement was made to us that the oil would prevent the heat units passing through the sheets and that the residue would cause trouble. We have in our power station at Bloomington the Stirling boiler. The water contains 12 to 15 grains of solids—lime and sulphates. The sulphate is very high, 9 grains, if I remember correctly. The Stirling boiler is a hard boiler to get a circulation in, particularly in the back tubes. The result was that the sulphates, lime and other substance collected in the back tubes. We have run these boilers now with this device for 18 months.

Our roundhouse up to 1904 was practically a workshop of men removing piston valves, putting in new rings and boring cylinders. We don't know what that is now.

Mr. D. J. Durrell (P. L. W. P.): In regard to the neutralizing

of treated and other waters, for the past three years we have been using purified water on some of our divisions and we found by installing one plant on one particular division, it neutralized the water not only from tanks adjacent to the purifying plant, but at more distant tanks, and nearly to help us out of our trouble. On this one division we had at one time 27 new consolidation locomotives. When they first came on the road we were troubled a great deal with cracked fire-box sheets. By installing this purifying plant we eliminated that trouble absolutely. We have reduced our roundhouse work at some points 25 per cent., at other places 45 per cent., by the use of purified water.

Mr. G. W. West (N. Y., O. & W.): We had a very bad water situation on a division of 100 miles, and installed a water softening plant. It increased the life of our flues 100 per cent.

Mr. Wm. McIntosh (C. R. R. of N. J.): We have one purifying plant and had arrangements to pipe rain water into a cistern and mix there with the treated water. We expected to control this by reducing the quantities of chemicals when there was a quantity of rain water, but have not succeeded in reaching the proper combination. To illustrate the necessity and importance of handling a purifying plant intelligently, we have recently discovered that through either negligence on the part of those in charge, or some chemical change, we were adding 12 grains more solid matter to the water than it contains in its original state.

Mr. G. W. Wildin (Erie): In July, 1904, we began experimenting on a single engine with the oil device. We had such phenomenal results that when the question came up as to what we would do to purify the water on the Chicago & Erie division—from Marietta, O., to Chicago, with 48 grains of incrusting solids, mostly sulphates—we decided to equip our engines with the oil device. We could equip the engines in that territory for about $15,000 initial outlay, as against $95,000 for treating plants. In some places where the water was bad, and where large quantities were used, we found we could treat water for less with the Talmadge system than with the water-treating plants. Our flue troubles were greatly reduced. Where formerly we removed flues every six months, both in passenger and freight locomotives, we are now getting a full year of service without any trouble.

The Talmadge system has absolutely prevented foaming. I rode myself on the experimental engine after it had been in service for about 36 days in the bad water district, without washing, and I invited the engineer to see if he could make the engine foam; it was impossible to do it. We are now washing our engines every 20 days on this territory, where formerly we washed them every five days.

Mr. Fuller: The cost of the Talmadge system depends altogether upon the water; it depends on the amount of oil necessary to use. In the iron ore district we use a gallon of oil to 126 miles. On our western division we use ½ gallon of oil to 150 miles, so that the cost depends entirely upon the number of miles you run per gallon of oil. The oil is fed into the boiler while the engine is working, and also while it is standing still, while the engine is on the road. We do not use over a gallon of water per 100 miles in our hardest service.

Locomotive Front Ends.—Mr. H. H. Vaughan read the report. At the conclusion of paragraph 10 relating to length of front end he said: This is one of the points on which we can hardly regard the tests as entirely satisfactory. There is no doubt about the correctness of the results, but they are so curious that we are practically at a loss to explain them. There is practically a 25 per cent. loss in draft with a 4½-in. shortening of the front end from the normal figure, or from the figure that the New York Central engine has. This is a peculiar result, and it is still more peculiar, that as the front end is shortened still farther the draft begins to improve again. It can only be explained, I think, by the fact that at certain lengths of the front end the currents of gases move freely through the front end.

Mr. David Brown (D., L. & W.): The best results were obtained from the 23-in. diameter stack, with a height of 29 in. This is about the limit of height that we can get with modern engines and large boilers. A higher stack is not practical, and with such a stack lowered we do not obtain the good results that we would expect. A single draft pipe is an unnecessary expense. A double pipe gave more results than a single one, showing that we still have been going to unnecessary expense. Small stacks are not to be considered. We get better results as we increase the diameter of the stacks, but with the false top we have to use the smaller stack for the best results. We do not gain much by going to the trouble of using the inside part of the stack. The smoke-box should be as short as possible. The best results were apparently obtained when the draft-pipe is down level with exhaust tips, but there is little difference in the draft when the pipe is raised 1 in., 8 in. or even 16 in. Yet our engineers have made an engine failure going east through lack of steam, and in coming west have said they fixed it by raising the petticoat an inch. If we have to use a stack 29 in. high, I don't see the necessity of enlarging it at the top, from the chokeup. I think if we would run the stack straight up from the choke it would give equally as good results as with the choke. When the choke was first brought out by the French engineers the stacks were long and small, and it was a benefit to increase from the choke, for the reason that there was less friction in passing through. The gases had done their duty, and could be allowed to get out of the stack freely. The netting they had at that time was a very crude affair on the top of the stack, with merely a ring and a breast across it and some heavy wires running through, the only form of netting in those days. By increasing the top of the stack 4 or 5 in. they were enabled to get a larger area of netting.

Mr. A. E. Mitchell: These tests were made without the netting. We all know that the netting produces a little reduction in the draft. Can we utilize these figures given here as correct with the netting as well as without?

Mr. C. H. Quereau (N. Y. C.): One of the tests made shows that only 50 per cent. of the draft in front of the diaphragm is utilized back of the diaphragm. This is a matter worth further investigation by this committee. It ought to be possible to devise some form of diaphragm that will not waste 50 per cent. of the draft created in front of the diaphragm.

Mr. W. G. Menzel (Wis. Cent.): From these tests we are liable to get the impression that it is wrong to put in a petticoat pipe. If a draft-pipe brings about the result of distributing the draft, it is a good thing to use, even if it does not increase the amount of draft.

Mr. H. H. Vaughan (C. P.): These experiments do not show that the short smoke-box is the best. The draft in the fire-box is the draft that counts, which gradually increases, if anything, as the front end is lengthened to its present length. The draft back of the diaphragm increases quite a little as the smoke-box is lengthened to its present length. The draft above the diaphragm has practically the same value with a very short box and with the present length of box, but the probability is that some action takes place in the flow of air past the diaphragm that changes the value of that draft. That draft is not a useful draft. There must be some peculiarity of action there, but that does not affect the draft on the fire. The draft on the fire with a given back pressure gets rather better as the front end is lengthened. It has been absolutely determined that a taper stack is better than a straight stack in each series of tests that has been carried out. A difference of ½ in. or 1 in. one way or the other makes very little difference if you have a stack only 29 in. high and a 15-in. choke. It doesn't really make much difference whether the stack is straight or tapered, but with the long stacks, in which the taper is long enough to be of some servive, then it is important to make it 1 in 6, 2 in. in a foot, total taper.

With regard to what Mr. Mitchell said about the netting, we have found that the draft is a direct function of the back pressure. In other words, if you have a 4-in. draft, with a 3½-lb. back pressure, you have an 8-in. draft with 7-lb. back pressure. If you put a netting in the way you simply put in an additional obstruction; you have to increase the back pressure to get a given effect on the fire. It follows that with the best arrangement for a given back pressure you also have the best arrangement for any other back pressure. If you put more obstructions in you simply have to decrease your nozzle.

The question of a suitable diaphragm was referred to in the last report of the committee, in which we stated that while we recognized the need of an arrangement of front end that would do away with the excessive loss in dragging the gases past the diaphragm, yet we do not see and cannot see how that can be carried out in the laboratory at present. The self-cleaning arrangement has been developed to a point where it is almost universally used. It would be almost impracticable to experiment on a lot of self-cleaning front ends in the laboratory. To-day everybody is using a certain type of front end. If we can develop a type of front end which can obtain the results without the diaphragm in service, or several types of front ends, which can obtain the results without the diaphragm in service, it will then be possible to investigate that on a laboratory testing plant. I do not think it would be useful to develop a given type of front end on the laboratory testing plant. To begin with, you would have to use fuel oil on the testing plant to get results. That immediately stops ascertaining properly the distribution of draft on the fire. Two roads using different coals will want radically different adjustment to burn the fire properly. We have all had experiences with engines sent out without a petticoat pipe. The local man has put in a petticoat pipe, and has reported it steaming better. We can now explain the reason for that. Suppose you had an engine with an 8-in. stack, you would have a 3.65-in. draft. If you put in a double draft pipe, you have improved it practically 10 per cent. Suppose you had a 21-in. stack and put in a petticoat pipe. You get only 1 per cent. of difference. There are times when a petticoat pipe will improve the draft, but what we have shown is that if you have the proper arrangement of stack and front end, you then cannot improve it by putting in a petticoat pipe.

Mr. F. M. Whyte (N. Y. C.): We have applied this proposed standard front end to a number of our engines. These locomotives have been very free steamers with the front end arrangements standard to them; therefore, the tests are hardly conclusive, except to show that the front end suggested by the committee is satisfactory for the locomotives and the possibility of increasing the diameter of the exhaust nozzle. The exhaust nozzle standard to the Atlantic type on the N. Y. C. & H. R. locomotives is 5¾ in. to 6 in. in diameter. The nozzles were made 6¼ in., 6⅜ in. and 6½ in. in diameter for use

with the stack and front end arrangements suggested by the committees. On one division the locomotives having 6⅜-in. nozzles did not steam satisfactorily, trailed the smoke badly, and did not clean the front end, especially on the horizontal plate of the smoke-box. The nozzles were changed back to 6⅛ in. diameter. On another division the locomotives having 6⅜-in. nozzles gave practically the same results, except that the locomotives made plenty of steam. On a third division the locomotives having nozzles 6 in. and 6¼ in. in diameter performed satisfactorily in every way, except the trailing of black smoke, and the accumulation of cinders on the horizontal plate of the smoke-box. The performance of the stack, as a whole, is considered good, and the elimination of the petticoat pipes will be a decided improvement, if it can be done and still get rid of the cinders so as not to have them accumulate in the front end.

Mechanical Stokers.—In the absence of Mr. Garstang, Mr. J. F. Walsh read the report. On motion the report was received and the committee continued.

Classification of Locomotive Repairs.—Mr. H. H. Vaughan, chairman of the committee, read the report.

Mr. H. A. Gillis (Amer. Loco. Co.): The principal object of the classification of locomotive repairs is to determine what your various shops are doing, and the relative merits of the work done on the various divisions. I do not think you obtain it at all by any kind of classification of repairs. The amount of repairs made in a shop and the number of engines turned out of a shop depends a great deal on the quality of the repairs. I know of one instance of two master mechanics who were changed. Before the change the number of class 3 repairs going through one shop was about 35 to 40 a month. Inside of two months the new man made a record of 60 a month, and also had a large percentage of the power in the shop. In one case the engine was actually repaired and put in proper condition. In the other case when it was repaired it was only half repaired, and when it went out on the road it broke down, and possibly after that as much repairs as ever had to be done on the engine. In the classification of repairs for these two divisions the man who really does the poor work usually shows up the best. The only way you can tell how your shops are going is how they are maintaining a certain number of engines in running condition on the road and the cost of the maintenance of these engines.

Mr. G. W. West (N. Y., O. & W.): I want to endorse Mr. Gillis's statement. My experience has been similar to his, that the number of engines turned out by a shop is no indication of the real amount of work that is being done there. I was at one time a master mechanic on a trunk line, and was followed by a man who is now passed into the other world. He met me on a train about a year after he took the place and he wanted to know if I knew what our pay-rolls were when I was master mechanic of the road, and I told him that I did. He told me they were turning out double the engines, with the same amount of expenditure that I had turned out when I was master mechanic of the road. I told him he was a good man, and if he was able to do that he ought to hold his position. Two or three years after that they abandoned eight or ten trains a day for the want of motive power.

Mr. Wm. McIntosh (C. R. R. of N. J.): I would suggest that the information usually desired could be readily determined if the superintendent of motive power obtained comprehensive reports of the work done in detail. He could readily judge then who was doing the galvanizing and who was doing straight work.

Mr. T. H. Curtis (L. & N.): The Louisville & Nashville road has abandoned the classification of repairs by numbers, and we have gone to the unit system of classifying repairs by a number of units. If an engine has Class 1 repairs—that is, $100 worth of repairs—Class 10 would be $1,000 worth of repairs, and Class 50 would be $5,000 worth of repairs. The master mechanic then putting on $1,000 worth of repairs gets credit for Class 10; $5,000 worth, Class 50. I find this is much better for the information of the superintendent of machinery.

Mr. C. H. Quereau (N. Y. C.): The plan suggested by the committee in conjunction with a compilation of the cost per ton-mile will show up the condition of affairs. The number of repairs turned out may not show who is shirking and who is not, but the cost per ton-mile will surely develop that feature. It would be wise to have two bases on which to compare efficiency. One based on cost per ton of locomotive repairs, the other the cost per ton-mile, by which you judge the efficiency of the division superintendent of motive power or master mechanic. I think a little analysis will show both of these methods are very desirable.

Mr. G. W. Wildin (Erie): There is only one object in having classification repairs of some kind. We want to know, when the engine leaves the shop, whether it is going to give service, and not have to wait until it breaks down to find this out. If you know its actual condition, and the repairs have been reported intelligently, then you know what the condition of the power is and what service you will get.

Mr. T. E. Adams (St. L. & S. W.): We have an inspector at our main shop who, when an engine goes into the shop, goes over the engine and discovers all the defects and makes a list of them. He gives this to the roundhouse foreman, who in turn distributes them to the different departments. That is the best method I have seen for taking care of engines in service. When the engine comes out of the shop I have this inspector look over the engine and have him make a list of everything which he finds wrong with the engine. The attention of the master mechanic is called to it and the matter is immediately remedied.

I do not believe that a large engine in heavy service, well taken care of, should necessarily be an expensive engine to maintain. The trouble is frequently that little things are found not to be in order and the master mechanic lets the engine go another trip. This is kept up until so many things are out of order, which you keep letting go, that the whole engine is finally on the point of breaking down. If each line of repairs is taken up at the proper time and given proper attention, it has a good effect in giving service and furnishing engines promptly when the transportation department needs them.

Mr. H. H. Vaughan: Every one has some sort of classification of repairs. In this report I have mentioned the fact that there is a certain amount of doubt as to whether the classification suggested was advisable. I have used this classification for two years, and I find it works conveniently. If we know that a shop is turning out 6, 10 or 20 No. 1 machinery repairs every month, we have a fairly good idea of what the shop is doing. We know they are spending so many thousand dollars for labor per month. If the output begins to fall off we want to know why it is falling. We watch the cost per mile of every engine going into the shop. The shops are run on an allowance system, and we want to know the number of repairs each shop is turning out per month. If you go on the $100 unit plan, what do you know as to what the man is doing? If he is putting in $30,000 on repairs, he must turn out 300 units. A shop may cost twice as much in one year as it did in some previous year, and yet it may not be turning out any more work in proportion to the increase in cost. We want to know, when an engine is overhauled, whether it is making the mileage which we expect it to make. We want to know whether tubes are reset and whether work has been done to the firebox. This information, of course, can be secured through detailed reports. The classification of shop repairs as treated in this report has a definite value. What the classification gives you is a more logical method of enumerating these repairs than the money system, or the system of numbering 1, 2 and 3 machinery. On the Lake Shore we had a 1, 2, 3, 4, 5 classification, and it came to be difficult to distinguish between No. 3 and No. 4. There was a good deal of trouble on that account, and we finally got down to a plain classification, No. 1 and No. 2, for light and heavy machinery, and No. 1F and No. 2F. "F" meant flues re-set. That worked very well.

We have engines coming in for a considerable number of odd jobs. They do not have the tires turned, but there are specific repairs; defect repairs, such as a broken crank-pin, or something of that kind. If you know the shop is turning out so many 1, 2 and 3 machinery repairs every month, you have a rough definition of the shop output. It does not take the case of other statistics, but as a useful supplement. I do not think the ton-mile is of any use in locomotive repairs. They will vary 3 or 4 to 1 on ton-mile basis. They will not vary as much on the engine-mile basis, and will vary much less on the 100 per cent. engine-mile basis than on the engine-mile basis. We have been working the 100 per cent. engine-mile basis for several years, and find the repairs compare closely with the tractive power of the engine. The closer the unit is the better. It is the best unit we have discovered so far. Our passenger power is figured on that basis, and also our switch power. In engines varying in tractive power in proportions of 3 to 1, that unit applies correctly, and is a fairly good test of the unit.

The first two sections of this report are of real importance to distinguish between engines in service and those under repair. We are criticised on the percentage of engines in service and out of service. All roads are criticised on that point. It would be of general advantage to adopt a standard classification determining when an engine is considered in service and when it is considered out of service for repairs. In view of a probable separation of running repairs, and especially repairs on performance sheets in the future, it would be to our advantage now to standardize a distinction between running and shop repairs, so that in interchange performance sheets we will know what it means. It will be interesting to know what it is per mile for running repairs.

The committee has proposed a classification for engines in service and engines out of service, and another one for running repairs. This convention should either reject them or adopt them, and if they adopt them they should be referred to the American Railway Association for use on standard performance sheets and mileage sheets. Every now and then there is an exchange of information of this character, and it would be interesting to know that the statistics are made up on a uniform basis.

Mr. George W. West: I move that 24 hours be adopted as the limit distinguishing between engines in service and those under repairs, and that $100 be adopted as the limit distinguishing between running and shop repairs. (Motion carried.)

Engine House Running Repair Work on Locomotives.—The Secretary read the report. There was no discussion.

Mr. Strickland L. Kneass read an individual paper on "The Modern Locomotive Inspector." There was no discussion.

Locomotive Lubrication.—The report was read by Mr. S. T. Park (C. & E. I.). The topical discussion on "*Grease vs. Oil in Driving Box Cellars*" was taken up at the same time in connection with the discussion of the report.

Mr. F. H. Clark (C., B. & Q.): The use of grease reduces engine failures, due to hot driving journals, reduces delay incident to oiling and reduces cost of lubrication. We have not found it necessary to reduce the tonnage rating, due to increased machinery friction with the use of grease.

Prof. W. F. M. Goss read a report of tests made to determine the relative friction of a locomotive using oil and grease. The tests showed a difference of 1,000 lbs. draw-bar pull in favor of oil lubrication. In concluding his report he said: "One thousand lbs. at the draw-bar when the locomotive is developing 30,000 to 40,000 lbs. is a small percentage. At slow speeds the power equivalent of the loss, is small, but as the speed becomes high and the maximum draw-bar force which the locomotive can develop becomes reduced to 6,000 or 7,000 lbs. then the 1,000 lbs. absorbed by the grease friction in excess of that required by oil becomes relatively large."

Mr. Geo. W. West (N. Y., O. & W.): We have something besides the loss of power to consider in the use of grease; we have freedom from train delays, and on a road where 18 or 20 cars is a good load for a 100-ton engine, it has never been found necessary to reduce tonnage on engines running with grease lubrication. We have found it reduces cost of lubrication, and we get more mileage on engines using grease than with those lubricated by oil.

Mr. Wallace (D., M. & N.): Since the adoption of grease in the locomotive driving-box cellars we have not found an increased fuel consumption. We have not made a reduction in tonnage, we have increased our coal mileage—that is, we have made a better coal record since the using of grease—for the reason that time is not taken up in oiling the engine.

Mr. Wickhorst (C., B. & Q.): The object of any kind of lubricant is to keep the metal surfaces apart, so that there is no actual metallic contact. A lubricant itself has some friction in all cases, but the idea is to have the friction of the lubricant less than the friction of the metallic contact. If we take surfaces with very light weights as in a watch the friction of a lubricant is so great that it is better to have no lubricant at all; it actually retards the movement of the very light parts. As we increase the load we have to interpose some lubricant, generally oil, and with very light machinery a light oil is used. As we get to heavier machinery, for instance, a locomotive, and keep on increasing weight on the bearing surfaces, it is necessary to increase the viscosity of the liquid in order that the surfaces will not actually come in contact, but the friction of the lubricant itself keeps on increasing. With the heavy locomotives we are running it is necessary to use this heavier lubricant in order to successfully keep the surfaces apart. That necessarily must result in increased internal friction of the lubricant itself. If it means a loss of 100 h. p. when running we have to stand that expense, because we have to keep the surfaces apart or there is excessive heating. We have found it impracticable to use any metal for bearing metal that is softer than bronzes. We have to have a phosphor bronze or something harder to successfully stand the heat.

Mr. G. R. Henderson: The inference drawn from this report would be that grease was not as good a lubricant as oil. I have known in a number of cases where the substitution of grease for oil, especially on crank-pins, reduced the number of broken pins fully 50 per cent. A hot pin means not only delay to the engine, but loss of metal in turning the pin and boring the brass, and we should bear in mind, although there may be more actual friction, grease gives much better practical results.

Mr. T. E. Adams (St. L. & W. S.): We use grease on driving-boxes, eccentric rods, front ends of main rods, etc., and have good success. We occasionally have a hot driving-box with grease. The engine will come in running perfectly cool, and apparently have plenty of grease in the cellar. It will leave the terminal point, and in a run of 25 miles will have a hot driving-box and the grease will have gone out of the cellar. Possibly the friction between the hub and the box was the cause for the grease going out of the cellar so suddenly. If we had some way of lubricating between the bearing and the hub that would be overcome. We have our enginemen in the roundhouse fill all the cups on the eccentrics and front ends of the main rod, so that there is little oiling for the engineer or fireman to do on the road. Practically the only oiling which they have to do is on the front end of the engine trucks. One screwing down at the terminal carries the engine 152 miles on a freight train of 2,000 tons, and there is no trouble experienced.

Mr. G. W. Wildin (Erie): We have now about 237 engines having pins and driving-boxes equipped for grease lubrication, and some of them have been in service for about two years. We have yet to have the first hot driving-box on the Erie Railroad in the case of an engine equipped with a grease cellar. We tried the grease lubrication on trailing wheels, but without success. Grease as a lubricant must be applied to some parts where there is more or less motion, so that it can get between the surfaces. In the case of trailing wheels there is nothing to give them a jarring motion, so that the grease cannot get between the surfaces, and it is not a success when applied to such surfaces. We are using a compression cup, which does away with the necessity of the engineer screwing down the plug. We get 3,000 miles from a side rod cup, 2,500 miles from a main connection and 1,500 miles from a main rod cup. Our cost of lubrication has been reduced materially. We made some experiments on the first engine, Atlantic type. It went out from the shop equipped with the Elden cellars and came in for general repairs a year afterward and went out afterward with the same grease in the cellars. It costs us 2.5 cents per journal per 1,000 miles with the grease, as against 31 cents per journal per 1,000 miles with oil. With the Atlantic type of engine we made it 10 cents per 1,000 miles for the driving-boxes with grease and $1.32 per 1,000 miles for the four driving boxes with oil, including the labor of packing, etc.

Mr. Pratt: The Chicago & North-Western made some tests that showed a little higher than that for oil and about 3 cents per 1,000 miles for grease. That the tonnage rating has not been reduced is in accord with the showing in the report, to which I have referred. Under the slow speed of ordinary freight service the loss is not great by the adoption of grease; but the fact remains that there is 1,000 lbs. difference, about, in the draw-bar stress, required to overcome the machine friction.

The recommendations in part No. 4 of the report, consideration of standard fittings, was referred to letter ballot for adoption as standard, and the committee be continued.

Specifications for cast iron to be used in cylinders, cylinder bushings, cylinder heads, steam chests, valve bushings and packing rings. Mr. Henderson presented the report.

Mr. T. H. Curtis (L. N.): The wearing quality of the cylinder can be varied a great deal by the manner in which the cylinder is made. I have experimented considerably in making locomotive cylinders, and believe it to be of advantage to use a dry sand mould and core, which is quite expensive to make, but insures a uniform cylinder. Again, the method of cooling the cylinder is a large factor in the wearing qualities of it. If a cylinder is poured and stripped of the mould as soon as possible, not permitting the iron to bleed, you will have a very hard cylinder, one so hard, perhaps, that you cannot machine it. If you bury the cylinder in the cylinder pit for two or three days and let it cool, you will have a very soft cylinder. By the method of cooling you can vary the hardness of the cylinder. If you want a hard valve sheet, when it is cooling, strip the valve sheet and let it cool quickly and it will chill to some extent.

On motion the committee was instructed to prepare and submit for adoption by letter ballot as standard a definite form of specification for unbushed cylinders with silicon limits 1.35 to 1.75, and also for adoption as recommended practice specifications for bushed cylinders.

Electricity on Steam Railroads.—Mr. Seley read the report.

Mr. G. R. Henderson: The New York Central had no idea of entering the field of electrification with the hope of reducing the cost of operation. The additional costs for the arrangement of terminals and the various facilities which were needed to get the full benefit and full advantage of electric traction were about three times the cost of actually equipping the track and getting the trains moving by electricity. That is one phase of the problem that has not always been studied and considered as completely as it should be.

W. R. McKeen, Jr. (U. P.): If you build a gasoline motor car to run on a steam railroad, it is necessary to build the car to withstand a shock like that of a collision with a locomotive or a strongly built railroad car. This necessarily makes the car much heavier unless you use steel construction. It would not be safe to run the ordinary electric car on a steam railroad. In developing the gasoline motor car we endeavored to put out a car that would be absolutely safe for the traveling public. That adds necessarily to the expense of the first cost. The gasoline cars of the present day are built principally for branch lines to establish economical service in sparsely populated territory with the same frequency of service as in a thickly populated territory. Where traffic is heavy you have to use a car of large horse-power, but on branch lines and in sparsely settled districts a 100 h.p. gasoline engine gives some remarkable results in operation. It is possible to attain a high speed at a low cost and a low development of horse-power.

It is difficult to get at the exact cost of motor cars on account of the varied service they are giving. We can only get at it on a mileage basis. The cost is dependent largely on the method of operation—that is, the number of miles the cars are going per day and what you pay the motorman and crew. If you insist on a conductor and a regular scale of wages, the handling of train orders, etc., it adds to the cost necessarily. If you follow out street car practice, having a motorman and conductor operating one car, with a lower rate of wages, it brings the cost down. Fourteen or 15 cents a mile could be easily obtained in any ordinary service, if the car makes 100 or more miles per day.

Mr. C. F. Street: In considering the electrifying of branch lines the incidental expenses would be no greater with electricity than with steam. With regard to the reduction of the cost of operation the average cost of operation for all of the electric lines of the

United States is given at 12½ cents per car-mile. The cost of operation per car-mile varies all the way from 9.51 cents per car-mile, on the Interborough Rapid Transit in New York, up to as high as 20 and 22 cents per car-mile. On the South Side elevated in Chicago they are operating for 10.50 cents per car-mile; Metropolitan, 10.2; Lake Street elevated, 10.2. I have a considerable list here running all the way from the Interborough at 9½ cents,, which I believe is the lowest, up to 20 cents. All other things being equal, the question hinges on that feature of operation. There is a traffic being operated by electric lines running up as high as 20 and 22 cents per car-mile. Providing a service which will be satisfactory can be given by the motor car, there is no question but that lines which are running with such operating costs as this, are motor-car propositions. There is a great field for the motor car. With regard to the question of cost of repairs, on one of the elevated railroads they are running motor cars 65,000 miles between heavy repairs. At the end of a 65,000-mile run the cars are taken into the shop and given a general overhauling, and the average cost of repairs per motor, at the end of 65,000 car-miles run is between $2 and $3 per motor. That is the heaviest cost of the repairs to electric equipment. The repairs for light controllers and light repairs are made on 800 cars by a force of four men. The cars are inspected at the end of every 1,000 miles run. The average number of light repairs made at each inspection on 800 motor cars is from 2 to 3 per day. This gives some idea of the very low cost of inspection and of heavy repairs to heavy electric equipment. The motors referred to are all of 200 h.p. capacity.

Mr. H. H. Vaughan (C. P.): A discussion on the relative cost of operation by steam and electricity is not a very profitable one at present. We can reason out what it is going to be and arrive at any conclusion you want to, almost, by accepting different premises. I was asked to get up a motor car last year, experimentally, for branch line service, to be operated by two men. A car that is operated by two men is impracticable, except on branch lines, where you are absolutely sure that only one car will be permitted on the branch line at a time. A third man is absolutely necessary for flagging, and now as the difference in cost between firemen and brakemen is very small, you might as well have a fireman on the car as a brakeman. However, as the result of the demand for a car to be operated by two men, we sent out a steam car operated with oil as fuel. We have had that car in service about a month now.

The car with the motor equipment weighs about 90,000 to 92,000 lbs.; it is a four-wheel truck car. The water carried adds 9,000 lbs. to that and the motor 30,000 lbs., making the total weight of the car about 130,000 lbs. Our boiler is the modified Scotch boiler, with a superheater and combustion chamber, or intermediate chamber, and circular furnace. One interesting feature is that we have found that on this small car with about a 200-h.p. engine the results obtained in locomotive practice on large boilers and large engines can be duplicated in every respect. The inches of draft per pound of back pressure are duplicated. The evaporation per square foot of heating surface is duplicated. The horse-power the car will develop is practically the same; the weight of the boiler per square foot of heating surface is rather less than in the ordinary locomotive. So we really have a reduced locomotive in every way running on that car, and our experience shows that it is perfectly safe to apply existing locomotive data to very small cars of that kind and expect the results to be duplicated. The master mechanics' improved form of stack cannot be duplicated, however. The stack has to be a little larger than the formula gives. I suppose that is because the size of the front end would be 24 in., and there is not enough room for the gases in the size the formula gives. After a certain amount of experiments we put the car in service, and the only troubles we have had are: The first trip the car broke a spring-hanger and the second time a cross-head arm actuating the Walschaert valve gear. That was due to defective design, but otherwise the car runs satisfactorily. We are making four round trips a day, 23 miles each way. Our regular local passenger schedule, 23 miles, is 50 minutes. We have made it in 38 minutes with the motor car. There is no difficulty in running at a speed of 50 to 55 miles to the hour. I am practically sure, however, that we will not go to oil fuel again. We will keep to coal. Coal fuel with us is the cheapest, for the amount of heat it develops. The motor car proposition is one of getting down to the cheapest fuel and making everything as cheap as you can to reduce the cost per mile. Where oil is cheaper and coal more expensive, of course the conditions will be reversed. We have automatic attachments on the car by which, when the engineer shuts off the throttle, he at the same time shuts off a portion of the oil, so that he regulates the supply and it does not form a very large amount of smoke. He has the lever in front of him and he turns on more or less oil, and with proper draft it is possible to maintain the steam pressure satisfactorily. The cost of operation is somewhere between 15 and 20 cents per mile. It depends largely on the engineers and firemen. In many ways the motor car is attractive to the public. If we were to put on a very small, old type engine, and old car, we could probably run a cheaper service than we can with the motor service, but the motor car is more attractive. It runs quickly, and with a nicely furnished modern car it gives an attractive branch line service. The question is whether it will pay to put the motor in the car or use a separate motor car. I think a separate motor car will probably be designed, attractive in appearance, to enable us to put the motor car in the roundhouse at night and the trail car in the yard. That is one of the objections to the combined car. Another objection is the difficulty of washing out; a small boiler, such as is used, has to be washed out properly just as a big boiler. One of the advantages about the steam car is the fact that you can put that car on a branch line and have no difficulty with men trained as engineers. The roundhouse force is accustomed to it, and there is nothing about the car that involves a new proposition or a new force, and the fuel is, of course, very cheap. With a car weighing 60 tons the oil consumption is 1.8 gallons per car-mile.

The election of officers for the coming year resulted as follows: President, J. F. Deems (N. Y. C.); First Vice-President, Wm. McIntosh (C. R. R. of N. J.); Second Vice-President, H. H. Vaughan (C. P.); Third Vice-President, G. W. Wildin (Erie); Treasurer, Angus Sinclair. Members of the Executive Committee, F. H. Clark (C., B. & Q.), C. E. Fuller (C. & A.), T. H. Curtis (L. & N.), to serve two years, and F. M. Whyte (N. Y. C.), to serve one year.

Mr. J. Snowden Bell was proposed for associate membership.

The meeting then adjourned.

Topical Discussions.

Is not a boiler pressure of 185 lbs. better than 200 lbs. for locomotives?

Prof. W. F. M. Goss (Purdue Univ.).—I assume that the question which is asked applies to simple locomotives using saturated steam; also that the question applies to proposed locomotives; that is, that I may discuss it as a question of design rather than a question of expediency controlling the operation of existing engines. Since the beginning of practice involving locomotives the steam pressure has steadily increased. I have taken from a paper by Mr. William Forsyth, published some time ago in the *Engineering Magazine*, a diagram showing the progress in steam pressure, with the years. On this diagram the 100-lb. limit was passed between 1860 and 1870; the 160-lb. limit was passed in 1890; the 200-lb. limit was exceeded in certain cases in 1900, and the tendency of the curve is still upward. In view of this history it is of importance to ask whether the limit of pressure has been reached; or, to word the question as it has been worded for me, as to whether the limit has not already been passed. As a preliminary to a more detailed discussion of the subject, I would call attention to the fact that as a problem in design the question of steam pressure does not directly affect the question of power. It is a common mistake to assume that a locomotive carrying an abnormally high steam pressure must be abnormally powerful. Of course, those of you who have studied the problem understand that that need not be so, since the power which the locomotive develops is represented by the stresses which are transmitted by the piston rods, and these stresses are as much a function of the cylinder volumes as of the steam pressure. Consequently, having selected our steam pressure, we may determine the volume of cylinders for any power which is within the capacity of the other proportions of the locomotive. The thing which I emphasize is, then, that the question of power is not related to that of pressure as a problem in design, except in so far as pressure may effect efficiency.

This leads us, then, to a consideration of the question: to what extent will increase in pressure improve the cylinder performance of a locomotive? I believe that a general view of the facts involved in this question may most easily be apprehended by referring to the performance of the ideally perfect engine, and for this reason I have given upon Diagram 2 as the curve A B the steam consumption per horse-power hour of an engine ideally perfect, using steam at various pressures and exhausting at a pressure of 5 lbs. above atmosphere. From this diagram you will see that beginning with a pressure of 25 lbs. the steam consumption per horse-power hour of this perfect engine is 40 lbs., and that the steam consumption diminishes rapidly as the pressure is increased until the pressures become considerable. For the higher ranges of pressure the increase in performance is very slight. For example, if you will scan the upper portion of that curve you will note that from 175 lbs. to 275 lbs. the inclination of the line is very slight. The performance at the higher pressure is but slightly better than that at 175 lbs. From this statement it appears that from theoretical considerations alone we should not expect any large improvement in the efficiency of the locomotive by merely increasing pressure.

Turning now to an experimental side of the question and considering what the actual performance of a locomotive may be when served with pressures of different values, I present to you the line C D, which fairly represents a series of more than 70 tests at all under pressures ranging from 120 to 250 lbs. per sq. in., and which have been conducted under the patronage of the Carnegie Institution. This curve C D fairly represents these 70 tests showing the steam consumption per horse-power hour for the several pressures given. I call your attention also to the form of this curve. Its upper portion you will see is almost vertical. The change in performance when the pressure is increased from 175 lbs. to 250 lbs. amounts

only to 13 lbs. of steam per horse-power hour. Moreover, I would add that these curves are plotted as shown, in terms of steam per horse-power hour, inasmuch as at the higher pressures a pound of steam represents more heat than at the lower pressure. If the plottings were made upon a heat basis alone, these lines would be even more nearly vertical than they are shown.

The losses which are represented by line C D are obtained in return for great vigilance in the maintenance of boiler and engine. Small leaks occur especially at the higher pressures, which, while they may attract but little attention, become the source of serious losses. These leaks and the effect which they have upon cylinder performance are more difficult to deal with as the range of pressure increases, so that if we take an actual engine working under conditions of service, the actual performance, as measured by steam per horse-power hour, is likely to take some other curve; not the curve C D, but some curve which may be C E. That is, the expected gain when the pressure is increased actually becomes a loss through incidental causes, chiefly through leaks.

Of course, the problem of coal consumption per horse-power hour is after all that which we are after. I cannot present to you any curve of coal consumption which will be as representative as that which I have given for steam consumption, since the data covering coal performance is not yet in hand; but I do present to you a curve which I have lettered F G which represents one series of tests. All the tests which were made were made with a given cut-off, about ¼ stroke—perhaps 15 or 18 tests altogether—and you will note that on the basis of coal consumption as determined from these few tests we have the minimum consumption at a pressure not greater, at any rate, than 200 lbs., and when the pressure is increased above that limit, the coal consumption increases. The values to which the curve F G refers are given at the top of the diagram.

This presents to you in rather brief form the performance of a single actual engine as regards cylinder performance and coal consumption. I must call your attention to the fact that this is not a fair and full statement of all of the problems involved, because of the fact that the tests here were run at comparatively low pressures, with a boiler which was designed for 250 lbs. pressure. That is, it was lower than a high pressure boiler.

Suppose, now, instead of proceeding as has been done with these experiments, there had been a new boiler available for each of these different pressures, which boilers would be constant in weight, but those which were designed for low pressures would be made enough larger in their heating surface to maintain their weight; that is, suppose in this record we had taken advantage of the opportunities which the selection of lower pressure would give for increasing the size of the boiler. It would then appear that all of these lines would show a lower steam consumption and a lower coal consumption, as we go downward. That is, the upper end of these lines would at once move to the right, showing that the point of minimum consumption would be lower than the points which are shown by them, and as a problem in design, of course, it is that view which must in the end prevail.

Summarizing the statements already made and adding others thereto, the following will be found to be true:

(1.) Very high steam pressures are not essential to the development of high power.

(2.) The advantages to be obtained from an increase of pressure above any given limit are only such as may be derived from an improvement in cylinder performance, and from a reduction in the dimensions of cylinders. For all increments of pressure above 150 lbs., the possible improvement in cylinder performance will be small; above 185 lbs. it is practically negligible. As to cylinders, it may be noted that conditions external to the locomotive may sometimes require the use of abnormally small cylinders, but such conditions will not often be a controlling factor. It is true also that small cylinders permit the use of lighter pistons, and hence they tend to simplify the problem of counterbalancing.

(3.) The disadvantages to be met when the pressure is increased above any given limit are as follows:

(a) An increased weight of boiler for a given amount of heating surface; or when the designer is required to observe weight limits, less heating surface than might otherwise be used and hence a boiler of lower efficiency.

(b) Where feed water is of poor quality it increases the difficulty attending the maintenance in working condition of injectors and boiler checks.

(c) It complicates the problem of keeping boilers tight and in general adds enormously to the cost of boiler maintenance.

(d) It increases incidental losses, especially those occurring in the form of leaks of steam or water from boiler and cylinders.

From these considerations it appears that a general solution of the problem of determining what is the most economical pressure for a locomotive involves three sets of facts:

(1.) Those defining cylinder and boiler performance. (2.) Those dealing with the weight of boilers designed for different pressures and different capacities. (3.) The degree of perfection with which the locomotives are to be maintained in service.

An abundance of data covering the first two of these points is now in hand, while the third probably can never be absolutely defined.

I may say that during the summer it is expected that an analysis based upon this data to which I have referred will be made, and I am hoping that by fall I shall be able to add to this discussion something that will be more conclusive than that which I give now. Meantime, I can only say, in response to the specific question which has been assigned me, that my investigations justify the assertion that a pressure of 185 lbs. will give better results in a simple locomotive using saturated steam than would be obtained from a pressure of 200 lbs.

The necessity of proportioning brake pressure to wheel loads.

Mr. Geo. L. Fowler.—Under present conditions of high capacity cars, something more than the ordinary brake-shoe pressure proportional to the empty car should be put on the cars. Take a car of 110,000 lbs. capacity, weighing 35,000 lbs. That gives you about 145,000 lbs. on the wheels of the loaded car. The proportion of brake pressure is 70 per cent. of the empty car, which gives you practically only 17 per cent. braking pressure for the loaded car. As braking pressures are a negative accelerating force, of course, the length of run after the brakes are applied would necessarily be four times as far with the loaded train as with the empty train. I can readily understand that to apply a varying brake-shoe pressure to loaded and empty cars in ordinary merchandise service would be an impracticable arrangement under present conditions. Cars are loaded to such varying weights, they run over such varying routes, and are subject to such abnormal conditions, you might say, in reference to each other, that to make a design that would be automatic, or non-automatic, would hardly be practicable, although it has been attempted a great many times and the Patent Office is full of records of devices of this sort. But for coal trains, or ore trains, and possibly cattle trains, running in regular service, a design which can be put on a car that would cut in or cut out, as the car is loaded would be an exceedingly valuable device. It would be more valuable if the automatic arrangement could be made to operate in only one direction: to have it cut out. For example, a train runs into the mines, loads with coal and starts to the seaboard; most of these trains run down grade all the way. If such a device for adding the brake pressure is cut in, the engineman has the full advantage of the load, of its extra brake pressure; whereas, on his return, if that cuts out automatically, he has simply a brake-shoe pressure applicable to the empty cars. In actual practice such work usually means that where the device is not automatic it is not really cut out; but the enginemen become so used to a device of that sort that they use a lower train pipe reduction on the empty cars than on the loaded cars, so that the brake-shoe pressures are proportional. Investigation will show that the actual amount of air consumed on a train that is running with a device of that sort will be less than it will be where the ordinary brake is used, using 70 per cent. of the brake-shoe pressure on the empty cars. While the M. C. B. Association decided positively, possibly with the intention of only referring to ordinary merchandise cars, that it was not yet desirable to make a variation in brake-shoe pressure upon their wheels, yet it does seem that where, for instance, a difference of four times is made in the actual stopping possibilities of a heavily loaded train always going down grade, such a device and such a possibility of obtaining such results is exceedingly desirable.

"Distortion of wheel centers and tires out of round, due to heavy counterbalance on 100-ton engines." Opened by Mr. Geo. W. West.

Mr. Geo. W. West (N. Y., O. & W.): In 1900 the N. Y., O. & W. built one 100-ton engine of the simple consolidation type, with Richardson balance valves, cylinders 21 x 32 in., 48-in. wheel centers. We now have twenty locomotives of this type. When these engines were new, or after they had been through the shops receiving general repairs, they were fine riding engines, and not until the tires were worn down to about 2¼ in. thick did we begin to have complaints of hard-riding engines. Nor did we find tires worn out of round to any extent until they had been turned the second time, and it was not until we had occasion to send one of these engines to the builders for general repairs that we discovered that the steel centers were out of round. It has been our practice to true up the outside on new, as well as old, tires. The locomotive company did not true up the new tire they applied, and every engineer complained of the engine riding hard. We removed the wheels, tested the tire and found centers out of round. The wheel was compressed between the counterbalance and the hub. We found it varying from $^{1}/_{32}$ to $^{3}/_{32}$ in. If you measure some wheels, even with new tires on, you will be surprised at the result. Mechanical engineers in designing cast steel parts for locomotives and car work are making the same mistake they made in substituting malleable for cast iron parts; in a great many cases simply changing the material with no greater factor of safety.

"To what extent should an engine be repaired in the main shop, and what class of repairs could be made to advantage in the roundhouse?"

Mr. C. A. Seley (C., R. I. & P.): It is a general custom, when engines go into the main shop for general repairs to completely dis-

mantle them. In some instances this may be necessary, but in many cases it is not necessary. It is quite probable that the injector was in thorough working order when the engine went into the shop. Why should it be removed? The same thing applies to the valve and cylinder lubricators and all cocks in the cab; to the air pumps, and this can be extended to the cylinder packing and the valve packing. It would be reasonable to suppose that these parts should not be disturbed when engines are passing through the shop. As an example, consider the work necessary in case a piston and its parts are in good order and removed, as is our custom. The heads are taken down, the pistons taken out, the piston taken to the lathe, the rods turned and the diameter reduced. A great deal of care is exercised to make a polish which will perhaps be not as good as the piston had when it went into the lathe. After it is replaced it requires new packing and work is wasted. There is a possibility in going through an engine of saving from $100 to $250 by not taking down unnecessary parts. This amount, applied to the number of engines held in a large shop will make a very considerable sum. Where the reduction of expenses in maintenance of locomotives is carefully watched, advantage can be taken of this. If the condition of an engine is accurately ascertained before shopping, and the master mechanic or others in charge of the engine, in sending it to the shop, give the shop full instructions as to what is to be repaired and what is to remain untouched, a large saving can be effected.

Mr. G. R. Henderson: Several years ago I adopted the system of having an individual card for each engine, and when the engine went out of the shop the cost of repairs and the general nature of repairs was stated on the cards. The next time the engine was sent to the shop it was reported beforehand, and it was a simple matter to look up and find out how much it had cost the last time it was repaired, and the work which the engine had done since it was last in the shop. The mileage made by the engine was recorded on the card, and you could tell at once whether the engine had made a sufficient mileage to warrant general repairs. If we found that the mileage performed by the engine since it was last shopped was comparatively small for the cost of the repairs, we sent instructions to the shop that only such work should be done upon the engine as was actually necessary, and called attention to the fact that only a small mileage had been made for the comparatively large cost of the previous repairs. We found that some shops made a habit of taking everything off the engine and scrapping parts that could be used and made to serve without any defect to the service.

"*Relative advantage of the piston valve, as compared to the slide valve.*"

Mr. E. A. Miller (N. Y. C. & St. L.): A test of four piston-valve engines made on the N. & W. shows, first, that old rings, old bushings and old valves in good condition showed an average leakage of steam through valves condensed of 267 lbs. of water; second, with new rings, new bushings and new valves, 539 lbs. of water; third, with new rings, new bushings and new valves in good condition, 288 lbs. of water; fourth, old rings, old bushings and old valves in good condition, 399½ lbs. of water, or an average steam leakage of 374 lbs. of water per engine for one hour.

Two slide valve engines tested on the N. & W. show an average leakage of 459 lbs. of water per hour, or 85 lbs. more than the average of piston-valve engines. The report of nine piston-valve engine tests on the L. S. & M. S., on a machinery mileage of from 13,000 miles per engine to 77,000 miles per engine, shows the lowest steam leakage to be 540 lbs. of water per hour, and the greatest steam leakage to be 2,880 lbs. of water per hour. Average machinery mileage of the nine engines is 39,700 miles per engine. The average steam leakage of the nine engines was 1,654 lbs. of water per hour. The report of the eight slide-valve engines on the L. S. & M. S. shows a machinery mileage of 26,750 miles per engine and an average steam leakage of 1,384 lbs. of water per engine for one hour, or 270 lbs. less per engine for one hour than the piston valve. While this report is favorable to the slide valve, as compared with the piston valves, so far as steam leakage is concerned, tests made by the Master Mechanics' Association committee in 1904 for valve leakage show both the piston and slide valves leaking more steam than should be allowed. An interesting part of the test made by the N. & W. is the table showing 222 engines equipped with piston valves. Number of rings per engine, 12; number of rings broken in 16 weeks, 266; number of rings removed for wear, etc., in 16 weeks, 314; total number of rings removed in 16 weeks, 580. This shows a considerable increase in the cost of repairs for the piston valves, as compared with the balance slide valves, which are usually run from shopping to shopping of engine without renewal of parts. Any change in valves or other parts of locomotives that will increase the repair work or the time that engines are held out of service should receive very careful consideration before being adopted as recommended practice. In testing two of our piston valve and two of our balance slide valve engines for valve leakage, we have the following results: Engine 141, piston valve, steam pressure, 200 lbs., machinery mileage, 36,850 miles; valves placed central, right valve steam leakage, 280 lbs. of water per hour; left valve, steam leakage, 343 lbs. of water per hour. Second test: Right valve, 5/8 in. ahead of center, left valve placed 5/8 in. back of center. Right valve steam leakage, 212 lbs. of water per hour; left valve, 351½ lbs. of water per hour. Packing rings in good condition, bushings worn 1/16 in. oblong; also 1/64 in. hollow. Engine 134: Piston valve, steam pressure, 300 lbs.; machinery mileage, 55,770 miles. Valves placed central. Right valve, steam leakage, 325 lbs. of water; left valve, steam leakage, 300 lbs. of water for one hour. Engine 45: Balance slide valve, steam pressure, 180 lbs.; machinery mileage, 33,846 miles. Valves placed central, right valve, steam leakage, 148 lbs. of water for one hour; left valve, steam leakage, 156 lbs. of water for one hour. While making this test the right valve was moved backward and forward about 5/8 in. by moving reverse lever. Valves not examined. Engine 49: Balance slide valve, steam pressure, 180 lbs.; machinery mileage, 33,116 miles. Valves placed central, right valve, steam leakage, 150 lbs. of water for one hour; left valve, steam leakage, 122 lbs. of water for one hour. The valves and seats, also balance strips and plates of this engine examined and found in first-class condition. In all of these tests the exhaust pipe opening was locked, so that every particle of steam leaking through valves was condensed. In this test the two piston-valve engines were from ten engines of the piston-valve class in freight service. The two balance slide-valve engines were also from ten engines of the balance slide-valve class, and in both cases the engines were taken for testing just as they happened to come into the terminal when test was made. While the average machinery mileage of the two piston-valve engines was 46,310 miles per engine, and the steam pressure 200 lbs., as compared with 33,482 miles and steam pressure of 180 lbs. for the slide-valve engines, nevertheless, the average of steam leakage of 624 lbs. per engine for piston valves, as compared with 288 lbs. for slide valves, is much in favor of the balance slide-valve engine. This test was with the plain Richardson balance slide valve and the piston valve with central steam admission, snap rings, as furnished by the American Locomotive Company. In the case of the slide-valve engines the valve seat, the balance strips and plates were newly fitted up, and in the case of the piston-valve engines the rings were new, but the bushings were not bored out. The engines had only been in service about a year at that time.

Mr. Wm. McIntosh: We have a large number of piston-valve engines in service, and they apparently wore so smoothly in the steam chambers that for a considerable period after they were put in service we did not consider it necessary to bore the chamber down, but on later examination we found they were wearing more or less. We thought it was advisable and necessary to true the chamber up at reasonable intervals in order to obtain necessary results and avoid excessive leakage, which is otherwise bound to occur.

Mr. J. F. Walsh (C. & O.): We have 75 engines, 22 x 28-in. cylinders, weighing 100 tons and carrying 200 lbs. of steam, equipped with 23-in. slide valves. It was next to impossible for the enginemen to handle these engines in the switching service in the yards running in and out of the coal mines on account of the difficulty of moving the reverse lever. We had to provide some easier means of handling these engines, and we took up the subject of piston-valve engines.

We have about 150 piston-valve engines. These engines have been in the service all the way from six months to three years. We have had little trouble from the cutting out of either valve or chamber bushings—not as much trouble as we had in renewing balance strips in the ordinary D valve. We have comparatively little trouble with them, as far as valve steam leakage is concerned. They are central admission valves, consequently all the leakage at the valve stem end is from the exhaust, which amounts to nothing, whereas with D valve engine you have a constant leakage from the valve stem packing. We do not know what it is to have leaky steam chests on the piston valves, and did not know what it was to have tight ones on the D valve. There is so much in favor of the piston valve, as against the D valve, that there is not much argument as to which is the best. The wear on the valve motion in the case of the piston valve is nothing in comparison with what it is in the case of the D valve engine. Such a thing as a distortion of the eccentric rods, which we are commonly subjected to with the D valve engines, is almost unknown in the piston valve engine.

Mr. F. Slater (C. & N. W.): In regard to the piston valve for large engines carrying high pressure we found in using the large slide valve it is almost impossible to operate the engine. The cost of facing the valve is great, and it has to be done frequently.

Mr. John Player: The comparative measure of the leakage of the piston and slide-valve engine should not be taken as the measure of the efficiency of the valve. It must be remembered that the length of the port in the piston valve engine is nearly double what it is in the slide valve engine. Consequently, in the case of a leakage measured by the efficiency of a port the leakage of a piston valve engine is considerably less than it would be in the case of a slide valve engine.

Mr. F. M. Whyte: The figures quoted by Mr. Miller are not correct for ordinary operation of the locomotives. It is usual in passenger service to have 200 lbs. pressure in the steam cylinder but a

very small part of the time. For freight service, of course, that pressure is in the cylinder a greater proportion of the time. Also the pressure on the other side of the valve, the exhaust pressure, is greater than what was experimented with. The leakage ought to be considerably less than the figures indicate.

Mr. John A. Pilcher (N. & W.): We made the test referred to on the N. & W. road in 1904. In these particular tests the leakage of the piston valve was less than the D valve or slide valve. The experiments on the road seem to indicate otherwise. The engines tested at that time were engines taken at random as they came into the shop, some just as they were going out and some just as they were going in. In some cases on the slide-valve engines we were not able with the apparatus we had to tell just what the leakage was. In the case of the piston valve engines, in all of them, we put mercury gages in the cylinder and measured the leakage as it passed through the cylinder cock openings. In most cases, on the piston-valve engines, there was no trouble in registering the leakage. Instead of having at this time over 200 engines with the piston valve, we have something over 500 engines with the piston valve, and all of them have been put on the road since the time we made the test.

Mr. S. T. Park (Mich. Cent.): With the piston valve the engineer cannot tell readily whether his valve is receiving the proper amount of oil, and that, no doubt, causes more or less broken rings and other parts, which is not true of the slide-valve engine. We took some indicator cards of the piston-valve locomotive at one time, and in order to tell the effect of running the valve dry one side of the locomotive was run practically without oil for fifty miles, and so far as the reverse lever was concerned, you could tell no effects from the dry valve, but the man taking the indicator card could see a noticeable difference in the travel of the valve stem.

Mr. E. A. Miller: In answer to some of the remarks which have been made in regard to lowering the cost of repairs of valve material by using the piston valve, it was our lot to get 30 consolidation engines of the piston-valve type, with solid valves. That has been shown to be a mistake, but they were put out by the locomotive works with the solid valves. Very quickly there developed a large breakage of eccentric straps, eccentrics, transmission bars, eccentric rods, rockers, etc. These are the figures for nine months:

Type of engine 8-wheel, freight balance valve: Engines 15, failures, 4; average failures per engine, .20.

Ten-wheel freight, balance valve: Engines 55, number of failures, 20; average failure per engine, .36.

Mogul engines, balance slide valve, 20 in service; number of failures, 2; average failure per engine, .10.

Consolidation, piston valve: Number of engines in service, 30; failures, 47; average failures per engine, 1.56, or 64.3 per cent. of failures for the piston valve, as compared with 2.7 for the mogul, 27.5 for the ten-wheel and 5.5 for the eight-wheel, balance valve. We changed the solid valves and put in the hollow piston valves and reduced the breakages materially.

Address of President Ball to the Master Mechanics' Convention.

. . . The tendency in locomotive building during the year has been along conservative lines, no radical changes in general design being noticeable. The four-cylinder balanced compound has not progressed in general favor as rapidly as was anticipated, its extended use being confined largely to those roads which participated in its early introduction. In view of the economy obtained in tests at the St. Louis testing plant, it is certainly deserving of more attention.

The Mallet type of locomotive, which is specially designed to meet conditions requiring a very powerful locomotive, is another type which is not being introduced as fast as its merits will warrant.

The most noteworthy change in detail design of the locomotive, one that marks a departure from long established American practice, is the acceptance of the Walschaert valve gear. This form of valve gear lends itself admirably to the heavy locomotive, having advantages in the way of accessibility for inspection and repairs, lightness and freedom from rapid wear.

The rapidity with which this gear has grown in favor with enginemen, as well as those who have to do with the maintenance of the engine, promises well for its future. Up to the 1st of January, 1905, there were 248 locomotives equipped with the Walschaert valve gear in this country; and as an indication of the tendency toward the general adoption of this gear, one road to-day has 225 engines equipped with it.

In boiler design, much has been done incidental to the introduction of the superheater, and more will undoubtedly follow as designers take up the problem of superheating of steam for locomotive engines. Apart from this, the most radical departures in boiler design are found in the use of a combustion chamber, in long boilers using bituminous coal, with attendant remarkable results in overcoming rapid deteriornation of flue ends and leaking. It is also worthy of note that the flexible staybolt is steadily gaining ground.

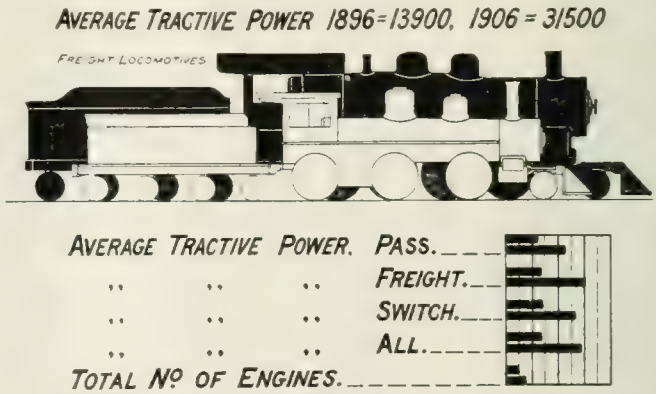
To meet the changed conditions in railroad operation, as a result of the growth of locomotives in recent years, no equipment detail furnishes a better example of progress than the advancement made in car braking appliances. The problem of braking trains having from four to five times their former weight, with double the number of cars, has been solved successfully, and with apparatus greatly simplified. The new engine and tender equipments represent a consolidation of all previous locomotive equipments, as far as effects are concerned, with a centralization of the functions of the different apparatus into one unit, thereby eliminating a great many parts.

Aside from what has been accomplished in the direction named, changes for economy of operation have also received attention. The introduction of the cross-compound air pump is opportune. The demands for air have increased to such an extent as to represent quite a large percentage of the boiler capacity for its production. It has been found that under normal working of a large freight locomotive hauling a train of 65 cars, 50 of which were air-braked, at 20 miles per hour, the simple air pump requires approximately 6 per cent. of the steam generated. If a portion of this can be saved by compounding, such saving should not be overlooked. Tests which have been made, show an economy for the compound pump, of 60 per cent. over the simple pump.

A list of improvements in details would not be complete without a mention of the advancement made in the art of manufacturing rolled steel wheels. Their increasing use promises well for this type of wheel.

The motive power problem: "reduced cost per ton-mile of transportation," is presented to us to-day for solution even more forcibly than it has been presented to those who preceded us, and is deserving of more careful consideration and study than has been accorded it heretofore. This is not merely a mechanical problem. How has the problem been met from a motive power standpoint? By providing a locomotive, the size of which has only been limited by the governing clearance dimensions. But there is something more that we can do.

It may not be out of place to refer at this time to the advancement that has been made in power capacity during the past ten years, and to reflect with pardonable pride on our having participated in the splendid movement in the upbuilding of the locomotive, which the following figures represent. The data was obtained from a road with which you are all familiar and is fairly representative of the progress which has been attained on all roads in the country. To better illustrate figures, diagrams have been prepared.



In the years 1896 and 1906, the average tractive power for each class of engine was as follows:

	1896.	1906.
For freight engines	13,000	31,500
For passenger engines	12,200	22,900
For switching engines	14,700	26,800
For all engines	13,700	28,700
Total number of engines, all classes	551	764

During the period of evolution represented by the foregoing figures, new difficulties arose; new problems required solution. In the desire for adequate boiler capacity within the limits of dimensions and weights imposed, errors were made in boiler design in restricting the depth of the firebox, in the spacing of the flues and in the use of abnormal grate areas. With the greater use of cast-steel, advantage was taken to reduce weights of details to the extent of contributing the weight thus saved to further increase the boiler dimensions. In some cases, such as wheel centers and frames, the lightness of the parts did not always result in failures, but their weakness contributed to the rapid wear, or failure of other dependent parts, and in other cases, failure of the parts themselves.

Experience has shown where errors of design have been made and a new basis for future calculations has been evolved, which has placed present design and construction on even a more satisfactory plane than that obtained with the lighter power. When the large locomotive went into commission the practices in vogue for the care and maintenance of the locomotive fell short of bringing results. In many cases they brought disaster. Much of this was attributed to poor design, when in reality the trouble lay in other directions. It was found a difficult matter to overcome flue leak-

age. A study of this subject by very able specialists in the motive power department has resulted in giving us definite rules regarding the care of the boilers, both on the part of the enginemen and roundhousemen, which are being extensively followed, with results as good, or better than were formerly obtained. The machinery of the locomotive, being heavier, also required special treatment at terminals, involving the adoption of the "stitch-in-time" policy, to keep the engine up to its maximum efficiency, and to avoid rapid deterioration which was found to result from any neglect.

To provide the care necessary for the large locomotive involved the expenditure of large sums for adequate terminals. Facilities for quick and frequent washing of boilers became imperative. Better drop pits, and more of them, were necessary. Engine houses with heating plants that would heat, and smoke jacks that would ventilate, were required. The lighting of the house at night to provide for a continuous operation of the plant on an efficient basis was a recognized improvement. All this has been accomplished and to-day we can be congratulated on having reached a plane of excellence, both in the design of the locomotive and in maintenance facilities, whereby the large locomotive is being handled just as expeditiously as the smaller one was, a few years ago.

Reports presented to this association on the subject of roundhouse terminals at two former conventions have had a marked influence in directing railroads to the appreciation of their shortcomings in the way of adequate terminals and facilities and have played no small part in bringing about improved conditions.

How shall we meet the motive power problem in the future?

The rapid growth in power which has marked the development of the locomotive in the past few years, and by which great economies of operation are being obtained, has apparently been arrested by the limitation of clearances, capacity of the firemen, and the reaching of the practicable train-length limit. It would therefore appear questionable to look for further economies, as a general proposition, by continuing to enlarge the locomotive under present conditions. The solution of the problem lies in other directions:

We shall be required to develop the mechanical stoker; compounding and superheating will be prosecuted with greater vigor than ever. The use of a feed-water heater may be resorted to, and among the smaller items, undoubtedly the compound air pump will be used, and perhaps the variable exhaust nozzle. We now have engines that will run successfully from terminal to terminal, and have reached a plane in the economical maintenance of our locomotives whereby the use of the foregoing fuel saving devices will make more apparent than heretofore the economies resulting therefrom. While considering the use of fuel saving devices, we must not lose sight of the economies that may be obtained through individual effort, with the facilities at hand.

This naturally leads to the subject of statistics. In following up fuel consumption on the average railroad, particularly where the pooling system is in vogue, the need for an up-to-date method of determining responsibility for the extravagant use of fuel is very apparent. Given proper weighing facilities, the problem presented is a systematic method for quickly determining at the end of each trip whether or not the coal used was in excess of the work performed, and, if so, the immediate placing of the responsibility either with the crew or engine, as the case may warrant.

Another phase of the motive power problem is the subject of organization. This subject has been referred to by former presidents, and while it is an old theme it presents increasingly difficult problems, if we would successfully cope with the progress of transportation. To obtain the best results in any organization, no one factor should be overtaxed. The progress of our railroads has been so great and the increase in business, while gradual, has been so persistent, that one is liable to awaken too late to the realization of having an organization inadequate to the demands placed upon it.

Consolidation of properties, and growth, have depreciated positions of the motive power department, compelling men to assume responsibilities beyond their positions. Those who have studied industrial and military organizations find that one officer will supervise not to exceed from 26 to 30 men; while in railroad organizations, this will extend to 150 men.

In analyzing the results of consolidation, we find a master mechanic in charge of two or more divisions, where formerly only one was under his jurisdiction. After thus greatly increasing his duties, added responsibility was placed upon him by increasing the capacity of the locomotive from 50 per cent. to 100 per cent. and rapidly increasing their numbers. The same is true of roads which have not gone through the evolution of consolidation, brought about by natural growth.

We find that work is now being performed at important division engine houses of a character that was formerly taken care of at division shops. The work is supervised by the engine house foreman, acting in the capacity of the former division master mechanic, having oftentimes no special advantages at his command in the way of facilities for turning out work, with the disadvantage of an official title, the possession of which gives to the incumbent no consideration for either adequate compensation for services rendered, or proper respect for those under his jurisdiction, or consideration from those in other departments with which he comes in contact. The modern engine house requires a bigger general at its head than the former small shop.

What has been said of the enginehouse foreman is also applicable to those subordinate in authority to him, and to those occupying similar positions of equal or greater responsibility in the shops, particularly as to compensation. Increases in wage rates granted to laboring men from time to time very rarely apply to the foreman, with the result, in many cases, of finding the men receiving more per month than those responsible for their direction. It may be stated that overtime rates have much to do with this condition. True, but who puts in more overtime than the average subordinate official, receiving a monthly stipend? An efficient organization, under the conditions mentioned, cannot be built up or maintained.

The large railroad to-day should have in its motive power department more division master mechanics, each to have allotted to him for care and maintenance such number of locomotives as can be properly looked after, and to the extent that he may know the shortcomings and weaknesses of each individual engine and be held responsible for its performance and cost of maintenance while out of main shop. This may require his having jurisdiction over two or more engine houses. The main shops on each grand division to be supervised by a shop superintendent, who will be held responsible for cost per unit of shop output; each grand division to be in charge of a division superintendent of motive power; and over the entire department, an official on the staff of the president, having a thorough understanding of the department, as to its details and needs, and of sufficient knowledge and experience to present the motive power problem, and to show that it is an element in the operating problem. It is gratifying to note that one such position has recently been created on one of our more important railroads.

Another detail of organization, which is part of the motive power problem, is the establishing of systems of apprenticeship, under proper supervision, whereby the apprentice can, and will be assured a thorough, practical course of training in the shops, and for those who show the aptitude, or inclination, a special course, with the end in view of providing sufficient technical training to fit them for positions of responsibility. The apprentice of to-day is rapidly drifting out of sympathy with his employers, by reason of the indifference displayed toward him by those having him in charge. To offset this tendency he must feel that the employers have his welfare at heart, and this can only be accomplished in these busy times by having an apprentice department with an official at its head, to relieve those in immediate charge. A very thorough and competent organization of this character is now in operation on the New York Central Lines.

Considerable thought and experiment has been devoted during the past year to the development of a motor car which could be used for branch line service, corresponding to the service furnished by the interurban electric car. The most promising field of effort has been the gasolene motor. Others have followed in the footsteps of our foreign friends and have experimented with steam, using oil for fuel. What the outcome will be cannot be conjectured at this time. It is safe to say, however, that with the demand for such a car in sight and American ingenuity at work, a satisfactory car will be evolved in due time.

The association has before it for consideration reports of unusual interest and exceptional value. . . .

The report and discussion on the subject of mechanical stokers should stimulate interest in the development of this exceedingly important detail of locomotive construction. We should know more about stokers, and the association has acted wisely in appointing a standing committee to report progress being made from year to year.

In the discussion of classification of locomotive repairs an opportunity is presented to get into the commercial questions of the department. This phase of the subject has not received the attention it deserves, and herein lies a great opportunity for motive power men.

In discussing the details of engine house running repair work it is absolutely necessary to treat the proposition as a whole, with the view of facilitating operations at terminals to meet the needs of the operating department.

The report to be presented on the subject of "Electricity on Steam Railroads," is worthy of the most careful consideration and discussion. In view of the economy obtained in tests of the locomotive on the Pennsylvania testing plant, where it was shown that a locomotive was capable of delivering a horse power at the drawbar upon the consumption of but a trifle more than two pounds of coal per hour, the discussion of this paper should excite more than ordinary interest.

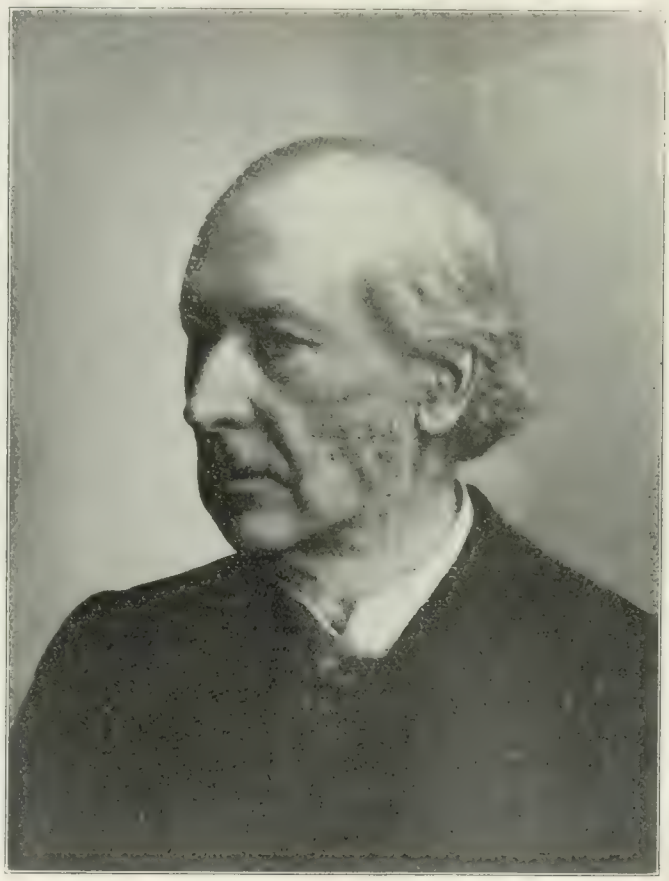
In the upbuilding process toward a higher plane of excellence of the steam locomotive, the association has for its future work the further development of the stoker, the superheater, the compound, and other details standing for lesser economies of operation, and with the end in view that their application may become general in

character, the working out of a better system of statistics which will show us where we stand and put us in possession of the business facts concerning our department, making them immediately available.

For the department as a whole, the association has for future work, organization as it applies to modern shops and engine houses; up-to-date apprenticeship systems applicable to large corporations; development of motor cars for light passenger service; establishment of a bureau for scientific research work.

In connection with the latter recommendation, this association should make provision for a bureau with a salaried official at its head, to whom research work of a scientific character required of committees can be referred, through the Executive Committee. This would add value to reports and would relieve members of committees of a large amount of detail work to which they cannot always devote the time necessary for a thorough investigation of the subject.

The time is past when a motive power officer should be merely a good mechanic and manager of men. He must have these attributes and much more also. He is called upon to-day to be a mechanical engineer in the design of locomotives, an executive in the management of a great department, an organizer in the building up of the department—keeping it abreast of the increasing difficulties of the problems. He must be a business man in knowing the costs of his work and in making every dollar of the stockholders' money bring the greatest returns. He must be a diplomat in dealing with the other officials and a general in managing his subordinate officials and his men. These qualifications a man must possess in order to be an important official in any large industrial organization, but in a motive power position additional qualifications are required which are best summed up in the statement that he must be a railroad man ready for any and every emergency and ready to fit his work into that of others in such a way as to complete an exceedingly important corner of the organization.



Sir Frederick Peel.

In fitting our work into that of the operating department lies an opportunity which is perhaps our greatest opportunity of the present time. Up to a certain point we can go with our own office, and up to a certain point we may introduce improvements, but beyond that point we cannot go without the heartiest co operation of others. And it is in the direction of securing this co-operation, or in applying the operating possibilities of our positions, that our greatest future lies. That the operating officers shall consider the motive power men as their strongest supporters and most helpful allies in the difficulties of their work should be our aim, and in this direction the motive power department can undoubtedly go much farther than it has ever gone, and it is to the importance of this that I direct your attention most earnestly.

We should co-operate to secure mileage of our engines, always bearing in mind the fact that locomotives are not intended to make good repair records; so much as to pile up ton mileage. If the ton mileage is not always obtained the railroad machine is not working to its best advantage, and there may be good reasons for this. By helping the operating official we may find that he can help us, and in the development which tends toward the most favorable operating service lies our greatest work for the future.

Let us remember that we are not merely heads of departments. We are officials of railroads striving to increase to the utmost the net earnings, and when we have gone to the limits of our ability as mechanical men we have yet a long way to go in the direction of the operating men to improve the results. By always conducting our department so that the motive power is ready for any emergency we shall help the department, help the other officials and incidentally help ourselves. There is more before us than is behind us in the way of improvements, and there is no work to-day lying before any class of men which is more important and more inspiring than that in which we are engaged.

Sir Frederick Peel.

A link with the British railroad legislation of 30 years ago has been broken by the death at the age of 83 of Sir Frederick Peel, the first President of the Railway Commissioners. As a railroad tribunal these Commissioners were brought into being by the Regulation of Railways Act, 1873, which was the outcome of a report by a joint committee of both Houses in 1872.

The Commissioners of that day were three in number. Sir Frederick Peel was appointed President, Mr. H. Macnamara represented the legal element required by the act, and Mr. W. P. Price (a former chairman of the Midland Railway) supplied the necessary railway experience. Sir Frederick Peel himself was neither a lawyer nor a railroad man. Though called to the Bar in 1849, after a brilliant career at Cambridge, he never practised, and devoted himself almost at once to politics, as became the son of a great Prime Minister. In quick succession Under Secretary for the Colonies, Under Secretary for War, Privy Councillor and Secretary to the Treasury, Peel was, nevertheless, content to leave politics alone for 20 years' experience of them. He was thus one of those "men of affairs" who make the best chairmen, and the many judgments which he has left on record show that he possessed in an eminent degree the judicial mind. This was all the more important as the duties assigned to the new body were highly responsible. To the Railway Commissioners were transferred the jurisdiction originally given to the Courts of Law by the Railway and Canal Traffic Act, 1854, over complaints against railroad companies as to refusal of facilities, undue preference and such like. They were also empowered to deal with differences between railroad companies and to take over the powers of the Board of Trade as to revision of working agreements, and as to the exercise of steamboat powers of railroad companies. The Commissioners were also given power to fix terminal charges.

Sir Frederick Peel continued to preside over this tribunal until the alteration of its name and constitution by the Railway and Canal Traffic Act of 1888. While it lasted there was only one change in its personnel, Mr. Miller, Q.C., having succeeded Mr. Macnamara. After 1888 the Railway Commissioners became the Railway and Canal Commission with revised and extended powers. Both Sir Frederick Peel and Mr. Price remained members of the new tribunal, but Sir Frederick was no longer President, while Mr. Miller retired.

The "old" Commissioners were all appointed, had only one President and sat only at Westminster. The new Commission varies its place of sitting and its President according to the "domicile" of the matters which it is to consider. While its two "appointed" members adjudicate at every sitting, they are presided over in England by an English judge, in Scotland by a Scotch judge, and in Ireland by an Irish judge. These judges are the *ex officio* members of the Commission.

During his long connection with the Railway and Canal Commission, Sir Frederick Peel witnessed many changes in its personnel. Mr. Justice Wills, who has only lately retired from the Bench, was its first English President, and survives him. The Present Master of the Rolls followed Mr. Justice Wills, and because of elevation to the Court of Appeal gave place to the late Mr. Justice Wright. Upon the death of the latter judge Mr. Justice Bingham became President. Sir Frederick Peel also had three different "appointed" colleagues on the Commission. First, Mr. Price, who died in 1891, then Viscount Cobham, who retired in 1905, and gave place to Mr. Gathone Hardy.

In his judicial duties Mr. Frederick Peel retained to the last the alertness of mind which was one of his chief characteristics. Moreover, his judgments, when in conflict with those of his brother Commissioners, were not seldom supported by higher courts.

New York Central All-Electric Signaling at New York.

As heretofore announced in the *Railroad Gazette*, the contract for all the block signaling and interlocking in the electric zone of the New York Central & Hudson River Railroad was awarded to the General Railway Signal Company of Buffalo, the largest signal contract ever awarded, and embodying an important advance in the art of signaling.

Both block and interlocking signals will be all-electric, operated by current taken from a power line running the whole length of the system. All track and signal circuits will be operated by alternating current; the only batteries to be used being storage batteries for the operation of interlockings, which will be charged by an AC-DC motor-generator drawing current from the power line.

In comparing proposals, the railroad company gave special consideration to safety and reliability and economy of operation, and also to quickness of delivery and erection, and the selection of this system was made only after the most systematic and careful deliberation.

At terminals and on short sections at interlockings, it was practicable to give up one of the rails of each track for signaling purposes, but for the greater part of the system it was of considerable advantage to the electric traction system to allow both rails of each track to be used for the return propulsion current, and this is done.

The system offered by the General Railway Signal Company, and known as the "Young system," was adopted. Alternating current is used for track circuits in connection with reactance bonds, permitting the passage of the direct propulsion current freely through both of the running rails, while impeding the alternating current used in signaling.

Track plans showing the spacing and arrangement of all signals were prepared by the railroad company, and together with specifications were submitted to all of the signal companies capable of handling the work. Separate bids were requested for the block signaling and the interlocking work.

To assist in finally deciding the system to be adopted, bids for block signaling were requested in eight different forms, covering both normal clear and normal danger systems, all-electric and electro-pneumatic design, and either with one rail of each track given up for signaling purposes or with both rails left available for power return.

Bidders were encouraged to make suggestions as to design and requirements of specifications, so that the specifications might not restrict the exercise of their best skill. In canvassing the proposals the Signal Committee of the New York Central Lines was called into consultation, and every feature was gone over in detail.

The work included by the contract covers what is known as the "electric zone," extending from the Grand Central Station, New York City, north to Croton, on the Hudson division, 35 miles, and from Mott Haven to White Plains, on the Harlem division, 19 miles. Throughout this distance there will be four main tracks, and the work includes about 3,000 interlocking levers and 1,400 track circuits, aggregating about 250 miles of track.

The work to be undertaken at the present time covers only that portion of the road to be electrified this year, which carries the work from the Grand Central Station to High Bridge on the Hudson division, six miles out, and to Wakefield on the Harlem division, about 12 miles out, or seven miles from Mott Haven junction, which is just above 138th street station.

Figure 1 is a sketch showing the lines of the electric zone. The two main power stations are at Port Morris and Yonkers. These deliver three-phase alternating currents of 25 cycles and 11,000 volts pressure. At the sub-stations this current is transformed and converted to direct current at 666 volts for delivery to the third rail for operating purposes.

The transformers for the signal service deliver alternating current at 3,000 volts to the signal transmission line, which, although extending the entire length of the district to be signaled, is cut half way between each pair of sub-stations, thus making that portion of the line fed by each sub-station entirely independent of the adjoining one.

The apparatus in each sub-station is protected with automatic and hand-operated switches. Should the alternating current fail, DC-AC motor generators, taking current from a storage battery in the sub-station will continue to feed the signal transmission line with alternating current so that the signals will work wherever trains can be moved. A synchronizer is installed between the transformer and the motor generator set.

The 3,000-volt transmission line is of No. 0 bare copper wire, carried on the pole line (with the power line) and in conduits, also with the power line, where there is not room for poles, and in other places. Fig. 2 shows the design of the poles.

Signal bridges are equipped with extension brackets, with cross arms for convenience in running wire lines to signals, as shown in Fig. 3. The standard signal bridge to be used on the four-track line is 21 ft. 6 in. high from the base of rail to the bottom of the

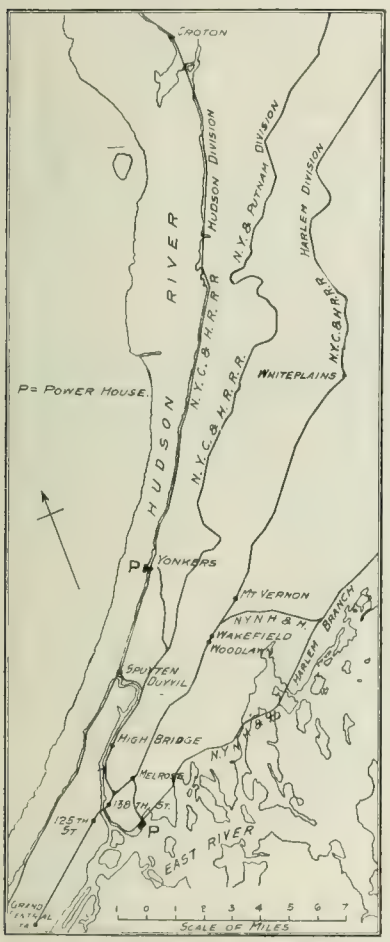


Fig. 1—Electric Zone of the New York Central.

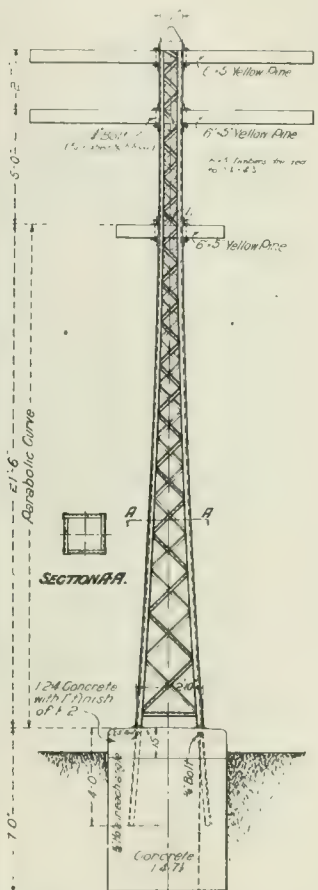


Fig. 2—Pole for Transmission Line.

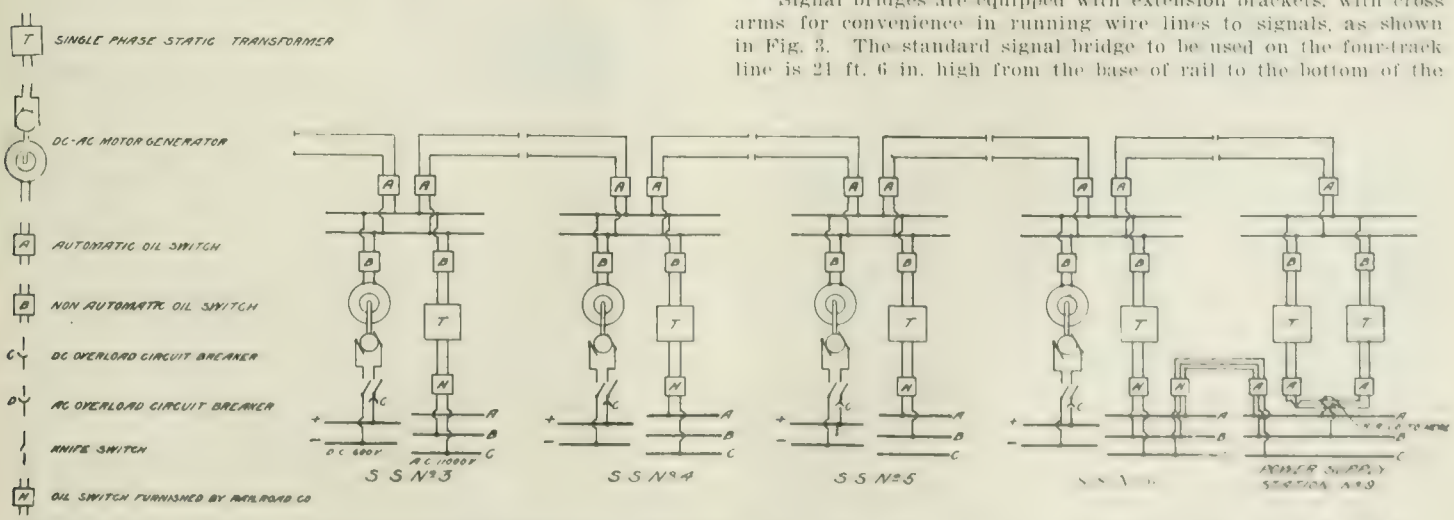


Fig. 4—Connections for Power Supply Equipment for Interlocking and Automatic Block Signals at Sub-stations 3, 4, 5 and 6.

bridge, and the truss [illegible] for spans of 51 ft. and less, and 7 ft. deep for spans [illegible] 51 ft. The truss is 6 ft. wide. The assumed loading on the trusses is one signal of 2,500 lbs. on the center line of each truss, 30 lbs. of snow per square foot, which equals 220 lbs. per [illegible] of truss, and a wind load of 30 lbs. per square foot of exposed bridge surface. The load due to the transmission lines and their supporting pole, including wind and ice, is calculated at 15,200 lbs.

The standard pole for electric transmission lines, Fig. 2, is designed to carry six high tension conductors. The pole is made up of four angles 3 in. x 3 in. x $\frac{1}{16}$ in. In cuts the top of the foundation is 6 in. above the base of rail, and on embankments it is 6 in. below the base of the rail. Each pole is grounded by a No. 3 annealed solid copper wire. The foundation is 7 ft. deep and 5 ft. square.

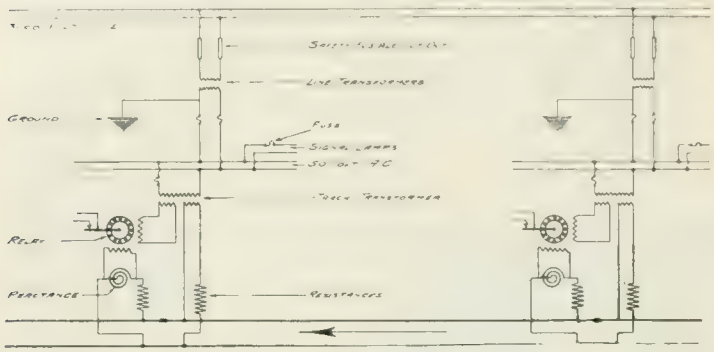


Fig. 6—Typical Alternating Current Track Circuit, with One Rail Given Up for Signaling Purposes.

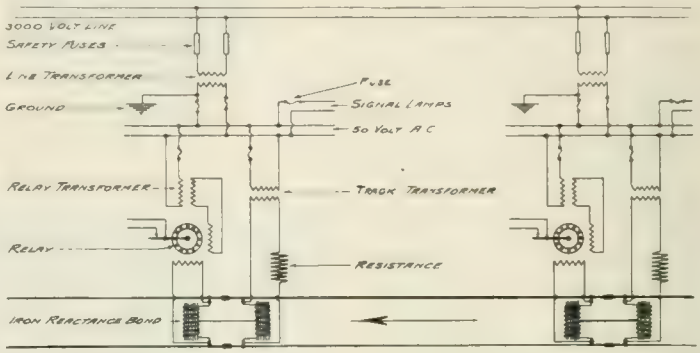


Fig. 7—Typical Alternating Current Track Circuit, Two-Rail Return, Iron Reactance Bond.

For the operation of signal circuits, signal motors, indicators and signal lighting, the 3,000-volt current is stepped down to 50 volts through transformers placed on signal bridges or the poles. The secondary of the transformer is provided with a ground connection, formed by burying a 2 ft. x 3 ft. x $\frac{1}{16}$ in. copper plate, to which is brazed a No. 4B&S gage copper wire.

For track circuit operation the voltage depends on the length of track circuits, and varies from 1½ volts for circuits of 200 ft. to eight volts for circuits of 5,000 ft. The reduction from 50 volts to the track voltage is made by a transformer provided with four taps, which will permit of one type of transformer being used on all track circuits.

Diagrams of connections for power supply equipment at typical sub-stations are shown in Fig. 4.

In laying out the block signaling plan, the length of the block was determined by the braking distance. For speeds not exceeding 45 miles an hour the blocks were made 1,200 ft. long; for speeds between 45 and 60 miles an hour 2,500 ft., and for speeds over 60 miles an hour 3,000 ft., the average length of the long blocks being about 3,200 ft. All blocks have a full block overlap. A distant signal is provided for each home signal, and as a rule it is on the post of the home signal next in the rear. If this is not far enough back for the speed desired, the distant signal situated two block sections back is connected and controlled. On account of the density of traffic and the necessity for quick operation the signal motors are designed to clear the signal in three seconds. Typical arrangements of the block signals are shown in Figs. 5 and 5a.

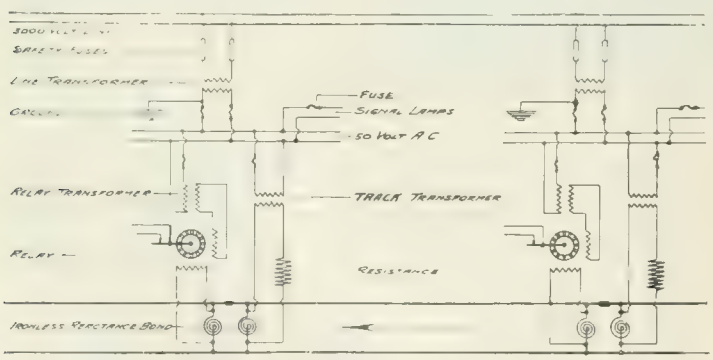


Fig. 8—Typical Alternating Current Track Circuit; Two-Rail Return, Using Ironless Reactance Bond.

The track circuits are of three types, as shown in Figs. 6, 7 and 8. Where they are 500 ft. or less in length, and where the drop in potential in the length of the track circuits is not greater than 50 volts, the "one rail" system is used, and one rail of the track is given up for signaling purposes. This arrangement is shown in Fig. 6. There being no direct current on the signal rail it is not necessary to use reactance bonds.

On all track circuits over 500 ft. long the "two rail" system is used, and both track rails are used for the return of the direct power current. On these circuits it is necessary to use the reactance bonds, by which a connection is made around the insulated rail joints, permitting the direct current to pass, while impeding the alternating current.

The insulated rail joints are of the Weber pattern, with a steel angle plate on the inside.

On track circuits between 500 ft. and 1,600 ft. long the "two rail" system is also used, and the reactance bonds consist of a copper bar 1 in. in cross-section and 30 ft. long coiled in eight turns around an iron core (Fig. 7). The construction of the reactance bond is shown in Fig. 9.

For track circuits over 1,600 ft. long a reactance bond formed of a coiled copper bar without any iron core is used. This circuit is shown in Fig. 8.

In a one-rail block section the propulsion current flows along the continuous rail, and in the event of a defect in this rail, the current must avail itself of the conductivity of adjacent tracks, and all of the tracks are cross bonded for this purpose (Fig. 10). In sections of the two-rail system each of the traffic rails of a track forms a separate and independent conductor so that if one rail is interrupted the other would act as a return conductor, even if there were no cross bonding to adjacent tracks.

The use of two styles of bonding was determined by the cross bonding for the electric traction system. The engineering department of the railroad company determined that the distance between such cross bonds should not exceed 1,600 ft. For blocks that are 1,600 ft. or less in length the type of bond shown in Fig. No. 9, allowing cross bonding at the ends of the track sections, was best suited to the conditions. For track circuits over 1,600 ft. long the ironless reactance bond is the least expensive and is the one to be used. In Fig. 10 is shown the proposed arrangement of the reactance bonds on all four tracks, and also the connections from the bonds to the rail, which consist of bare stranded copper cable of 1,200,000 circular mils. Specifications require that the connections shall not be made within 2 ft. of the rail joint, and that 2 ft. of slack shall be allowed to provide for creeping of rails. All of the reactance bonds are enclosed in water-tight cast-iron boxes set on foundations. The boxes are filled with oil to carry off the heat generated. The bond is designed to permit the continuous passage of 3,000 amperes for each rail of the track without injurious heating. The casing of the box is made to cover the terminals and connections to the rail to keep them from being tampered with.

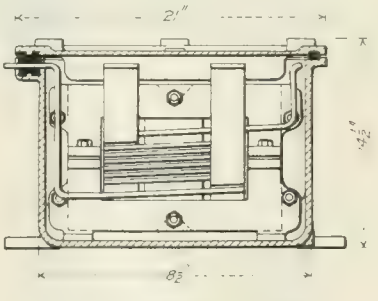


Fig. 9—Reactance Bond.

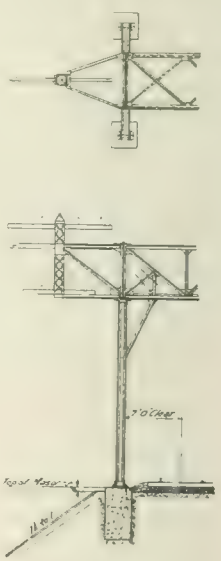


Fig. 3—Support for Wires on Signal Bridge.

The track relay is of the induction motor type with two field coils. One coil is energized by the 50-volt signal operating current

(Page 708, 709)

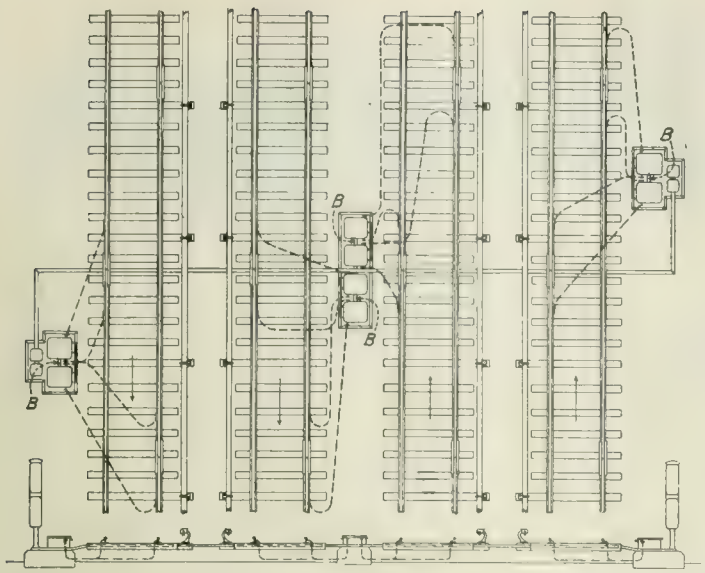


Fig. 10—Connections Between Rails and Reactance Bonds.

All of the parallel tracks, whether there be two, three or four, are bonded together to make one single return conductor for the propulsion current, and this cross bonding is connected to a track between the ends of two adjacent sections insulated for signaling purposes, as at B, B, B, B.

which gives the greater part of the energy required to magnetize the fields and armature. The other coil is energized by the current from the track rails, and this current need only be strong enough to give sufficient magnetism to rotate the armature. The armature revolves through an angle of 37½ deg., during which movement the contacts are separated through 23½ deg., and made up through 14 deg., thus giving a good rubbing contact. With the windings as indicated a much greater turning effect results than in the case of relays receiving their energy from the track circuit only, assuming the power impressed by the track circuit to be the same in either case. This relay responds only to current of the proper phase. Inasmuch as energy applied to adjacent sections is of opposing polarity, a broken insulation will result in opening the relay contact. Very hard carbon is used for the fixed point of contact, while the moving point is of platinum. As the controlled current is an alternating one, there is little sparking, although currents of from ⅛ to ¼ h.p. are used.

The signals are to be of the General Railway Signal Company's motor operated type, with mechanism placed in the base of the signal mast, and worked by a single-phase alternating motor of ¼ h.p., using current at 50 volts. The signal operating mechanism has an alternating current motor and releases quickly. It revolves in one direction to clear the upper arm, and in the other direction to clear the lower arm. Motion is transmitted to the slot wheel through the medium of a train of gears operating a slow moving clutch mechanism—hardened steel ratchets so arranged that when the motor turns in a given direction it clears one of the arms, and in the reverse direction clears the other arm. The buffer dash pots permit an initial movement of the arm in going to the stop position, thus reducing to a minimum the liability of the signals sticking clear. The circuit controllers are enclosed in a tight case which has a glass-covered opening for inspection.

The signal is held in the clear position by an alternating current, which requires approximately 20 volt amperes. The operation of the motor requires about 600 volt amperes, and with this consumption the blade moves to clear in about 2½ seconds. Under the same conditions a direct-current motor would require approximately 125 mil amperes at 25 volts to hold the signal in the clear position, and six amperes at 25 volts to operate it. When storage batteries are used for the operation of signals and are charged direct from a 600-volt line, a large part of the energy is wasted in the resistance controlling the charging current. Thus, while the alternating current signal requires considerably more current to operate it, it obtains this current direct from the line, with the result that the demand on the central station is about the same as when a direct-current is used. The contractor guarantees that the signal mechanism will work with 2.5 amperes and can be held clear with 0.1 ampere.

The signals are of 60 deg. two-position type, using New York Central standard spectacles and blades. These impose on the signal motor a load equal to the lifting of a 17-lb. weight at a distance of 4 ft. from the center of the shaft. With this load the motor will clear the signal in from two to three seconds as stated. On the New York Central square end blades are used on home signals at interlockings, and pointed end blades on automatic home block signals.

The circuits by which signals are controlled are shown in Fig. 14. The plan calls for a full block overlap, and the control of the distant signal through a circuit breaker on the home signal. The signal lamps are the New York Central standard pattern, and provided with an electric light attachment. The electric lamps are of 4 c.p., working on a 50 volt circuit, and are connected in parallel, with a fuse cut out to allow any lamp to be disconnected, without affecting other lamps supplied on the same circuit. The filament of the lamp is wound in a small circle to bring the point of maximum illumination within the focus of the lens.

The signals to be used in the Park avenue tunnel, two miles long, will consist of lights only, without any moving parts whatever. Electric lights will be arranged in a box behind lenses of

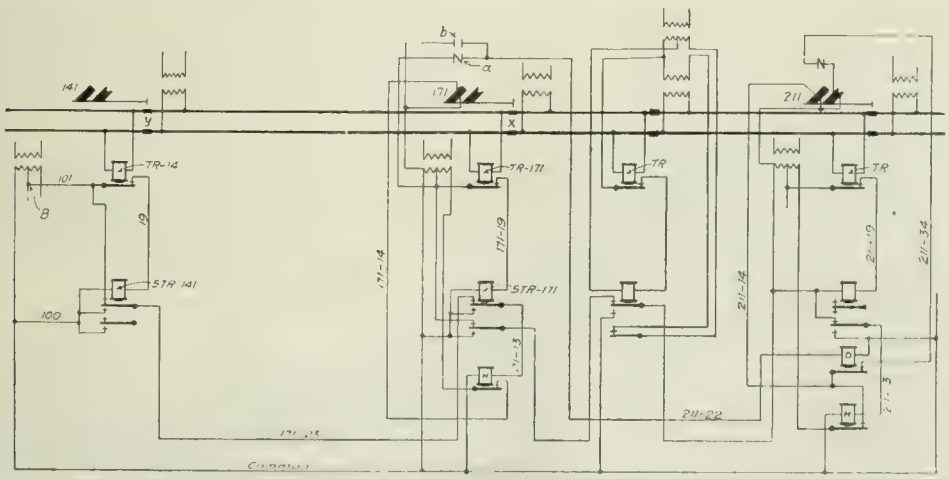


Fig. 14—Typical Automatic Block Signal Circuits.*

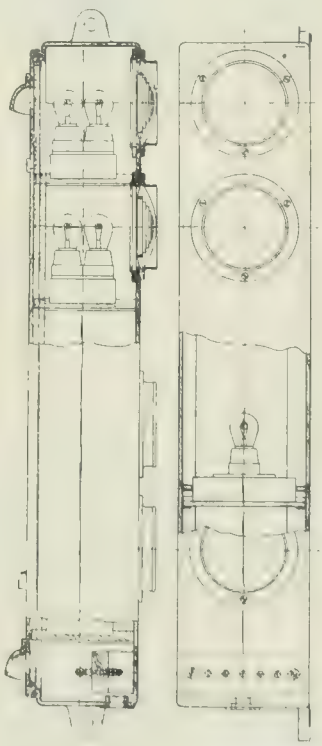


Fig. 21—Lamp Signal for Use in Tunnel.

*The number of a signal is determined by its distance from the terminus and by the track for which it indicates. For example, Signal No. 171 is 1.7 miles from the Grand Central Station and governs track No. 1 (southbound). The track relay (which is an alternating current relay, but is here shown by the usual conventional rectangular diagram) is marked T R. Relay S T R is a secondary track relay interposed because it is necessary to control a number of circuits. This could not be satisfactorily done with the delicate adjustments of the a. c. relay. Signal 171 is controlled by track circuit *xy* through T R 171, secondary track relay circuit 171-19, wire 171-13, and home signal relay H. The overlap wire is 171-23, which also controls relay H. The overlap circuit and that which is controlled by track circuit *xy* may be traced through 171-13; points of S T R 171; wire 171-23; points of S T R 141; wire 101 to circuit supply. S T R 141 is controlled by track circuit *yz*. To trace the wire circuit more naturally we may begin at the current supply, *B*, and read as follows: 101, points of S T R 141, 171-23, points of S T R 171, 171-13; coils of H; to common wire. By wire 211-22 home signal 171, moving the circuit closer *a* controls distant signal 211, through relay *D*.

Circuit closer *b*, also fixed to signal 171, and actuated by the movement of its upper arm, is closed when the arm goes to the stop position. This connects wire 211-22 with the common return wire, so that relay *D* is the same as grounded on both sides and thus is left without any current supply. This arrangement is adopted as a safeguard against the danger of home signal 211 being cleared (while home signal 171 is in the stop position), by the crossing of any other wire with wire 22.

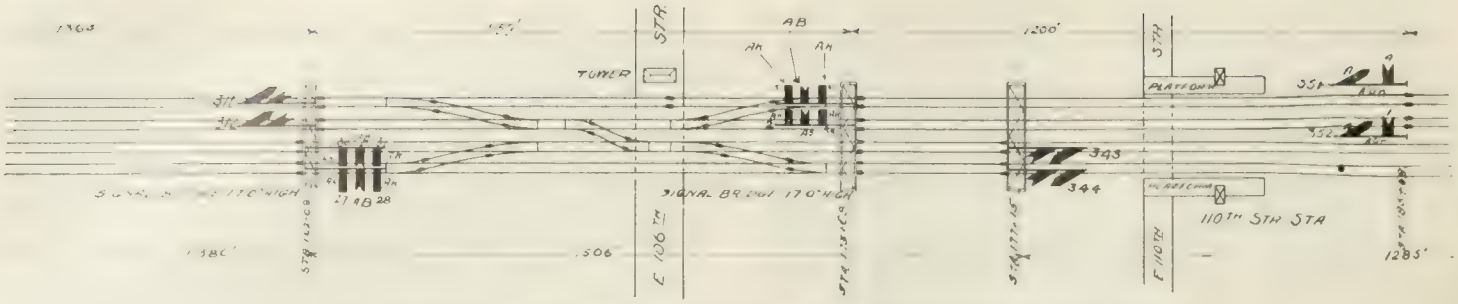


Fig. 5—Block Signals at and near One Hundred and Sixth Street, New York.

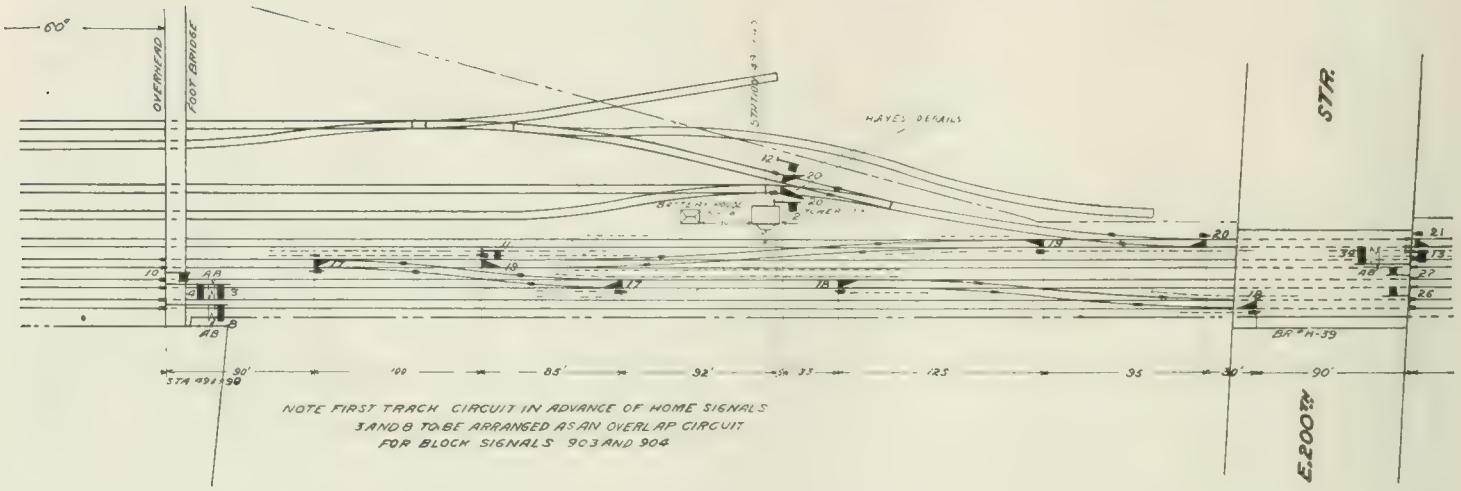


Fig. 17—Interlocking at Bronx Park, Harlem Division—Continued on Next Page.

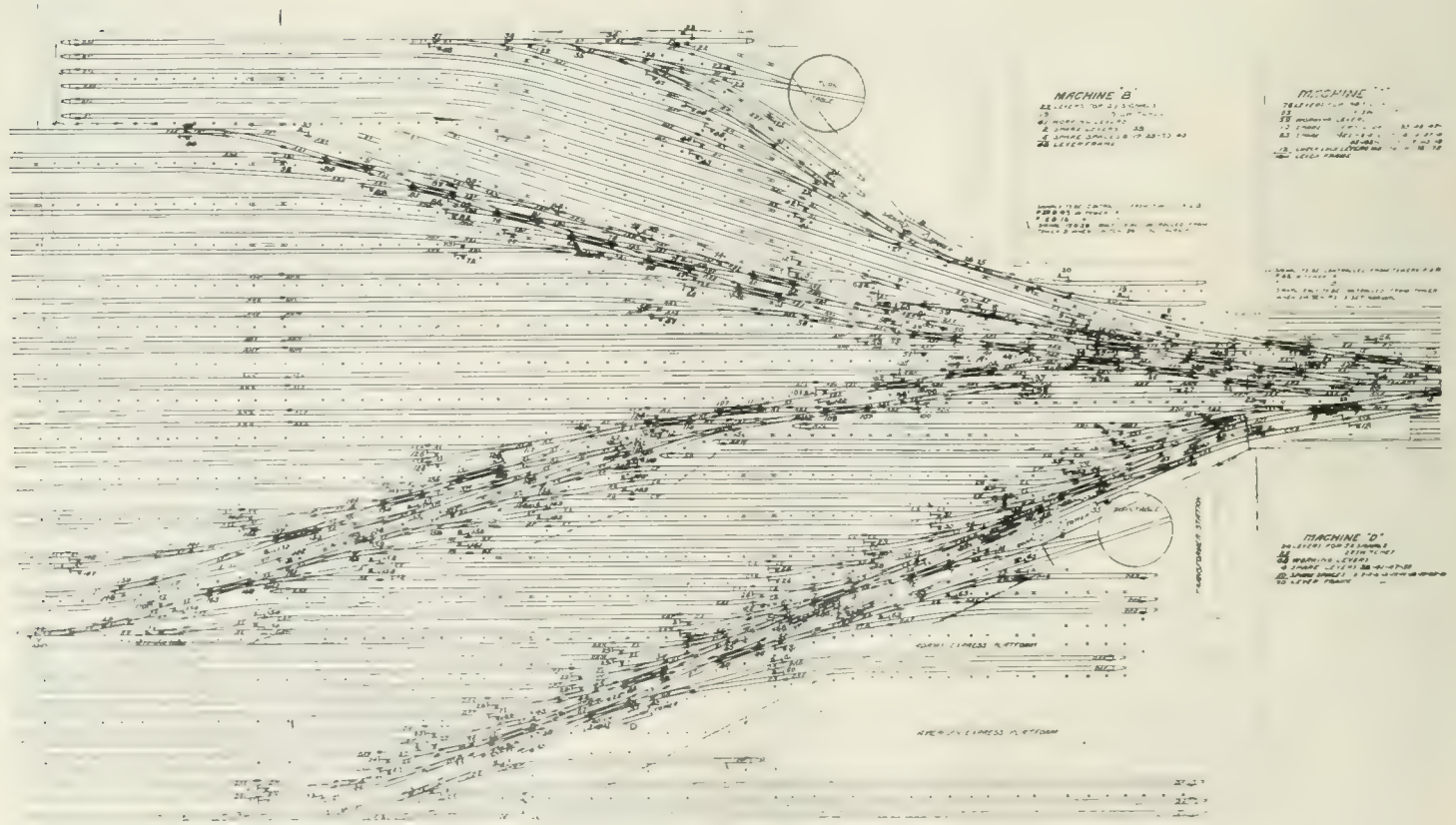


Fig. 22—Plan of Switches and Signals for Grand Central Terminal Yard, Main or Upper Level. Continued on Next Page.

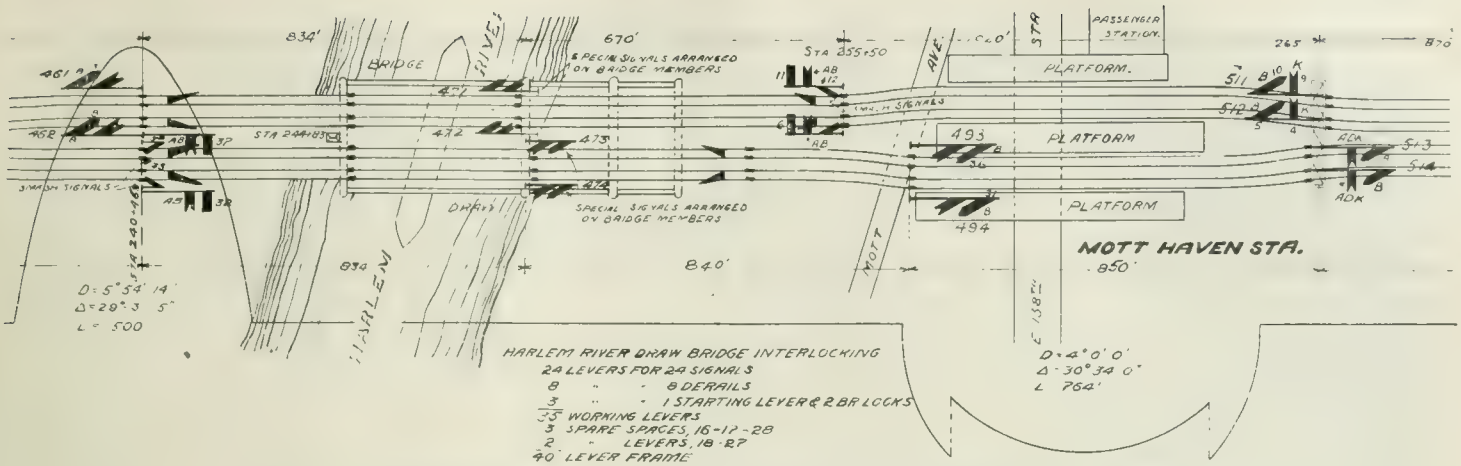


Fig. 5a—Block Signals at and near Harlem River Draw Bridge, New York City.

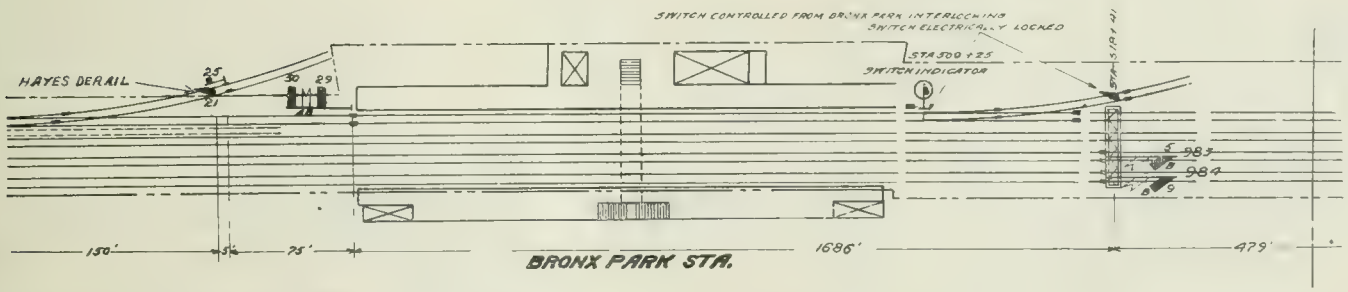


Fig. 17 Continued—Interlocking at Bronx Park, Harlem Division.

proper color, and the current for the lamps will be directly controlled by the relay contacts. Lamps giving the proper color for the stop or caution indication will be lighted when the track relay is de-energized, and those giving the proceed indication will be lighted when the relay contact is closed.

With this installation the colors used by the New York Central for the night signal indication will be changed in the electric zone, and instead of using white for proceed and green for caution, the use of green for proceed and yellow for caution will be introduced for the first time on this road.

A typical plan of an interlocking is given in Fig. 17, which shows the plant to be installed at Bronx Park. These interlockings are of the standard "all-electric" type, made by the General Railway Signal Company, in which direct current, furnished from storage batteries, is used to move the switches and signals. The "indication" is given by the current generated by the motor, which on completing its stroke at the signal or switch movement is changed to a generator and by its momentum gives sufficient current to release the lock of the lever of the machine. The typical interlocking circuits are shown in Fig. 18.*

The current to charge these storage batteries is to be obtained from an AC-DC motor-generator set, taking current from a transformer fed from the 3,000-volt signal transmission line and furnishing current of 150 volts.

The storage battery consists of 55 cells of capacity varying from 80 to 320 ampere hours, according to the number of daily lever movements to be made. The capacities are such that the usual time between chargings will be four days.

The motor generators, with the switch boards, will be fixed in the basement of tower buildings and a separate battery house will be provided to keep the fumes of the batteries away from the signalmen and from the apparatus in the towers.

The interlocking machines are provided with a latch for each lever, so as to require a definite action on the part of the operator to change the position of the lever. The lever handles are colored according to their functions. There will be a separate lever for each high signal arm and no selectors will be used, except in the Grand Central terminal yard. By an arrangement recently devised, two switches may be controlled by one lever.

The interlocking signals will be of the General Railway Signal Company type, with dynamic indication current return. These signals, where slotted, will return to the stop position when the current through the slot magnet is open, but the return indication from the signal motor is not received at the lever until the lever is first restored to the normal position.

The operating circuits for the signals are run through controllers on all facing switches in the main line, insuring that the switches shall be properly set before the signals can be cleared.

Block signals on the same mast with a distant signal controlled from a tower are controlled by a lever in the machine, requiring the block signal to be put to the stop position before a signal can be cleared for a reverse movement on the main line.

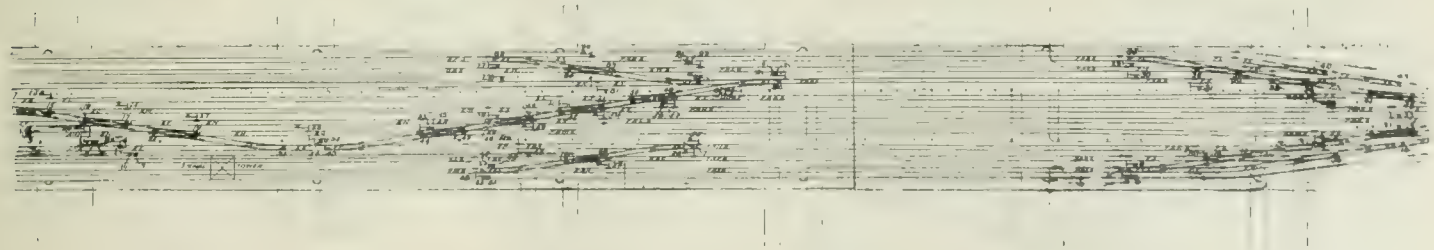


Fig. 22 Continued—Grand Central Terminal Yard.

The advance signals for each track, although operating as automatic block signals, are controlled from the interlocking and are provided with a square-end blade to enable the signal man to hold a train, if it is desired to do so.

Approach locking will be provided for main line switches. This locking becomes effective when a train has reached a point one mile or more in the rear of the distant signal.

In order to permit the signal man to change the route for a train in case of a mistake, a setting is made a mechanical screw retract is provided. This screw can be turned in 1½ minutes thus allowing the releasing of the lever and changing the route on the expiration of that time after the signal has been restored to the stop position.

A counter, reading to five figures, is to be placed on all high signals to register the number of movements.

The movement to be used to operate the switches is of an entirely new type. With the small clearance under the third rail on

*Page 711.

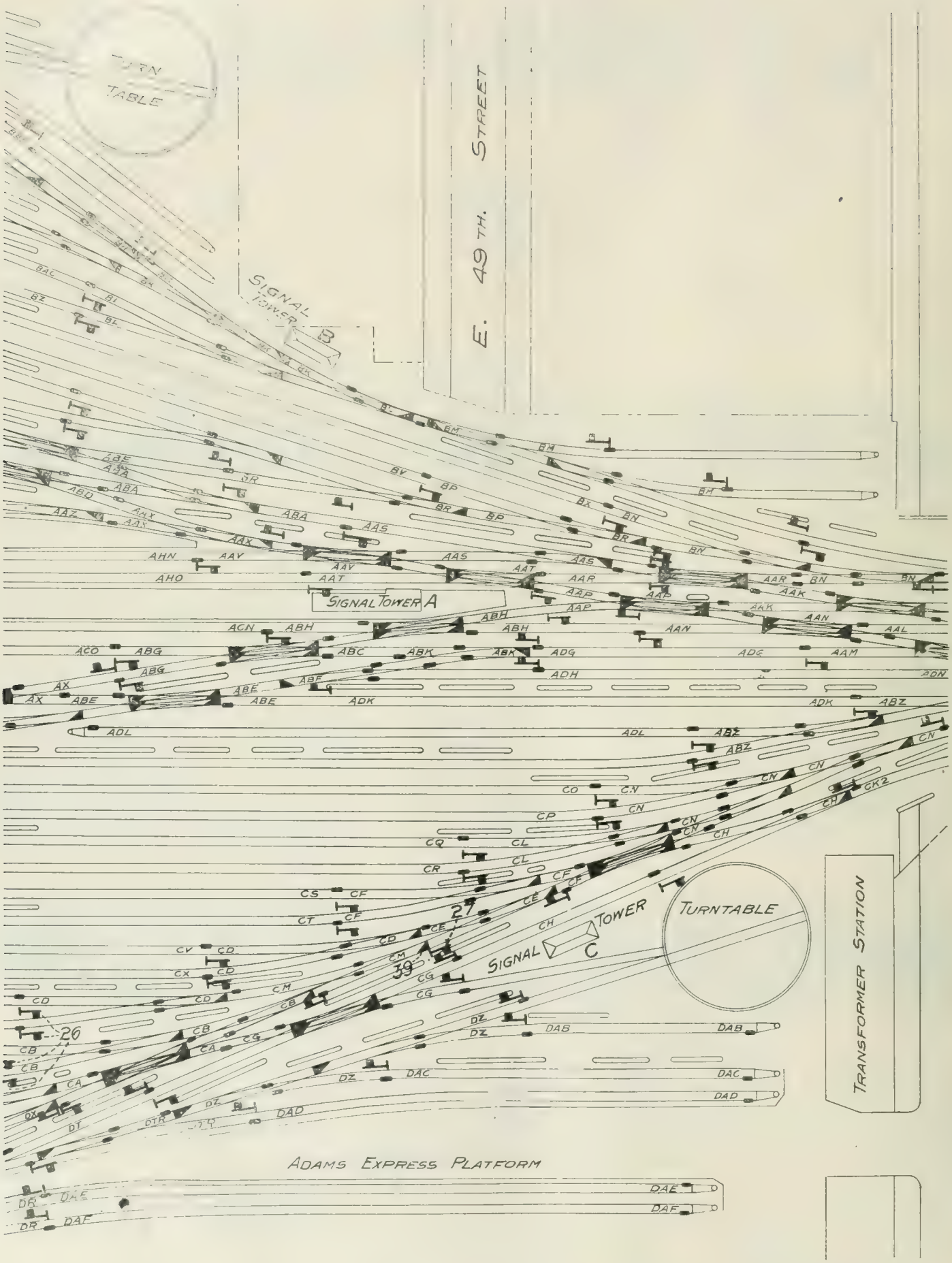


Fig. 22a—Enlarged Section of Grand Central Terminal Yard Showing Short Track Circuits Used in Place of Detector Bars.

tact shoe, a mechanism that will not project above the top of the running rail was found necessary. This movement is enclosed in a neat casing with the gear and escapement crank arranged horizontally. The reversible pole changer and indication switch box are also enclosed in the casing with the switch mechanism, protecting these parts and giving an exceedingly neat appearance to the apparatus.

The movement is fitted with an improved locking device which, in case the plunger should catch on the locking rod, as it will do if the switch does not lock up properly, will release the plunger, allowing it to stop while the main part of the movement completes its stroke. The arrangement prevents the motor from forcing the plunger through the lock rod in case it should not have come to the proper position.

The type of dwarf signal to be used is a new one. In it the signal arm is moved by a motor mechanism arranged horizontally at the base of the post. With this apparatus the indication will be returned to the lever by the current generated by the motor instead of by battery current, as is required with a solenoid mechanism.

In this installation the use of detector bars is practically abolished, a few only being used on the outside rail on sharp curves. Short electric track circuits are provided in their place, the track relays locking the switches during train movements by controlling locks on the switch levers. The use of these short track circuits with the controlling wires to the interlocking machine makes possible, at small expense, the use in the interlocking tower of an illuminated track indicator consisting of a track plan of the interlocking painted on a piece of ground glass with the track circuit sections divided on the back of the glass into separate compartments in which are a red and a white electric light. When the track section is occupied a red light will be shown on the indicator plan, and when unoccupied a white light will be shown.

In places like the Grand Central terminal, where the tracks will be entirely roofed over, it will not be possible for the signal man to see the movements of many of the trains, and an indicator of this kind is an absolute necessity to enable him to keep in touch with the situation. A plan of the signaling in the upper or express level of the Grand Central terminal is shown in Fig. 22. This diagram shows the tracks and switches on such a small scale that a portion of it is reproduced larger in Fig. 22*a*, for the purpose of showing the large number of short track-circuits which take the place of detector bars. These track-circuits are designated by letters, the first letter in each case indicating the tower from which it is controlled. For example, A A Z is controlled from tower A. The second and third letters (A Z) are equivalent to No. 52.

In this yard, where speeds are always strictly limited, selectors are used; as, for example, the four signals numbered 26 in the lower left hand part of the diagram, Fig. 22, indicating for converging routes, are worked by the same lever. All these tracks lead to signal 27, switch 39. The structures indicated on the diagram by parallel lines joined at the end by curved lines are supports for bridges or buildings above the tracks.

As in the automatic block signals in the Park avenue tunnel, the signals in the Grand Central Station interlocking will be shown entirely by lights, without any blades or moving parts. In this interlocking work, however, the lever for the signal completes the circuit for the lamps to give the proper color for the indication required. A light signal is shown in Fig. 21.*

*Page 707.

The signal towers will be of brick and of attractive design, with as much window space as possible.

The plans and specifications for this work were prepared under the direction of Mr. W. J. Wilgus, Vice-President, in charge of construction. Mr. W. H. Elliott, reporting to the Vice-President, is in charge of the signal forces and will supervise the installation. In passing upon the merits of the various systems proposed by the bidders the general committee of the New York Central lines was called into consultation, and before concluding the contract with the signal company the plans and specifications were signed by a committee composed of Mr. W. H. Elliott, Mr. H. S. Balliet, Engineer of Maintenance of Way of the Electric Division, and Mr. C. Schwartz, Assistant Engineer of the Electrical Department.

The system of signaling to be used was devised by Mr. S. Marsh Young, Manager of the Electric Railway Department of the General Railway Signal Company, who has been assistel in its development by Prof. Fitzhugh Townsend, of Columbia University, acting as Consulting Engineer. Mr. H. M. Sperry, New York manager of the General Railway Signal Company suggested the use of the overlap. The apparatus in detail was designed by Mr. W. K. Howe, Chief Engineer of the General Railway Signal Company, and on the part of the contractor will be installed under the direction of Mr. W. G. Hovey, Construction Manager.

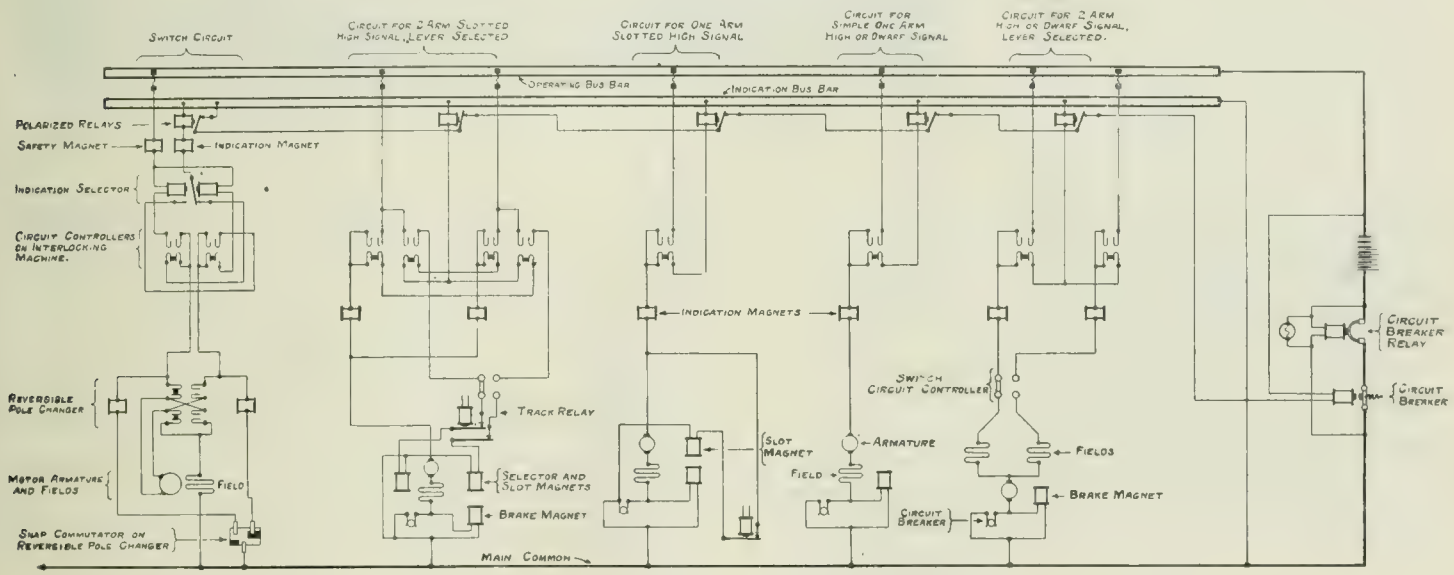


Fig. 18—Typical Interlocking Circuits.

Railway Telegraph Superintendents.

The twenty-fifth, or "silver," anniversary convention of the Association of Railway Telegraph Superintendents was held at Denver, June 20. The gathering was called to order by the president of the association, Mr. E. E. Torrey, superintendent of telegraph of the Mobile & Ohio. Eight active and five associate members were elected. The report of Treasurer P. W. Drew showed the association to be in an excellent condition both numerically and financially. Charles Selden (B. & O.) opened the business of the convention by reading a paper on train order rules. Mr. Selden protested against the loose use of 31 and 19 train orders that now prevails. We make a good rule, requiring the use of desirable safeguards against collision and then when delay is occasioned thereby we deliberately abandon the rule and use the "X response" or other short cut. If we are going to depend so fully on the operation let us acknowledge the fact and frame the rules accordingly. This will tend to prevent men from cultivating disrespect for the rules.

U. J. Fry (C., M. & St. P.) sent a letter on composite circuits. The new instruments for this class of service furnished by the American Telephone & Telegraph Company are giving excellent results. R. L. Logan (Kansas City Southern), another member of the committee on composite circuits, of which Mr. Fry is chairman, spoke of the value of portable telephone apparatus at blind sidings. The Howler type of apparatus gives the very best results. F. H. Van Etten (Southern Indiana) had found the Howler apparatus very efficient. F. F. Fowle, of the American Telephone & Telegraph Company, Chicago, spoke on the advantages of the new Howler type of instrument. W. F. Williams (Seaboard Air Line) has several sets of this apparatus in use. They are used as often as thirty or forty times a day, and the few dry cells required are renewed about every three months. Mr. Drew called attention to the fact that the consumption of battery on this class of service was occasioned by users leaving the receiver off of the hook.

In the afternoon W. W. Ryder (Burlington) read a paper on Increasing Railway Telegraph Facilities, and Mr. F. E. Fowle dis

cussed the question of The Traffic of Railway Communications. W. B. Glardon, of the National Telegraphone Company, Rochester, N. Y., stated that composite circuits had been expected by many to render as good service as metallic circuits, which was impossible. He told of the use of his telegraphones on various railroads.

B. F. Forbes (Oregon Short Line), Salt Lake City, said that the system of H. O. Rueh, of Sandwich, Ill., was in use on his road and was giving satisfactory results. The instruments are of simple construction and do not get out of order.

On Thursday there was a discussion of Rules for the Telegraph Department, and it was voted to try once more to formulate a code which will be acceptable to the American Railway Association, where a former report still slumbers in committee.

The committee on pole line construction, through its chairman, Mr. E. P. Griffith, of New York, reported progress. The standard of line construction has been much improved and from forty to fifty poles to the mile is the rule, with the result that a more efficient and permanent service is secured.

E. Parsons (Illinois Central) read a paper on overhead crossings. Small companies insist upon crossing railroads with their wires without due regard to the use of safety devices. The laws of Michigan, Kansas and Ohio regulating the crossing of railroads are ample to protect them, but in many states the legislatures are entirely indifferent.

In the election of officers E. A. Chenery (Missouri Pacific), St. Louis, Mo., was elected president; E. P. Griffith (Erie), vice-president, and P. W. Drew (Wisconsin Central), Milwaukee, Wis., secretary and treasurer (for the twenty-fourth consecutive term). The next meeting is to be held at Atlantic City, N. J.

EXHIBITS.

Western Electric Company, Chicago and New York.—Samples of railway composite telephones and of portable Howler types, shown in operation on a quadruplex circuit of the Chicago, Burlington & Quincy.

United States Electric Company, 95 William street, New York.—The Gill Telegraph Selector. The inventor says that this device has been adopted by the Western Union Telegraph Company as well as by a number of railroads.

American Telephone and Telegraph Company.

Morse Code Signal Co., Milwaukee.—Complete railroad set, consisting of a combined telegraph sounder, selective features and a continuous ringing drop, all in one instrument, and controlling a set of signaling buzzers, or operators' use in the stations along a railroad circuit. This system is now in operation on the Seaboard Air Line and the Buffalo & Susquehanna.

Delany Telegraphic Transmitter Company, New York.—New and novel devices in electric and mechanical automatic dot making telegraph keys. These instruments are intended to improve the quality of the Morse signals and make transmission easier.

Mecograph Company, Cleveland, Ohio.—The mecograph transmitter. Several thousand mecographs are now in use.

National Telegraphone Company, Rochester, N. Y.—Latest Type of composite instruments and portable Howler for use in connection with composite telephone sets, also standard condenser and loud transmitter.

North Electric Company, Cleveland, Ohio.—Magneto telephone equipment, switchboard equipment and linemen's portable test sets.

Sandwich Electric Company, Sandwich, Ill.—The Sandwich Telegraphone for talking on an ordinary telegraph line without interfering with the Morse signals.

The Railroad Supply Company, Chicago.—New lightning arrester in two styles: mounted on slate base in one or more units, and an enclosed pattern for outside use. Suitable waterproof iron boxes are furnished to hold from 4 to 14 arresters. These lightning arresters are built upon the choke coil principle, which is supplemented by an induction coil. The arrester is furnished without fuses, none being required. The Southern Pacific and other Harriman Lines have recently ordered 20,000 arresters to be used to protect line wires in connection with automatic block signals.

The Government Railroad Monopoly in Italy.

BY ING. COMM. GIUSEPPE SPERA.

II.

(*Continued from page 185.*)

As will have been seen from our preceding article, the Italian Government was compelled to take over the railroads, but the Minister of Public Works, Tedesco, proved himself to be so incompetent that he was compelled to abandon the post. After this crisis the Ministry presented a new project of a purely temporary character, by which the state assumed the railroad monopoly, while entrusting the technical and economic management of the railroads to an autonomous administration. On the 30th of June, 1905, the three great lines reckoned a total of 7,701 miles.

	Miles.
Railroads belonging to the State	5,592
" " " State and private companies	90
" " " Mediterranean Railway Co.	245
" " " Southern (Meridionali) Cos.	1,135
" " Adriatic Company	279
" " Sicilian Companies	149
Various companies	211
Total	7,701

In consequence of the lack of all preparation and accord with the working companies, the Italian Government did not find itself in a position to really solve the railroad problem by completely taking over all the railroads belonging to private companies. Under these circumstances, the government proposed to Parliament that it should take over the management of the railroads belonging to it, of those belonging to various private companies, and of certain portions of the railroads of the Southern Railroad Company (Società Meridionali), thus forming a railroad system of 6,597 miles. The Southern Railroad Company (Società Meridionali) was conceded the management of its own line.

The autonomous administration consisted in a General Manager appointed by the government, and of an Administrative Council composed of six members appointed by the director from among the state employees and those of the old railroad companies. This law was passed April 22, 1905, and was to have been enforced the first of the following July, and the hurry which occurred in creating the different offices, and arranging the diverse services, certainly did not contribute towards the proper working of the railroads. Consequently, the results of the new system are of such a defective kind as to cause grave concern to the country.

Trains no longer arrive at the stated hours; these delays have become rather systematic than incidental, and discipline throughout the staff is weakened to such an extent that the comparison between the new and the old system results vastly in favor of the latter, despite the many defects and inconveniences which it presented.

Thus, whereas at the time of the company's management, the transport of grapes from the south to the north of Italy presented difficulties which were to a great extent remediable; under the new system the service is quite inadequate to the demand, and has caused incalculable loss to the producers who have to stand by while their produce rots in the stations. In the same manner, the principal centers of commercial activity, such as Bari, Naples, Milan, Genoa and Venice, have lodged complaints against the insufficient railroad service, which remains paralyzed in face of the new and ever growing activity of the country.

On the other hand, as might have been foreseen, rivalry has sprung up between the state service and that of the Southern Companies, a form of rivalry which does not make for the welfare of the country, for it does not manifest itself in competition between them for the improvement of the service, but rather in perpetual obstacles and difficulties they create for one another, or which, at any rate, they do not avoid by a little mutual good will.

As regards the working of this new administration, besides its unprepared condition and technical defects, the lack of cohesion and accord—thanks to which the management is slow and difficult instead of being easy and rapid—the pseudo-autonomy which was granted to the administration is a further cause of not less serious difficulties. The law desired an autonomous administration so as to free the management from Parliamentary control, but besides the difficulties in the way of rendering autonomous an administration which has an equally great influence on the state budget and on the economic condition of the country, this law, thanks to the hurried manner in which it was prepared, establishes no conditions regulating the nature and the limits of this pretended autonomy.

The perpetual disputes on competence which take place between the Minister of Public Works and the railroad administration, both on trivial and important points, are therefore only natural. Luckily, however, this law is only of a temporary and transitory character, and thus we may sincerely trust, for the sake of the country's welfare, that a seriously thought out law may soon be passed which will really solve the railroad problem in Italy, not only superficially, but in fact. In a further contribution I will try to point out what, given the present conditions of Italy, the fundamental points of this serious undertaking ought to be.

The Coal Traffic Inquiry.*

The Interstate Commerce Commission announced Friday last that the inquiry into the relations between railroads and coal shippers would be indefinitely suspended, probably until the Autumn. At the last session the Commission heard the testimony of officers of the Western Maryland and the Buffalo & Susquehanna. The W. M. owns the Davis Coal & Coke Co. No complaints have been received by the road from operators of lack of cars. C. A. Steiner, Division Superintendent of the Western Maryland, owns five shares of stock in a coal company. The Buffalo & Susquehanna controls every coal company on its line except one, which belongs to the Erie Railroad. There are extensive coal lands along the company's lines for which the company would be glad to put in side tracks, if requested to do so.

Fourth Vice-President Thayer, of the Pennsylvania, was heard again at length concerning the distribution of coal cars by that road. It was not until the great expansion of business about 1902 that any one complained of lack of cars. Coal shipments over the road have increased about 100 per cent. in the last six years. An attempt was made a few months ago to forbid the use of private cars, but it was found impossible to carry out such a radical change. The number of private cars used by coal shippers on the Pennsylvania is about 15,000. It is hoped to do something within a few months to stop the jealousies aroused by the use of private cars, though the problem is a difficult one.

Mr. Thayer said that in the past six years the number of coal shipping points had increased 85 per cent. In the years 1900-1904 157 new sidings had been put in for bituminous coal mines east of Pittsburg. The number of bituminous mines increased in the period from January 1, 1900, to January 1, 1906, by 232 mines. On June 1, 1906, the 516 mines along the line were operated by 301

*Previous reports May 25, June 1, 8 and 22, pages 527, 554, 606, 683.

operators. These facts were set forth to show that the demoralization pictured by some of the witnesses could not have existed; for the company was making comprehensive efforts to accommodate all its shippers, and new capital was eager to undertake new operations.

Mr. Trump, General Superintendent of Transportation, declared that there was no underhanded business in the distribution of cars.

On June 14 the Commission notified the Pennsylvania and other roads that the Commission would on June 21 hear any officers of the roads who might wish to appear, but Mr. Thayer and Mr. Trump seem to have been the only officers on any road who came to the hearing voluntarily.

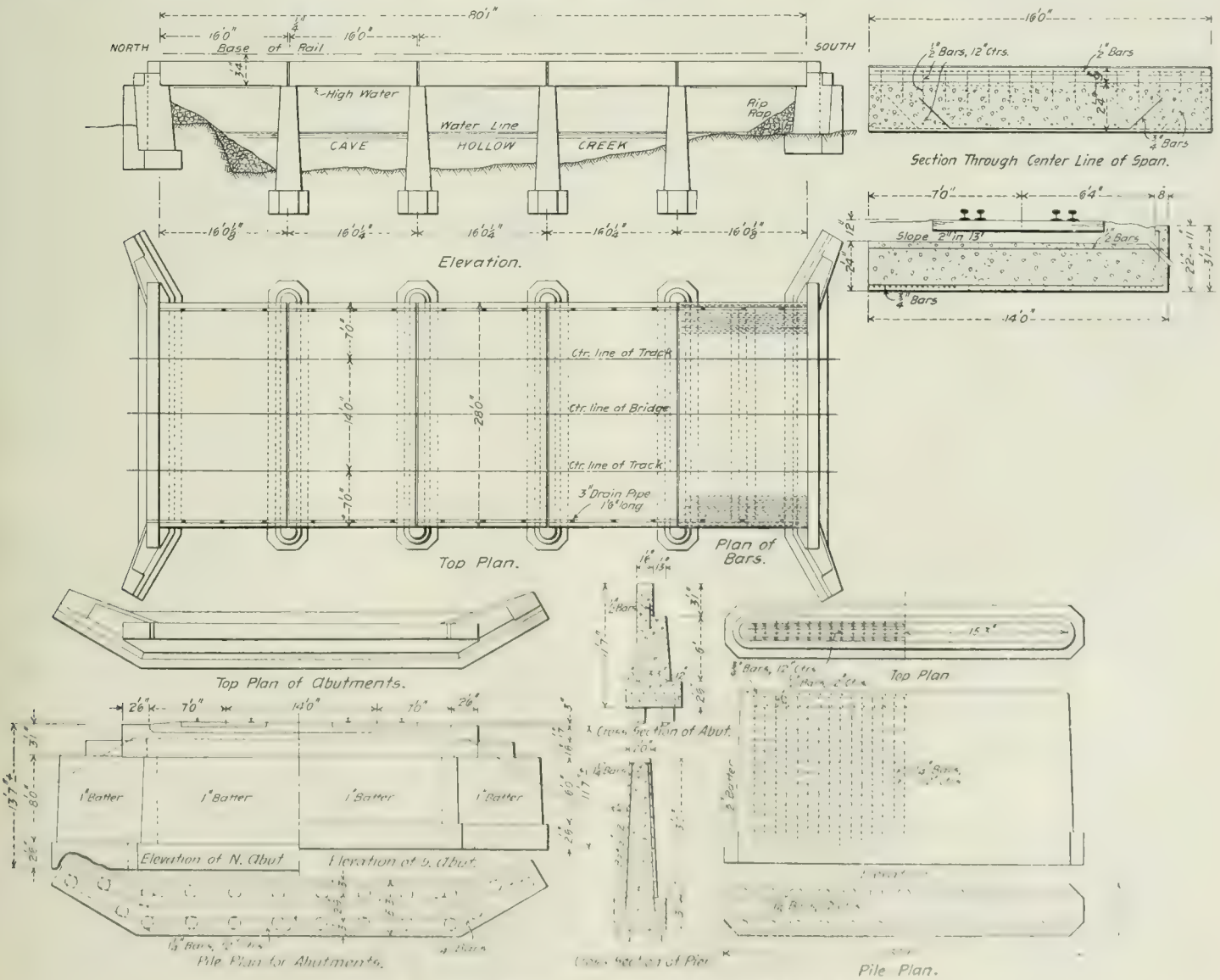


Burlington Reinforced Concrete Trestle Over Cave Hollow Creek.

Reinforced Concrete Trestle on the Burlington.

The Chicago, Burlington & Quincy has been reducing grades and straightening the line on its Hannibal division from St. Louis to Hannibal, Mo. At some points this has involved relocation of the line, one such place being two or three miles south of Hannibal. This section of the line crosses Cave Hollow creek, and the old bridge was a 70-ft. through plate girder on pile piers, built in 1897. The new line crosses on a reinforced concrete trestle, drawings for which are reproduced herewith. It is a five-span double-track bridge, the distance between the pier centers being a fraction over 16 ft. The pier footings are 33 ft. 6 in. long by 5 ft. wide, and rest on 26 piles 16 ft. long, spaced as shown, the load line per pile being 12½ tons. The abutments have 22 piles each.

The superstructure is composed of reinforced concrete slabs 16 ft. long, 28 ft. wide, 2 ft. 4 in. thick at the center, and 2 in. less at the sides, with a parapet 11 in. high on each side. The detail drawings show the disposi-



Reinforced Concrete Trestle for the Chicago, Burlington & Quincy.

tion of the reinforcing rods which are Johnson corrugated bars, ½ in., ⅝ in. and 1¼ in., the latter being in the foundations. The section through the center line of span shows three forms of bars in the bottom of the slab, two bent, of different lengths, and one straight bar the same length as the longer bent bar. These three forms alternate across the slab in the manner shown. There are 11,612 lineal ft. of ½ in. bars, 8,396 lineal ft. of ⅝ in. bars, and 1,500 lineal ft. of 1¼ in. bars in the structure, the total weight being approximately 17 tons. The total amount of concrete was 520 cu. yds. gravel concrete equivalent to a 1 2 4 mixture being used in the decks and piers, and the equivalent of a 1 3.6 mixture in the abutments.

The bridge was built by the bridge department of the road with company forces. We are indebted to Mr. C. H. Cartlidge, Bridge Engineer, for the data.

The American Society for Testing Materials.

The ninth annual meeting of the American Society for Testing Materials was held at Atlantic City, June 21-23. The society now has a membership of about 850, an increase of 143 over the number reported at the last meeting. The attendance at the convention was 204. The Secretary reported the society in a better position, financially and otherwise, than ever before, and said that for the next meeting he hoped it would be possible to prepare advance copies of the more important papers. The cost of preparing these papers will undoubtedly be more than offset, as they will lend to the value of the discussions by enabling the members to prepare for them before the meetings. The following officers were re-elected to serve for two years: President, Charles B. Dudley; Vice-President, Robert W. Lesley; Secretary and Treasurer, Edward Marburg, University of Pennsylvania, Philadelphia, Pa., and James Christie, member of the Executive Committee. Aside from the usual number of committee reports, papers were read as follows:

Annual address by the Vice-President, Robert W. Lesley, "The American Society for Testing Materials—Its Past and Future"; "Memoirs of Deceased American Investigators Who Have Contributed in a Marked Degree to the Advance of the Testing of Materials," by Gaetano Lanza; "The Development of the Test for Cementing Value of Road Materials," by Allerton S. Cushman; "Notes on the Hardness and Abrasion Tests of Road Materials," by P. L. Wormeley, Jr.; "The National Bureau of Standards," by S. W. Stratton; "Concrete Column Tests at Watertown Arsenal," by J. W. Howard; "Some Effects of Earthquake Shock and Fire on Materials and Buildings at San Francisco," by Richard L. Humphrey; "The Corrosion of Steel as Affected by Its Chemical Composition," by J. P. Snow; "Electrolytic Corrosion of Steel," by Maximilian Toch; "Topical Discussion on the Corrosion of Iron and Steel" (opened by H. M. Howe, Allerton S. Cushman and James Christie); "The Effect of Heat Treatment on High Carbon Steels," by William Campbell; "The Beneficial Treatment of Adding High-grade Ferro-silicon to Cast Iron," by A. E. Outerbridge; "Tests of Reinforced Concrete Beams," by Gaetano Lanza and S. J. Tilden; "Note on Compression Tests of Cement," by W. P. Taylor; "Consistency of Concrete," by Sanford E. Thompson; "The Present Status of Our Knowledge in Regard to the Constitution of Portland Cement," by Clifford Richardson; "Progress Made in the Investigation of Structural Materials During the Fiscal Year Ending June, 1906," by R. L. Humphrey; "Discussion on Standard Specifications for Ship Material," by E. P. Stratton and W. R. Webster; "Experiments on the Segregation of Steel Ingots in its Relation to Plate Specifications," by C. L. Huston; "Fire-Box Steel—Failures and Specifications," by Max H. Wickhorst; "Protective Coatings for the Preservation of Steel," by Arthur B. Harrison; "Practical Testing and Valuation Japan," by Robert Job; "Testing of Shellac Varnish," by A. C. Langmuir; "Some Results of the Government Fuel Tests at St. Louis," by J. A. Holmes; "Investigation on the Conductivity of Concrete and the Effect of Heat Upon its Strength and Elastic Properties," by Ira H. Woolson; "The Determination of the Specific Gravity of Cements," by R. K. Meade; "A New Device for the Mechanical Sifting of Concrete Aggregates," by C. N. Forrest; "Relation Between Some Physical Properties of Bituminous and Oils," by A. W. Dow; "The Proximate Composition and Physical Structure of Trinidad Asphalt, with Special Reference to the Behavior of Mixtures of Bitumen and Clay," by Clifford Richardson; "Some Sand Experiments Relating to Per Cent. of Voids and Tensile Strength of Cement Mortars," by J. Y. Jewett; "Some Mistakes in Water Proofing," by E. W. DeKnight; "Methods of Testing Cements for Waterproofing Properties," by W. P. Taylor (discussion opened by Mr. E. W. Lazell); "New Features of Two Large Testing Machines," by W. C. DuComb, Jr.; "The Purdue University Impact Machine," by W. K. Hatt and W. P. Turner; "The Effect of Combined Stresses on the Elastic Properties of Iron and Steel," by E. S. Hancock, and "Tests of Metals in Reverse Torsion," by E. S. Hancock.

Papers in the above list which are of particular interest to railroad men will be printed in whole or in part in future issues of the *Railroad Gazette*.

The Train Despatchers' Convention.

The nineteenth annual convention of the Train Despatchers' Association of America was held at Buffalo, June 19, 20 and 21. Sixty-five delegates and about 40 ladies were present. The report of the Secretary showed a membership of 954, a net gain during the year of 73. Twenty-eight applications for membership were received. The Association is on a good financial basis, having more than $2,500 in its treasury.

The Train Rules Committee reported that its recommendations had been largely incorporated in the new standard code of the American Railway Association.

Two entire sessions were devoted to a free discussion of the interpretation of certain train rules and to practices relative to train movements. Some of the topics presented were: methods of delivery of 19 orders; the use of 19 orders for superior trains; the use of clearance cards, both in connection with delivery of train orders and for terminal clearance; method of handling "31" orders as on the Northern Pacific, i.e., giving "complete" on the repetition, the despatcher not getting the signature of the conductor; the office of the train register and methods of use. Considerable discussion arose over the question, "What is a station?" having particular reference to the word "station" in the list of definitions and in Rule 5. The question whether an extra running on Example 3 of Form G should proceed with caution through a yard, looking out for yard and other engines, occasioned interesting debate.

The representation of despatchers from the east of Pittsburg and Buffalo was especially large, particularly from New England. For the first time a New England man was elected to the presidency, Mr. James E. Holloren, of the Boston & Maine, Springfield, Mass. H. P. Riggs, of the Wisconsin Central, Fond du Lac, Wis., was elected Vice-President. Executive Committee, J. D. Beaver, Pennsylvania Railroad, Buffalo, N. Y.; Charles H. Mullinix, Illinois Central, Fulton, Ky.; T. W. Kane, P. E. Ry., Los Angeles, Cal., and J. B. Jerome, Kentucky & Indiana Bridge Co., New Albany, Ind. John F. Mackie, Chicago, was re-elected Secretary-Treasurer.

In presenting his annual report Mr. Mackie called attention to the gratifying progress of the Association, in the character of its upbuilding, recalling his first annual report, 12 years ago, when the membership was 250 and the treasury showed a deficit of $400 in one year. Gaining wisdom by experience the Association has since prospered. It aims to promote the prosperity of railroads by consideration of subjects vital to their interests and by offering suggestions which are the results of actual contact with working conditions. The next annual meeting is to be held in Boston.

A representative of the Telegraph Signal Company of Rochester, N. Y., was in attendance and demonstrated that company's electric call bell and signal apparatus, whereby the despatcher can call, by bell, any or all offices and can set any train order signal in the stop position. The convention expressed, by vote, its approval and the desirability of some such safety device. At a blind siding, the control of the signal by the despatcher, in conjunction with the telephone, would make the use of the middle order possible at such sidings.

Pacific Locomotive for the Southern Railway.

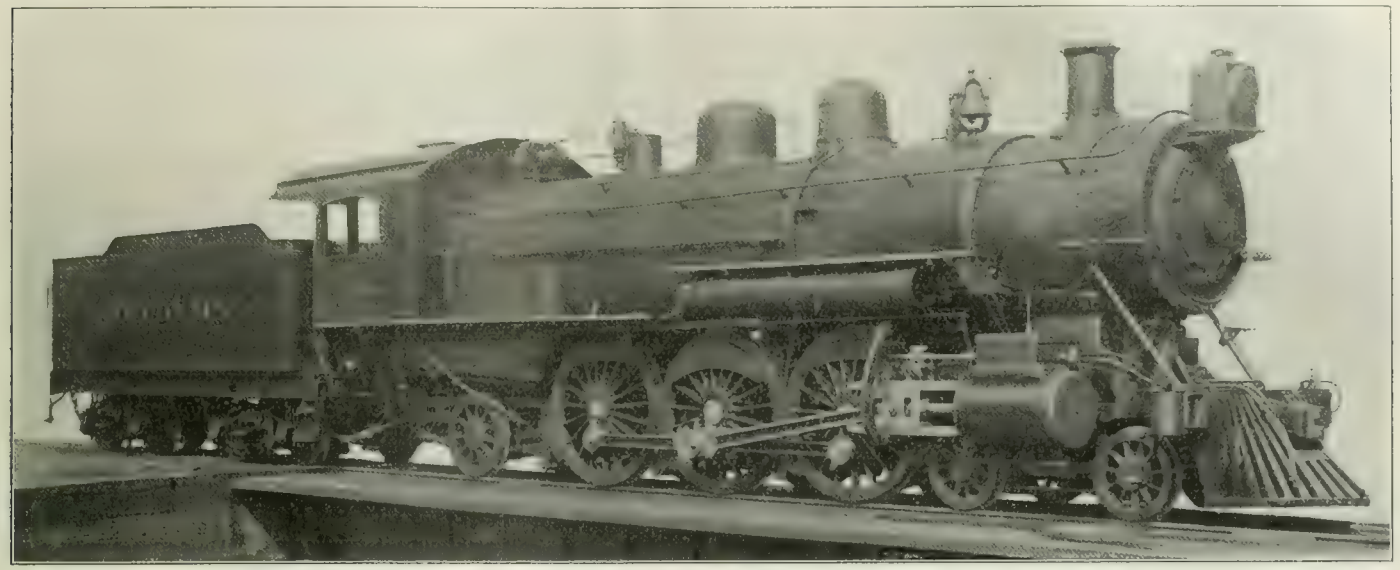
The Baldwin Locomotive Works has recently built 20 Pacific type (4-6-2) locomotives for the Southern Railway. This class of engine was originally designed for both passenger and fast freight service. In the case of these engines there is a slight difference in dimensions by which some of them are especially fitted for fast passenger work, while the others are suited for either passenger or freight service. This difference lies in the diameter of the driving wheels. There are 15 of these engines which have wheels 63 in. in diameter. The other five have 72½ in. drivers. The photograph and drawing shown herewith are of the locomotives with 72½ in. drivers.

These engines show no great novelty in design, but represent the latest development in the design of this class of equipment. An unusual feature is the high steam pressure, 220 lbs. per square inch. This is not unknown in American practice but is considerably higher than that ordinarily used. After these engines have been in service it will be interesting to note the economy resulting from use of this high pressure, especially in view of the differences of opinion existing as to the desirability of using high pressure on simple locomotives. The cylinders are 22 in. x 28 in., and the tractive power, 34,940 lbs. As the weight on the drivers is 143,000 lbs. the factor of adhesion is 4.09.

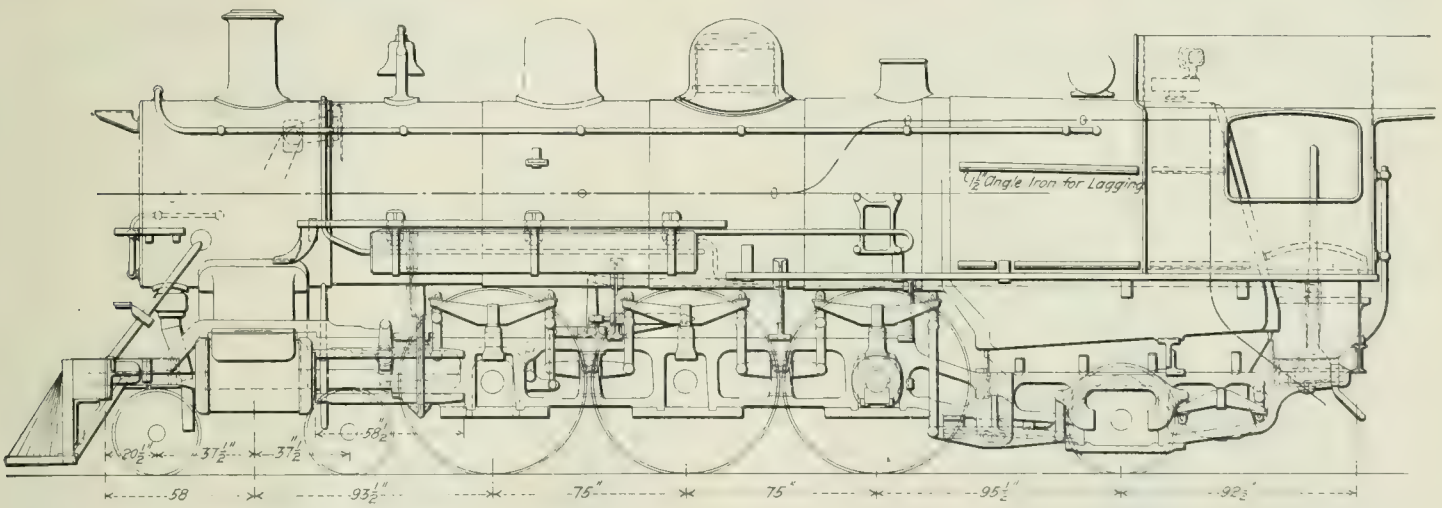
The boiler is straight top with sloping throat and back head. It is radially stayed, with double riveted circumferential seams,

the longitudinal seams being butt-jointed and welded at each end. The dome ring has a welded seam on the top center, with a liner inside. The boiler is well provided with washout plugs, and has 3/8 in. liners in the waist over the supporting guide bearer and waist

tion is made of the drawings of locomotives that have appeared within the past few months in the *Railroad Gazette* it will be seen that the injector check is placed all the way from 18 in. to 8 ft. or even farther back of the front tubesheet.



Pacific Locomotive for Southern Ry. Built by Baldwin Locomotive Works.



Pacific Locomotive for Southern Railway, Built by the Baldwin Locomotive Works.

sheets. It is also an example of the recent tendency toward the use of long tubes as these are 20 ft. long and 2¼ in. in diameter.

A reference to the photograph and the side elevation will show that rather heavy bar frames are used, and that the cylinder fastenings are unusually strong. They are fastened with a double row of bolts in the vertical flanges and a double row of rivets to the smoke-box. The frames are cast-steel, with the splice at the front end in the usual place just back of the cylinders, and at the back, below the front end of the firebox, in accordance with current practice, which is there supported by a vertical buckle plate.



The Rushton trailer truck is equalized with the drivers; the rear end of the engine being carried on an inverted semi-elliptic spring which is expected to result in easy riding.

The link motion is indirect. The rocker is placed in front of the leading drivers and connected to the link by a transmission bar which spans the leading driver axle.

The headlight is electric with the dynamo set on the boiler just in front of the cab.

Attention is called to the location of the injector check which is placed back of the center line of the sand box, or about 8 ft. from the front tube sheet. This merely shows that there is no uniformity of opinion as to where the check should be placed in order to obtain the best results in maintenance and operation. If an examina

The following are some of the principal dimensions of this engine:

Cylinders, diameter	22 in.
Cylinders, stroke of piston	28 "
Boiler, diameter of	70 "
" thickness of sheets	and 13/16 in.
" pressure	220 lbs.
Firebox, length	108⅛ in.
" width	72½ "
" depth front	76¼ "
" depth back	66¾ "
" thickness, side, back and crown sheets	"
" water space, front	"
" water space, sides and back	"
Tubes, No. 314, diameter 2¼ in. length	20 ft
Heating surface, fire box	195.0 sq. ft.
" " tubes	
" " total	
Grate area	
Driving wheels, diameter	in.
" " main axle journal, diameter	"
" " main " " length	"
" " trailing " " diameter	"
" " trailing " " length	"
Truck wheels, front, diameter	
" wheels, rear	
" journals, front, diameter	
" " front, length	
" " rear, diameter	
" " rear, length	
Wheel base, rigid	
" " engine	
" " engine and tend	
Weight on driving wheels	
" " front truck wh	
" " back truck wh	
" of engine	
" of engine and tend	
Water capacity	
Coal capacity	

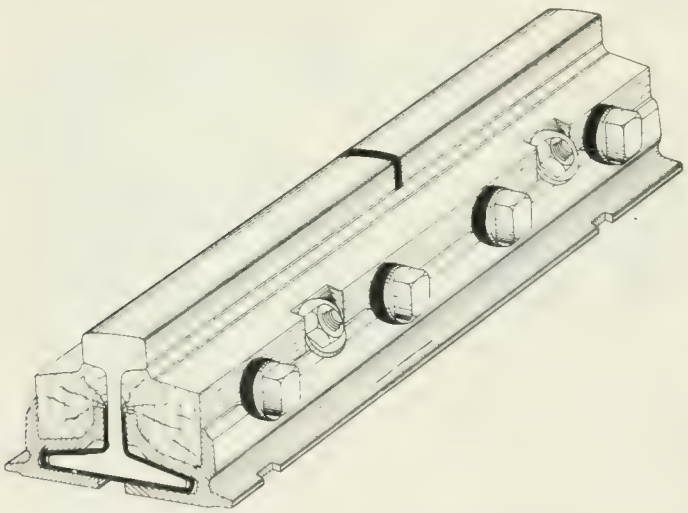
From these dimensions the following ratios are deduced

Weight on drivers	143,000	
Tractive effort	24,040	5.95

Total weight	220,500	6.31.
Tractive effort	34,940	
Tractive effort x diameter of drivers	34,940 x 72.5	65.31
Heating surface	3,878.5	
Heating surface	3,878.5	7.15.
Grate area	54.25	
Firebox heating surface	195	0.05.
Total heating surface	3,878.5	
Weight on drivers	143,000	36.87.
Heating surface	3,878.5	
Total weight	220,500	54.69
Heating surface	3,878.5	
Volume of two cylinders	12.32 cu. ft.	
Heating surface	3,878.5	314.81.
Volume of cylinders	12.32	
Grate area	54.25	1.40.
Volume of cylinders	12.32	

The Kohn Insulated Rail Joint.

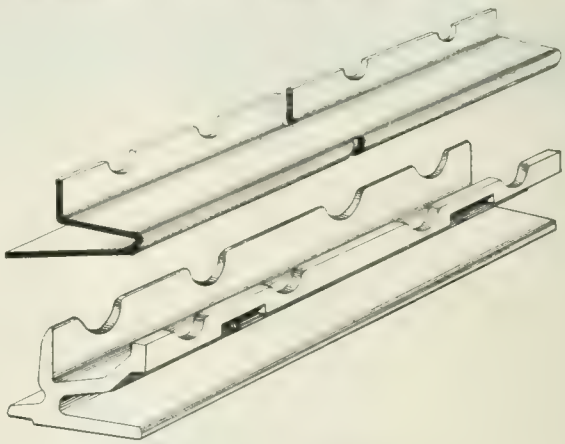
The Kohn insulated rail joint shown in the accompanying illustrations was designed with three principal ends in view, to give a strong and perfectly insulated connection between the rails, to avoid any possibility of damage or breaking down of the insulation, due to creeping, and to give protection against deterioration of the fiber insulation, due to abrasion and moisture. The serious objections to some of the forms of insulated rail joints now in use is the crushing of the insulation where it is located between the heads of the rails and the vertical legs of the angle bars and the cutting and abrasion of the fiber thimbles used around the transverse bolts, owing to the downward thrust and the creeping of the rails. The sharp edges of the holes in which the thimbles are inserted tend to cut into the fiber and break down its structure when the transverse bolts are twisted out of line, due to movement of the rails. The design of this joint, it is claimed, does away with these objections.



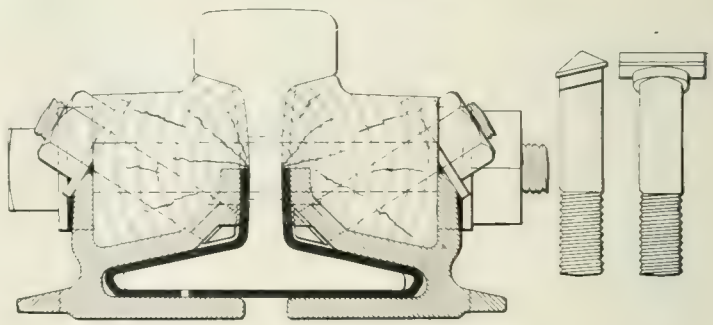
Perspective View of the Kohn Insulated Rail Joint.

The joint is composed of two rolled splice bars, which are interchangeable, right and left. The lower part of these bars is formed to correspond to the contour of the base of the rail and the elevated projecting flanges are cut out for spike slots. Insulating bars of hicque (a very hard wood grown in Cuba) are cut to conform to the contour of the rail and the open vertical channels in the splice bars, these channels being formed by the center thrust plates, the inner brace plates and their connecting webs, a portion of these webs being inclined as shown. These insulating bars are secured to each splice bar by two ¾-in. bolts having grip threads and special triangular heads. The bolts are inserted in an oblique position as shown in the cross-section. The heads of these bolts are shaped to conform to the openings notched out of the under sides of the sloping legs of the splice bars, and under the head they are formed with elliptical shoulders which fit in similarly shaped holes in the splice-bar legs, preventing the bolts from turning. The top edges of the vertical legs, or thrust plates, of the splice bars are beveled to receive the 2-in. metallic washers put on under the nuts of the oblique bolts, and the upper edges of the wooden bars are chamfered out for bearings for the washers. When these bolts are tightened up the splice bars and the wooden insulating bars are held firmly together. The work of assembling these parts is done before delivery of the joints is made. If the nuts on these oblique bolts become loosened, they cannot come into contact with wheel flanges passing over the joint as the angle of inclination of the bolts gives a space of 2 in. if the nut is brought out on a line with the bottom of the flanges. This, however, cannot occur, as the short length of the bolt would cause the nut to fall to the ground.

To apply the joint, the two pieces of fiber insulation formed to fit the bases of the rails are put on and the assembled bars applied from each side. The four ⅞ in. transverse bolts are then inserted, together with the ½ in. fiber washers, 2¼ in. in diameter, and the ⅛-in. metal washers of the same diameter, which are put under the heads of the bolts and the nuts on each side of the joint. The holes in the webs of the rails are drilled to give the usual clearance. The inclined legs of the metallic splice bars next to the webs of the rails are cut out to a diameter of 1⅜ in., giving a clearance of ¼ in. under the bolts and on each side. This prevents the bolts from coming into contact with the steel splice bars when the rails creep and renders it unnecessary to use insulation at these points. The vertical legs of the splice bars are cut out to a diameter of 2¼ in., with rounded corners, to prevent cutting of the fiber washers, which are securely recessed in the openings. These washers are smooth cut and are thicker than the vertical legs or thrust plates of the steel bases, this extension of the insulation preventing the metallic



Insulating Strip and Splice Bar.



Cross-Section of the Kohn Insulated Rail Joint.

washers on the transverse bolts from coming into contact with the steel bases when vertically or longitudinally displaced. The creeping strain is carried principally by the oblique bolts and the steel bases, and there is no shear or any fiber thimbles or washers.

The end post used in the joint is ⅜-in. thick and conforms to the contour of the head of the rail and to the base of the rail, but is made wider than the thickness of the web, the wooden bars and longitudinal insulation being recessed at the center to allow for this greater dimension. Cutting the upright portions of the insulation at the meeting ends of the rails to accommodate the increased width of the end post, and also at the outside junction, prevents crushing of the fiber, owing to the removal of all sharp angles. The end post, however, may be made the same width as the webs of the rails and the insulating separators left intact. The outer junction of the insulation is made inclined, as shown, to allow ample margin when the joint is being applied to the rails. The insulating sheets or separators between the rails and the splice bars are made in two parts, one part being carried across the opening between the splice bars under the rails. It is claimed that this will prevent any leakage, as ballast or other short-circuiting material cannot come in contact with the rails. The fiber sheets extend up on the web only to the height of the splice bars. The joints may be made to permit of the use of snow flangers on locomotives if desired.

Several hundred of these joints have already been ordered by a number of railroads in the East. The joint is the invention of Koby Kohn, 45 West 119th street, New York City.

GENERAL NEWS SECTION

NOTES.

One of the members of the Georgia State Railroad Commission, Mr. O. B. Stevens, will hereafter spend most of his time in traveling about the state to investigate complaints in the localities where they arise.

John B. Horn, engineman of the Poughkeepsie train which was in collision with a New Haven train in New York City December 19, has been found responsible by a coroner's jury for disregarding the stop signal, and has been held by the coroner in $2,000 bail to await the action of the Grand Jury.

According to the Harrisburg *Star-Independent* the Pennsylvania Limited express train (23-hour train to Chicago) on Christmas day ran from Jersey City to Pittsburg, stopping at Philadelphia, Harrisburg and Altoona, without a single passenger. What was done with the perishable viands in the dining car is not stated.

At Chicago, December 29, the Grand Jury in the Federal Court returned indictments against the Chicago, Burlington & Quincy railroad and D. Miller and C. C. Burnham, officers of the road, for granting illegal rebates to the United States Steel Products Co., of New York. Twenty-six separate offenses are charged.

The Enterprise Transportation Co., running a steamboat between New York and Fall River, has complained to the Massachusetts Railroad Commissioners that the New York, New Haven & Hartford Railroad discriminates against complainant by refusing to honor baggage checks issued by the boat line, and in other ways.

A press despatch from Springfield, Ill., says that after hearing an application from the railroads for a modification of the recent order making a reduction of 20 per cent. in freight rates, the State Railroad Commissioners have decided that, so far as the first five classes are concerned, the order shall go into effect at once; but on the lower classes further investigation will be made.

The regulations for the transportation of explosives recently adopted by the American Railway Association have been made the rules of the State Railroad Commission of Massachusetts; and the Commission, acting under the law provided for the purpose (Sec. 99, Chap. 102,) has published the regulations in full in the Boston *Advertiser*, the Worcester *Telegram*, and the Springfield *Republican*.

At Chattanooga, Tenn., a suit has been filed against the Cincinnati, New Orleans & Texas Pacific for damages for the death, last August, of a switchman of the Southern Railway, who, it is claimed, was overcome by the fumes of formaldehyde in a sleeping car which had just been fumigated. In August strict sanitary precautions were enforced on account of the presence of yellow fever in the Gulf states.

The "Cuban Special," the 24-hour train of the Illinois Central between Chicago and New Orleans, made its first trip south December 26 and its first northward trip December 28. Both trains arrived on time. The distance is 923 miles. This is probably the only line in the world, so long as 900 miles, which trains traverse without changing watches. The schedules are made on Central Standard time all the way.

The Tehuantepec National Railway, which has for some time past been handling local traffic, is expected to be open for transcontinental traffic by July, 1906, by which date the works on the terminal harbors of Coatzacoalcos, on the Atlantic, and of Salina Cruz, on the Pacific, will be sufficiently advanced to permit steamers drawing 30 ft. to load and discharge at all times, in still water, alongside the quays direct into cars or warehouses as required.

After a conference with the Governor of Indiana, the passenger traffic officers of the principal railroads in that State have decided to issue an interchangeable mileage ticket, such as is desired by the Governor and by the traveling men for whom he speaks. Mr. Ford, of the Pennsylvania, is reported as saying that a mileage book will be sold at 2 cents a mile, but that it will not be sold for local traffic in any State; meaning, apparently, that the ticket will be made available only to and from junction points.

On a line of the Burlington Traction Co., Burlington, Vt., on October 7, two cars collided and sixteen persons were injured; and the Vermont State railroad commission finds that the collision occurred because one of the cars was overcrowded and in charge of an inexperienced motorman; also that he had no written orders to meet another car at an unusual place, the scene of the accident being a switch seldom used. The custom of employing inexperienced men and operating cars without specific orders prevails on nearly every electric railroad in the State, a "rash practice," says the commission.

The Union and Southern Pacific roads have put on a fast train between Omaha and San Francisco which carries nothing but mails. It will make the time westbound about 5½ hours quicker than the Overland Limited, and will save 24½ hours (from New York) over the time hitherto made by the regular mail train. Mail leaving New York at 3:15 a. m. on Tuesday; Chicago, 2:45 a. m. Wednesday, will reach Ogden at 3 p. m. Thursday and San Francisco at 12:30 p. m. Friday. Mail leaving San Francisco at 6 p. m. Monday will reach Chicago at 10:30 a. m. Thursday and New York at 11:53 a. m. Friday. The new train makes connections for Oregon and Washington, saving 12 hours, and with the San Pedro, Los Angeles & Salt Lake for Los Angeles.

In New York City last week A. C. Newburn, a traveling salesman arrested on a charge of forgery in signing the name of George E. Whitcomb to a ticket which he had bought from Whitcomb, was brought before Justice Leventritt on a writ of habeas corpus and was released from custody, the justice holding that no forgery had been committed. Whitcomb bought the ticket at the railroad office, was followed and seen to meet Newburn outside of the office; and then Newburn was followed until he presented the ticket for passage. He signed Whitcomb's name and was then arrested. Counsel declared that Whitcomb had authorized the writing of his name by Newcomb whenever he should be asked to do so by the railroad, and the court sustained the legality of this proceeding.

The Interborough Rapid Transit Co., New York City, has raised the pay of guards for the first year from $1.55 per day to $1.70. This is the second-year rate, and it will henceforth be the rate both for the first and the second years. The third-year rate is $1.80 and the fourth-year rate $1.95. First-year switchmen have been advanced from $2.15 to $2.25; and all switchmen receiving $2.35 are advanced to $2.40. The rate for hand switchmen will henceforth be $2.25 the first year and $2.40 thereafter. Clerks and starters working 12 hours a day are now allowed two days off each month, with pay. The Canadian Pacific has increased the wages of track foremen and laborers east of Fort William. The New York Central has made an increase of 10 per cent. in the wages of freight handlers at Little Falls.

Mr. Charles T. Yerkes, the well-known street railroad capitalist and manager, died in New York City December 28. He was born in Philadelphia in 1837 and opened a broker's office there in 1858. In 1861 he purchased a banking house, which he managed until his failure ten years later. In 1874 he resumed his business and became prominent in street railway operations, later extending his field of influence to Chicago, where he obtained control of the north and west side surface roads and several suburban and elevated roads. For some years past he has been prominently interested in building and managing the underground railroads in London. In latter years he was Managing Director of the Underground Electric of London, Limited, which was incorporated in 1902 and controls the Metropolitan, Metropolitan District, Great Northern, Piccadilly & Brompton, Baker Street & Waterloo, and Charing Cross, Eustin & Hampstead subways, and also the London United Tramways.

To Obey the Law.

The men who represented the western railroads in conference with the Interstate Commerce Commission at Washington, Dec. 28, were J. C. Stubbs, vice-president and traffic director of the Union Pacific and the Southern Pacific, who was the chief spokesman; G. T. Nicholson, vice-president of the Atchison, Topeka & Santa Fe; H. R. McCullough, vice-president of the Chicago & North Western; J. H. Hiland, vice-president of the Chicago, Milwaukee & St. Paul; J. M. Johnson, assistant to the vice-president of the Missouri Pacific and allied lines; J. F. Holden, freight traffic manager of the Chicago, Rock Island & Pacific; J. W. Blabon, freight traffic manager of the Chicago & Alton; Howard Morris, vice-president and general counsel of the Wisconsin Central; C. L. Wellington, general traffic manager of the Colorado & Southern; C. Haile, traffic manager of the Missouri, Kansas & Texas; W. L. Martin, vice-president of the Minneapolis, St. Paul & Sault Ste. Marie; and E. E. Smythe, general freight agent of the Kansas City Southern.

The commissioners present were Messrs. Knapp, Clements and Cockrell. At the close, Chairman Knapp said: "The conference was not sought by the Commission, but its purpose was legitimate and commendable, and warrants the expectation of beneficial results. At a recent meeting in Chicago, the representatives of practically all the lines west of that city, from the Canadian border to the Gulf, adopted the following resolution:

"'That a joint committee, representative of lines in Western Trunk Line Committee, the Trans-Missouri Freight Bureau, Southwestern Tariff Committee, and the Transcontinental Freight Rate Committee, be appointed and instructed to wait upon the Interstate Commerce Commission; declare the desire and purpose of the respective members of said committees or bureaus to co-operate with the Commission in the enforcement of the law to the extent of pointing out ways and means, and giving the Commission any specific

information that may come to our knowledge which will lead to effective inquiry in uncovering unlawful practices.'

"The object of that committee was to present this resolution, and assure the Commission of the united and determined disposition of the lines represented to conform to the law in good faith, and in every respect, and to aid the Commission in its enforcement. Pledges to this effect were given by all present, with the further promise to report every illegal transaction which may come to their knowledge, or of which they may have well-grounded suspicion.

"While this visit was unsolicited, as above stated, it was not unwelcome, and the Commission has no reason to doubt the sincerity of the movement or its practical value. That it will result in the complete discontinuance of wrongful practices is perhaps too much to expect, for time alone will test the degree of its usefulness, but a marked improvement in the observance of tariff rates may be fairly anticipated. If the promised co-operation is actually and continuously afforded, the payment of rebates and the granting of secret advantages will, it is hoped, be reduced to a minimum."

Completion of the Maumee Bay Straight Channel.

The Maumee bay straight channel, which makes possible Toledo's classification as one of the big ports on the Great Lakes, was completed on October 6th by the Great Lakes Dredge & Dock Company. It was finished just five days behind time on a six year contract. This is remarkably good work and close calculation on a job of its kind. The cost of the work was $950,000. For 48 months, working from early spring until navigation closed in the fall, a fleet of three dredges, three tugs and 12 scows, manned by 50 men, labored and battled with heavy seas and many storms. They dug blue clay which was so hard at times that sharp axes could not break it.

The harbor improvement is technically known to the Bureau of Navigation as "the straight channel," and is 400 ft. wide by 23 ft. deep throughout its entire length. The plans called for 22 ft. depth, but an extra foot was dredged to allow for fill. The channel is about 14 miles long, extending from the Lake Shore railroad bridge to the new fog station and lighthouse. The Government dredge performed the work between the bridges and the contractors did the work extending from the Wheeling bridge to the new lighthouse. All told, the government has spent $2,150,700 on the waterways improvements at Toledo, the additional sum of $124,000 having been spent on the old crooked Turtle Light channel which was abandoned in 1891.

When the straight channel was ordered dredged it was made 200 ft. wide by 17 ft. deep. In 1899 the work of widening and deepening the channel was undertaken, and it is this last piece of work which has just been finished. The contract was originally given to Lyden & Drews, which firm was later absorbed by the Great Lakes Company. The man who engineered this gigantic task of removing ten million cubic yards of earth in six years was Mr. James G. Murray, who is Manager of the lower lakes fleet for the company named. Mr. Wm. T. Blunt was the Government's engineer in charge.—*Steam Shovel News.*

Class Legislation.

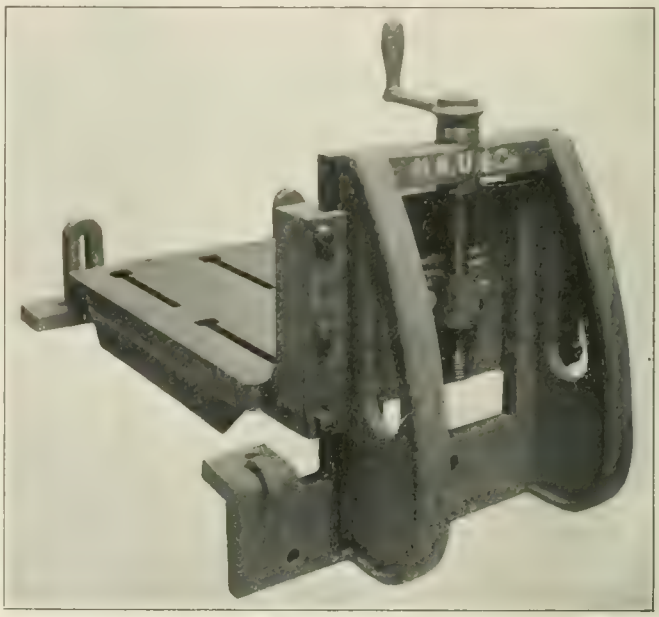
Jokes which were flourishing in the seventeenth century usually get laughed at, not because they were once funny, but because of their reflex humor, so to speak; the humorousness which one is compelled to feel at their hardihood in appearing in public after death. The bill to forbid sleeping car porters to let down the upper berth when the occupant of the lower isn't feeling pleasant, would seem to belong in the same class; though this notion dates back only to the middle of the nineteenth century. This year's manifestation occurred at Washington, on the third day of the session. The bill was presented by Mr. Brownlow; and how he came to waste two days in getting it before his colleagues is a mystery. Representative Brownlow, says the reporter, weighs nearly 300 pounds, and when he lies on his back he projects so far upward that the upper berth comes within painful proximity to his stomach. "I always travel in a lower berth," he said to a friend inquiring about the bill, "and, of course, if any one buys the upper berth I don't object to its being made up; but it is an outrage for a railroad company to put that lid on a fellow just for the fun of the thing." All the fat men in Congress who have long distances to travel in getting from their homes to the capital consider the bill as of more importance than those concerning the rebate question.

Proposed Railroad in Nicaragua.

Two new railroads to be built by American capital are projected in Nicaragua. The first is to connect the city of Managua, the capital, with the northwest part of the republic. This is to run through the States of Managua, Leon, Matagalpa, Jinotega and Segoira. Surveys are under way on some 175 miles. Henry Francis Lefevre, formerly connected with the Guggenheim Exploration Co., is Engineer of Construction. The road is to be built by the Nicaragua Concessions Co., which has been formed to take over a large number of concessionary rights in that country. The other road is to be built by the Great Central Railway of Nicaragua, which is controlled by the Nicaragua Concessions Co. It is to run from the head of navigation on the Coco river, on which the company now has steamboat service, about 250 miles into what is said to be a rich mineral region. Preliminary surveys for the first section of 60 miles have been completed. James Deibrick, Park Row Building, New York City, is connected with both companies.

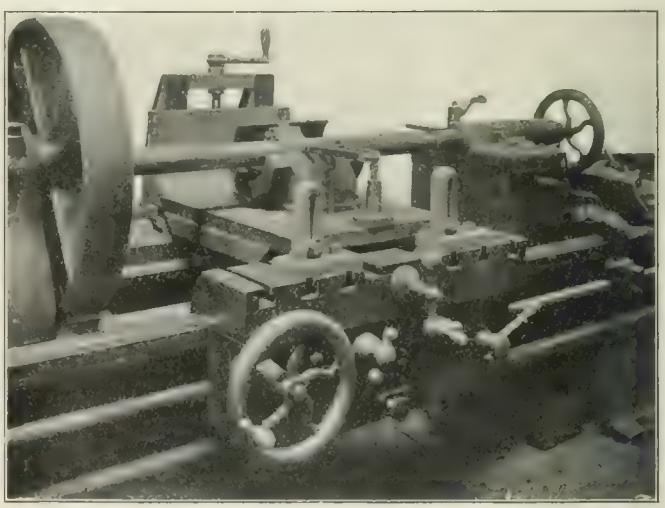
A Lathe Attachment for Boring.

The accompanying illustrations show an ingenious arrangement made by H. B. Underwood & Co., Philadelphia, Pa., for converting a lathe to a horizontal boring mill. This attachment can be made to fit any size lathe, and it is claimed that with it an output equal to the output of a boring mill both in quantity and quality can be produced. It consists of a lower plate with an angle projecting down and



Boring Mill Attachment for Lathe.

fastened to the rear side of the lathe carriage. The surface of this angle plate is planed true with all the other parts of the attachment. For a 30-in. lathe the bed has three T slots for ⅝-in. or ¾-in. bolts, and is 31 in. long x 22½ in. wide. It is provided with a 5½-in. vertical adjustment. When set on the lathe carriage it is true with the carriage in all directions. By means of the vertical adjusting screw the table is either raised or lowered parallel with the



Boring Mill Attachment for Lathe.

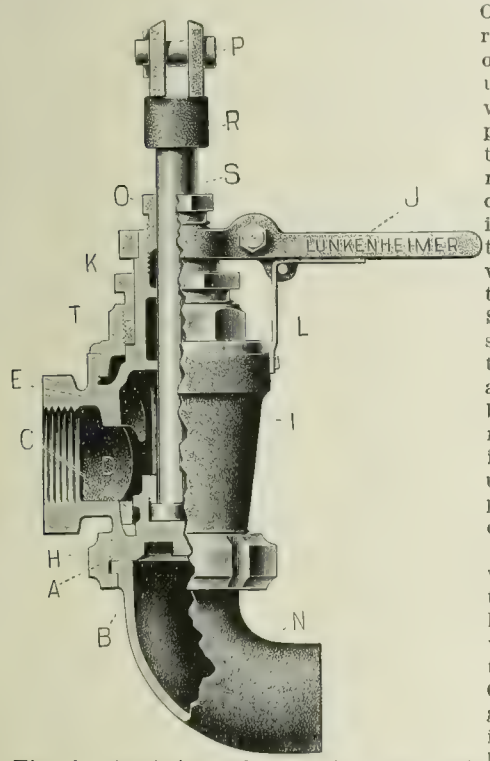
lathe shears. After being brought in position, the two slotted angle pieces (they having been previously bolted on the front of the carriage) are firmly attached to the table by the two screws shown, holding the bed to the lathe carriage. It can readily be seen that it gives a true adjustable bed equal to any well designed machine tool for holding pieces to be bored. In practice a 3-in. or 3¼-in. diameter bar with suitable cutterheads and automatic feed is desirable. By attaching one end of the boring bar to the face plate of the lathe, and the other end of the bar in the steady rest or other bearing, a powerful boring mill is produced which is entirely independent of the lathe centers. The weight of the device complete for a 30-in. lathe is 685 pounds.

Boston & Maine Pensions.

The question of establishing a pension department for the employees of the Boston & Maine, which has been under consideration for a number of months, appears to have been settled at a meeting of delegates of employees' organizations held at Boston, December 24. According to the reports of this meeting, the delegates (150 in number) voted unanimously in favor of a plan under which the employees will contribute to a pension fund 1 per cent. of their wages, and the railroad company will contribute an equal amount. It appears that the officers of the road had asked the employees to consider the matter and had virtually promised to adopt any reasonable plan which should be agreed upon. It is said that on the basis named, the contributions will amount to $300,000 annually, which was the sum appropriated by the Pennsylvania road four years ago; and on the Pennsylvania the number of employees must be several times as large as on the Boston & Maine. The details are yet to be arranged.

The Lunkenheimer Locomotive Blow-Off Valve.

The illustration herewith shows a new form of locomotive blow-off cock which has been applied on a number of locomotives recently built for several large railroads. The valve is operated by hand, and is constructed to eliminate any tendency to fouling, sticking or leaking. Two distinct valves are combined in one body. One of these is for regular use and the other for emergency use in case the main valve will not operate properly. The connection to the boiler is made at D and the outlet from the valve is through the ell at the bottom. The main valve disc is moved off the seat by the stem S, which is raised by suitable levers carried to an accessible point above the running board. By lifting the main valve as far as it will go a free and unrestricted passage is provided for the blow-off water.



The Lunkenheimer Locomotive Blow-Off Valve.

The emergency valve consists of the tapered plug C, which has a ground fit in valve body, and is rotated by the handle. Ordinarily, this emergency valve remains in an open position, but should the main valve fail to work properly the emergency valve can be turned part of a revolution and cut off the opening from the boiler connection. With the main valve raised to its full open position all blow-off operations can be performed with the emergency valve. As a further preventive for the failure of the main valve to seat tight, the valve disc is provided with an upper flange sliding loosely within the emergency valve C. As the main valve is lowered past the opening from the boiler this flange gradually reduces the opening, causing wire-drawing of the escaping water which bursts into steam and because of its high velocity is effective in washing away any sediment which may have been deposited on the main valve seat, and which would prevent its closing tightly. Should a piece of boiler scale become lodged in the opening it can usually be removed or broken up by giving the emergency valve a partial turn, and thus back again to the normal position. All parts of this valve are made to standard gages and templates, and any part which is broken or worn can be quickly and easily renewed. The valve was invented by Frederick Wertsheimer, Supt. M. P., Cincinnati, Hamilton & Dayton, and is made and sold by the Lunkenheimer Co., Cincinnati, Ohio.

Mr. Hill Discusses the Situation.

The *Wall Street Journal* quotes J. J. Hill as follows. I regard the business situation in this country to-day as no better than it was a year ago. The reason I think so is, that the Russian disturbance is a menace, the extent of which we cannot yet determine. Business in this country is at high pitch. As far as possible adverse legislation is concerned, we are not afraid of anything of the kind.

The problem in this country is how not to waste opportunity just as the problem of railroading is how not to waste train mileage. The duty of a railroad agent is not to sit on a rolling stool and figure on waybills as a 16-year old boy could do, but to stand on the platform and see that two cars are not used for freight that could be put in one. The duty of the country is to take advantage of its opportunities, some of which are leaving us and will not return.

We have put some large ships on the Pacific ocean and they sail for the Orient filled; but why are they filled? Because we fill them. This was our experiment. We do not think much of it as a source of profit.

What has this country got that it can export profitably in competition with Germany and other countries? It ought to have almost everything, but has it anything? We ship cotton to the Orient, but most of the cotton used there comes from India. There they pack their cotton better. The bales are 6 to 8 in. shorter than ours, the covering is neat and substantial. Our cotton covering is coarse and wears badly. We ordinarily ship about one-fifth of the cotton used in the Orient. This year we will ship not more than 10 per cent. We send them some cotton piece or cotton cloth goods, but they will not buy cotton above a certain price. Cotton is too high for them now.

A German consul has a residence where he can entertain people decently. An American consul has a room upstairs somewhere. The result is what you might expect.

I do not believe this country will ever have a merchant marine under its own flag, under existing laws. It costs us five times as much to dock a ship at one of the Pacific ports as it does at Nagasaki.

In some respects this country, industrially, is going the way of England, where the labor unions have dominated business with the result that there is no town in England of over 15,000 inhabitants where you cannot buy almost any important article to better advantage by selecting one of foreign make. German cutlery is sold in Manchester to-day to advantage. The glass works in England closed down and factories were started in Belgium, with the result that the English glass makers are out of employment.

Germany's laws governing industrial conditions are stringent and they are enforced. There a man works 11 hours a day, and if he makes a blunder such as destroying the fabric or material he is working on he is summarily discharged.

What has labor in this country to look forward to? Our immigration is 1,000,000 a year or more, and the natural increase in population is two and one-half times as much. There is homestead land left to be sure—the kind a man can starve on—and besides that there is the irrigated land being opened up, enough to supply the new population for a few years perhaps. And then what? If labor finds itself beaten in this country—and many think it is beaten now—it will have itself to blame. It will have killed the goose that laid its golden egg.

As for the railroads, they throw away too much of their product. They consume too many train miles for their ton-mile revenue. The rate problem in the west is different from that in the east. Great Northern's rate per ton-mile as compared with New Haven's is as .79 to 1.40. You can figure out what this would have meant in our revenue last year if we had the Consolidated Road's rate. The traffic density on the Pennsylvania system east of Pittsburg is six times that on Great Northern.

Main Line Electrification in England.

The Allgemeine Elektrizitäts Gesellschaft, acting in connection with the British Thomson-Houston Company (the English counterpart of the General Electric Company) has been given the contract to electrify the London, Brighton & South Coast Company's South London line. The conversion will take place over the track between Battersea Park Junction and Peckham Rye, a distance of about five miles. The Winter-Eichberg system, of which the Thomson-Houston Company own the British rights, will be adopted, and all the switch gear, together with most of the motors and control apparatus, will be made by the company in England. The first few motors are to be made by the A. E. G. in Germany, as that firm has already been successful in carrying out similar work. An English firm has secured the subcontract for the overhead equipment, so that British labor will be utilized for the major part of the undertaking. This has removed a certain amount of dissatisfaction resulting from the successful bid of the German firm. The main reason for the action of the directors was, however, that in adopting the Winter-Eichberg system they were not committing themselves to an untried method, but to one that had already been successfully put into practice and of which the A. E. G. are the introducers.

Another Decision in Favor of the Railroad.

The Interstate Commerce Commission has announced its decision, in an opinion by Commissioner Cockrell, in the case of Brabham et al. against the Atlantic Coast Line and the Charleston & Western Carolina. The passenger fare from Ellenton, S. C., to Augusta, Ga., 22 miles, is 80 cents, and from Jackson, S. C., to Augusta, Ga., 15 miles, 60 cents, and these fares are alleged to be unreasonable. The local passenger fares in South Carolina and

Georgia are controlled by a maximum of three cents a mile, fixed by state authority. Between the points named the Atlantic Coast Line has trackage rights over the other line, and all fares collected are turned over to the C. & W. C. The financial condition of the C. & W. C. is poor, and the traffic is light.

The Commission holds, first, that the rates fixed by the State Commissions of South Carolina and Georgia are presumptively reasonable, but such presumption is not conclusive, and the railroad companies are entitled to show the contrary in a case involving the rates on interstate traffic; second, that a railroad company is entitled to a fair return upon the value of that which it employs for public convenience, and that it is not apparent that the interstate passenger rates complained of are unreasonable.

Ohio Canals, Mines and Forests.

Governor Herrick of Ohio, in his annual message to the legislature, says that the State canals must either be rebuilt or abandoned. "It will not do to go on forever declaring for the maintenance of what we ironically call our 'waterways' and then permit them to sink gradually into a worse and worse condition of ruin and wretchedness. If the people want to keep them, the duty is plain and the way is clear. The State cannot both maintain and abandon the canals, what it has been trying to do for many years." The Governor recommends additional legislation to protect life and property in the mines in the State and the enactment of laws which will foster and preserve the rapidly diminishing forest areas of the State.

Manufacturing and Business.

The Railway Appliance Co., Chicago, successor to the Q. & C. Co., is distributing an amusing sketch entitled "Pigs is Pigs."

Wm. T. Butler has been appointed Pacific coast representative of the H. W. Johns-Manville Co., New York. His headquarters will be at San Francisco, with branch offices at Los Angeles, Cal., and Seattle, Wash.

The Association of American Portland Cement Manufacturers, Philadelphia, Pa., has just published a paper by Mr. Newberry, entitled "Concrete Building Blocks." The pamphlet is for free distribution, and may be obtained by addressing the association.

Henry C. Ebert, assistant to the Third Vice-President of the Westinghouse Electric & Mfg. Company, Pittsburg, Pa., has resigned his position to become the President of the Cincinnati Car Company and Vice-President of the Ohio Tractions Company. Mr. Ebert's connection with the Westinghouse Electric & Mfg. Company dates back about 15 years.

A contract has just been placed by the Louisville & Nashville with the Weir Frog Company, of Cincinnati, for the supply of all its frogs and switches for 1906. This contract is a renewal of a contract held many times by the Weir Frog Company, and is one that has been continuously held since the Weir Co. moved into its new plant at Norwood, one of the suburbs of Cincinnati.

The Westinghouse Electric & Manufacturing Company recently renewed an annual contract covering the requirements of the Moline Elevator Company, Moline, Ill., so far as its motor needs are concerned. The renewing of this contract is due to the highly satisfactory performance of Westinghouse elevator motors under the most trying conditions, their design and construction rendering them peculiarly adapted to the requirements of the severest elevator work.

Iron and Steel.

Contracts have been given by the Florida East Coast for 6,000 tons of rails and by the Western Maryland for 5,000 tons.

Contracts are to be let for 30,000 tons of steel castings for the American Locomotive Company, deliveries to be made at the rate of 2,500 tons per month.

The Twenty-third street ferry terminals of the Delaware, Lackawanna & Western, New York City, recently damaged by fire, will be rebuilt by the American Bridge Company.

The Pennsylvania Steel Company has been given a contract by the New York & Long Branch Railroad to build a bridge over the Raritan river, which calls for 5,000 tons of fabricated steel.

OBITUARY NOTICES.

—Mr. E. R. Reynolds, formerly Vice-President and General Manager of the Long Island, died recently at the age of 41.

—Mr. William S. Thorn, Assistant General Passenger Agent of the Minneapolis, St. Paul & Sault Ste. Marie, died at St. Paul, Minn., on December 26.

—Mr. Matthew P. Wood, Consulting Engineer, died recently in New York at the age of 70. During the Civil War, Mr. Wood was Superintendent of Motive Power of the Government Military railroads under General Herman Haupt.

—Mr. J. P. Hovey, formerly Superintendent of Motive Power of the Kansas City, Mexico & Orient, died recently at Wichita, Kan., at the age of 84. Mr. Hovey was connected with the Union Pacific for many years, and had been Master Mechanic on the Cleveland & Pittsburg.

—Mr. Edward Wilder, Secretary and Treasurer of the Atchison, Topeka & Santa Fe, died recently at Topeka, Kan. Mr. Wilder was born in Boston in 1843 and entered railroad service in 1859 as clerk in the Superintendent's office of the Boston & Worcester. After being promoted several times, he left that road in 1870 to become Land Commissioner of the Hannibal & St. Joseph. The next year he was appointed Assistant Secretary and Assistant Treasurer of the Atchison, Topeka & Santa Fe, being appointed to his last position in 1876.

—Mr. George B. Spriggs, General Freight Agent of the New York, Chicago & St. Louis, died recently at Cleveland, Ohio, at the age of 71. Mr. Spriggs was born in England and entered railroad service there in 1852 on the London & Northwestern. After holding several offices on this road, he came to the Great Western of Canada, where he was appointed General Freight Agent. In 1871, he was appointed Assistant General Freight Agent of the Baltimore & Ohio, but in 1877 returned to the Great Western of Canada as General Freight and Traffic Manager. This position he left in 1882 to take the office which he held at the time of his death.

—Mr. John Dougherty, who was for many years in the service of the Pennsylvania Railroad, died in New York December 28. He was born in Ireland in 1840 and entered railroad service in this country on the Pennsylvania in 1863. He was steadily promoted until he became Assistant Secretary. In 1880, he went to the Denver & Rio Grande as Comptroller and Assistant Treasurer, and in 1884 he became Treasurer, Auditor and Purchasing Agent of the Buffalo, New York & Philadelphia, now a part of the Pennsylvania. In 1888, he left railroading to become General Manager of the Colorado Coal & Iron Co. He was later Secretary and Auditor of the William Cramp Ship & Engine Building Co., resigning in 1899 to become President of the New York Continental Jewell Filtration Co., which position he held at the time of his death.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Railway Signal Association.

The January meeting of this association, as heretofore announced, will be held at the Grand Union Hotel, New York City, on Tuesday next. The morning session is to begin at 11 o'clock and the afternoon session at 2.

United Engineering Society.

The directors of the American Institute of Electrical Engineers have appointed John W. Lieb, Jr., one of the three trustees to represent the Institute for three years on the board of trustees of the United Engineering Society, invested with the care and administration of the new United Engineering Building. Mr. Lieb succeeds Dr. Wheeler, elected President of the Institute. Work on the building is in active progress, and it is expected to lay the corner stone early in the spring.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atlantic Coast Line.—W. R. Sullivan has been elected Assistant to the President.

Chicago, Cincinnati & Louisville.—By order of the Receiver of the Cincinnati, Hamilton & Dayton, the officers of the C., H. & D. have ceased acting as officers of the C., C. & L.

Cincinnati, Hamilton & Dayton.—J. L. Cramer, Assistant Comptroller of the Erie, the C., H. & D., and the Pere Marquette, has been appointed Comptroller of the C., H. & D. and the Pere Marquette.

Pere Marquette.—See Cincinnati, Hamilton & Dayton.

San Pedro, Los Angeles & Salt Lake.—W. H. Leete, Cashier and Paymaster, has been elected Treasurer, with office at Los Angeles, Cal., succeeding F. K. Rule.

Operating Officers.

Lehigh Valley.—R. W. Baxter, Superintendent at Wilkesbarre, Pa., has been appointed Superintendent at Buffalo, N. Y., and also Superintendent of the lake lines of the Lehigh Valley Transportation Co., succeeding J. T. Keith, resigned. J. F. Maguire succeeds Mr. Baxter.

Little Rock & Hot Springs Western.—H. E. Martin, Acting General Superintendent, has been appointed General Superintendent of this road and of the Pine Bluff Western, succeeding G. L. Morris, resigned, with office at Hot Springs, Ark.

Missouri Pacific.—G. H. Stapp, who was recently appointed Superintendent of the Joplin division, was born in 1872. His first railroad service was in 1887 as an operator on the Pennsylvania Lines West. He became chief clerk to the Superintendent of the Louisville division of that road in 1894 and assistant trainmaster in 1902. In 1904 he resigned to go to the Chicago, Rock Island & Pacific, where he was for a time in the office of the General Superintendent of Transportation. He then went to Logan, N. Mex., as Superintendent in charge of the switchback at that point. In June, 1905, he went to the Maintenance of Way department of the Missouri Pacific, being appointed Superintendent of the Joplin division in December.

Mobile, Jackson & Kansas City.—E. W. Davis, Chief Clerk to the General Manager, has been appointed Car Accountant, succeeding William O'Rourke.

Northern Pacific.—D. Boyle, Superintendent at Livingston, Mont., has been appointed Assistant General Superintendent, with office at the same place. Mr. Boyle's authority will extend over the Yellowstone and Montana and the Rocky Mountain divisions. F. N. Finch, Chief Clerk to the General Manager, succeeds Mr. Boyle.

Philadelphia, Baltimore & Washington.—James Buckelew, Principal Assistant Engineer, has been appointed Superintendent at Media, Pa., succeeding C. J. Bechdolt, deceased.

Southern.—W. N. Foreacre, Superintendent at Atlanta, Ga., has been appointed Assistant General Superintendent of the Western division, with office at Birmingham, Ala. Mr. Foreacre's authority will extend over the Asheville, the Mobile, the Atlanta, the Birmingham and the Nashville divisions.

Traffic Officers.

Atlantic Coast Line.—H. M. Emerson, Traffic Manager, has been appointed General Traffic Manager, and the office of Traffic Manager has been abolished. R. A. Brand, General Freight Agent at Wilmington, N. C., has been appointed Freight Traffic Manager. W. J. Craig, General Passenger Agent, has been appointed Passenger Traffic Manager. J. W. Perrin, Assistant General Freight Agent, has been appointed General Freight Agent of the First division. C. McD. Davis has been appointed Assistant General Freight Agent of the whole system. The offices of all will be at Wilmington, N. C.

Central of Georgia.—J. M. Mallory has been appointed Industrial Agent, with office at Savannah, Ga., reporting to the Second Vice-President.

Chicago, Burlington & Quincy.—F. E. Bell, City Passenger Agent at Chicago, has been appointed Assistant General Passenger Agent.

Cincinnati, Hamilton & Dayton.—C. L. Thomas, Assistant Freight Traffic Manager of the Erie, has been appointed General Traffic Manager of the C., H. & D.

Erie.—The office of S. P. Shane, Freight Traffic Manager, has been moved from New York to Chicago. F. A. Wann, Freight Traffic Manager, and C. L. Thomas, Assistant Freight Traffic Manager of the lines west of Buffalo and Salamanca, have resigned. See Cincinnati, Hamilton & Dayton.

Missouri River & Northwestern.—G. P. Corey has been appointed General Traffic Manager, with office at Rapid City, S. Dak.

Pere Marquette.—A. Patriarche, Freight Traffic Manager, has been appointed General Traffic Manager.

Vera Cruz & Pacific.—C. Cardona, Auditor, has been appointed General Freight and Passenger Agent.

Wheeling & Lake Erie.—W. C. Maxwell has been appointed Assistant General Traffic Manager of this road and of the Wabash-Pittsburg Terminal, with office at St. Louis, Mo.

Engineering and Rolling Stock Officers.

Canadian Pacific.—C. Kyle, Master Mechanic at North Bay, Ont., has been appointed Master Mechanic at Montreal, Que., succeeding J. B. Elliott, promoted. G. T. Fulton, General Foreman at Carleton Junction, Ont., succeeds Mr. Kyle.

Houston & Texas Central.—S. Millican, heretofore Acting Superintendent of Motive Power and Machinery, has been appointed Superintendent of Motive Power and Machinery of this road and also of the Houston East & West Texas and the Houston & Shreveport; office at Houston, Tex.

Pennsylvania Lines West.—J. W. Barrie, Engineer of Maintenance at Toledo, Ohio, has been appointed Engineer of Maintenance at Chicago, succeeding N. Neff, transferred. R. C. Harris, Engineer of Maintenance at Cambridge, Ohio, succeeds Mr. Barrie. Guy Scott, Assistant Engineer at Chicago, succeeds Mr. Harris.

LOCOMOTIVE BUILDING.

The Chicago, Rock Island & Pacific has decided to order 50 additional locomotives.

The Union, it is reported, has ordered three locomotives from the American Locomotive Co.

The Harriman Lines have ordered from the Baldwin Locomotive Works 15 compound Atlantic (4-4-2) locomotives and 19 heavy consolidation (2-8-0) locomotives for the Union Pacific; 23 heavy consolidation (2-8-0) locomotives, six Pacific (4-6-2) locomotives and 10 switching locomotives for the Oregon Short Line; 25 heavy consolidation (2-8-0) locomotives, six Pacific (4-6-2) locomotives, and 14 switching locomotives for the Southern Pacific, and three Pacific (4-6-2) locomotives for the Oregon R. R. & Navigation Co. These locomotives are to be constructed under the same specifications as the original order of 140 locomotives, descriptions of which were published in our issue of September 22 last. This makes a total of 261 locomotives ordered in 1905 for their requirements in 1906 and 1907.

The New York, Philadelphia & Norfolk, as reported in our issue of December 15, has ordered two simple 10-wheel locomotives from the Baldwin Works for February, 1906, delivery. These locomotives will weigh 147,975 lbs., with 117,000 lbs. on drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 6 ft.; type of boiler, Belpaire, with a working steam pressure of 180 lbs.; total heating surface, 2,395 sq. ft.; 290 iron tubes, 2 in. in diameter x 14 ft. 10 in. long; firebox, 105 in. x 60 in.; grate area, 43.7 sq. ft. The tender will have a capacity for 6,700 gallons of water and 10 tons of coal. The special equipment includes: Westinghouse air-brakes, Franklin magnesia boiler lagging, National-Hollow brake-beams, steel back brake-shoes, Munton pivoted couplers, Sellers injectors, U. S. metallic piston and valve rod packings, Coale muffled safety valves, Leach pneumatic sanding devices, Detroit sight-feed lubricators, Crosby steam gages and steel wheel centers.

The Canadian Northern, as reported in our issue of September 15, has ordered 20 simple 10-wheel (4-6-0) locomotives from the Canada Foundry Co., Toronto, for delivery commencing in May; 10 simple 10-wheel (4-6-0) locomotives from the Locomotive & Machine Co., for April delivery; 10 simple 10-wheel (4-6-0) locomotives from the Canadian Locomotive Co., for July and August delivery, and four simple six-wheel switching (0-6-0) locomotives from the Canada Foundry Co., Toronto, for April delivery. The 20 10-wheel locomotives will weigh 160,000 lbs., with 130,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 57 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 1,901 sq. ft.; 240 tubes, 2 in. in diameter and 14 ft. long; firebox, 9 ft. 1⅜ in. long and 3 ft. 6 in. wide; grate area, 31.8 sq. ft.; tank capacity, 5,000 imperial gallons of water, and coal capacity, 11 tons. Ten of the 10-wheel locomotives will weigh 135,345 lbs., with 105,785 lbs. on the drivers; cylinders, 18 in. x 24 in.; diameter of drivers, 62 in.; radial stayed wagon top boiler, with a working steam pressure of 200 lbs.; 248 tubes, 2 in. in diameter and 13 ft. $2^{5}/_{16}$ in. long; firebox, 103 in. x 42 in.; tank capacity, 5,000 imperial gallons of water, and coal capacity, 10 tons. The other ten 10-wheel locomotives will weigh 135,000 lbs., with 107,000 lbs. on the drivers; cylinders, 18 in. x 24 in.; diameter of drivers, 63 in.; radial stayed wagon top boiler, with a working steam pressure of 200 lbs.; 236 tubes, 2 in. in diameter and 13 ft. long; firebox, 102 in. x 41 in.; tank capacity, 5,000 imperial gallons of water, and coal capacity, 10 tons. The switching locomotives will weigh 130,000 lbs.; cylinders, 19 in. x 24 in.; diameter of drivers, 50 in.; straight top boiler, with a working steam pressure of 180 lbs.; 260 tubes, 2 in. in diameter and 10 ft 6 in. long; firebox, 96 in. x $42^{5}/_{8}$ in.; tank capacity, 3,200 imperial gallons of water, and coal capacity, six tons. The special equipment for all includes: Westinghouse air-brakes, asbestos boiler lagging, Simplex brake-beams, Monarch couplers, Pyle National electric headlights for six of the 10-wheel locomotives, Ohio and Gresham injectors, Canadian Bronze Co.'s journal bearings, Brydges sanding devices and Detroit sight feed lubricators.

CAR BUILDING.

The Tacoma Eastern will shortly order 10 additional coal cars and five box cars.

The Illinois Traction System has ordered six cars from the Cummings Car Co.

The Toledo & Indiana has ordered four large interurban cars from the Jewett Car Co.

The Colorado & Southern, it is reported, will build several dining cars at its own shops.

The Louisiana & Arkansas has ordered 75 flat cars of 60,000 lbs. capacity from Barney & Smith.

The National of Mexico, it is reported, is in the market for 300 gondola cars of 80,000 lbs. capacity.

The Evansville, Suburban & Newburg has closed contracts for one baggage car and three passenger cars.

The Detroit United Railway has ordered 10 interurban and some single truck cars from the Cincinnati Car Co.

The Delaware, Lackawanna & Western has ordered 50 Hart convertible cars from the Rodger Ballast Car Co.

The Evansville & Terre Haute has ordered 1,500 gondola cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The International Railway, Buffalo, N. Y., has ordered 100 cars from the J. G. Brill Co., but the details have not yet been definitely decided.

The Chicago Great Western, as reported in our issue of December 29, will build 200 36-ft. box cars of 70,000 lbs. capacity at its own shops. The special equipment includes Barber trucks.

The St. Louis Construction & Equipment Company, as reported in our issue of December 22, is considering the purchase of 1,000 cars. As yet nothing definite has been settled in regard to the details of this work.

The Maine Central has ordered two second-class passenger coaches from the Wason Manufacturing Co. for February, 1906, delivery. These cars will measure 60 ft. 5 in. long over end sills x 9 ft. 8 in. wide. The bodies and underframes will be of wood.

The Boston & Maine, as reported in our issue of December 29, has ordered 1,000 box cars from the Pressed Steel Car Co. for April, 1906, delivery, and 500 box cars from the Pullman Co. for November, 1906, delivery. These cars will have a capacity of 60,000 lbs. and will weigh 32,900 lbs. They will measure 36 ft. x 8 ft. 6 in. wide x 8 ft. high inside. The bodies and underframes will be of wood. The special equipment includes: Wrought iron axles, Pressed Steel bolsters, Simplex brake-beams, cast-iron brake-shoes, Westinghouse brakes, lead-lined brasses, Gould couplers, Miner tandem draft rigging, Gould dust guards and journal boxes, Railway Steel Spring Co.'s springs, Fox pressed steel trucks and 33-in. 600-lb. cast-iron wheels.

The Canadian Northern, as reported in our issue of December 15, has ordered 1,000 36-ft. box cars of 60,000 lbs. capacity, for August delivery; 300 flat cars of 60,000 lbs. capacity, for delivery before May 31; ten 69-ft. 2-in. day coaches and three 60-ft. baggage cars from Rhodes, Curry & Co.; and ten 56-ft. day coaches, and five 60-ft. mail and express cars for July delivery, from the Crossen Car Manufacturing Co. The special equipment for all includes: Simplex bolsters and brake-beams for box and flat cars and Simplex brake-beams for passenger cars; Westinghouse air-brakes; Canadian Bronze Co.'s brasses; Monarch steel couplers for box and flat cars; Chicago steel couplers for passenger cars; Forsyth curtain fixtures for the 69-ft. 2 in. day coaches; Jones door fastenings for box cars; Miner draft rigging; Safety Car Heating & Light Co.'s heating system and Commercial Acetylene Co.'s safety light for passenger cars; American Asphaltum & Rubber Co.'s roofs for box cars; Diamond frame trucks for box and flat cars, and Canadian Northern standard trucks for passenger cars; Pullman wide vestibules for day coaches, and Rhodes, Curry & Co.'s wheels for box and flat cars, and steel tired wheels for passenger cars.

The Chicago, Indianapolis & Louisville cars reported in our issue of December 22, are to be equipped with the Curtain Supply Co.'s curtain fixtures instead of with Dayton Supply Co.'s curtain fixtures, as stated.

BRIDGE BUILDING.

Baltimore, Md.—The Western Maryland, it is said, is planning to build a bridge over North avenue, at its Walbrook station, to carry double tracks, replacing the present single-track structure.

Bonaventure, Que.—The town council will build a steel bridge over the Bonaventure river at this place.

Brownsville, Tex.—Announcement has been made that the St. Louis, Brownsville & Mexico will build a bridge over the Rio Grande river, connecting this place with Matamoras.

Carthage, Tenn.—Plans are being made for building a bridge over the Cumberland river at this place.

Gravenhurst, Ont.—The Dominion Railway Commissioners have approved the plans for two steel bridges on the Kleinburg-Sudbury branch of the Canadian Pacific Railway, one over the Muskoka river and the other across the outlet of the same river near Bala.

Houston, Tex.—Bids are wanted January 11 by John B. Ashe, County Auditor, for building a bridge over Cypress creek on East Montgomery road.

Indianola, Miss.—The Bellefontaine Bridge & Iron Co. will put up a bridge and viaduct 360 ft. long at this place.

Lethbridge, N. W. T.—The Canadian Pacific has completed the surveys for a 6,000-ft. trestle bridge at this place, to cross Belly river flats.

Lewisburg, Pa.—Union County Commissioners are planning to build a bridge over the Susquehanna river at this place to cost about $100,000.

Norristown, Pa.—The County Commissioners have given contracts to the Canton Bridge Co., at $18,100, for the superstructure and to James T. Smith of Perkiomenville, for the substructure, at $9,474, for the inter-county bridge over the Schuylkill river near Pottstown.

Pembroke, Ont.—A steel bridge, costing $25,000, will be built over the Madawaska river here.

Roanoke, Va.—A contract has been given by the Tidewater Railroad to the Virginia Bridge & Iron Co., of Roanoke, Va., for building a large number of bridges and a long iron trestle on its proposed road west from this place. The cost of the work will be about $650,000.

Seaforth, Ont.—The County Engineer has recommended that the following bridges be built as early as possible in 1906, all with steel superstructure on concrete abutments: Jamestown bridge, 110 ft. clear span; Day's bridge, with one span 120 ft. clear; Belgrave bridge with a 25-ft. span.

Tacoma, Wash.—Bids are wanted by the Board of County Commissioners January 5 for building a bridge over Rock creek in Pierce County. I. M. Howell is County Auditor.

Other Structures.

Birmingham, Ala.—Bids will soon be asked by the Southern for putting up a union passenger station here.

Chattanooga, Tenn.—Application has been made by the Chattanooga Station Co., which has applied for a charter with a capital of $100,000, to build a new passenger station for the Southern Railway. The incorporators of the company include: H. Fonde, T. H. Cooke and others.

Detroit, Mich.—The Wabash, it is said, has bought 60 acres of land at Oakwood, which will be used as a site for new yards. The work includes the building of a new roundhouse.

Indianapolis, Ind.—Official announcement has been made by the Cleveland, Cincinnati, Chicago & St. Louis that an appropriation of between $2,000,000 and $3,000,000 has been made for new shops at Indianapolis.

New Orleans, La.—Bids are wanted February 6 by the Board of Port Commissioners for building seven new steel sheds over the new wharves, at a cost of about $400,000.

Salt Lake City, Utah.—The Rio Grande Western, it is reported, will replace its shop recently destroyed by fire with a new structure to cost $60,000.

Spokane, Wash.—The Oregon Railroad & Navigation Co., it is said, is ready to begin work on its proposed passenger station on the north side of the Spokane river, to cost about $50,000.

Watertown, N. Y.—The New York Central has decided to spend about $500,000 on a new passenger and freight house and a new yard.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Arizona & California (A., T. & S. F.).—A contract has been given by this company to the Grant Bros. Construction Co., of Los Angeles, for building an extension of its road from Mile 50.47 to Mile 60 in Arizona, a distance of 9½ miles. Surveys are also being made for an additional 49 miles to Barker, Ariz.

Atchison, Topeka & Santa Fe.—See Jasper & Eastern below.

Atlantic & Western.—Surveys have been completed by this company for its projected road from Broadway, N. C., to which point the road is now finished to Goldsboro, an additional 70 miles.

Chicago, Lake Shore & South Bend (Electric).—A contract has been given by this company to the John R. Lee Construction Co., of New York, for building an electric railroad from South Bend west through Laporte and Porter Counties, Ind., to connect with the portion of the road between Indiana Harbor and South Chicago, now in operation. The company has increased its capital stock to $6,000,-

000 and authorized a bond issue of $3,000,000 to secure funds to carry out the work.

CHICAGO, ROCK ISLAND & GULF.—An officer writes that contracts have been let and work begun on building a road from Amarillo, Tex., west to the Texas-New Mexico state line, 70 miles. Surveys have also been made for an extension from Dallas, Tex., southeast to Houston, 228 miles.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Bids are wanted January 7 by W. M. Duane, Superintendent of Construction, Cincinnati, Ohio, for grading on relocation of single track of the Cairo division. The work calls for the excavation of 665,000 cu. yds. (See Advertising page 22.)

COAL RIVER.—This company, which operates 18 miles of road and recently laid track on five miles from Holleyhurst, W. Va., to Bull Creek, has given a contract to J. C. Carpenter & Co., of Clifton Forge, Va., for building an extension from Sproul to Rock Creek, 17½ miles. The company also intends to build 35 miles additional.

COUNCIL CITY & SOLOMON RIVER.—An officer writes that this company, which recently completed five miles on its road as far as John's creek, Alaska, will build an extension, for which surveys are being made, for an additional 35 miles toward Council City.

CONWAY COAST & WESTERN.—This company, which recently completed 12 miles of road from Conway, S. C., north to Cool Spring, is building an extension from the latter place to Ayner, a distance of about four miles.

DELAWARE & EASTERN.—This company, which recently completed 10 miles of its proposed road from Arkville, N. Y., southwest to Union Grove, has given a contract to J. R. Dolan & Co., of Downsville, N. Y., for building its proposed road from Union Grove southwest to East Branch, N. Y., 25 miles, and from Shaverton north to Andes, an additional eight miles.

DENVER, ENID & GULF.—See Denver, Kansas & Gulf below.

DENVER, KANSAS & GULF (D., E. & G.).—An officer writes that this company has under construction a line from Kiowa, Kan., north to Great Bend, a distance of 100 miles. (Sept. 22, p. 95.)

DULUTH, MISSABE & NORTHERN.—Contracts have been given by this company to the Drake & Stratton Co. and to John Runquist, both of Duluth, and also to Winston Bros. Co. & Werdenhoff, of Minneapolis, for building the extension of its road from Alborn, Minn., to Buckeye mine, a distance of 55 miles.

DULUTH, ST. CLOUD, GLENCOE & MANKATO.—A contract has been given by this company to E. L. Tobie & Co., with offices at New York and at Freeborn, Minn., for building its proposed road from Albert Lea, Minn., northwest to Mankato, a distance of 52 miles. The company is also making surveys for extending the line from Albert Lea to Duluth, a total distance of 287 miles.

GLEN COVE (LONG ISLAND).—This company is planning to build an extension from School street, Glen Cove, N. Y., to Garvies Point, 1.25 miles.

GREAT NORTHERN OF CANADA.—An officer writes that surveys are being made by this company to extend its line from Garneau Junction, Quebec, to Quebec, 80 miles.

GULF & SHIP ISLAND.—This company, which has recently completed eight miles of railroad from Silver creek south and 13 miles north from Columbia, Miss., is to build a connecting link 11 miles long between these two portions of its road. The contract has been given to the Bradford Construction Co., of Gulfport, Miss.

ILLINOIS CENTRAL.—An officer writes that surveys are being made by this company for building a line from Corinth, Miss., southeast to Haleyville, Ala., a distance of 80 miles.

See Yazoo & Mississippi Valley below.

ILLINOIS, IOWA & MINNESOTA. This company, which operates 125 miles of railroad from Rockford, Ill., southeast to Momence, is making surveys to extend the road from its northern terminus northeast to Milwaukee, Wis., a distance of 100 miles.

INDIANA HARBOR.—A contract has been let by this company to the F. L. Hartigan Construction Co., of Chicago, Ill., for building a branch from Indiana Harbor, Ind., southeast to Dune Park, 18 miles.

INTERNATIONAL (CANADA). Work has been commenced by K. A. Morrison and Alex. Finlayson, of Sable River, N. S., extending this road from North Sydney to Sydney Mines, N. S., a distance of 2.6 miles.

JASPER & EASTERN (A., T. & S. F.). This road, which has recently been completed to Deridder, La., is to be extended 17 miles to Pickering. The work is being done by the Lantry-Sharpe Contracting Co., of Kansas City, Mo.

KANSAS CITY, MEXICO & ORIENT.—An officer writes regarding the work to be carried out by this company during 1906 that the line east from Wichita, Kan., probably to Emporia, and possibly to Osage City will be completed. The company also expects to build a line south from Custer City to a connection with the line building north from Sweetwater, Tex. The completion of this line will give the company a continuous line from Sweetwater, Tex., to Osage City, Kan. In Mexico the company will probably complete about 32 miles east from San Sostenes and possibly may double-track this distance. West from Bocoyna, about 60 miles additional will be built in the mountains. On the west coast, from Las Hornillas east, the line will probably be extended to La Junta, which is about 125 miles from Topolobampo. The company proposes also to build several hundred miles besides the lines here named.

LONG ISLAND.—See Glen Cove above.

LOUISVILLE & NASHVILLE.—An officer writes that grading for the following construction work is now under way:

Henderson division; revision of line and grades between Greenbrier, Tenn., and Guthrie, Ky., a distance of 25.7 miles. Walton, Wilson, Rodes & Company, Knoxville, Tenn., are the contractors.

For revision of line and grades, Bakers Hill, Henderson division; Mason & Hoge Company, Frankfort, Ky., contractors.

Knoxville division; revision of line and grades from Saxton, Ky., to Corbin, Ky., 25.9 miles. Contract for this work let to Edington, Griffitts & Company, Knoxville, Tenn., and Southern Contracting Company, Ludlow, Ky.

Atlanta, Knoxville & Northern Railway; Atlanta connection, extending from Ellen N. on the Western & Atlantic Railroad to a connection with the Atlanta Belt Line, West End, Atlanta, 6.2 miles in Georgia. The contractors are Wm. J. Oliver, Knoxville, Tenn.; Wright, Williams & Wadley, Dalton, Ga., and A. C. Wright and J. T. Pruden, Atlanta, Ga.

A contract for building a branch line up the left-hand fork of Straight creek has been let to the Callahan Construction Company Knoxville, Tenn.

MCCLOUD RIVER.—This company, which has recently completed seven miles of road in California, has projected a road to run from McCloud west to Mott, 17 miles, and from the end of the present track north to Merrill, Ore., an additional 77 miles.

NEW YORK, NEW HAVEN & HARTFORD.—A contract has been given by this company to the T. Stuart & Son Co., of Boston, for building an extension from a point near West Roxbury west to Needham, Mass., a distance of 4.35 miles.

NORFOLK & WESTERN.—An officer writes that this company has work under way which will be completed during 1906 as follows:

Iaeger & Southern R. R.—This road has recently been completed from Lynn, W. Va., up Dry fork of Tug river to coal fields for a distance of 20 miles, and will be extended 4.6 miles.

Speedwell Extension.—This line, recently extended from Cripple Creek, Va., one mile to ore properties, will be extended for an additional five miles.

Pocahontas & Western will be extended 3.7 miles.

Blackstone & Lunenberg will be extended 5.75 miles.

OREGON SHORT LINE.—This company, which recently completed 8½ miles of road from the Logan Sugar Works to Wellsville, Utah, has given a contract to Soren Hausen, of Hyrum, Utah, for building an extension from the latter place north to Mendon, a distance of five miles.

PACIFIC & IDAHO NORTHERN. An officer writes that a contract has been let by this company to Slick Brothers, of Council, Idaho, and work is under way on an extension of its road from Council to Stevens, 14.50 miles. Track has been laid from Council for a distance of about 4 miles. The company is also making surveys for an extension from Stevens to a point near Pollock, Idaho.

PAN AMERICAN. An officer writes that this company has given contracts to Lyons Bros. and Everett & Gordon, of Tonala, Chiapas, Mexico, for extending its road from Coapa to San Benita, 125 miles, and is making surveys for an additional 31 miles from San Benita to the Guatamala Boundary.

QUEBEC & LAKE ST. JOHN. Work is under way on the extension of this road from a point 12 miles west of La Luque Junction, Quebec, to St. Maurice Keier, a distance of 28 miles. Joseph Paquet of La Luque Junction is the contractor. The company has also projected a road from its northwest terminal at Roberval northwest to Chute a l'ours, an additional 30 miles.

ST. LOUIS, BROWNSVILLE & MEXICO.—This company, which recently completed its road north as far as Bay City, Tex., has given a contract to P. M. Johnston, of St. Elmo, Ill., for extending the line from that point north to Alvin, a distance of 50 miles.

SAN PEDRO, LOS ANGELES & SALT LAKE.—This company has given a contract to the Utah Construction Co., of Ogden, Utah, for building spurs near Topliff, Utah, aggregating 4½ miles in length, and chang-

ing the location of the old main line at Trent for a distance of about five miles.

Texas Southeastern.—This company, which recently completed its road from Diboll, Tex., west to the Naches river, a distance of nine miles, is building from the latter place northwest to Weches, a distance of 25 miles.

Tidewater.—MacArthur Bros. Co., of New York, who have been given the contract by this company to build about 120 miles of its road from Norfolk, Va., west, are asking for bids on 108 miles of the road from Roanoke west to West Virginia. The work will be heavy, much of it through solid rock, and there will be a number of short and long tunnels, and will take about two years to complete.

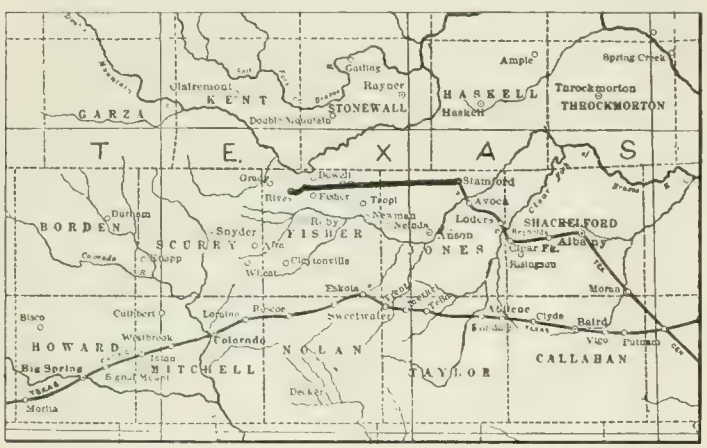
Topeka & Northwestern.—A contract has been let by this company to Kilpatrick Bros. & Collins, of Beatrice, Neb., for extending its line from Station No. 2, Kansas to Onaga, 17.37 miles. Work is already begun.

Trinity & Brazos Valley.—A contract has been given by this company to P. M. Johnson & Co., of Mexia, for extending its road from Mexia southeast to Houston, 157 miles, and from Brewer north west to Waxahachie, a distance of 70 miles. (Sept. 8, p. 80.)

Western Allegheny.—A contract has been given by this company to F. A. Maselli & Co., of Pittsburg, for building an extension of its road from Rosepoint west toward Newcastle, a distance of 10.7 miles.

West Jersey & Seashore (Electric).—A contract has been given by this company to P. McManus, of Philadelphia, for the work incident to the electrification of its lines from Camden to Atlantic City.

Texas Central.—This company is planning to build an extension of its road from Stamford, Tex., west for a distance of 45 miles to



Texas Central.

Rives, in the northwest corner of Fisher County. Contracts have been let for the rails and ties. Over 90 per cent. of the line will be tangent.

Western Maryland.—An officer writes that this company, which is building west to Cumberland, Md., has surveys under way for building an additional 155 miles of road.

Wichita Valley.—A contract has been let by this company to J. P. Nelson, of Seymour, Tex., for extending its road from that place southwest to Stamford, 61 miles.

Yazoo & Mississippi Valley (Ill. Cent.).—A contract has been let by this company to the Hemingway Construction Company, of Jackson, Miss., for extending its line from Philipp, Miss., north for a distance of 15 miles.

Youngstown & Southern (Electric).—An officer writes that this company, which is planning to build its projected road from Columbiana, Ohio, west to Salem and south from Columbiana to East Liverpool, a total distance of 36 miles, has 16 miles of roadway under temporary operation by steam from Youngstown south to Columbiana. Surveys have been made and construction work will be started early next spring. The road when completed will be operated by electricity.

RAILROAD CORPORATION NEWS.

American Railways Company (Electric). This company has acquired a controlling interest in the common and preferred stock of the Scranton (Pa.) Railway, having bought both classes at par ($50). The Scranton Railway operates 81 miles of road and has outstanding $2,000,000 common, $1,500,000 5 per cent. cumulative preferred stock and $3,000,000 bonds.

Boston Elevated.—The gross earnings for the year ended June 30 were $12,689,676, an increase of $298,323, and expenses were $8,617,653, a decrease of $13,900. The surplus available for dividends was $835,084, an increase of $5,313, and the net surplus was $37,084.

Canadian Pacific.—The gross earnings of this company during the month of November increased about $1,000,000, or 21 per cent., as compared with the same month last year. The increase in net was $691,431, or 41 per cent.

Central of Georgia.—It is reported that the company has bought, for $400,000, the Stillmore Air Line, which runs from Wadley, Ga., to Collins, 54 miles. It has $175,000 capital stock and $350,000 first mortgage 4 per cent. bonds of 1920 outstanding.

Chicago & Eastern Illinois.—The Supreme Court of the State of New York has decided in favor of the plaintiffs in the action begun by two bondholders of this company to annul the traffic agreement made on April 14, 1904, between the C. & E. I., the St. Louis & San Francisco and the St. Louis, Memphis & Southeastern. An agreement was entered into, in 1902, putting the properties of the Chicago & Eastern Illinois into the hands of a trustee in order to preserve these assets for the benefit of the stockholders, and trust certificates were then issued by the Colonial Trust Co. against the bonds of the railroad company. The second agreement, made in 1904, gave to the St. L. & S. F. nearly all of the traffic of the C. & E. I., and on the strength of this agreement an issue of $16,000,000 in bonds, secured by the properties of the St. Louis, Memphis & Southeastern, was announced. The court holds that this second agreement was a violation of trust, inasmuch as it imposed a new obligation on the C. & E. I., thereby violating the conditions of the first agreement.

Chicago Elevated Roads.—During 1905 the Northwestern Elevated carried 28,238,621 passengers, an increase of 9.89 per cent. as compared with the previous year. The South Side Elevated carried 32,959,752 passengers, an increase of 8.47 per cent. The Metropolitan Elevated carried 45,358,915 passengers, an increase of 8.8 per cent.

Cincinnati, Hamilton & Dayton.—The receiver has been given permission to borrow $900,000 to help pay the interest due January 1st on various C., H. & D.-Pere Marquette securities. No funds have been received by the American Loan & Trust Co., Boston, to meet the January coupons on the $3,500,000 C., H. & D.-Pere Marquette 4 per cent. collateral trust bonds secured on the Chicago, Cincinnati & Louisville stock. The interest on the $3,500,000 4½ per cent. first mortgage bonds of the Toledo Railway & Terminal Co., which were guaranteed by the C., H. & D. and Pere Marquette, has been defaulted and the company is therefore liable to sale under foreclosure. This would destroy the Pere Marquette's control of the property through ownership of a majority of the stock. No announcement has been made as to payment of the guaranteed dividends on Pere Marquette common and preferred stock. (Dec. 29, p. 208.)

Colorado Southern, New Orleans & Pacific.—The stockholders have adopted an amendment to the charter of this company, increasing the capital stock from $5,000,000 to $12,000,000.

Kansas City Southern.—The meeting of the stockholders called for Feb. 1st, to act on the question of authorizing $5,100,000 six-year 5 per cent. collateral notes, has been postponed.

Minneapolis, St. Paul & Sault Ste. Marie.—The estimated gross earnings for November were $1,060,000, an increase of 16 per cent. over the figure for the corresponding period of the previous year. The increase for five months was 32 per cent., and the surplus for ten months increased 106 per cent.

New York, New Haven & Hartford.—The directors have decided to allow the holders of the $185,300 outstanding 4 per cent. convertible debenture bonds of 1908 to exchange them for stock, par for par. The privilege of conversion of these bonds originally expired on April 1, 1903, at which time about $16,000,000 had been exchanged.

Pennsylvania.—The preferred stock of the Allegheny Valley will be exchanged at the office of the Union Trust Co., Pittsburg, on or after April 2, 1906, for Pennsylvania stock at the rate of 1⅛ shares of the last named securities for two shares of Allegheny Valley. (November 17, p. 160.)

Pere Marquette.—See Cincinnati, Hamilton & Dayton.

Southern.—The Transylvania is now operated under lease by the Southern as part of its Asheville division. (Dec. 29, p. 208.)

Stillmore Air Line.—See Central of Georgia.

Toledo Railway & Terminal.—See Cincinnati, Hamilton & Dayton.

GENERAL NEWS SECTION

NOTES.

The Committee of the lower House of Congress on Interstate and Foreign Commerce will report favorably the Mann General Bridge bill. This bill codifies all the existing Federal statutes relating to bridges, and provides that hereafter bills merely stating where the bridge is to be constructed shall be considered by Congress, it being understood that all bridge statutes apply to bridges constructed with Government sanction. The Stephens bill extending the length of time live stock may be kept in cars will be the subject of hearings January 23 and 24.

The National Lines of Mexico will place in service January 16 a semi-weekly through limited train between St. Louis and the City of Mexico via Laredo, Tex., on a 59-hour schedule. The equipment is to be entirely new and of the best possible character. A tourist car service will be inaugurated this month also. The General Passenger Agent of the National Lines, Mr. Geo. W. Hibbard, recently with the Duluth, South Shore & Atlantic Ry., has initiated these new features in connection with an effort to colonize the southern part of Mexico. An advertising department has been created and will be in charge of J. A. Ball, for two years past Assistant Advertising Agent of the Chicago, Burlington & Quincy.

The American Institute of Electrical Engineers Building Fund.

The General Electric Company in view of the great importance and utility of the United Engineering Building, as a home and center for the engineering professions and arts, has made a contribution of $25,000 to the land and building fund of the American Institute of Electrical Engineers. President C. A. Coffin, who takes a warm personal interest in the matter, has also sent his own check for $5,000. The committee, which had already received gifts and pledges amounting to nearly $70,000, is greatly encouraged by this generous support of its work. The fund is now, with other new subscriptions, well over $100,000, and with renewed energy the committee has begun its canvass of the field with the object of securing the second necessary $100,000. About 600 members have already subscribed to the fund, and the committee expects to have no difficulty in at least doubling this number. It has just issued to members a handsome pamphlet describing the new building.

A Plain Tale from the Corridor.

From the speeches that floated over the transom of the executive room of the Governor's office at the State House to-day it was evident that the representatives of the Central Passenger Association, called to participate in a conference with reference to a simpler form of mileage book, were trying in every possible way to do a great deal of talking and say nothing. In fact, Governor Hanly accused them of so doing, in effect, when he was heard to interrupt one of the speakers with the remark: "What I want you to do is to stop all the fol-de-rol talk, and get down to business." The speakers for the railroads spoke all around the subject. They contended that whatever Indiana's executive might do, it would not be binding for the other states in the association; that Governor Hanly did not have the right to try to regulate the affairs of the other states; that the present railroad commission law made any sort of a mileage book illegal, because it was a discrimination in rates; that the present system was fair. In fact, so many phases of so many subjects were introduced by the various speakers that time and again Governor Hanly was heard to say:

"Gentlemen, the proposition is very simple; what we want is a just modification of the present form of the interchangeable mileage book, one that is good on the train, and one that costs only $20. That is all there is up for discussion."

Several representatives of various travelers' associations spoke, all upholding the Governor in his contention that the present plan was unjust and unnecessary. One speaker pointed out that on one road, east of Pittsburg, the mileage was good on the train, and on the same road, west of Pittsburg, the mileage had to be exchanged.—*Indianapolis News, Dec. 29.*

A Faux Pas.

When the construction gang of the James' Bay Railway, which is being built from Toronto to Sudbury, encountered three narrow streams of water at Bala, at the western end of the famous Muskoka lakes summer resort, they apparently thought that nature had been unduly generous. Accordingly, they proceeded to fill up the first channel, and to bridge the second. Their plans with regard to the three had not developed when the Ontario government was notified, and a sudden halt was called to the whole procedure.

The railway engineer in charge had not realized that three channels at Bala are the sole outlet of the whole Muskoka Lake region, and that being very narrow, their capacity is often severely taxed. In the old days there were only two channels, and then the lake region was subject to disastrous freshets which would carry away boathouses, etc., and work damage wherever the rising waters reached. Accordingly the government constructed a third channel and there is a system of movable dams, by which it is sought to regulate the lake level at the varying seasons. The government when notified of the railway's action, at once informed the company that it must clean out the channel that had been filled. The channel on either side of the central pier must be excavated so that the large boats may sail into Bala, as they have been in the habit of doing. The government has been notified that the work of reclaiming the channel would be begun to-day.—*Ottawa Citizen.*

Manufacturing and Business.

In order to meet the demand for its new improved types of milling machines the Kempsmith Mfg. Co., Milwaukee, is building a two-story addition to its shops.

The new Robb-Mumford Boiler Works, South Framingham, Mass., has installed four electric Northern traveling cranes and several electric rivetter hoists made by Northern Engineering Works, Detroit, Mich.

At a meeting of the Board of Directors of the Locomotive Appliance Company, held in their offices in the Old Colony Building, Chicago, Tuesday, January 2, Mr. H. M. Pflager, of St. Louis, was elected Director to fill the unexpired term of Mr. Edward B. Lathrop, deceased. Mr. W. H. England was elected Treasurer.

The Ingersoll-Rand Company states that it has secured exclusive control of the product of the Imperial Pneumatic Tool Company, with shops at Athens, Pa., including pneumatic hammers, drills, riveters, reamers, hoists and plug drills. The Ingersoll-Rand Company is also the maker of the Haeseler pneumatic tools.

The Telegraph Signal Co., of Rochester, N. Y., recently incorporated to make Wright's signal apparatus for the electrical control by the train despatcher of stop signals at stations along the road, is preparing to equip a shop in Rochester, where the apparatus will be manufactured. The device was recently tested at Liverpool, on the R., W. & O. division of the New York Central.

At the coming Chicago Electrical Trades Exhibition, the General Storage Battery Company, New York, will show, in addition to a full line of Bijur "High-Duty" plates and batteries, a working booster system handling violently fluctuating loads while maintaining a steady load on the generator. This will be accomplished by a "Bijur" automatic regulator working on a new principle, achieving results which will be well worth seeing.

The Dayton Pneumatic Tool Co., Dayton, Ohio, maker of "Green" pneumatic hammers, reports business for 1905 as having been most satisfactory. Notwithstanding the fact that there is a tendency toward the end of the year to delay purchases until after the beginning of the new year, an unusually large number of orders were received in December. The company has recently ordered additional machinery for its Dayton works which will increase the capacity to about 300 hammers a month.

For a number of years past B. M. Jones & Co., 141 Milk street, Boston, Mass., has existed as a partnership. The concern has now been incorporated under the name B. M. Jones & Co., Incorporated, with Benjamin M. Jones as President; James A. Warren, Vice-President and General Manager; Richard L. Thomas, Second Vice-President, and Walter J. Klein, Secretary and Treasurer. Mr. Jones is well-known as senior member of B. M. Jones & Co. Mr. Warren has for some time past represented the company in Chicago and Mr. Thomas in New York City. Mr. Klein has been with Mr. Jones in Boston for some time. Mr. Thomas, who is a member of the Finance Committee of the New York Railroad Club, was for some years with the National Lock Washer Co. of Newark, from which position he has just resigned, and has been identified with the railroad supply business for a long time. The new company will act as sole representative in the United States, Canada and Mexico for Samuel Osborn & Co., of England, makers of R. Mushet's "Special," "High-Speed" and "Titanic" steels and high grade tool steels, and will handle the Taylor Best Yorkshire iron for staybolts, axles, piston rods and crank pins for Taylor Bros. & Co., Ltd., of England. Mr. Warren will have headquarters in Chicago and Mr. Thomas in New York City.

Reconsignment of Hay at East St. Louis.

The Interstate Commerce Commission, in an opinion by Chairman Knapp, has announced its decision in the case of the St. Louis Hay & Grain Company against the Illinois Central and the Mobile & Ohio. The service of defendants in handling reconsigned hay at and from East St. Louis is found to be more expensive than the service performed in case of shipments through East St. Louis, while the privilege of reconsigning hay from that point at a charge

less than the established local rate is of substantial value to dealers in that city. The Commission decided that the fact that through rates are less than the sum of in and out rates is not of itself a valid ground of objection, nor is it unlawful for defendants to maintain reconsignment rates which are higher in some cases than their proportions of through rates; and also that the fact that the reconsignment rate is sometimes the same as the proportion of the through rate does not warrant an inference of illegal conduct or support a charge of unjust discrimination.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

The Southern and Southwestern Railway.

The next meeting of this club will be held in Convention Hall, Piedmont Hotel, Atlanta, Ga., January 18. Subjects for discussion are Cole Balanced Compound Locomotive, by G. M. Basford, and Steel Cars, by L. O. Cameron.

Canadian Society of Civil Engineers.

At the meeting of the Electrical section held January 4, a paper was presented on "A Burning Question—Defective Wiring." The Secretary announces that the annual meeting will be held in Toronto during the fourth week in January.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Annapolis, Washington & Baltimore.—The office of the President has been moved from Cleveland, Ohio, to Baltimore, Md.

Atchison, Topeka & Santa Fe.—William B. Jansen has been appointed Fourth Vice-President, in charge of accounting, the treasury, lands and fuel properties, with headquarters in Chicago. This is a newly-created position. Mr. Jansen is 38 years old, having been born in Chicago in November, 1868. He was educated in private schools in that city and finished at De Veaux Military Academy. His railroad career began in 1888 at Topeka, Kan., as a car checker in the local freight office of the Santa Fe. A few months later he was made a train collector and continued in that service for two years, when the train collectors were taken off. He then entered the operating department at Topeka as a clerk and advanced rapidly to the position of Assistant to the General Manager. He was transferred to Chicago in March, 1897, to become Secretary to the President, and in June, 1901, was made Assistant to the President. He will continue to discharge the duties of the last-named position in addition to those newly assigned.



W. B. Jansen.

Edward L. Copeland has been appointed Secretary and Treasurer, with office at Topeka, Kan., succeeding E. Wilder, deceased. Mr. Copeland was born in Winnebago, Ill., August 25, 1859. At the age of 20 he went to Topeka to take a position in the office of the auditor of the Santa Fe, and two years later was transferred to the treasurer's department. He was made Assistant Cashier in 1883, and in 1887 was promoted to Cashier, the position he has held up to the present time.



E. L. Copeland.

Chicago, Rock Island & Pacific.—W. M. Hobbs, Assistant to the Second Vice-President, has resigned, and the office has been abolished.

Denver & Rio Grande.—R. F. Watkins has been appointed Assistant Treasurer at Denver, Colo.

Iowa Central.—P. B. Seevers has been appointed General Claim Agent of this road and of the Minneapolis & St. Louis, with office at Minneapolis, Minn., succeeding M. Barr.

Midland Valley.—J. F. Holden, Freight Traffic Manager of the Chicago, Rock Island & Pacific, has been elected Vice-President of the Midland Valley, with office at Fort Smith, Ark., effective February 1.

Missouri & Illinois Bridge & Belt.—G. L. Ball has been elected Secretary, with office at St. Louis, Mo., succeeding E. D. Taylor.

Missouri & Louisiana.—W. C. Perry, General Attorney, has been elected also President, succeeding R. H. Keith.

Operating Officers.

Canadian Northern.—J. R. Cameron, Assistant Superintendent at Kamsack, Assin., has been appointed Superintendent at Port Arthur, Ont., succeeding W. A. Brown, promoted. J. Abbott has been appointed Superintendent at Battleford, Sask.

Chicago, Indianapolis & Louisville.—B. E. Taylor, hitherto Assistant to the President, has been made General Manager. The appointment comes after 26 years of varied experience in railroad service, mostly in the operating department. Mr. Taylor was born in Plymouth, Mich., in 1862, and began railroad work as a helper at the station in that town in 1879 on what is now the Pere Marquette Railroad. Having thus learned telegraphy, he filled positions as agent and operator at various small stations on the road, and also was a clerk in the general freight office. In 1884 he was sent to Milwaukee as cashier in the freight office, and in March, 1885, was transferred to the office of the Assistant General Freight Agent in Detroit. One year (1886-87) was spent in Florida on account of the health of a member of his family, and during that time he was chief clerk to the General Superintendent of the Florida Railway & Navigation Company. Returning north at the end of that time, he accepted the position of private secretary to the Receiver of the Wabash, but a few months later he entered the service of the Chicago, Indianapolis & Louisville as chief clerk to the General Superintendent. In 1896 he was made Purchasing Agent in addition to his other duties. In 1899 he was advanced to the General Manager's office as chief clerk. In 1903 he was made Assistant to the President and General Manager, the position from which he is now promoted to General Manager. He is also Secretary of the Indianapolis & Louisville, a subsidiary company of the Monon, and a director in the Consolidated Stone Company and the Indiana Stone Railroad, both Monon properties.



B. E. Taylor.

Chicago, Rock Island & Pacific.—The office of T. H. Beacom, Superintendent of the St. Louis division, has been moved from St. Louis, Mo., to Eldon, Iowa.

Indiana Harbor.—See Michigan Central.

Lehigh & New England.—H. C. Shields, Master Mechanic, has been appointed Superintendent, with office at Pen Argyl, Pa.

Michigan Central.—J. H. Snyder, General Superintendent of the Indiana Harbor, has been appointed Assistant General Superintendent of the Michigan Central, succeeding H. A. Worcester, promoted.

Minneapolis, St. Paul & Sault Ste. Marie.—G. S. Baxter, trainmaster at Gladstone, Mich., has been appointed Superintendent at Enderlin, N. Dak., succeeding C. F. Seymour.

Mississippi Eastern.—T. C. McWilliams has been appointed Superintendent, with office at Quitman, Miss., succeeding A. C. Schryver.

National Lines of Mexico.—A. Hulvershorn, Assistant Superintendent, has been appointed Superintendent of Express, succeeding H. P. Gallagher, resigned. J. E. Pettigrew succeeds Mr. Hulvershorn, both with offices at Mexico City.

Pittsburg, Allegheny & McKees Rocks.—J. V. Maher has been appointed General Manager, with office at McKees Rocks, Pa.

Southern.—F. J. Egan, Superintendent of the Mobile division, has been appointed Superintendent at Atlanta, Ga., succeeding W. N. Foreacre, promoted. J. H. Stanfiel, trainmaster at Knoxville, Tenn., succeeds Mr. Egan, with office at Selma, Ala.

Texas & Pacific.—J. B. Paul, Superintendent of the New Orleans division, has been appointed to the new office of General Superintendent of the lines in Louisiana and as far west as Marshall, Tex., with office at New Orleans. A. S. Wilson, chief train despatcher at New Orleans, has been appointed Assistant to the General Superintendent, with office at New Orleans. R. C. Andrews, assistant train despatcher, has been appointed Assistant Superintendent at Marshall, Tex.

Washington County.—J. Asnault has been appointed Superintendent, with office at Calais, Me., succeeding N. P. Baker, resigned.

Traffic Officers.

Chicago, Rock Island & Pacific.—J. F. Holden, Freight Traffic Manager, has resigned to go to the Midland Valley. Mr. Holden is succeeded by Harry Gower, Assistant Freight Traffic Manager. Mr. Gower was born in 1853 in England. He entered railroad service in this country in 1878 as clerk in the Auditor's office of the Chicago, Rock Island & Pacific, on which road he has remained ever since. In 1881, he was appointed chief clerk of the General Freight department, and in 1887, Second Assistant General Freight Agent. The next year, he became First Assistant General Freight Agent, where he remained until 1896, when he was appointed General Freight Agent. In 1899, he was appointed Assistant Freight Traffic Manager, from which position he is promoted to become Freight Traffic Manager.



H. Gower.

Cincinnati, Hamilton & Dayton.—W. B. Calloway, Assistant General Passenger Agent, has been appointed General Passenger Agent.

Erie.—C. W. Clarke, General Manager of the Erie Despatch, has been appointed General Freight Agent of the lines west of Buffalo and Salamanca, with office at Chicago, succeeding H. G. Krake, resigned.

Kansas City Southern.—F. D. Hunt is Industrial Agent, with office at Kansas City, Mo.

New York, New Haven & Hartford.—The office of E. L. Somers, Freight Traffic Manager, has been moved from Boston, Mass., to New Haven, Conn., and that of F. S. Holbrook, General Freight Agent, has been moved from New Haven to Boston. L. H. Kentfield has been appointed Assistant General Freight Agent, with office at New Haven.

St. Joseph & Grand Island.—H. W. Prickett has been appointed Assistant General Freight Agent, with office at Kansas City, Mo., succeeding W. N. Marshall.

Southern Indiana.—The office of H. P. Radley, General Freight and Passenger Agent, has been moved from Terre Haute, Ind., to Chicago, Ill.

Toledo, St. Louis & Western.—R. J. McKay, District Passenger Agent, has been appointed Assistant General Passenger Agent at St. Louis, Mo.

Engineering and Rolling Stock Officers.

Chicago & Alton.—G. H. Kimball, Chief Engineer, has resigned.

Chicago, Rock Island & Pacific. N. D. Ballantine, Superintendent of Transportation of the Kansas City Southern, has been appointed Superintendent of Car Service of the C., R. I. & P.

Gulf & Ship Island.—A. Bardsley has been appointed Master Mechanic, with office at Gulfport, Miss., succeeding M. S. Curley.

Kansas City Southern.—See Chicago, Rock Island & Pacific.

Lehigh & New England.—F. S. Anthony has been appointed Master Mechanic, with office at Pen Argyl, Pa., succeeding H. C. Shields, promoted.

South & Western.—W. F. Steffens has been appointed Engineer of Bridges and Buildings, with office at Bristol, Va.

Tacoma Eastern.—E. D. Fletcher has been appointed Chief Engineer, with office at Tacoma, Wash., succeeding Henry Shaw.

Special Officers.

Kansas City Southern.—W. D. Lanier is Horticulture Agent, with office at Texarkana, Tex.

LOCOMOTIVE BUILDING.

The Michigan Central, it is reported, is in the market for additional locomotive equipment.

The Atchison, Topeka & Santa Fe has ordered 24 Atlantic (4-4-2) locomotives, 20 Santa Fe (2-10-2) locomotives, 11 compound Pacific (4-6-2) locomotives, and 25 six-wheel (0-6-0) single expansion switching locomotives from the Baldwin Locomotive Works. The Atlantic and Santa Fe locomotives are to be almost exact duplicates of those previously ordered by this road. The Pacific locomotives are for spring delivery, and will weigh 226,700 lbs., with 151,900 lbs. on the drivers; cylinders, 17 in. x 28 in.; diameter of drivers, 73 in.; wagon top boiler, with a working steam pressure of 220 lbs.; heating surface, 3,595 sq. ft.; 290 tubes, 2¼ in. in diameter and 20 ft. long; firebox, 108⅛ in. x 71¼ in., and tank capacity, 8,500 gallons of water. The switching locomotives are for April delivery and will weigh about 144,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; wagon top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,905 sq. ft.; 281 tubes, 2 in. in diameter and 12 ft. long; firebox, 102⅛ in. x 41¼ in.; grate area, 29 sq. ft.; tank capacity, 3,900 gallons of water, and coal capacity, eight tons. The special equipment for both includes: Westinghouse air-brakes, Gollmar bell ringers, Franklin boiler lagging for switching locomotives, Kewanee brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Tower couplers, Pyle-National headlights for Pacific locomotives, and Schroeder headlights for switching locomotives, Ohio injectors, Hewitt bronze journal bearings, U. S. piston and valve rod packings, Crane safety valves, Leach sanding devices, Chicago sight-feed lubricators, Simplex Railway Appliance Co.'s springs, Crosby steam gages and Standard Steel Co.'s wheel centers.

The Chicago & Alton has ordered 10 simple consolidation (2-8-0) locomotives, five simple Atlantic (4-4-2) locomotives, and 10 simple six-wheel (0-6-0) switching locomotives from the Baldwin Locomotive Works. The consolidation locomotives will weigh 207,000 lbs., with 185,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 57 in.; crown bar boiler, with a working steam pressure of 200 lbs.; heating surface, 3,251 sq. ft.; 407 tubes, 2 in. in diameter and 14 ft. 4 in. long; firebox, 120 in. x 40¼ in.; grate area, 33.6 sq. ft.; tank capacity, 9,000 gallons of water, and coal capacity, 15 tons. The Atlantic locomotives will weigh 184,500 lbs., with 97,000 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 80 in.; crown bar boiler, with a working steam pressure of 200 lbs.; firebox, 120 in. x 40¼ in.; grate area, 33.6 sq. ft.; tank capacity, 9,000 gallons of water, and coal capacity, 15 tons. The switching locomotives will weigh 144,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; crown bar boiler, with a working steam pressure of 180 lbs.; heating surface, 1,947 sq. ft.; 324 tubes, 2 in. in diameter and 10 ft. 6 in. long; firebox, 120 in. x 42 in.; grate area, 35 sq. ft.; tank capacity, 4,000 gallons of water, and coal capacity, 15,000 lbs. The special equipment for all includes: Gollmar bell ringers, Keasbey & Mattison magnesia boiler lagging, Damascus brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Climax couplers, U. S. headlights for consolidation and switching locomotives, Pyle-National electric headlights for Atlantic locomotives, Monitor injectors, U. S. piston and valve rod packings, Crosby safety valves, Maryland inside sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashcroft steam gages, Consolidated steam heat equipment for Atlantic locomotives, and cast-steel wheel centers.

CAR BUILDING.

The Erie is making inquiries in regard to 1,500 refrigerator cars of 60,000 lbs. capacity.

The Seaboard Air Line has ordered two coaches from the American Car & Foundry Co.

The Harriman Lines have ordered 600 refrigerator cars from the American Car & Foundry Co.

The Cleveland, Painesville & Eastern will probably order some new cars during the coming year.

The Evansville & Terre Haute has ordered 1,500 gondola cars from the American Car & Foundry Co.

The Barber Asphalt Company, it is reported, is about to build a number of extra heavy steel flat cars.

The Washington, Idaho & Montana has ordered 150 logging cars from the American Car & Foundry Co.

The Cincinnati, New Orleans & Texas Pacific has ordered one private car from the American Car & Foundry Co.

The Tidewater has ordered 300 stock cars and 100 flat cars of 80,000 lbs. capacity from the Western Steel Car Co.

The Colorado & Southern has ordered 1,500 box cars, 100 stock cars and 38 cabooses from the American Car & Foundry Co.

The Wabash & Rochester is figuring on the purchase of four gasolene motor cars and 10 freight cars of 80,000 lbs. capacity.

The Great Northern has ordered 10 combination mail and baggage cars, 10 baggage cars and eight mail cars from the American Car & Foundry Co.

The Mexican Central has ordered 50 additional tank cars from the American Car & Foundry Co. The specifications for these cars were published in our issue of September 8.

The Buffalo, Rochester & Pittsburg, as reported in our issue of December 29, has ordered 100 box cars, 200 drop-bottom gondola cars and 100 twin hopper gondola cars from the American Car & Foundry Co.

The Delaware, Lackawanna & Western, as reported in our issue of January 5, has ordered 50 Hart convertible cars from the Rodger Ballast Car Co. These cars will be built by the American Car & Foundry Co.

The Nevada Northern, it is reported, will shortly be in the market for new equipment. A number of steel ore cars of 100,000 lbs. capacity will be included. Address the Nevada Consolidated Copper Co., San Francisco, Cal.

The St. Louis, Rocky Mountain & Pacific, as reported in our issue of December 29, has ordered two combination passenger cars and one first class coach from the American Car & Foundry Co., as well as 10 box cars and two cabooses.

The Toledo & Indiana, as reported in our issue of January 5, has ordered four interurban cars from the Jewett Car Co. These cars, including equipment, will weigh 70,000 lbs., and will measure 40 ft. long x 8 ft. 6 in. wide, inside measurements. The bodies will be of wood and the underframes will be of metal.

The Louisiana & Arkansas, as reported in our issue of January 5, has ordered 75 flat cars of 60,000 lbs. capacity from Barney & Smith for March delivery. These cars will be 40 ft. long and 9 ft. wide. The special equipment includes: Westinghouse air-brakes, More-Jones Brass & Metal Co.'s brasses, Tower couplers and American Continuous draft rigging.

The Solvay Process Company, as reported in our issue of December 29, has ordered 60 gondola cars of 90,000 lbs. capacity fitted with coke racks from the Middletown Car Works. These cars will weigh 36,000 lbs., and will measure 39 ft. 7 in. long x 9 ft. ½ in. wide x 3 ft. 7 in. high, all inside dimensions. The bodies and underframes will be of wood. The special equipment will include: National-Hollow brake-beams, Westinghouse air-brakes, Ohio Bronze Co.'s brasses, Gould couplers, diamond trucks and Lobdell or Maryland Car Wheel Co.'s wheels. The coke racks will consist of stakes and planks forming an open rack 8 ft. 2 in. high from the top of car floor. The cars will be leased to the Delray Construction Railroad Co. and will be so marked.

The Southern has ordered 10,229 cars as follows: 1,572 gondola cars of 100,000 lbs. capacity from the Standard Steel Car Co., for September, October and November, 1906, delivery; 1,157 hopper cars of 100,000 lbs. capacity from the American Car & Foundry Co., for October and November, 1906, delivery; 1,250 box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co., delivery to commence in May, 1906, of from 18 to 20 cars per day; 3,000 box cars of 60,000 lbs. capacity from the Mt. Vernon Car Manufacturing Co., delivery to begin in March, 1906, and to be at the rate of 500 cars per month; 1,750 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for July and August, 1906, delivery, and 1,500 box cars of 60,000 lbs. capacity from the Lenoir Car Works, delivery to begin in March, 1906, at the rate of from 10 to 12 cars per day. The gondola cars will weigh 38,000 lbs., and will measure 41 ft. 9 in. long x 9 ft. 5 in. wide x 4 ft. 6 in. high, all inside dimensions. The bodies and underframes will be of steel. The hopper cars will weigh 36,000 lbs., and will measure 30 ft. long x 9 ft. 6 in. wide, inside measurements. The bodies and underframes will be of steel and they will be fitted with Dunham doors. The box cars will weigh 34,000 lbs., and will measure 36 ft. long x 8 ft. 6 in. wide x 8 ft. high, all inside dimensions. The bodies and underframes will be of wood. The special equipment for all the above cars will include: Steel axles; Bettendorf bolsters, except the hopper cars, which will be equipped with Simplex bolsters; Damascus brake-beams; cast-iron brake-shoes; Westinghouse brakes; Ajax plastic brasses; Major couplers; Jones doors for the box cars; Miner draft rigging; Harrison dust guards; McCord journal boxes; Lowe Bros. and Sherwin-Williams paint; Chicago-Winslow improved roofs; Railway Steel Spring Co.'s springs, and arch-bar trucks, except for 500 of the box cars, which will be equipped with Bettendorf steel trucks.

BRIDGE BUILDING.

BIRMINGHAM, ALA.—Jefferson County officials are locating the site for a steel bridge to be built over the Warrior river.

CHATTANOOGA, TENN.—At a recent meeting of the Board of Public Works, the opening of bids for the Eleventh street bridge was postponed until January 30. The extension of time was made to enable the contractors to bid on other plans for the bridge than those already prepared. City Engineer Hooke will have a new set of plans for a plate girder skew bridge ready shortly. The former plans call for steel truss structures with paved roadways and sidewalks.

CINCINNATI, OHIO.—Plans, it is said, are being made for building a viaduct over Duck creek to cost about $75,000.

COUNCIL BLUFFS, IOWA.—A bill is before the House of Representatives authorizing the Central Railroad & Bridge Company to build a bridge over the Missouri river at or near this place.

DES MOINES, IOWA.—Plans are being made by George D. Dobson, of this city, for building a Melan arch over the Des Moines river at Locust street, to be similar to the one recently built on Sixth avenue.

KANSAS CITY, MO.—Announcement has been made by J. M. Gruber, General Manager of the Burlington lines east of the Missouri river, that this company will reconstruct the Hannibal bridge; build extensive freight terminals in Clay County, and a new freight house in the West bottoms during 1906.

MINNEAPOLIS, MINN.—Bids are wanted January 15 by Hennepin County Commissioners for repairing a number of bridges. H. R. Scott is County Auditor.

HAVERHILL, MASS.—Bids are wanted January 19 by the Commissioners of Essex County at Salem, Mass., for five spans of pin-connected steel trusses, 153½ ft. long, and one plate girder span 61 ft. long for a highway bridge over the Merrimac river at Haverhill, which is to have a roadway of 32 ft., with a sidewalk. James C. Hale is Clerk.

PEMBROKE, ONT.—Bids are being received by James Coxford for building a steel bridge with stone foundation over the Madawaska river, in the township of McNab (near Arnprior), in the county of Renfrew. Plans at office of James H. Smith, County Engineer, Pembroke, Ont.

PERTH AMBOY, N. J.—Contracts for the new iron drawbridge to consist of 17 deck girder spans on masonry piers to carry two tracks are reported let to McMullen & McDermott, of Philadelphia, Pa., for the sub-structure and to the Pennsylvania Steel Company for the metal work and machinery. The cost of the complete structure will be about $1,000,000.

PINE BLUFF, ARK.—A bill has been introduced in the House of Representatives authorizing the Pine Bluff North & South Railroad Co. to build a bridge over the Arkansas river here.

WASHINGTON.—A bill has been introduced in both Houses of Congress authorizing and directing the Secretary of War to build a bridge across the Spokane river in the state of Washington.

WAUPACA, WIS.—Bids are wanted January 16 by the Town Board for building a stone arch bridge over the Waupaca river. C. C. Boyce is Chairman of the committee.

WENATCHEE, WASH.—On Jan. 4 a bill was introduced in the United States Senate and House of Representatives authorizing W. T. Clark to build a bridge across the Columbia river at this place.

WINGHAM, ONT.—Bids are wanted January 20 by John Ansley, County Commissioner, for building three steel bridges in Huron County.

Other Structures.

BROOKLANDVILLE, MD.—A contract has been given to J. J. Walsh & Son by the Northern Central for putting up a brick passenger station two stories high to cost about $10,000.

FAIRVIEW, PA.—The Pennsylvania, it is said, will begin work shortly on its new shop buildings at this place. During the present month work will be commenced on the car house, planing mill and store house.

SUPERIOR, WIS.—Announcement has been made that the Chicago

& North-Western will at once build a dock on the lake front here to cost about $600,000.

WAYCROSS, GA.—Announcement has been made by the Atlantic Coast Line that bids for new shops to be built at this place will by opened by R. E. Smith, Gen. Supt. Motive Power, at Wilmington, N. C., January 29. The proposed shops will cost $1,000,000, and are to be among the largest in the south, giving employment to about 1,200 men.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA & MISSISSIPPI.—It is said that this company, which operates 18 miles of railroad from Vinegar Bend, Ala., southwest to Leakesville, Miss., has extended its line in Green County, Miss., for a distance of 6 miles, and has projected an extension of 15 miles additional.

ALABAMA ROADS.—W. R. Sweeney and others, of Hopewell, Ala., and Tallapoosa, Ga., who own extensive saw mills in that section, will build a new line of railroad from Hopewell northwest to Edwardsville, in Cleburne County, thence south through Clay County to Montgomery, through a rich agricultural section, a distance of about 110 miles.

ASHEVILLE SOUTHERN.—A charter has been granted a company under this name in North Carolina to build a railroad five miles long on the east bank of the French Broad river. A. B. Andrews and other Southern Railway officials are interested in the new company.

BIG HORN (C., B. & Q.).—An officer writes that a contract has been let by this company to Guthrie & Co., of Garland, Wyo., for building an extension of its road from Frannie, Wyo., southeast to Worland, a distance of 91 miles.

BUFFALO & SUSQUEHANNA.—This company last year laid track on its line from Wellsville, N. Y., to Caneadea, and from Sandusky to Yorkshire, N. Y., also from Juneau, Pa., to Sagamore, Pa., a total of 53 miles. A connection between the sections of its road from Caneadea, N. Y., to Sandusky, and from Yorkshire to Buffalo is expected to be completed and in operation early next summer.

CENTRAL OF GEORGIA.—An officer writes that the Henry Ellen branch of this company is to be extended for a distance of 10½ miles to the Tunnel Coal Co. An extension is also being built from Greenville, Ga., north to Newnan, a distance of 24 miles. The contractors are Redmond & Gabbett, of Henry Ellen, Ala., and W. J. Oliver & Co., of Greenville, Ga.

CHESTERFIELD & LANCASTER.—This company, which operates 21 miles of railroad in South Carolina, has given a contract to O. H. Page & Son, of Cheraw, S. C., for extending its road from the present terminus at Ruby west to Lynches river, 18 miles.

CHICAGO & ALTON.—This company is building an extension of its road from Iles, Ill., southwest to Murrayville, 34.31 miles.

CHICAGO, BURLINGTON & QUINCY.—See Big Horn above.

CHICAGO, MILWAUKEE & ST. PAUL.—The contract for extending this road from Saranac, S. Dak., southeast to Colton, eight miles, and the White River Valley from Presho westward for a distance of 80 miles, has been let by this company to McIntosh Bros., of Milwaukee, Wis.

CHICAGO, ROCK ISLAND & PACIFIC.—See Rock Island, Arkansas & Louisiana below.

DEERING SOUTHWESTERN.—An officer writes that this company, operating six miles of railroad from Deering, Mo., has filed an amendment to its charter providing for an extension of its present line west to the Missouri-Arkansas state line. This calls for the building of about 11½ miles of track. The work will be done by the company's forces and will be completed during the next 15 months. The character of the work will be light. (December 8, p 183.)

DENVER, NORTHWESTERN & PACIFIC.—An officer writes that this company, which recently completed 34 miles of road from Arrow, Colo., to Sulphur Springs, has given contracts to Orman & Crook, of Pueblo, Colo., and to Dunphy & Nelson for building an extension from Sulphur Springs west to Toponas, an additional 68 miles. Surveys are also being made for a further extension from Toponas, Colo., west to Salt Lake City, Utah, 410 miles.

DURANGO CENTRAL.—Surveys have been made by this company for an extension from Descubridora, state of Durango, to Indo, about 100 miles. The line is through a rich mineral region that has been but little developed on account of lack of transportation facilities. Rails and other materials have been ordered.

ESQUIMALT & NANAIMO.—This company will apply to the Dominion Parliament for permission to extend its lines through Comax north to Campbell river; also to build branches from Duncan's via the valley of the Cowichan northwest to Alberni and a branch from some point near Englishmen's river to Alberni canal or a branch from Comax via Cumberland southwesterly to the Alberni canal.

GAINESVILLE MIDLAND.—This company has let a contract for extending its road from Jefferson, Ga., southeast to Athens, a distance of 18 miles.

GRAND RAPIDS TERMINAL BELT.—This company has filed articles of association with the Secretary of State at Lansing, Mich., with a capital of $100,000, to build a belt line around Grand Rapids, connecting five of the railroads. Rights of way have been practically secured. Such a road will greatly facilitate the handling of freight in carloads. The construction of the new road is not to interfere with the laying of double tracks from Wealthy avenue to Mill Creek by the Grand Rapids & Indiana and the Pere Marquette railroads. This work is already under way. A meeting of the new company will be held in January, when officers will be elected and plans arranged. The following names appear in the articles: James A. Hamler, St. Louis; Edward A. Wescher, St. Louis; Thomas A. Whitmore, Chicago; Edward H. Christ, Grand Rapids, Mich., and Jacob Kleinhans, Grand Rapids, Mich.

GREEN RIVER VALLEY (L. & N.).—This company is making surveys, and, it is said, will ask for bids by April 1 for building its proposed road from Stamford, in Lincoln County, Ky., on the Louisville & Nashville, southwest to Scottsville, in Allen County, on the Chesapeake & Nashvile, a distance of 100 miles. This project has been under consideration for several years. When completed the road will form part of the L. & N. system.

HOLSTON RIVER.—Incorporation has been granted this company in Tennessee with a capital of $100,000 to build a railroad from Rogersville, Tenn., northeast to Bristol, on the Tennessee-Virginia State line, a distance of 45 miles. The officers are: James B. Wright, President; J. H. Frantz, Vice-President, and Howard Cormick, Secretary and Treasurer, all of Knoxville.

KANSAS CITY, TULSA & SOUTHWESTERN.—An officer writes that this road, which was incorporated last year to build and operate a railroad from Kansas City, Mo., to Wichita Falls, Tex., is making surveys from Joplin, Mo., to Tulsa, Ind. T., a distance of 126 miles. W. H. Hendren is Chief Engineer, Tulsa, Ind. T.

LOUISVILLE & NASHVILLE.—See Green River Valley above.

MEXICAN ROADS.—A concession has been granted by the state government of Oaxaca to Charles A. Hamilton, President of the San Juan Taviche Mining Co., and work is to be started shortly on a railroad from Ocotlan to San Geronimo Taviche, a distance of about 17 miles. The road will be narrow gage and the work will be easy, as it passes through a level section, with the exception of five miles. Surveys have all been completed.

A concession has been granted by the Mexican Government to John Henderson to build a railroad from Port Lobos to the town of Caborca, in the state of Sonora. Surveys are to be begun within six months. Six miles must be completed within 18 months, and a similar length completed each year until the road is finished, which will take about six years. The office of the company will be at Nogales, which is the terminus of the Guaymas Railroad. Port Lobos is south of Guaymas, and Caborca is in the southern section of the Altar district. The line will be southeast of and parallel to the Guaymas & Nogales road.

MIDLAND VALLEY.—An officer writes that this company, which recently completed 58 miles of its road to Foraker, Okla. T., has given contracts to Kalmann & McMurray, of Kansas City, and to Maney Bros., of Oklahoma City, for building an extension of its road from Foraker northwest to Silverdale, Kan., a distance of 29 miles.

NEVADA NORTHERN.—This road is to be finished by next April, we are informed; and 20 miles of track is already laid. The company was incorporated to build a railroad from Toano, Nev., on the main line of the Southern Pacific, south to Ely, a distance of about 140 miles, and it has let the contract for the entire road. Grading has been finished for 80 miles. The road is being built by the Nevada Consolidated Copper Company, of San Francisco, to carry ore from its mining works to be built at Ely. The cost of the road will be about $2,000,000. C. B. Beatty is Superintendent, and A. Judell Chief Engineer.

NEW JERSEY ROADS (ELECTRIC).—Chicago capitalists have completed negotiations with William J. Thompson, of Gloucester City, for the right of way, said to be owned by him, for a railroad from Gloucester City to Atlantic City, N. J. The cost of building a road between these places will be about $6,000,000.

NIAGARA, ST. CATHARINES & TORONTO (ELECTRIC).—Application will be made to Parliament by this company operating 12 miles of

electric roads in Ontario, for permission to extend its line from Thorold south to Port Colborne, thence east to Fort Erie and north to Niagara Falls, from Niagara Falls north to Niagara-on-the-Lake; also from Niagara Falls to Brantford, and from St. Catharines to Niagara-on-the-Lake. Permission will also be asked to absorb any company having similar powers.

Oklahoma Western.—A charter has been granted a company under this name in Oklahoma with authorized capital of $8,000,000 to build a railroad from Pawhuska, in the Osage nation, via the Middle Saline reservation, in Woodward County, and Kenton, in Beaver County, to a point in Union County, N. Mex., passing through the Osage and Kaw reservations and the Counties of Pawnee, Kay, Noble, Garfield, Grant, Woodward and Beaver, a total distance of 450 miles. The incorporators are: W. Graham, Paul D. Howse, Sidney H. Selig and others, of Chicago, and John A. Stine, H. A. Noah and others, of Alva.

Oregon & Southeastern.—This company, which operates 16 miles of railroad in Oregon, has completed surveys for building an extension from Eighteen-Mile Post to Bonita, a distance of 10 miles.

Rock Island, Arkansas & Louisiana.— (C. R. I. & P.)—An officer writes that this company has given a contract to Craney, Dalhoff & Peters for the grading, track laying and bridge work at Little Rock, Ark., and to Collins Bros., of Rock Island, Ill., for work on the proposed extension from Haskells, Ark., southeast to Crossett, a distance of 107 miles, with a branch from Summerville southwest to Eldorado, an additional 36 miles. The company has completed 35 miles from Haskells toward Fordyce.

Shreveport & Northeastern.—This company, which has projected a road from Shreveport, La., via Homer to Memphis, Tenn., has surveys completed from Shreveport to Homer, and has secured the right of way. A contract has been let to A. Kinnebrew & Co., of Homer, and grading has been completed for about 18 miles. (November 17, p. 160.)

Somerset.—An officer writes that this company, which recently completed 10 miles of road from Deadwater, Me., to Lake Moxie, has given a contract to J. G. White & Co., of New York, for building a line from Lake Moxie to Kineo, a distance of 33 miles.

Stoneville & Southwestern.—Application has been made by a company under this name in Mississippi to build a railroad from Stoneville, in Washington County, Miss., southwest to a crossing with the Yazoo & Mississippi Valley, thence southwest through Issaquena County to Ben Lomond, on the Mississippi river, about 50 miles. The incorporators are: R. W. Carington, F. H. Icy and C. A. Douglas, all of Leeland.

Susquehanna & New York.—This company is making surveys for grade revision on its line from Short Run, Pa., northeast to Ellenton, a distance of eight miles.

Tennessee.—An officer writes that contracts have been let by this company to Eskridge & Carroll, of Huntsville, Tenn., and Burgin, Carson & Co., of Pioneer, Tenn., for extending its road from Buffalo creek, Tenn., to Smokey creek, a distance of 18 miles.

Tidewater.—The MacArthur Bros. Co., which has the contract for building a portion of the Tidewater-Deepwater railroad, has sublet contracts for a part of the work through Virginia and West Virginia as follows: Mason, Hanger, Coleman Company, Frankfort, Ky., grading and tunnel, $250,000; P. J. Millett, Paris, Ky., bluff work, $250,000; D. J. McDonald, Aurora, Ill., grading, $225,000; Mike Elmore, Alliance, Neb., grading, tunnel and bluff work, $600,000; Bates & Rogers, Chicago, masonry, $300,000; James Hearn & Co., Ada, W. Va., grading, $65,000; W. N. Camp & Co., Roanoke, Va., grading, $100,000; Carpenter & Boxley, Clifton Forge, Va., grading and tunnel, $377,000; Chill & Purnell, Eggleston, Va., bluff work, $100,000; J. C. Zobrist & Co., Roanoke, Va., grading, $60,000; Ingles & Shelburne, East Radford, Va., grading, $70,000; W. H. Johnson, Salem, Va., part of section 263, all of section 264 and part of section 265, grading; Litz & Co., Graham, Va., sections 359 to 362, grading and tunneling. A contract for bridges and a mile-long trestle has also been let to the Virginia Bridge & Iron Company.

Tonopah & Goldfield.—An officer writes that this company, which recently completed 35 miles of road from Tonopah to Goldfield, Nev., is making surveys for a further extension from Goldfield southeast to Bullfrog, an additional 80 miles.

Tonopah & Tidewater.—This road, which was incorporated last year to build from Ludlow, Cal., has filed a description of its route as follows: From Ludlow north through Amargosa canyon and Inyo County to Bullfrog, Nev., 158 miles, with a branch from a point in Inyo County to Borax mine, in Death Valley, 7½ miles. F. M. Smith, of Oakland, Cal., is the promoter.

Waynesburg & Washington.—Announcement has been made that this company, which at present operates a narrow gage road 29 miles long from Washington, Pa., south to Waynesburg, will be changed to standard gage and an extension built south to Dotysburg and eventually to West Virginia. Surveys for the proposed extension have been completed.

White River Valley.—See Chicago, Milwaukee & St. Paul above.

RAILROAD CORPORATION NEWS.

Arizona & Utah.—This road, which runs from McConnico, Ariz., to Chloride, 22 miles, has been sold by the receiver under a judgment of $452,000 granted to the Atchison, Topeka & Santa Fe, which owns all the stocks and bonds.

Atlanta, Birmingham & Atlantic (Atlantic & Birmingham.)—This company has filed a mortgage for $30,000,000 in favor of the Old Colony Trust Co., of Boston.

Boston & Lowell (B. & M.)—The stockholders have authorized an issue of $500,000 4 per cent. 20-year refunding bonds to take up $500,000 of 4 per cent. bonds maturing November 1, 1906.

Cripple Creek Central.—The directors have declared a quarterly dividend of 1 per cent. and an extra dividend of 1½ per cent. on the $2,500,000 common stick, payable January 17. The last dividend on the common stock was 3 per cent. in October. The regular quarterly dividend of 1 per cent. on the preferred stock was also declared.

Hudson Valley.—A circular has been issued to security holders of this company asking their consent to a reorganization of the company, which, the committee points out, is absolutely necessary. It is proposed, in addition to the existing 5 per cent. consolidated mortgage bonds amounting to $4,000,000 and $3,000,000 of common stock, to issue $500,000 of 5 per cent. non-cumulative debenture A bonds and $2,500,000 of 2 per cent. debenture B bonds. It is provided that after two years the B debentures may be converted into 5 per cent. non-cumulative preferred stock. The holders of present consolidated bonds are asked to surrender to the treasurer of the company 20 per cent. of their holdings of these bonds, and to accept for the same an equal amount of debenture A bonds. The holders of Hudson Valley demand-notes outstanding to the extent of $222,125 are asked to accept an equal amount of debenture B bonds. The Hudson Valley Railway Company trust notes amounting to $30,000 will be paid off in cash to be provided by the sale of debenture B bonds at 30. It is proposed to sell at this price $1,500,000 of these bonds, which will supply $450,000 in cash, which will be used to liquidate floating debt and for general improvements. The present common stock, according to the plan, is to be put in a voting trust for five years, the trustees named being John W. Herbert, E. Clarence Jones and James H. Caldwell.

Mobile & Ohio.—The bill passed by the last session of the Mississippi Legislature legalizing the merger of the Mobile & Ohio and the Southern has been vetoed by the Governor of the State. It is understood that no effort will be made to pass the bill over this veto.

New York Central & Hudson River.—The statement for the quarter ended December 31, partly estimated, shows gross earnings of $23,272,200, an increase of $2,187,223, and net earnings of $6,252,200, an increase of $230,190. The partly estimated figures for the year ended December 31 show gross earnings of $85,849,600, an increase of $7,276,391, and net earnings of $24,592,900, an increase of $2,142,076; surplus after dividends, $2,163,600, an increase of $1,221,361.

New York, New Haven & Hartford.—The outstanding 5 per cent. 20-year gold bonds of the New Haven Steamboat Co., of which $349,000 were issued, will be redeemed at the office of the Treasurer of the N. Y., N. H. & H. on February 1, 1906, at $105 a share.

Ottumwa Railway & Light.—This company has been incorporated with $1,000,000 common stock and $500,000 preferred stock to take over the property of the Ottumwa Traction & Light Co.

Rock Island, Arkansas & Louisiana.—The stockholders have authorized an issue of $15,000,000 bonds. One-half of this is to be issued soon, and will be used to refund the $1,260,000 bonds outstanding and to liquidate other construction debt. (November 24, p. 166.)

Southern.—See Mobile & Ohio.

Toledo Railway & Terminal.—Judson Harmon has been appointed Receiver.

United Railways Investment Company.—A stockholders' meeting has been called for January 31 to vote on the proposed increase of common stock from $10,000,000 to $25,000,000. Part of the new issue is to be used to pay off the $900,000 back dividends on the preferred stock. This company owns all the stock of the United Railroads of San Francisco. (See Philadelphia Co., December 1, p. 176.)

GENERAL NEWS SECTION

NOTES.

George L. Rives, counsel to the New York Rapid Transit Commission, says that a bill permitting the board to let separate contracts for the construction and operation of future subways has been drafted and sent to Albany.

On all the roads of Mexico where Pullman cars are in use, the rates for berths and seats in those cars are to be advanced on February 1 about 50 per cent. The change in the value of silver is given as the principal reason for this action.

The fast Havana express of the Mobile & Ohio, which is to run once a week between St. Louis and Mobile, made its first trip on January 5 and 6. This train leaves St. Louis at 9:45 p. m. and reaches Mobile at 3 p. m. the next day. The time through to Havana is 53 hours.

The publishers of *McClure's Magazine* have been sued for $100,000 in each of two suits for libel by the Union Refrigerator Transit Company, of Wisconsin. The plaintiff claims to have been injured by the publication of articles in the magazine concerning illegal freight rates.

The Erie Railroad is experimenting with a fan at one of the shafts of the Bergen tunnel, Jersey City, to exhaust the smoke and gases from the tunnel. A large fan made by the Buffalo Forge Co. has been set up at the top of the shaft, with a second-hand locomotive boiler to furnish power.

The committee of western traffic men who recently made a pilgrimage to Washington to inform the Government that they intended to obey the laws, has adopted a permanent organization. Mr. Stubbs is Chairman and Mr. W. H. Hosmer, of the Western Trunk Line Committee, is Secretary.

A press despatch from Washington says that a committee representing the eastern Trunk Lines has called upon the Interstate Commerce Commission and given to the commissioners the same assurances concerning their intentions to obey the law that were given by the western roads a fortnight since.

According to the Wilmington (Del.) *News* the freight train men of the city, presumably those running on the Philadelphia, Baltimore & Washington, are now so busy and in such constant demand that when a trainman goes to a theatre he gives the box office the number of his seat, just as is done by physicians, so that when he is wanted he can be quickly reached. The theatre men find on their list more railroad men than physicians.

At Utica, N. Y., January 10, the Grand Jury in the United States Court indicted the New York Central and the Delaware & Hudson roads for giving to the General Electric Company, Schenectady, rebates of 20 cents a ton on freight. It is said that this rebate is an allowance for terminal expenses. The General Electric Company has tracks and shipping facilities of its own, and delivers freight to the railroads in carloads, ready to be sent forward.

By new tariffs which went into effect on the first of January eastbound freight rates from St. Louis are considerably modified, so as to absorb a part of the bridge arbitrary on most commodities; and, according to announcements made in St. Louis, the westbound rates to St. Louis over the same roads will be reduced in a similar manner on February 1. Including a reduction in the bridge charge on soft coal from Illinois, the business of St. Louis, it is said, will be benefited several hundred thousand dollars yearly.

At Altoona, Pa., a new order has been issued forbidding employees in the railroad shops to cross the tracks or to ride on engines or freight cars while going to and from work; and not only has the order been emphasized but watchmen have been stationed to detect and report violations of it. It appears that among the thousands of men employed in the Altoona shops there are a great many who have made free use of the extensive freight yards as thoroughfares, and that many serious accidents have occurred.

The eight "auditors" now collecting fares on trains of the Great Northern Railway are so satisfactory that, it is said, about 50 more men will be put on to trains to perform this service. According to the Minneapolis *Tribune* the conductors will now be able to give their undivided attention to the handling of their trains; and, if the railroad company's circular is correctly quoted, the "auditors" will also be expected to give undivided attention to the work assigned to them, for they will "under no condition be permitted to occupy seats with lady passengers." The auditors are expected to assist the other train employees in making passengers comfortable.

Passes.

According to a newspaper item, the number of season passes now in force on the Long Island Railroad is 3,800 less than it was on January 1. By the same authority it is stated that the travel on the 3,800 passes now cut off has amounted to $6,000 a month. A press dispatch from Altoona says that the abolition of passes on the Pennsylvania Railroad has been followed by the withdrawal of the half-rate privilege on "charity tickets." It appears that the half-rate tickets sold to town and city officers for the benefit of paupers, or other indigent persons, have been so manipulated as to benefit persons who were able to pay full rates. At Philadelphia a meeting of Pennsylvania Railroad employees is said to have indulged in protracted grumbling because the superintendent has notified them that henceforth they can have only four or five passes a year, and that on the West Jersey & Seashore they (P. R. R. men) can have none.

Lively Traffic Doings in the Effete East.

The cordial relations which have existed for more than twenty years between the New York, New Haven & Hartford Railroad, which controls the Sound steamboat lines from New York City to New England points, and the Metropolitan Line, which operates freight boats between New York and Boston, outside of Cape Cod, will shortly be broken and a bitter rate war for the control of New England freights is likely to be precipitated. The disruption has resulted, it is said, from the acquisition by the Morse interests, which now control the Metropolitan Line, of the Eastern Steamship Company's lines from Boston to Maine and New Brunswick ports, thus threatening a monopoly of freights east of Boston. The New Haven road also resents the entrance of the outside line into the passenger business, the latter having given an order last fall to the New York Shipbuilding Company, of Camden, for two fast turbine passenger steamers to go on the route early next year.

The New Haven interests have now placed an order with the Cramps for three large freight steamers, to be delivered next January, and will start another outside route between New York and Boston to compete with the all-water route of the Metropolitan Line, which has enjoyed a 10 per cent. differential over the Sound lines for Boston and points east of there.

The first gun in the fight will be fired next Monday when R. T. Haskins, who has been connected with the Metropolitan Line for 36 years, latterly as traffic manager, assumes charge of the freight traffic of the Sound lines, and who will also be made general freight agent of the new outside line. Harry H. Benedict, outside freight solicitor for the Metropolitan Line, has also resigned to accept a position as Mr. Haskins' assistant.

It is understood that a subsidiary company will be formed to operate the New Haven's outside line. The water lines at present in the New England and Maine fields are the Metropolitan Line, Fall River Line, Providence Line, Stonington Line, Norwich Line, New Haven Line, Starin's Line, Joy Line, New Bedford Line, Central Vermont Line, Norwalk Line and the new Enterprise Transportation Company. The Maine Steamship Company, which operates a tri-weekly service between New York and Portland, handles a large share of the Maine passenger and freight traffic.—*Journal of Commerce, New York.*

The Deadly Tender.

The railway mail clerks who have runs on the Rock Island are up in arms against that road as the result of a recent ruling that the company will not turn the mail cars, but will run them just as they happen to be picked up. The cars are divided into two sections. One contains the cases where the clerks are at work, and the other end is used for the purpose of storing the mail. Heretofore all the roads have turned the cars so as to have the storage end next to the engine. The advantage of this in case of a wreck can easily be seen. In every case of a head-on collision the tender telescopes the mail car, running back into the car from 10 to 15 ft. It has been estimated that the cost of turning the cars amounted to about 50 cents each time. The clerks are preparing a petition which will be sent to the department at Washington. If it is decided there that nothing can be done in the matter, a petition will be sent to Congress asking that a law be passed compelling the roads to turn the cars.—*Wichita (Kan.) Eagle.*

Train Lighting by Electricity in England.

The use of electricity for train lighting is now receiving increased consideration in England. The strong recommendations which were made by the Board of Trade inspectors who investigated the cause of the Witham Accident on the Great Eastern at the end of last summer have been followed by the most noteworthy performance yet recorded in train electric lighting. The experiment has consisted of a long trial of the Leitner-Lucas system on the

Great Western express service between London and Plymouth, and between Plymouth and Penzance. Three of the patent equipments were run on this train during the months of October, November and December. The equipment remained under seal for this period, and when the seals were broken on January 1 a mileage of 23,800 miles for one coach and 25,200 miles for another had been run without any failure whatever in the lighting of the carriages. During the whole of the experimental period the dynamos with their oil wells, brush and reversing gear, automatic cut-outs, and also the storage batteries, were all under seal, so that nothing in the way of repairs, etc., could be done. The installation in one coach comprised 12 osmium lamps of 10 c.p. each in three first-class compartments, 10 12-c.p. carbon lamps in five third-class compartments, and eight 8-c.p. carbon lamps, making 304 c.p. altogether for the coach. It is reported that the energy consumption of the osmium lamps was from 1.7 to 2 watts per candle, and that of the carbon lamps 3½ watts per candle. The dynamo is of the Leitner Lucas self-regulating type, of 2½ kw. capacity, and is used to charge a battery of accumulators giving 23 volts and having a capacity of 180 ampere-hours. The whole equipment for a train is self-contained and automatic. The dynamo has a single armature and commutator, but by means of a special arrangement employing a pair of auxiliary brushes, it is stated to give a practically constant current.

Exports in 1905.

The total value of exports of breadstuffs, provisions, cotton and mineral oils from this country during 1905 was $828,107,062, comparing with $729,341,151 in 1904 and $841,061,180 in the year before. The value of breadstuffs shows a great increase over 1904, but a large decrease from 1903, the figures being, respectively, $146,110,962, $92,311,812 and $192,920,616. Shipments of these staples have been increasing rapidly in the last four months, the figure for December, $26,475,200, being the largest for any month in the last four years at least. During 1905, 8,902,403 bales of cotton, valued at $392,224,458, have left the country, as compared with 6,556,953 bales, in 1904, the valuation then being $368,535,000. Wheat exports (included in breadstuffs) were 20,555,817 bushels, or $16,907,480 last year; in 1904 they were 13,015,394 bushels, $10,8[illegible]9,737. The number of barrels of wheat flour exported in 1905 was 11,281,937, valued at $49,694,482, the corresponding figures for 1904 being 11,368,503 barrels, $49,648,243. The value of provisions exported, including cattle, hogs and sheep, was $213,076,889 in 1905 and $[illegible]0,277,172 in 1904. Mineral oils were exported in 1905 to the amount of 1,165,440,249 gallons, the value being $76,694,753. The price is noticeably lower than in 1904, when the value of the 985,729,957 gallons exported was $78,217,167.

Andrew Carnegie Research Scholarship.

The Iron & Steel Institute (London) is hereafter to award annualy, on the recommendation of the Council of the Institute, a research scholarship, or scholarships, Mr. Andrew Carnegie, past President of the Institute, having given $89,000 in 5 per cent. bonds for this purpose. Applicants, who may be of either sex or any nationality, must apply to the Secretary of the Institute before the end of February, for a prescribed blank form. The object of the scholarships is to enable students who have passed through college, or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects. Appointments are to be for one year, but may be renewed. Scholars are to report the results of their work, and where a scholar's paper is of sufficient merit, the Andrew Carnegie gold medal will be awarded. The Secretary of the Institute is Mr. B. H. Brough, 28 Victoria street, London.

A Handy Information Bureau.

The queerest illustration that we have seen of the value of journalism was the story of the passengers in a stalled train away off in New Mexico who telegraphed to *The Times*, asking the explanation of the delay which they could not secure where they were. Well, within half an hour we were able to telegraph back to them that they had been "held up" for 58 hours at the little way station of Duran because there were snowdrifts in the Pecos Valley below them so deep and hard that the big rotary plows had not yet succeeded in cutting a path through. We also told them that their imprisonment would soon end, as arrangements were making to send their train westward over lines further to the south. Of course these passengers had sought nearer at hand for information before they looked for it 2,500 mile, away. Incidentally, we cannot help wondering why a great railroad company should leave for almost three days the passengers on a transcontinental train in absolute ignorance as to the cause of their long detention, thus making it very much harder to bear, and certainly not accumulating popularity for the company's management. Corporations have an instinctive hatred for explaining their own mishaps and shortcomings, and as they all follow the same apparently stupid policy just as often and as long as they can there must be some good reason for it from the corporation standpoint. *New York Times.*

Sir George Gibb.

In our issue of January 5 we announced the appointment of Sir George Gibb as Deputy Chairman of the Underground Electric Company of London, which controls the Metropolitan, the Metropolitan District, the Great Northern, Piccadilly & Brompton, Baker Street & Waterloo, and Charing Cross, Eustin & Hampstead subways, and also the London United Tramways. Mr. Edgar Speyer was elected Chairman of the company to succeed Charles T. Yerkes, deceased. In the new organization, however, the management control rests with the Deputy Chairman, who has been a long and valued friend of the *Railroad Gazette*. The accompanying picture of Sir George Gibb is an excellent likeness. He was born at Aberdeen, Scotland, in 1850. His first railroad service was in 1887 as Assistant in the Solicitor's office of the Great Western. In 1882 he went to the North Eastern as Solicitor and became General Manager of that road in 1891. He acted as arbitrator for the North Eastern in the Wages Arbitration case in 1897, was appointed a member of the Committee on War Office Reorganization in 1901, a member of the Royal Commission on London Traffic in 1903, and visited the United States for the purpose of taking evidence in that connection. He was knighted in 1904.

In the 14 years that he has been General Manager of the North Eastern Railway his work has been in many ways radical if not almost revolutionary from a British standpoint. He has been the foremost advocate in Great Britain of ton-mile statistics and of heavy train loading, two topics which are sure to provoke much hostile discussion at any meeting of British railway shareholders, as was the case two years ago, when the ton-mile question was pretty thoroughly thrashed out by a number of large companies at their meetings. It is interesting and noteworthy in this connection to observe that some of the most conservative British companies, such as the London & North Western, really keep for their own use pretty full statistics, but do not publish them nor render them available to the inside or outside public. In the face of opposition, however, Sir George has been fearless and consistent in his methods. A solicitor by training, his entire attitude of mind is quite different from that of the traditional English manager. He has always wished to satisfy himself on important points *de novo*, and he analyzes the traditions of railway working as if they appertained to new matters instead of to old ones. For some years after he entered upon his duties as General Manager, he was chaffed more or less by his associates for inquiring most minutely into all the details of operation, asking questions which seemed to subordinate officers to be rudimentary. It is scarcely necessary for an American to be told that in this way he has acquired a wonderful knowledge of every detail of the working of a British railway. He knows where the profits are and where the losses are, and he has been most active in increasing the former and cutting down the latter. For example, in the last five years he has increased his freight train loads by 52 per cent. He has also introduced rail motor cars to handle branch line traffic, although at present not convinced of their economy; and his company, along with the Lancashire & Yorkshire, was the pioneer in electrifying branch line territory, with the important difference between the two that the Lancashire & Yorkshire designed its own power house equipment while the North Eastern buys its power, and apparently has the better bargain of it. The Scotch habit of mind looks into the future far more than does the English, and it is safe to say that there is no railway in Great Britain that has studied and discounted its future more intelligently in recent years than has the North Eastern. In his personality Sir George is quiet and modest and has much charm of manner.



Sir George Gibb.

A Comparison.

H. C. Barlow, executive director of the Chicago Commercial Association, says: "We hear much about the greatness of the railroads, but does not the average railroad place a high estimate on its own importance? The annual value of the manufactures within the limits of what is known as commercial Chicago is almost equal to the entire gross freight earnings of all the railroads of the United States. A Southern Railway agent was surprised a few days ago to find that the retail business done in Chicago by one merchant is larger than the entire business of Mr. Spencer's system."—*Chicago Press Despatch.*

The Gill-Alexander Operators' Call Bell.

This device is in use on about 40 railroads, including the Atchison, the Burlington, the Rock Island, the Chesapeake & Ohio, the Cincinnati, Hamilton & Dayton, the Colorado Midland, the Fremont, Elkhorn & M. V., the Great Northern, the Mexican Central, the Missouri, Kansas & Texas, the Missouri Pacific, the Northern Pacific, the Southern Pacific, and the Union Pacific. This device consists essentially of a call bell worked by a local circuit in a station telegraph office, which local circuit is closed by a combination of dashes sent over the wire by the train despatcher. The bell, when started, rings until the operator responds and opens the local circuit. The bell is made loud enough to wake him at night if it be placed by his bedside, or to draw his attention (when placed in the office) if he is engaged outside or in the freight house, or is at any place within hearing of the bell. The despatcher's office has different combinations of dashes for each office in which there is a call bell. There is an advantage over the ordinary Morse-sounder call, not only in loudness, but also in the fact that the call requires no repetition to be effective. Where a wire is busy it is not necessary to interrupt senders of messages to repeatedly call inattentive operators. This apparatus is in service at general offices, large warehouses, shops, in the homes of superintendents and train despatchers, and in many other situations. It is made by the Gill-Alexander Electric Co., Kansas City.

Another Brotherhood.

At Lancaster, Pa., January 11, the Brotherhood of Railroad Freight and Baggage Men of America held its second biennial convention, about 100 delegates being present. The President is R. P. Neil, of Lancaster.

Discouraging to the Gossips.

James J. Hill spent to-day in conference with officials of the Burlington. He denied absolutely the truth of all stories current that he desired connection with the Atlantic seaboard for his railroad. "Nineteen out of every twenty carloads coming over our lines from the Northwest change owners at Chicago. We are through with the consignments at the same time the owners are," said Mr. Hill.—*Chicago Press Dispatch.*

Proposed Monorail Road to Coney Island.

An application has been made to the New York Rapid Transit Commission for a route for a monorail line from the subway terminal in Brooklyn, N. Y., at Atlantic and Flatbush avenues, to Coney Island. F. B. Behr, President of the Behr Monorail Company, submitted the proposition to the board and asked for a public hearing.

Manufacturing and Business.

J. T. Keith, formerly Superintendent of the Lehigh Valley at Buffalo, is now Superintendent of G. B. Markle & Company, miners and shippers of coal, Jeddo, Pa.

The Allis-Chalmers Company, Milwaukee, Wis., has furnished a complete pumping equipment for the irrigation system of the Makee Sugar Company, Keila, Island of Kanan, Hawaiian Territory.

The General Storage Battery Co., New York, is to enlarge its factory at Boonton, N. J. The new buildings will contain 48,000 sq. ft. of floor space and will be devoted to the manufacture of the company's Bijur "High Duty" elements.

The Robins Conveying Belt Co., New York, has opened an office at 749 Railway Exchange Building, Chicago. Mr. C. Kemble Baldwin, Chief Engineer of the company, is in charge of this office, which will attend to all business for the Middle West.

The Lima Locomotive & Machine Company, Lima, Ohio, builders of the "Shay" geared locomotive, state that there are over 1,500 "Shay" locomotives in successful operation in all parts of the globe. The company's plant at Lima occupies over 14 acres of land.

The Chicago Pneumatic Tool Company, Chicago, is making arrangements for an addition to its compressor plant at Franklin, Pa. The present capacity of the plant is about 400 compressors per year. On the completion of the proposed extension the annual capacity of the plant will be between 650 and 700 compressors.

Five float bridges of the Pennsylvania Railroad for the freight ferries in the Harsimus Cove freight yard, Jersey City, are now raised and lowered by electric motors. The seven steel screws, 6 in. in diameter, on which a bridge is lowered and raised, were made by the Steele & Condit Company, of Jersey City, who also installed the electric motors furnished by the Westinghouse Company.

Several wood working machines have been shipped to the Harlan & Hollingsworth Co., Wilmington, Del., by the S. A. Woods Machine Co., Boston, Mass. Special attention is given to car shop machinery by the S. A. Woods Machine Co., and it has recently furnished equipment for a large number of railroad car shops, including a No. 10 car-sill dresser, a heavy vertical hollow chisel mortiser, and an automatic knife grinder for sharpening planer knives for the East Buffalo shops of the Lake Shore & Michigan Southern.

The J. G. Brill Company, car and truck builders, Philadelphia, Pa., are shipping 50 gondola cars to the Tramway Rural a Vapor, Buenos Ayres. This is a duplicate of an order of a year ago. The railroad company operates lines within the city of Buenos Ayres and has recently electrified its system. It also has a steam line running out of the city. The Brill Company is building at present 75 of its semi-convertible type of car for the city lines, and a fine dining car for the steam road. Practically all of the equipment of the Tramway Rural has been furnished by the J. G. Brill Company.

Iron and Steel.

A contract has been given by the Rio de Janeiro Light, Tramway & Power Company, to the United States Export Product Company, for 10,000 tons of rails.

Orders for rails have recently been given by the following companies: Pennsylvania Railroad, 20,000 tons in addition to the contracts given by this road last fall. The Missouri, Kansas & Texas has given an order for 20,000 tons of rails, and the Duluth, Virginia & Rainy Lake one for 8,000 tons; Syracuse Traction, 7,000 tons; Minneapolis, St. Paul & Sault Ste. Marie an additional order for 4,000 tons; Green Bay & Western, 3,000 tons; Texas & Pacific, 3,500 tons; International & Great Northern, 1,500 tons; Cleveland Frog & Switch Company, 1,000 tons. There also has been reported 500 tons for the Ramapo Valley Railroad and 1,000 tons for export to Costa Rica.

OBITUARY NOTICES.

Mr. Robert G. Erwin, formerly President of the Atlantic Coast Line, died of heart disease, at Saybrook, Conn., on January 13. Mr. Erwin resigned as President of the A. C. L. last November, remaining, however, a director of it, and of the Louisville & Nashville and other companies.

Mr. Homer F. Frost, Assistant General Freight Agent of the Chicago, Cincinnati & Louisville, died recently at Louisville, Ky., at the age of 61. Mr. Frost was appointed to the position he held at the time of his death in 1893. Before that he had been General Agent of the freight department at Louisville, Ky., and later Assistant General Freight Agent at Elkhart, Ind.

Mr. Francis J. Duke, Secretary and Treasurer of the Richmond, Fredericksburg & Potomac, died recently in Richmond, Va., of heart disease. Mr. Duke was born in 1842 and served as telegraph operator on the Louisa Railroad (now the Chesapeake & Ohio) during the war. In 1868 he went into the Treasurer's office of the Richmond, Fredericksburg & Potomac, being later appointed Assistant Treasurer, and finally Secretary and Treasurer.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Association of General Freight Agents.

This is the name of an association which was organized in New York City, November 21, and which proposes to hold its first general meeting soon. The organizers are all southern men, being officers of roads south of the Ohio and east of the Mississippi, but it is their purpose to have the coming meeting held in some centrally located city so as to attract freight officers of eastern, central and western roads. The object of the association is mainly to promote acquaintance and good fellowship, but incidentally "to afford opportunity for the discussion of topics of general interest" to the freight department. The membership clause of the constitution makes eligible all freight traffic officers of the rank of Assistant General Freight Agent, or higher, actively connected with any regularly chartered steam railroad or coastwise steamship line of the United States, Canada, West Indies and Mexico. One-third of the membership is to constitute a quorum for the transaction of business. The President is D. M. Goodwyn, General Freight Agent of the Louisville & Nashville, Louisville, Ky. The other officers and

members of the Executive Committee are C. C. Cameron (I. C.), C. R. Capps (S. A. L.), R. L. McKellar (Southern), Key Compton (B. S. P. Co.), H. M. Emerson (A. C. L.), H. F. Smith (N., C. & St. L.), J. R. Ruffin (N. & W.), E. D. Hotchkiss (C. & O.), L. Green (Southern), and Haiden Miller (M. & O.).

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Buffalo & Susquehanna.—W. H. Baumes, Auditor, has been appointed Comptroller. T. J. Elmer succeeds Mr. Baumes.

Canadian Northern.—The general offices of this company have been moved from Toronto, Ont., to Montreal, Quebec.

Chesterfield & Lancaster.—A. H. Page, Vice-President and General Manager, has been elected President, and W. Godfrey, General Freight and Passenger Agent, has been elected Vice-President, both with offices at Cheraw, S. C.

East Broad Top.—S. J. Livingston has been elected Secretary and Treasurer, succeeding J. E. Haverstick, and C. D. Jones has been appointed Auditor, succeeding E. C. Hall, transferred, both with offices at Philadelphia, Pa.

Florida.—H. L. Edwards has been appointed Auditor, succeeding T. P. Alston, who remains Secretary, General Passenger Agent, Superintendent and Car Accountant.

Operating Officers.

Denver & Rio Grande.—H. T. Herr, Acting General Superintendent, has resigned. P. B. McAtee has been appointed Assistant Superintendent of the Fourth division, with authority from Chama, N. Mex., to Durango, Colo., including the Silverton and Farmington branches and the Rio Grande, Pagosa & Northern, with office at Durango. A. Meloney remains Assistant Superintendent of the Fourth division, with jurisdiction from La Veta, Colo., to Chama, N. Mex., including the Chama yards and the Creede and Santa Fe branches.

East Broad Top.—E. C. Hall, Auditor, has been appointed Assistant to the General Manager, with office at Orbisonia, Pa.

Flint River & Northeastern.—J. W. Byrd, Vice-President, General Manager and Purchasing Agent, has resigned. His duties have been assumed by J. F. Sikes, Superintendent.

Indiana Harbor.—Frank Beckwith, Engineer of Bridges and Structures of the Lake Shore & Michigan Southern, has been appointed General Superintendent of the Indiana Harbor, succeeding J. H. Snyder. F. T. Bowles, Superintendent of the Lake Erie & Western at LaFayette, Ind., has been appointed Superintendent of the Indiana Harbor, succeeding R. L. Scott.

Lake Erie & Western.—E. R. Bissell, Trainmaster at Lima, Ohio, has been appointed Superintendent at Muncie, Ind., succeeding W. J. Davis.

See Indiana Harbor.

Lake Shore & Michigan Southern.—See Indiana Harbor.

Mexican Central.—D. S. More, Acting Superintendent at Guadalajara, has resigned to become Traffic Manager of the Peruvian Central, with office at Lima, Peru. Mr. More was born in Milwaukee in 1864 and entered railroad service at the age of 16 as an operator on the Chicago, Milwaukee & St. Paul. Since that time he has served consecutively as station agent, despatcher, conductor, trainmaster and Acting Superintendent of several roads in the United States and Mexico.

Ohio River & Western.—The general offices have been moved from Zanesville, Ohio, to Woodsfield, Ohio.

Philadelphia, Baltimore & Washington.—James Buckelew, who has been appointed Superintendent of the Central division, was born in New Jersey in 1864. He graduated from Princeton in 1885, and entered the service of the Pennsylvania as rodman. The next year he was transferred to the maintenance of way department, and in 1888 was appointed assistant supervisor. He was made supervisor of the Tyrone division two years later, and next served in the same position on the Trenton Cut-off until he was appointed Assistant Engineer of the Middle division of the Philadelphia & Erie in 1900. The next year he returned to the Tyrone division as Assistant Engineer, and in 1902 was transferred to the Pittsburg division with the same title. In 1903 he was promoted to be Principal Assistant Engineer of the P., B. & W., where he has remained until his recent appointment.

St. Louis, Brownsville & Mexico.—W. J. Carnohan, Superintendent, has been appointed General Superintendent. George Huestis, Trainmaster, has been appointed Superintendent, succeeding Mr. Carnohan.

Tidewater.—E. E. Gardner has been appointed Car Accountant, with office at Norfolk, Va.

Traffic Officers.

Chicago, Rock Island & Pacific.—See St. Louis & San Francisco.

Delaware, Lackawanna & Western.—W. E. Dowle, Division Freight Agent at Buffalo, has been appointed to the new office of Assistant General Freight Agent; headquarters unchanged.

Minneapolis, St. Paul & Sault Ste. Marie.—H. M. Lewis, Chief Clerk to the General Passenger Agent, has been appointed Assistant General Passenger Agent, with office at St. Paul, Minn., succeeding W. S. Thorne, deceased.

National Lines of Mexico.—W. B. Ryan, Traffic Manager, has resigned, and the office has been abolished.

St. Louis & San Francisco.—The authority of W. B. Biddle, Third Vice-President in charge of traffic of the Chicago, Rock Island & Pacific, has been extended over the St. Louis & San Francisco.

Western Maryland.—B. H. Griswold, General Traffic Manager, has resigned, and the office has been abolished. J. T. Hendricks, Assistant General Freight Agent, has been appointed Freight Traffic Manager, and the office of Assistant General Freight Agent has been abolished.

Wheeling & Lake Erie.—W. C. Maxwell, who was recently appointed Assistant General Traffic Manager of this road and of the Wabash Pittsburg Terminal, was born in 1865 and entered railroad service as a messenger boy on the Chicago, Burlington & Quincy. He remained with that road for 24 years, being in the local freight service, then in the general freight office, and later serving as general agent, being finally promoted to the office of Assistant General Freight Agent. On Sept. 1, 1905, he came to the Wabash as Assistant General Traffic Manager, his jurisdiction being extended over the W. & L. E. and W. P. T. on Jan. 1, 1906.

Engineering and Rolling Stock Officers.

Atlantic Coast Line.—C. M. James, who has been appointed Engineer of Roadway of the lines north of Savannah of the Atlantic Coast Line, was born in 1875. He graduated from the Baltimore Polytechnic Institute and entered railroad service as rodman on the Baltimore & Ohio. He was promoted through various stages until he became Assistant Engineer in 1899. In 1904, he went to the Atlantic Coast Line as Assistant Engineer. He was appointed Acting Engineer of Roadway in July, 1905, and the appointment was made permanent on the first of this month.

Brandon, Saskatchewan & Hudson's Bay.—P. E. Thian, who was recently appointed Chief Engineer of this road, was born in 1862 and graduated at Georgetown University in 1881. He started railroad work the same year in the engineering department of the Denver & Rio Grande. In 1882, he went to the Canadian Pacific, and four years later to the Chicago, Milwaukee & St. Paul, being later appointed First Assistant Resident Engineer at Kansas City. Later he went to the New Orleans & Northwestern as Assistant Engineer on Construction, and, in 1890, became Locating Engineer in Washington for the Northern Pacific. In 1894 and 1895, he was City Engineer at Everett, Wash., and for the next few years was engaged in mining work and in the United States Geological service. He returned to railroad work in 1899 as Assistant Chief Engineer of the Kootenay Valley. He then became Engineer of Construction on the Montana Central, and in 1901 went to the Algoma Central as Locating Engineer. After being engaged for a time in Mexico in mining, he became Assistant Chief Engineer of the Oregon Water Power & Railway Co. In 1904, he went to the Great Northern as Locating Engineer, from which position he has resigned to accept his present appointment.



P. E. Thian.

Great Northern.—J. C. Paterson, Principal Assistant Engineer, has been appointed to the new office of Assistant Chief Engineer at St. Paul, Minn. Alexander Stewart, Resident Engineer at

Seattle, Wash., has been appointed to the new office of Assistant Chief Engineer at that place.

Six districts for Resident Engineers have been established, as follows: St. Paul district, office at St. Paul, Minnesota, with jurisdiction over the Terminals division, Willmar division, Willmar & Sioux Falls Railway, Breckenridge division and Fergus Falls division. Superior district, office at Superior, Wisconsin, with jurisdiction over the Superior division and Mesabi division. Grand Forks district, office at Grand Forks, North Dakota, with jurisdiction over the Northern division and Dakota division. Minot district, office at Minot, N. Dak., with jurisdiction over the Minot division, Montana division and Montana Central Railway. Spokane district, office at Spokane, Wash., with jurisdiction over the Kalispell, Spokane division, and Spokane Falls & Northern System. Seattle district, office at Seattle, Wash., with jurisdiction over the Cascade division and coast lines.

P. S. Hervin has been appointed Resident Engineer of the Grand Forks district. C. H. Swigart has been appointed Resident Engineer of the Seattle district.

Huntingdon & Broad Top Mountain.—A. E. Yohn has been appointed Master Mechanic, with office at Saxton, Pa., succeeding C. R. Yohn, resigned.

Pennsylvania.—W. H. Brown, Chief Engineer, is to be retired on pension on March 1st. H. S. Meily, Supervisor at Middletown, Pa., has been appointed Assistant Engineer at Buffalo, N. Y., succeeding E. Lee, transferred.

A. W. Byron has been appointed Assistant Master Mechanic at Olean, N. Y.

Southern Pacific.—John Dove Isaacs, who was recently appointed Consulting Engineer of the Southern Pacific, Union Pacific, Oregon Short Line, and the Oregon Railroad & Navigation, was born in Virginia in 1848. He graduated from the University of Virginia in 1869, and entered railroad service in 1875 on the Southern Pacific as a draftsman. He became chief draftsman the next year, and in 1885 was appointed Assistant Superintendent of Bridges and Buildings. Five years later he was made Acting Superintendent of Bridges and Buildings, and, in 1891, was appointed Second Assistant Engineer of Maintenance of Way. He was promoted, in 1900, to be Assistant Engineer of Maintenance of Way of the Pacific System of the Southern Pacific, and of the S. P. Lines in Oregon, which position he has held ever since, being, however, appointed, in 1901, also Engineer of Bridges of both the Pacific and Atlantic Systems of the Southern Pacific.



J. D. Isaacs.

Special Officers.

Minnesota Railroad & Warehouse Commission.—Dwight C. Morgan, formerly with the Chicago, St. Paul, Minneapolis & Omaha, has been appointed by the Commission to take charge of the valuation of railroad properties in Minnesota. Mr. Morgan was born in Illinois in 1868 and is a graduate of the University of Michigan. In 1887 he was engaged in the government service in reporting upon the value and cost of reproducing the Central and Union Pacific Railroads. He was later Assistant Engineer on construction of the Illinois Central bridge across the Ohio river at Cairo, Ill., and after that had the same position on the construction of the Merchants' bridge at St. Louis. In 1891, he was instrument man on construction on the Northern Pacific, and then was appointed Assistant Engineer of Maintenance on the Southern Pacific. He resigned from this position to join his father in the firm of Richard P. Morgan & Son, Civil Engineers. In 1893 he was appointed the Consulting Engineer of the Illinois Railroad & Warehouse Commission. He returned to railroad work in 1899, as Assistant Engineer of the Chicago & Alton, and later was appointed Engineer of Maintenance of that road. In 1901 he was appointed Assistant Engineer of the Chicago Great Western, and the next year went to the Chicago, St. Paul, Minneapolis & Omaha, where he was for two years Assistant Engineer and later Assistant to the General Superintendent.



D. C. Morgan.

LOCOMOTIVE BUILDING.

The Italian Railway Administration is asking prices on 50 locomotives.

The Chesapeake & Ohio, it is reported, is in the market for switching locomotives.

The Southern of Peru has ordered 10 locomotives from the Rogers Locomotive Co.

The Western, of Havana, has ordered two locomotives from the Rogers Locomotive Works.

The Chicago, Indianapolis & Louisville has ordered four locomotives from the American Locomotive Co.

The Denver & Rio Grande has ordered 20 consolidation locomotives from the American Locomotive Company.

The Illinois Central, it is reported, has ordered 75 locomotives as follows: Twenty-five passenger, 25 freight and 25 switching locomotives.

The Sierra Railway Company, of California, has ordered four oil burning locomotives from the H. K. Porter Company, instead of two as reported in our issue of December 29.

The Grand Trunk has ordered 20 passenger locomotives and 61 freight locomotives. It is reported that all of the locomotives with the exception of ten of the passenger locomotives will be made in Canada.

The Mexican Central is considering the purchase of 25 simple locomotives as follows: Twenty consolidated freight locomotives and five six-wheel switchers. Nothing has been determined as yet in regard to the details of the locomotives.

CAR BUILDING.

The Illinois, Iowa & Minnesota is in the market for 500 box cars.

The Kansas City Southern is figuring on buying 100 freight cars.

The Pullman Co. is asking bids on material for 200 refrigerator cars.

The Detroit, Toledo & Ironton is reported as in the market for some coal cars.

The Lehigh & Hudson River is reported as in the market for 300 freight cars.

The Denver & Rio Grande, it is reported, is figuring on buying 1,000 dump cars.

The Milwaukee Electric Railway & Light Company is figuring on buying 50 cars.

The Long Island is reported as in the market for additional freight equipment.

The California North-Western expects to be in the market soon for 100 freight cars.

The Mexican International is in the market for 300 gondola cars of 80,000 lbs. capacity.

The Mexican Central is in the market for 950 box cars, 160 stock cars and 75 flat cars.

The Seaboard Air Line has ordered 1,000 box cars from the American Car & Foundry Co.

The Tidewater has ordered 100 flat cars and 300 stock cars from the Western Steel & Foundry Co.

The Atchison, Topeka & Santa Fe, it is reported, will shortly be in the market for additional tank cars.

The Spokane International has ordered six passenger and three baggage cars from the Wason Manufacturing Co.

The Chicago, Rock Island & Pacific is in the market for five observation cars, five postal cars and three dining cars.

The Bolivia National is figuring on the purchase of 100 passenger cars, 50 baggage and express cars and two private cars.

The Toledo, St. Louis & Western is about to order 1,000 box cars of 60,000 lbs. capacity, and 750 gondolas of 80,000 lbs. capacity.

The Oregon Railroad & Navigation Company has ordered 45 tank cars of 12,500 gallons capacity from the Pressed Steel Car Company.

The Pennsylvania, it is reported, will shortly order a number of passenger cars for use on its West Jersey & Seashore line, which is now being electrified.

The Midland Valley is in the market for 600 coal cars of 80,000 lbs. capacity and 250 36-ft. standard box cars. Address Henry Wood, Vice-President, Girard Building, Philadelphia, Pa.

The Lake Shore Electric has ordered ten 51-ft. cars from the Niles Car & Manufacturing Co. The cars will weigh approximately 34 tons. The special equipment includes: Westinghouse air-brakes and Baldwin trucks.

The Southern Pacific has ordered 300 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars are similar in every respect to those ordered by the Union Pacific, the details of which are given above.

The Union Pacific has ordered 300 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will measure 39 ft. 10¾ in. long x 8 ft. 2¾ in. wide x 7 ft. $6^{9}/_{16}$ in. high, all inside dimensions. The bodies will be of wood, and the underframes will be of metal. The special equipment will include steel bolsters, Congdon brake-shoes, Hewitt brasses, Climax couplers, Miner draft rigging, and Railway Steel Spring Company's springs.

The Buffalo, Rochester & Pittsburg, as reported in our issue of December 22 last, has ordered 200 steel hopper coal cars of 100,000 lbs. capacity from the Standard Steel Car Co., for June delivery. The special equipment includes: Atha cast-steel bolsters, Pennsylvania steel brake-beams, Westinghouse air-brakes, Climax steel couplers, Sessions draft rigging, Symington journal boxes, Patterson Sargent paint, and Railway Steel Spring Company's springs.

The Chicago & Milwaukee Electric, as reported in our issue of December 22 last, has ordered 10 closed interurban motor cars from the Jewett Car Co., for May delivery. These cars will weigh 34 tons, and measure 53 ft. 4 in. long, 9 ft. 6.5 in. wide and 14 ft. 2 in. high, over all. The special equipment includes: Chicago & Milwaukee standard brake-shoes, Van Dorn couplers and draft rigging, Hartshorn curtain fixtures, Pantasote curtain material, P. Smith heating system and Railway Steel Spring Company's springs.

The Fort Smith & Western has ordered 100 box cars of 60,000 lbs. capacity from the Mt. Vernon Car Works. These cars will measure 36 ft. ½ in. long x 8 ft. 6 in. wide x 8 ft. 3 in. high, all inside dimensions. The bodies will be of wood and the underframes will be of steel. The special equipment includes Bettendorf bolsters, Mt. Vernon brake-beams, Westinghouse brakes, Moore-Jones brasses, Climax couplers, Minor tandem draft rigging, Harrison dust guards, McCord journal boxes, Winslow improved roofs, and Mt. Vernon car wheels.

The Wabash has ordered 1,000 wooden box cars of 80,000 lbs. capacity and 1,000 wooden coal cars from the American Car & Foundry Co.; 2,000 composite gondola cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co., and 2,000 composite gondola cars of 100,000 lbs. capacity from the Standard Steel Car Co. The box cars are for June and July delivery and will be 40 ft. long x 8 ft. 6 in. wide x 9 ft. 3 in. high, all outside measurements. All gondola cars are for September and October delivery, and will be 41 ft. long x 9 ft. 5 in. wide. The special equipment for the box and gondola cars will include Westinghouse air-brakes, Climax couplers, Railway Steel Spring Co.'s springs and arch-bar trucks.

BRIDGE BUILDING.

Atlantic City, N. J.—Application has been made by the Cape May Board of Free Holders, to the Atlantic County Board, to jointly build a bridge to connect Beasley's Point with Somers Point, for which plans are being made.

Bethlehem, Pa.—The Bethlehem Street Bridge Company has been chartered at Harrisburg, Pa., to build a bridge to connect Bethlehem with South Bethlehem.

Birmingham, Ala.—The County Board of Revenue is taking action towards building a bridge over the Warrior, to cost about $20,000.

Carthage, Tenn.—A private stock company is being organized to build a steel bridge over the Cumberland river, to cost $50,000. Bids are to be asked next month.

Fort Francis, Ont.—Application has been made for incorporation by a company in which Z. A. Lash, of Ontario, is interested, to build a combined railroad and highway bridge over the Rainy river near this place. This is supposed to be a Mackenzie & Mann project.

Laporte, Ind.—Bids are wanted February 6 by the Board of County Commissioners, for building six iron bridges in Laporte County.

Lewisburg, Pa.—A contract has been given to the Oswego Bridge Company, of New Jersey, at $124,580, for building the new bridge over the river at this place. The proposed structure will have five piers in the river. It will be 1,230 ft. long, 22 ft. wide, and is to be completed within one year of the date of signing the contract. There were 12 bidders. The Oswego Bridge Co. submitted bids for 35 different designs.

Nashville, Tenn.—The Grand Court of Davison County, at a recent meeting, decided to build a bridge over the Cumberland river, in North Nashville, to cost about $300,000.

Newark, N. J.—The Public Service Corporation has been asked by the boards of Essex and Hudson Counties to decide whether it will pay one-third of the cost of building a bridge over the Passaic river at Clay street. The total cost of the structure will be $150,000.

Pembroke, Ont.—Bids are wanted Jan. 22 by James Coxford, Chairman of the Committee, for building a steel bridge on stone abutments over the Madawaska river, in the County of Renfrew. James H. Smith is County Engineer.

Peoria, Ill.—The Chicago & Alton and Vandalia lines, it is said, have decided to withdraw from their terminal arrangements with the Peoria and Pekin Union, and are planning to build a bridge over the Illinois river at this place.

Philadelphia, Pa.—Preliminary work has been started on the concrete bridge over the Wissahickon creek and ravine at Walnut Lane. The plans call for a structure with a central arch of 225 ft., 60 ft. wide and 120 ft. high, with approaches of 45 ft. at each end. The cost of the structure will be about $200,000.

Portland, Ore.—The Northern Pacific has given an order for 20,000 tons of steel for its bridges to be built over the Columbia and Willamette rivers. It is planning to have both bridges completed by 1907.

Spokane, Wash.—Plans of the Northern Pacific for a new bridge over the subway at Washington street have been submitted to the Board of Public Works.

Richmond, Va.—The Richmond and Chesapeake Bay has been granted permission by the Board of Supervisors, of Henrico County, to build a viaduct over Oak, Bacon, Shedd and Henrico streets.

St. Boniface, Man.—A new bridge is proposed over the Seine river at this place.

Trenton, N. J.—In the House of Representatives on January 11 a bill was introduced authorizing the Pennsylvania Railroad Co. and the Pennsylvania & Newark Railroad Co. to build, maintain and operate a bridge across the Delaware river.

Yankton, S. Dak.—On January 10th the U. S. Senate passed the bill extending the time for commencing and completing the bridge of the Winnipeg, Yankton & Gulf over the Missouri river at this place.

Other Structures.

Baltimore, Md.—The Pennsylvania has given a contract for building a grain drier, to have a capacity of 15,000 bushels per day. It is expected to have it ready for service by April 1.

Green Island, Troy, N. Y.—The Federal Railway Signal Company will build an addition to its works on Center street, largely increasing the capacity of the shops.

Lowell, Mass.—The New York, New Haven & Hartford, it is said, is having plans made to build an outbound freight house 300 ft. x 40 ft., and an inbound freight house 200 ft. x 25 ft.

Pittsburg, Pa.—The Pennsylvania Company is considering the question of putting up additional shops at Columbus, Ohio, and at Fort Wayne, Ind., or Crestline, Ohio.

San Francisco, Cal.—The Southern Pacific, it is said, has begun work on large sheds on a plot of ground at North Oakland abutting San Francisco bay, which the Western Pacific has been trying to secure as a site for its proposed terminal. This action is the result of strife for advantage in terminal locations and will lead to further strife.

Washington, Pa.—The Pennsylvania Company, it is reported, has given a contract to a local firm to put up a brick passenger station to cost about $40,000.

WINDSOR, ONT.—The Canadian Pacific, it is said, is planning to make alterations to its station at this place.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—See San Francisco & Northwestern, below.

BUTTE COUNTY.—This company, which recently completed an extension of its road from Stirling City, Cal., to Gallagher, a distance of 17 miles, is building an additional 15 miles from the latter place to North Valley.

CANADIAN PACIFIC.—Announcement has been made that this company will build a loop 20 miles long in Field, B. C., to overcome several heavy grades. The estimated cost of the work, which will be heavy, through rock, is about $1,200,000.

CANADIAN ROADS.—Application will be made at the next session of the Dominion Parliament by Robertson & Robertson, of British Columbia, for permission to incorporate a company to build a railroad from the city of Vancouver or a point on Burrard Inlet to the northern boundary of the province by way of Lillooet, the Fraser valley, Tacla lake, Stinkine and Teslin lake, or by the most feasible route through the Chilcotin valley.

CHARLESTON, PARKERSBURG & WESTERN.—Incorporation has been granted a company under this name in West Virginia to build and operate a railroad for a distance of eight miles from Charleston, W. Va., to develop the Bruen coal fields north of that place. A. S. Alexander is President and C. P. Peyton, Vice-President and General Manager. The board of directors include F. M. Staunton and Alexander J. Bruen, of New York.

CHICAGO & ILLINOIS WESTERN.—This company, which recently completed 15 miles of road between Hawthorne and Willow Springs, is making surveys to extend its road southwest through Joliet and thence west across Illinois to the Mississippi river, aggregating about 225 miles.

CINCINNATI, GEORGETOWN & PORTSMOUTH.—This company, which recently extended its line to Russellville, Ohio, has given a contract to Thomas Daulton for building four miles additional from that place east to Eagle Creek, and has completed surveys for an additional 12 miles east from the latter place.

GRAND TRUNK PACIFIC.—It is reported that this company has completed its survey into Edmonton, and that it has under consideration two routes. This survey covers the entire distance from Portage la Prairie to Edmonton, with the exception of a 20-mile stretch about 100 miles east of Edmonton.

This company has been granted additional privileges in Port Arthur and Fort William, including permission to run a track alongside the Canadian Pacific track from Port Arthur to Fort William.

GREAT MINERAL OF MEXICO.—This company, which was recently organized with a capital stock of $3,000,000, is planning to build an extensive system of railroads in the western part of Mexico. The company has acquired the Pittsburg-San Jose Railroad, which at present is built out of San Jose del Sitio for a distance of about 25 miles. This road will be extended southward to a connection with the Kansas City, Mexico & Orient and northward to the city of Parral. M. B. Place, of Pittsburg, Pa., promoted the organization of the company. The route of the proposed new lines is through a rich mining section. E. S. Stafford has been named as chief engineer of the road.

GREAT NORTHERN.—See Vancouver, Victoria & Eastern below.

GULF & NORTHWESTERN.—This company, which is building a line from Waco, Tex., northwest via Meridian and Stevenville to Thurber, a distance of 110 miles, is making surveys from Waco to Strawn and securing rights of way. No contracts have as yet been let, but as soon as this survey is completed, contracts for the first 40 miles from Waco to Meridian are to be let. (August 18, p. 54.)

KAMLOOPS & YELLOWHEAD PASS.—Application will be made to the British Columbia Parliament by Tupper & Griffin, of Vancouver, for authority to incorporate a company under this name to build a railroad from a point at or near Kamloops north, following the valley of the North Thompson river, Canoo river and McLennans creek, to a point at or near Tete Jaune Cache, in the province of British Columbia.

MEXICAN CENTRAL.—The Paredon extension of this road, it is said, will be completed and opened for traffic about next June. The Federal Government may modify its exclusive concession granted to the National of Mexico, in which the latter is given the exclusive right to occupy a strip of country 20 miles wide bordering the Rio Grande for a length of 400 miles, so as to enable the Mexican Central to build to the Rio Grande border. If this modification is decided upon, the Paredon line will probably be extended to San Antonio, Tex., crossing the Rio Grande at a point about 25 miles above Laredo.

This company's engineers have located the route for its proposed Mexico City-Tampico line. The maximum grade will be 2½ per cent., with 6 per cent. curves. The time for beginning construction work has not yet been decided upon, but it may be started during the present year.

MEXICAN ROADS.—An important line of railroad is to be built in the state of Yucatan by Juan N. Martinez and associates. The proposed line will run from San Ignacio to Huchucma. Mr. Martinez obtained a concession from the federal government some time ago for building this road, and now has everything in shape to begin work.

MIDWAY & VERNON.—Application will be made by this company to the Dominion Parliament at its next session for authority to build a railroad from Vernon, B. C., to Kamloops and also to build a branch line from some point on the company's line to Penticton.

MINNEAPOLIS, RED LAKE & MANITOBA.—This company, which recently completed a 26-mile extension of its road in Michigan, has given a contract to Halverson & Carkon for rebuilding its old line from Nebish north to Red Lake, a distance of about 12 miles.

MISSISSIPPI CENTRAL.—An officer writes that this company, which recently extended its road from Silver Creek, Miss., west to the Pearl river, has given a contract to the Worthington Construction Co., of Birmingham, Ala., for an extension from the Pearl river west to Brookhaven, an additional 22 miles. The company is also projecting a line from Brookhaven across the state to Natchez, an additional 70 miles.

MUNISING.—An officer writes, respecting the proposed action to be taken by this company asking for authority to extend its lines, that the company has been allowed to amend its charter to extend its main line west from Little Lake, in Marquette County, Mich., to Princeton mine, a distance of about eight miles. Work is now under way, and the line will probably be ready for operation in June of this year. December 8, p. 183.)

NATIONAL OF MEXICO.—This company, it is reported, is projecting a road from Teziutlan to Fubers to develop the oil fields owned by the Oil Fields Company of Mexico. Surveys for the proposed road have been made under the direction of J. M. Reed, Chief Engineer o fthe National, and it is said that the road will soon be built.

NEW YORK CANADIAN PACIFIC.—This company, which during the past summer has been making extensive surveys for its proposed railroad from New York City to Canada, has filed an application in New York for an extension of its corporate existence. The authorized capital is $10,150,000. The length of the proposed road is 332 miles. Verplanck Colvin is President, and George C. Van Tuyl, Treasurer, both of Albany.

NEW YORK CENTRAL & HUDSON RIVER.—This company, it is reported, has bought a large plot of ground in West Albany, N. Y., on which to lay from 10 to 15 additional yard tracks.

OREGON WATER POWER & RAILWAY COMPANY.—This company, operating 52 miles of railroad in Oregon, is making surveys to build an extension of its road from Cedarville to Troutdale, a distance of 7½ miles.

PACIFIC COAST RAILWAY (PACIFIC COAST CO.).—This company will build an extension from a point on its line at Santa Maria, Cal., to Shuman, a distance of three miles; also one from Santa Maria to Shuey, seven miles.

PORTLAND & SOUTHWESTERN.—Incorporation has been granted a company under this name in Oregon with a capital of $100,000 to build a railroad from Scappoose to Nehalem Bay. The incorporators include H. G. Platt, of Portland, and G. J. Perkins, of Portland.

RIO GRANDE, SIERRA MADRE & PACIFIC.—The survey for the proposed extension of this road from Nueva Casas Grandes to Temosachic has been completed. From Temosachic the road will be continued into timber lands owned by W. C. Green, of New York, and will eventually be extended to the port of Topolobampo, on the Pacific coast.

SALT LAKE & OGDEN.—This company, which recently completed six miles of new line in Utah, is building from Layton north to Ogden, an additional 15 miles.

SAN FRANCISCO & NORTHWESTERN (A., T. & S. F.).—An officer writes that this company, which recently added 13 miles of new line bringing its southern terminus to Shively, Cal., has projected a line from that point south to San Francisco, a distance of 260 miles.

SOUTHERN.—This company, according to reports, has given a contract to W. J. Oliver & Co., of Knoxville, Tenn., at about $5,000,000 for building its Johnson City road, which will be a coal line from Embreeville, Tenn., to Marion, N. C.

SOUTH SIDE COAL & IRON.—An officer writes that this company,

which proposes to build a railroad from Paris, Ark., east to Dardanelle, a distance of 38 miles, will begin construction work about the 15th of next month. He denies the report that this road is owned by the Kansas City Southern. (August 18, p. 55.)

Temiskaming & Northern Ontario.—This company, which is building 100 miles north of its present terminus at New Liskeard, Nipissing, Ont., has 80 miles graded and 40 miles of track have been laid. The grading on the remaining 20 miles will be finished this spring, and it is expected to have the entire line in operation next fall.

Texas Roads.—John H. Kirby, of Houston; Henry King, and others, have applied for a charter for a new road to run from Burr's Ferry, in Jasper County, to Rockland and Chester, in Tyler County, a distance of 80 miles. The proposed road will cross the Santa Fe, the Southern Pacific and the Missouri, Kansas & Texas, and is to form a connecting link in the lines of the Yoakum System. The contract for the work, it is said, will be given as soon as surveys are completed.

Toluca, Marquette & Northern.—This road has extended its line from its northern terminus at McNabb, Ill., north for a distance of five miles to Granville.

Uniontown & Wheeling Short Line.—Construction work has been commenced by this company on its proposed railroad from Uniontown, in Fayette County, Pa., west to Wheeling, W. Va., 68 miles. The company is building with its own force the abutments for the large bridge to cross the Monongahela River at McCann's Ferry, and has let contracts to the American Bridge Co. and the Jones & Laughlin Steel Co. for the superstructure. The total cost of the bridge will be about $1,000,000. Contracts will shortly be let for grading and also for building seven tunnels on the line of the proposed road. (November 3, p. 144.)

Vancouver & Northwestern.—This company will apply to the legislative assembly of the province of British Columbia for permission to incorporate a company and build a railroad from Vancouver eastward to the Pitt river, thence continuing east to Lillooet river and to the Stave river, thence to the Harrison river and north to a point at or near Lillooet, via Fort George, on the Fraser river by the most feasible route to the sixtieth degree of latitude.

Vancouver, Victoria & Eastern. (Great Northern).—Surveys, it is said, have been completed by this company for its proposed line from Midway to Hope, B. C. Construction work is to be commenced at once from Hope to Chilliwack.

Western Allegheny.—Contracts, it is reported, will shortly be let by this company for building its proposed extension from Newcastle, Pa., to East Brady.

Willamette Valley Traction.—Grading work has been commenced on this proposed electric road at Salem, Ore. It is proposed to build north to Portland, 50 miles. The promoters of the road say that it is being financed by New York capitalists. The project is known under the above name, although it does not appear that the company has as yet been incorporated.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—See Denver, Enid & Gulf.

Atlantic Coast Line.—This company has finally acquired the Macon, Dublin & Savannah, which it bought in October, 1904, but the taking over of which has been delayed by litigation. The M., D. & S. runs from Macon, Ga., to Vidalia, 94 miles, and has $1,500,000 first mortgage 5 per cent. bonds of 1951, and $1,250,000 capital stock outstanding.

Chesapeake & Ohio.—It is announced from London that an agreement has been made between the Chesapeake & Ohio, the Norfolk & Western, and the Southern for shipping freight from Newport News and Norfolk to Liverpool and London by the Furness Line. The Furness Line is to take over the boats of the Chesapeake & Ohio Steamship Company and also those of the Neptune Steamship Company. The Chesapeake & Ohio Steamship Company is a British corporation, but is controlled by the C. & O. through ownership of three-fifths of its capital stock.

Chicago, Milwaukee & St. Paul of Washington.—The Pacific Railway Co. has filed amended articles of incorporation changing its name to the Chicago, Milwaukee & St. Paul of Washington.

Cincinnati, Hamilton & Dayton.—See Pere Marquette.

Denver, Enid & Gulf.—The entire outstanding capital stock of this company, amounting to $1,120,000, has been purchased by the Atchison, Topeka & Santa Fe. The D., E. & G. has 119 miles of road between Guthrie, Okla., and Kiowa, Kan., and has $1,120,000 5 per cent. mortgage bonds outstanding.

Detroit, Toledo & Ironton.—The gross earnings for the six months ended December 31, including those of the Ann Arbor, were $2,069,140, and net earnings $662,057.

Great Northern.—The New York Stock Exchange has been asked to list $25,000,000 additional preferred stock of this company. This is the stock which it was announced last October would be issued to the stockholders at par. (Oct. 13, p. 120.)

Illinois Central.—Gross earnings of this company for the month of November were $4,588,622, an increase of $148,962, and net earnings were $1,613,743, an increase of $18,105. This is the first month of the current fiscal year in which the earnings of this company have shown an increase, the yellow fever quarantine having affected them badly until some time in October.

Long Island Consolidated Electric.—This company has been organized as a holding company for the purpose of taking over the control of the various subsidiary electric lines owned or controlled by the Long Island Railroad, as well as such other electric lines as may be either bought or built. A meeting of the new company has been called for March 14 to approve an issue of $10,000,000 4½ per cent. 40-year collateral trust mortgage bonds. The electric lines to be held by the new company are the Huntington Railroad, Ocean Electric, Northport Traction, Nassau County Railway, Glen Cove Railroad, and the Jamaica & South Shore. The cost of the purchase or construction of these lines, up to Nov. 1, 1905, is given as $779,235, and their total length is 65 miles. It is announced that the new company will also hold one-half of the capital stock and bonds of the New York & Long Island Traction, and of the Electric Railway Co.; this proportion of the securities of the N. Y. & L. I. is already owned by the Long Island Railroad, and the securities of the other company are to be immediately acquired. The total cost of its future interest in both of these companies is given as $1,360,508.

Macon, Dublin & Savannah.—See Atlantic Coast Line.

Missouri Pacific.—This company has sold to a syndicate composed of Kidder, Peabody & Co., F. S. Mosely & Co., of Boston, and Baring, Magoun & Co., of New York, an issue of $6,000,000 5 per cent. collateral notes of 1908. They will be used to refund an issue of similar notes for the same amount maturing Feb. 10, 1906, and are secured by deposits of the following collateral with the Equitable Trust Co. of New York: twenty thousand shares of Wabash preferred, 100,000 shares Denver & Rio Grande common, 40,000 shares Denver & Rio Grande preferred, and 25,000 shares St. Louis, Iron Mountain & Southern. The underwriting syndicate has already sold the entire issue.

Northern Securities.—The balance sheet of this company, as of Dec. 31, 1905, has been issued and is the first official statement of the assets of the company made public since Dec. 31, 1902. The statement shows that since the date of organization, Nov. 13, 1901, dividends of $39,886,688 have been collected on stocks belonging to the company, and dividends of $36,299,620 have been paid on the stock of the company. The present capital stock has a par value of $3,954,000, but its market value is between two and three times this sum. Stocks of other companies held as assets were acquired at a cost of $6,047,666, but it is not stated what these stocks are. The cash on hand amounts to $420,768, from which is to be substracted the 5 per cent. dividend recently declared. (Dec. 15, p. 194.)

Pacific.—See Chicago, Milwaukee & St. Paul of Washington.

Pennsylvania.—The estimated gross earnings of this company for the year ended Dec. 31 were $135,000,000, an increase of nearly $17,000,000 over 1904. The net earnings, also estimated, were $42,000,000, an increase of about $5,750,000. This makes nearly 11 per cent. earned on capital stock before deducting betterments. The gross earnings for November were $12,580,725, the largest figure on record.

Pere Marquette.—An order has been issued by the United States Circuit Court in Ohio directing the receiver of the C., H. & D. to surrender the stock and leasehold of the Pere Marquette held by the C., H. & D. This order was issued on the petition of W. B. Horn, the original complainant in receivership proceedings, on the ground that if the receiver adopted the lease it would impose upon the C., H. & D. an annual charge of over $750,000, and that the lease is unprofitable and burdensome.

Pittsburg, Youngstown & Ashtabula.—Under this name, the New Castle & Beaver Valley, which operates 15 miles of road, and the Pittsburg, Youngstown & Ashtabula, which operates 125 miles of road, are to be consolidated, the shareholders of the two roads having ratified the agreement recently. Both roads are controlled by the Pennsylvania Company, but are operated under their own organization.

GENERAL NEWS SECTION

NOTES.

One of the Union Pacific gasoline motor cars has been sent to Los Angeles.

The electric train staff has been put in use on the Louisville & Nashville between Nashville and West Nashville.

At Savannah, Ga., three ferry boats and tugs have been fined $200 each by the Collector of the port for failure to carry fog horns, as required by law.

The State Railroad Commission of Minnesota has sent to the railroads of the state new freight tariffs, making large reductions; and calling on the roads to show cause why the reduced rates should not be adopted.

William A. Humphrey, Chief of Police of the New York Central & Hudson River Railroad, reports that during the year 1905 his department made 3,944 arrests. The number of convictions secured was 3,572; stolen property recovered, $13,793. Among the persons arrested were 31 pickpockets.

Lake Erie being open, in consequence of the unprecedented warm weather of the past month, a large lake steamer, the Stanton, started from Buffalo on January 19, according to a press despatch from that city, to go to Cleveland for coal. No vessel man can remember a boat clearing from Buffalo in January before.

The three grain dealers of Louisville, Ky., who were found by the Interstate Commerce Commission to be guilty of fraudulent practices in obtaining reduced freight rates on grain from Louisville to southeastern points, and who were indicted by the grand jury, have pleaded guilty and have been fined $1,025 each.

Following the discovery of one or more counterfeit certificates of stock of the Norfolk & Western, the officers of the Philadelphia & Erie, and, it is said, of other companies controlled by the Pennsylvania, have decided to issue new certificates of the stocks of the company and to call in and destroy all those now in use.

A passenger who rides daily in the New York Subway, southward in the morning and northward in the evening, reports to the New York *Evening Post* that the average time made by the express trains on which he traveled (not the average of all expresses) for seven days, between 116th street and Fulton street, was, in the morning, 39 minutes, and in the evening about 36 minutes. These figures he compares with "Fifteen minutes to Harlem," the claim which was made for the subway before it was built. Trains have made the distance in 15 minutes under favorable circumstances.

"The scalpers have been driven out of Texas." This is the assertion of Colonel T. J. Anderson, General Passenger Agent of the Southern Pacific, as reported in the *Galveston News*. It appears that the governments of the principal cities have taken action to regulate and repress illegal and irregular ticket brokerage, and that an injunction has been issued forbidding the sale of signed return tickets by scalpers. Colonel Anderson says that the railroads will now feel free to be more liberal in granting excursion rates.

The State Railroad Commission of Georgia has issued an order that, beginning February 19, the Southern Railway, the Central of Georgia, and the Atlantic Coast Line must make reductions of about 10 per cent. in their local freight rates; and the companies are forbidden to try to evade this order by making changes in classification. It is also said that all freight rates in force now in the state which are lower than those which have been prescribed by the state will be adopted by the commission, and the roads forbidden to raise them.

According to the Louisville *Courier-Journal* a rural telephone line was utilized recently on the Southern Railway, near New Albany, Ind., to prevent a collision of freight trains. An eastbound freight ran past a train order signal at a small station. The train despatcher was at once informed, but was unable to reach the opposing train by telegraph. But somebody thought of a telephone line connecting with a farmhouse several miles out on the road, and a member of the farmer's household was informed of the trouble and he (or she) ran out on to the track and flagged the eastbound train.

E. S. Halstead & Co., of New York, have secured a verdict of $2,200 in the state Supreme Court against the Postal Telegraph Company for an error in a telegram, which is said to have cost them the sum named. The message as sent, giving the price of cloth, read two-eighty and three-eighty, meaning 2.80 cents and 3.80 cents per yard. As delivered, the message read two-eighth and three-eighth, which was taken by Halstead & Co. to mean 2⅛ and 3⅛. As will be understood by those familiar with the Morse alphabet, a sender, to make this mistake, would need only to shorten by about one-tenth of a second the space between the two dots in the middle of the letter *y*.

The New York State Court of Appeals has decided in favor of the state the contention made by the New York Central that it was not liable for state taxation on the great number of freight cars that are outside the state part of the time. The assessment in question was that made annually upon corporations on that portion of capital stock employed in this state. The annual tax on this part of the company's rolling stock involves thousands of dollars, and the decision of the Court of Appeals, which sustained that of the Appellate Division in upholding the right of the state to tax this rolling stock, will be appealed by the railroad company to the United States Supreme Court on the ground that the capital embraced in these cars is not to be held to be capital employed in this state.

Mr. W. M. Prall, Commissioner of the Pittsburg Car Service Association, has been appointed Manager of the Cleveland Car Service Association also, and, according to the Pittsburg *Gazette*, is to manage both associations. It is said that the 30-hour average plan, which is in use at Cleveland, will be done away with by Mr. Prall. This plan permits consignees 30 hours in which to unload a car, after which car service charges are imposed. It is said to have proved unsatisfactory at Pittsburg district in 1903. The weakness of the plan is the fact that if 100 cars are received in a day and 95 are unloaded in 24 hours, the consignee saves 95 times six hours, which is cumulative and gives him 570 additional hours on the five remaining cars. This cumulative time on daily receipts of cars caused the congestion in 1903.

The Michigan State Board of Tax Commissioners has fixed the valuation of railroad property in the state, for the year 1905, at $207,080,000, which is $10,285,000 greater than the figure for 1904, but about $14,000,000 less than in 1903. The law provides that the rate of the tax on railroad property shall be the average rate paid on all other classes of property during the previous year. According to this scheme the rate during 1904 and 1903 was $16.92 upon every $1,000 of assessed valuation. The last legislature, however, gave the Board authority to add $300,000,000 to the assessed valuation of other than railroad property because it was held, after a thorough investigation, that the assessment of this property by the state assessors had been smaller than the true value by this amount. The addition of this sum does not increase the amount of taxes paid on other property, but lowers the average rate of taxation from $17.40 to $14.61. The amount of taxes for which the railroads are liable is, therefore, $3,020,000. The Attorney-General, it is said, will begin action to set aside the addition of the $300,000,000 referred to above, on the ground that the law giving the Board this right is unconstitutional and void, since it gives that body arbitrary power to ignore the sworn statements made by other assessing officers.

Proposed Block System Law in Massachusetts.

A bill has been presented in the Massachusetts legislature to require "every railroad company operating passenger cars" in the state to equip its line with a block signal system to be approved by the railroad commissioners; and to have the same in operation by, or before, a date yet to be specified.

More American Steel Cars for the London Underground.

The American Car & Foundry Company has been awarded a contract by the Underground Electric Railways Company of London for 150 steel cars to be used on the Charing Cross, Euston & Hampstead division of the extensive system in and around London in which the late Charles T. Yerkes was a dominant factor. The contract calls for 60 motor cars and 90 trailers. It is the most important contract of this sort ever awarded an American firm, and is the second one obtained by the American Car & Foundry Company, which received, some eighteen months ago, a contract for 100 steel cars for the Baker Street & Waterloo Railway operated by the same London company. Most of these cars are already in use. The cars just ordered will be built at the American Car & Foundry Company's new plant at Trafford Park, near Manchester, where about 500 men are employed. L. F. Candee, formerly superintendent of the company's steel car shop at Berwick, Pa., is resident manager. The steel and other materials to be used will be

shipped from this side. Delivery of the cars will, according to the contract, be completed this year.

American interests have secured practically all the principal contracts in connection with the London underground railway system, which are estimated to represent an aggregate of almost $20,000,000. The Westinghouse company undertook the complete work of building and equipping the large power station at Chelsea, a suburb of London. This is the largest structure of its kind in England and cost more than $6,000,000. The motors for the cars were ordered from the British Thomson-Houston Company, which is controlled by the General Electric Company. A contract worth upwards of $2,000,000 was placed for the Otis elevators. The car contracts already let the American Car & Foundry Company represent a value of almost $2,500,000.

English Street Railroads.

In the United Kingdom there are now 2,117 route miles of tramways representing a capital outlay of $78,000 per mile of single track. Per annum, according to the statistics just officially issued for the year ended March, 1905, about 2,069 millions of passengers travel at an average fare of 2.2 cents. The working expenses amount to 66.19 per cent. of the gross receipts. Of the 320 undertakings, 174 are municipally controlled, and 146 belong to private companies. All the lines are operated on the overhead trolley direct current principle, excepting two which use underground conduits, and one surface contact. Several lines are now being equipped on the last-mentioned method.

Wood Pipe.

The Wyckoff wood pipe, shown in the accompanying illustration, made by A. Wyckoff & Son Co., Elmira, N. Y., is specially adapted for conveying water and is used for this purpose by a number of railroads in preference to iron pipe. It is claimed by the makers that this pipe is cheaper in first cost than iron pipe, that it is easier to handle and that it will not rust or corrode, as it is not affected by sulphur or other impurities. It is also claimed that it is cheaper to lay and that it is less liable to freeze, and that it lasts longer than iron pipe. All pipe up to 6 in. in diameter is bored out of the solid log, and all pipe from 6 in. up to 20 in. in diameter is made of white pine staves in lengths of from 4 ft. to 8 ft. joined by regular tenon and socket joints. It is also tightly wound on the outside with steel hoops or wire, and is then coated with a mixture of asphaltum and pitch which protects the steel bands against corrosion. The hoops are further protected from corrosion by being coated with a preparation of cement before they are wound on the pipe. These pipes are made to stand any pressure up to 160 lbs. per sq. in. Elbows, tees, bends, crosses, reducers, plugs, tubes, nipples, and special pump and valve connections are also made to go with these pipes. Pipes made of hard maple in the same manner as the pine pipes will convey culm and other material without injury to the pipe, as the action of the culm on the interior of the pipe produces a surface as smooth as glass, which is not injured by grit or other material in the culm. Round and coated wood pipe is also made by the Wyckoff Co., in the same manner as the strengthened pipe, except that it is not wound with steel hoops. This pipe is largely used for underground work where the pressure is not great. Among some of the railroads which are now using the Wyckoff wood pipe are the Chicago, Milwaukee & St. Paul, the Pennsylvania, the Erie and the Lehigh Valley.



The Wyckoff Reinforced Wood Pipe.

A Falling Off in Train Robberies.

The *Express Gazette* continues its record of the doings of train robbers and stage robbers, and for the year 1905 shows only about half as many attacks on trains as in 1904. The tables show, for the last eleven years of the 19th century (1890-1900 inclusive) an average of 26 "hold-ups" a year; but since then a much lower rate, as follows:

"Crimes of the Rail" in the United States

1890....	12	1894....	34	1898....	28	1902....	22
1891....	16	1895....	40	1899....	15	1903....	13
1892....	16	1896....	28	1900....	29	1904....	13
1893....	33	1897....	30	1901....	16	1905....	7

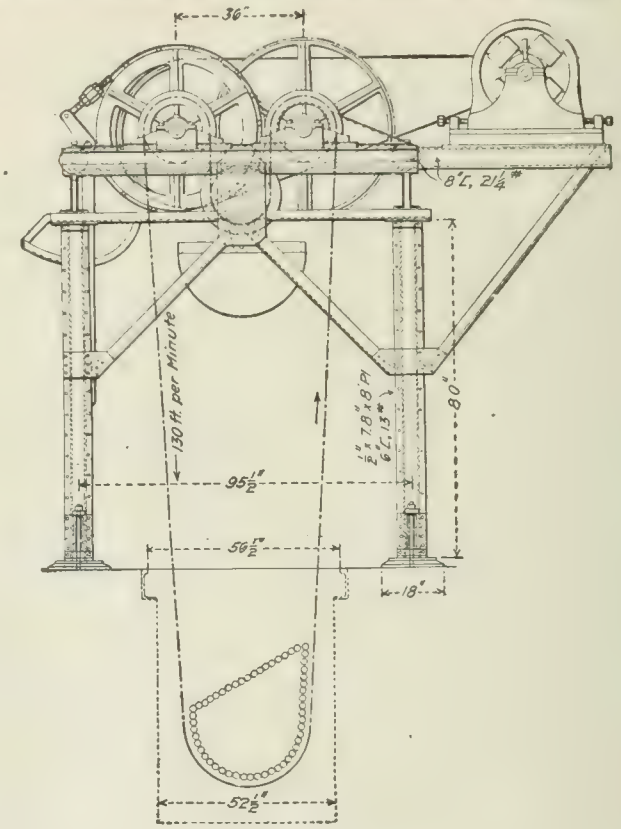
Total number of trains "held up" in 16 years	361
Total number of persons killed	103
Total number of persons injured	113

Record for 1904 and 1905

	1904	1905
Total number of train "hold ups"	13	7
Number of stage robberies	4	6
" " passengers and trainmen killed	3	1
" " passengers and trainmen shot	2	1
" " robbers killed	1	0
" " robbers shot	1	0

A New Flue Cleaning Machine.

A new type of flue cleaning machine for which many advantages are claimed is illustrated herewith. It consists of a steel framework over a concrete pit built under the floor of the shop and partially filled with water. The flues, while being cleaned, are suspended in the water by two wide-faced case-hardened, wrought-iron chains, forming continuous loops in which the flues roll over and over upon themselves as the chains are driven. All gearing is overhead and driven by a direct-connected motor. To keep the flues in position, fenders are provided in the pit, and are adjustable to flues from 8 to 20 ft. long. The rear chain is supported by a traverse carriage, which is moved toward or away from the front chain by screws driven by the main driving motor, thus adjusting the chains to the length of flues handled. The flues may be raised or lowered by means of an idler over which the driving chain passes and which, by alternate raising and lowering, correspondingly lengthens or shortens the suspending chain. By this arrangement flues are raised by the machine itself independent of the crane service of the shop. There are tracks on each side of the tank upon which a small push car is run. Flues to be cleaned are brought over the pit on a push



The Ryerson Flue Cleaning Machine.

car, lifted from the car by the chains, the car removed, the flues lowered into the pit and the machine started.

The machine illustrated has a capacity for 500 2½-in. tubes at one time. To place the tubes in position to lower requires about 4 minutes and the only labor required is that to push the car in position. To lower the flues ready for rattling requires one man one minute. The actual time of rattling is about the same on this machine as in the barrel form of rattler, but as this machine will take five or six times as many flues as the ordinary rattler, the cost to handle them is reduced to less than 4 cents a hundred. Another great advantage is the absence of noise, the rattling taking place under water, which makes the machine practicaly noiseless. Furthermore, the water washes out the soot and dirt from the inside of the tubes at the same time that the scale and other material is being removed from the outside of the tube. The propelling chain moves at the rate of about 130 f. p. m. A 20-h.p. direct-connected motor is used to drive the machine.

Some of the largest roads are using these machines, among them the Santa Fe and Northern Pacific. They are sold by Joseph T. Ryerson & Son, Chicago, who own the patents.

Two New Passenger Ferryboats for the Long Island.

The Long Island recently ordered two ferryboats from the Harlan & Hollingsworth Co., Wilmington, Del. The contract calls for delivery within a period of seven months. The boats will be similar in type to those now in use on the North river by the Pennsylvania. They will be 203 ft. long over all by 65 ft. wide over guards. The depth from the base line to the top of the deck beams at the center will be 17 ft. 6 in. The hulls are to be of steel with

seven transverse bulkheads, two longitudinal bulkheads and eight sub-bulkheads subdividing the hull into 20 water-tight compartments. This arrangement of bulkheads will provide a greater factor of safety to the public than the average ferryboat, which has but six compartments. The center of the horse gangway housings, together with the interior walls of the cabins, will be entirely of steel. The outboard wall will be of the usual construction. The decks as far as possible will be of steel. The engine equipment will consist of two fore and aft compound engines with cylinders 18 in. and 38 in. by 28 in. Almy water tube boilers are to be used. The boats will be lighted by electricity and will be equipped with a full complement of lifeboats, liferafts and lifepreservers. This equipment will be double that required by the United States Government. The Long Island has recently adopted the Keystone of the Pennsylvania as an emblem for its stacks. The stacks of the new boats will be decorated with the keystone on a blue field with a white border, with the words Long Island in white letters across the face.

Bids for Building Railroads in the Philippines.

The bids recently opened at Washington for building railroads in the Philippine Islands were as follows: A syndicate composed of Cornelius Vanderbilt, J. G. White & Co., of New York; Charles M. Swift, Detroit; William Salomon & Co., H. R. Wilson, Heidelbach, Ickelheimer & Co., and the International Banking Co., all of New York, for building 100 miles on the Island of Negros, 100 miles on Panay and 95 miles on Cebu, at an estimated cost of $10,000,000. The bid provides for a full guarantee on 4 per cent. bonds for 30 years on 95 per cent. of the cost of construction. If this bid is accepted the work is to be done by J. G. White & Co. The other bid was from Speyer & Co., of New York, for building lines in southern Luzon, from Manila to Batangas, with branches to Santa Cruz and Lucena; Pasacao to Legaspi and Tobaco, and Manila to Cavite and Naic, 29 miles. In northern Luzon Speyer & Co. propose to build 86 miles of branch lines to be operated in connection with the existing railroad from Manila to Dagupan, also a line from the latter place to Camp Number One, an additional 25 miles. They propose to build all the above lines without the government guarantee. A second bid has been submitted by the same people for building a line from Dagupan to Laoag, conditional upon the acceptance of the former bid. On the latter they ask for the full guarantee. Speyer & Co. propose to operate the new lines in connection with the present railroad in Luzon, making an aggregate length of 208 miles. There were no bids submitted for the railroads on the islands of Leyte and Samar. The awards will probably be made next week.

Mr. L. E. Bennett, who made the preliminary survey for J. G. White & Co., says that on the Island of Panay construction work will be easy, and that from Iloilo to Capiz the cost will be about $35,000 a mile, this high estimate being due to the necessity of providing against great floods. The country is rich, but at present is mostly unproductive because of the lack of transportation. On the Island of Negros the route of the proposed railroad is 130 miles long, through a rich sugar country. Its line is from Jumaymayalam on the west coast to Escalante on the northeast. Danao, the port of Escalante, will make an excellent harbor when the bar has been dredged from the mouth, and should provide anchorage for ten large steamers.

The Island of Negros is very largely of volcanic formation, and it is the volcanic ash in the composition of the soil which accounts for the productiveness of the sugar plantations. It is estimated that once the railroad is established the sugar output may be increased to 400,000 tons, while the present output is less than 80,000 tons. In the highlands of the island there are thousands of acres of timberland on which grow a great variety of timber. At present this timber is quite unavailable because of difficulties of transportation. It is planned to build many spurs from the main line of the road tapping these timber lands.

The conditions which obtain on the islands of Panay and Negros are practically duplicated on Cebu, so far as railroad construction is concerned. This road will be about 70 miles long between the main terminals. Cebu, the main city on the island is on the west coast, and Argoa, a cable port, is on the east coast.

The White firm has been carrying on big engineering operations throughout the archipelago, having had the contracts for the harbor improvements at Iloilo and Cebu. It was the builder of the Manila electric railways and has a trained force of native foremen and workmen, and will be able to work rapidly.

London Subway.

The London County Council has completed its subway, which will enable a through service of single-deck electric cars to be run between the Strand and Islington. This is an important section forming part of the scheme for connecting the tramway system of North London with that on the South Side, which scheme, it may be remembered, is still held back by the decision of the House of Lords not to allow electric cars to run along the embankment and over the Thames bridges to the present South Side terminus. The construction of this shallow subway has followed the Boston and Budapest subways as models. At one point it is only 3 ft. below the street surface, but at another the line runs in deep level cast-iron tubes which dip to a depth of 31 ft. in order to avoid sewers. The only stations are at points where the tube rises to the surface. The subway has cost about $1,400,000 to build. On each side it has pipe subways for gas, water and electric mains. At a considerable depth beneath it the Great Northern & Piccadilly electric tube line is being built. The electric service will be opened to the public about February 1. The conduit method is adopted, as in all other London County Council tramways so far built.

Recent Changes in the New York City Bridge Department.

Bridge Commissioner Stevenson has appointed Kingsley L. Martin, hitherto assistant engineer of the Williamsburg Bridge, engineer in charge of the Brooklyn and Williamsburg bridges at a salary of $5,000 a year. Mr. Martin is a son of C. C. Martin, who was Chief Engineer and Superintendent of the Brooklyn Bridge from 1870 until his death, in 1905. Archibald McLean, who has been in charge of the Brooklyn Bridge, has been made an assistant to Mr. Martin, but retains his $5,000 a year salary. Olaf M. Kelly, formerly assistant engineer of the Williamsburg Bridge, will have charge of that structure under the superintendence of Mr. Martin. These changes have been made by Commissioner Stevenson to secure better traffic conditions on the Brooklyn and Williamsburg bridges.

As we go to press it is announced that Commissioner Stevenson has appointed Colin M. Ingersoll, Jr., chief engineer of the department, to succeed Mr. O. F. Nichols, who is made Consulting Engineer. Mr. Ingersoll is now Commissioner of Real Estate of the New York, New Haven & Hartford, and until recently was Chief Engineer of that road.

Bond Issues in 1905.

According to the *Wall Street Journal*, the total amount of corporation bonds issued and sold in the New York market in 1905 was $1,130,000,000. Of this large total, the greater part came from a few corporations. The following is a list of total bond issues by railroad companies that sold $15,000,000 or more: Pennsylvania, $115,000,000; Southern Pacific, $105,000,000; Western Pacific, $50,000,000; New Haven, $40,000,000; Oregon Short Line, $40,000,000; Atchison, $32,000,000; C., H. & D., $31,000,000; Rock Island, $25,800,000; Missouri Pacific, $25,000,000; C., B. & Q., $23,859,000; New York Central, $23,000,000; Colorado & Southern, $17,000,000; total, $537,659,000. These 12 railroad corporations supplied almost 50 per cent. of the total new corporation underwriting in Wall street in 1905. In the lists, no allowance is made for refunding, for none should be made in most cases. Straight underwriting is generally involved, whether the money is used for refunding or not. In the C., H. & D. and the Rock Island items all the bonds of all subsidiary companies are grouped to make the total.

Manufacturing and Business.

James L. Pilling is now with the Railway Appliances Company, Chicago. He will receive inquiries relative to improved compressed air locomotive turntable devices; hoisting engines, both portable and stationary, for all purposes, all of which are equipped with the Pilling improved engine.

The Robins Conveying Belt Co., New York, has recently opened an office in the Frick Building, Pittsburg, Pa., G. R. Dekamater, Resident Engineer for the company, is in charge of the office and is prepared to receive inquiries from the vicinity of Pittsburg relating to conveying and hoisting machinery.

The J. A. Fay & Egan Co., Cincinnati, Ohio, maker of wood working machinery, is distributing a handsome calendar. The upper part contains an illustration of the company's works as well as reproductions of the medals awarded to the company for its wood working machines at the various expositions both in this country and in Europe.

The Sullivan Machinery Company, Chicago, has appointed H. T. Walsh Manager for the Pacific Coast, with headquarters with Henshaw, Bulkley & Co., San Francisco. Mr. Walsh has had an extended experience with mining equipment, having represented the Sullivan Machinery Co. in the Rocky Mountain region for a number of years. Henshaw, Bulkley & Co., who have been for a long time the agents of this company, will continue to carry a stock of Sullivan rock drills and compressors.

The Chester B. Albree Iron Works, established in Allegheny, Pa., in 1885, maker of bridge railings and ornamental iron work for railroads and buildings, and also maker of the Pittsburg pneumatic riveters, has been recently incorporated under a Pennsylvania charter. Additional capital and the erection of a large addition to the works on adjoining land, together with a new equipment of machine tools, will enable the new company, which will be called the Chester B. Albree Iron Works Company, to continue the old lines of work to much greater advantage and to take up the manu-

facture of the "Inertia Valve Pneumatic Tools" invented by Chester B. Albree, which the old company has spent three years in perfecting.

The Otis Elevator Company, maker of the escalator, states that a careful count made at Macy's department store, New York, of the handling of customers from one floor to another during the recent holiday season showed that the escalator took, on an average, more people from the first floor than all of the elevators in the entire building. These facts are interesting inasmuch as the elevators in the Macy store occupy 25 times the aisle space and many times the floor space occupied by the escalator.

The Vulcan Iron Works, Wilkes-Barre, Pa., have just completed three freight locomotives of the mogul type, two for shipment to Cuba and one for shipment to Louisiana. They have also just built one six-wheel combination freight and passenger locomotive for shipment to Salaverry, Peru, and have shipped two oil-burning locomotives for the Pacific coast, this being the first consignment of an order for six engines for that section. Three locomotives have also just been shipped to the Bethlehem Steel Co. at their mines at Juraqua, Cuba. These will be used for switching around the mines of the Juraqua Iron Company.

What is claimed to be one of the largest single orders for machine tools ever given at one time by a single company was recently given by the Allis-Chalmers Company, of Milwaukee, to cover a portion of the equipment for the new extensions to its West Allis Works, now under construction. Forty-two machine tools of extra heavy pattern, designed especially for use with high-speed steels, and driven by Allis-Chalmers motors, were ordered from several of the most prominent builders of machine tools in the country (Niles-Bement-Pond Company, Wm. Sellers & Company, Inc.; Detrick & Harvey Machine Co., Manning, Maxwell & Moore, etc.). The combined weight of these machines, without motors, is about 4,282,000 lbs., or 2,141 tons. About 75 Allis-Chalmers motors of various sizes and aggregating a total of 1,200 h.p., will be employed to drive these machines. In addition to the order for machine tools, 34 electric traveling cranes were ordered at the same time from Pawling & Harnischfeger. The combined weights of the cranes ordered is approximately 940 tons.

OBITUARY NOTICES.

Mr. Henry V. Miller, inventor of the Miller block signal, which he was engaged in promoting, and who at one time was Superintendent of Telegraph of the Chicago & Alton, died in Chicago December 27, last. He was born in Marion, Ohio, Feb. 14, 1848.

Mr. George Foot, Resident Engineer of the Mexican Railway, died at Mexico City on January 17 at the age of 74. Mr. Foot was a member of the British Society of Civil Engineers and was at one time General Manager of the Vera Cruz Railroad.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Colorado & Southern.—A. D. Parker, who is now Vice-President in charge of operating, traffic and auditing of the Colorado & Southern, is a graduate of Racine College, having taken his B. A. degree in 1879 and an M. A. in 1882. He began railroad work in 1883 on the Denver & Rio Grande as a section laborer. After serving some time in the shops, he became, in 1884, a clerk in the Auditor's office, advancing during the next nine years through different grades to the position of chief clerk to the Auditor. In 1893 he was appointed Auditor during the receivership of the Union Pacific, Denver & Gulf. The next year his jurisdiction was extended over the Denver, Leadville & Gunnison. In 1899 these roads were reorganized under their present name of the Colorado & Southern, and Mr. Parker became General Auditor. He was elected also Second Vice-President in October, 1905, and in December was relieved of his duties of General Auditor and was given the authority he now exercises.

Denver, Enid & Gulf.—J. L. Soule has been elected Secretary and O. J. Fleming has been elected Treasurer, succeeding H. S. Ames, Secretary and Treasurer, resigned.

Grand Trunk Pacific.—H. J. Symington has been appointed Solicitor.

Pittsburg & Lake Erie.—The jurisdiction of E. V. W. Rossiter, John Carstensen and G. J. Grammer, Vice-Presidents, and D. W. Pardee, Secretary, of the Lake Shore & Michigan Southern and other New York Central lines, has been extended over the P. & L. E. J. G. Robinson, heretofore Secretary, is now Assistant Secretary.

Union Pacific.—J. N. Baldwin, General Counsel for Nebraska and Iowa has been appointed General Solicitor, succeeding W. R. Kelly, resigned.

Wabash Pittsburg Terminal.—W. M. Bonar, Assistant Secretary and Auditor, has resigned.

Operating Officers.

Chicago, Cincinnati & Louisville.—R. P. Dalton, Superintendent, has been appointed General Superintendent.

Chicago, St. Paul, Minneapolis & Omaha.—J. W. Koopman, chief clerk to the Superintendent of the Nebraska division, has been appointed Assistant to the General Superintendent, succeeding D. C. Morgan, who, as announced last week, has been appointed by the Minnesota R. R. Commission to take charge of railroad valuation in that state.

Hocking Valley.—Arthur Pearce, chief clerk to the General Superintendent, has been appointed to the new position of Assistant to the Superintendent of car service.

Pittsburg, Cincinnati, Chicago & St. Louis.—Nettleton Neff, recently appointed Superintendent of the Richmond division, graduated from Harvard in 1891. The same year he entered railroad service as assistant on an engineering corps on the Pennsylvania Lines West of Pittsburg. In 1895 he was appointed Assistant Engineer of the Erie & Ashtabula, and the next year was transferred to the Cleveland & Pittsburg. In 1897 he went to the Western division of the Fort Wayne with the same title. In 1898 he enlisted in the First Volunteer Cavalry, and when that regiment was mustered out, was temporarily given special work under the direction of the General Manager of the Lines West. In 1899 he became Engineer of Maintenance of Way of the Indianapolis division, being transferred in 1901 to the Chicago Terminal division, where he remained until his recent appointment.



Nettleton Neff.

Rio Grande Western.—F. S. Elliott, hitherto Assistant Superintendent of the Great Northern, at Everett, Wash., has been appointed to the new position of Superintendent of the Rio Grande Western.

Union & Glenn Springs.—P. J. Welles, General Manager, has resigned.

Traffic Officers.

Chicago & North-Western.—S. F. Miller, Assistant General Freight Agent at Chicago, has been transferred to Omaha, succeeding J. A. Kuhn, resigned, to engage in private business. H. W. Beyers and J. S. Talbot have been appointed Assistant General Freight Agents at Chicago, succeeding Mr. Miller and T. S. Rattel, assigned to other duties.

Cleveland, Cincinnati, Chicago & St. Louis.—W. G. Pennell, General Agent of the New York Central Lines at Columbus, Ohio, has been appointed Assistant General Freight Agent of the C., C., C. & St. L. at Louisville, Ky., succeeding H. F. Frost, deceased.

Norfolk & Southern.—The authority of R. E. L. Bunch, Traffic Manager of the Atlantic & North Carolina, has been extended over the Norfolk & Southern, effective February 1.

Wabash.—J. D. McNamara, hitherto Southwestern Passenger Agent of the Chicago, Burlington & Quincy, has been appointed Assistant General Passenger Agent of the Wabash, at St. Louis.

Western Maryland.—J. T. Hendricks, who was recently appointed Freight Traffic Manager of the Western Maryland, began railroad service as a clerk in the general freight office of the Cincinnati, Hamilton & Dayton. After four years he was made soliciting freight agent in Cincinnati. He then became traveling freight agent of the Atchison, Topeka & Santa Fe, and in 1894 was appointed soliciting agent of the International & Great Northern. Three years later he was made General Freight Agent of the same road and then went to the Union Pacific, for which road he was General Agent in Philadelphia. In November, 1905, he was appointed Assistant General Freight Agent of the Western Maryland, from which office he is appointed to his present position.

Engineering and Rolling Stock Officers.

Canadian Pacific.—J. H. Boyes, Locomotive Foreman, has been appointed Superintendent of air-brakes, with headquarters at Vancouver, B. C.

Chicago & Alton.—W. D. Taylor has been appointed Chief Engineer, succeeding G. H. Kimball, resigned. Prof. Taylor is 46 years old and took the Civil Engineer's degree at the Alabama Polytechnic Institute in 1881. After doing post-graduate work at Johns Hopkins University, he was for several years Professor of Civil Engineering at the Louisiana State University. From 1889 to 1891 he was Chief Engineer on the construction on the mineral roads of the Louisville & Nashville at Birmingham and Anniston. He became Chief Engineer of the St. Louis, Peoria & Gulf in 1898, and the next year went to the Chicago & Alton, in charge of the reconstruction of the Missouri river bridge, and later was Assistant Engineer in charge of track elevation in Chicago. In 1901, he went to the University of Wisconsin as Professor of Railway Engineering, where he has remained since, having acted during that period also as engineering expert for various commissions.



W. D. Taylor.

Tidewater.—The Principal Assistant Engineers of this company are as follows: L. R. Taylor, Eastern district, with office at Norfolk, Va.; E. Gray, Jr., Middle district, with office at Roanoke, Va.; W. P. Taft, Deepwater Railway, with office at Princeton, W. Va. The following are Division Engineers: A. L. Cornell, First division, with office at Norfolk, Va.; P. B. Houston, Second division, with office at Keysville, Va.; F. A. Jones, Third division, with office at Brookneal, Va.; W. C. Knowlton, Fourth division, with office at Roanoke, Va.; W. P. Stalnaker, Fifth division, with office at Christiansburg, Va.; D. B. Dunn, Sixth division, with office at Eggleston, Va.; D. W. Crane, Seventh division, with office at Oakvale, W. Va.; A. D. Exall, Eighth division, with office at Matoaka, W. Va. Philip Aylett has been appointed Resident Engineer at Southern Branch, Va.

Purchasing Agents.

Chicago, Cincinnati & Louisville.—J. A. S. Graves, Assistant Treasurer, has been appointed General Purchasing Agent.

LOCOMOTIVE BUILDING.

The Evansville & Terre Haute is in the market for eight locomotives.

The International & Great Northern is in the market for 15 locomotives.

The Chicago & Illinois Western, it is reported, is in the market for locomotives.

The St. Louis Southwestern, it is reported, is in the market for additional locomotive equipment.

The Chicago, Rock Island & Pacific has ordered 11 locomotives from the American Locomotive Co.

The Chesapeake & Ohio has ordered one 8-wheel switching locomotive from the American Locomotive Co.

The Kansas City Southern has ordered 15 consolidation (2-8-0) locomotives from the American Locomotive Co.

The Illinois Central has ordered 40 freight and five passenger locomotives from the American Locomotive Co.

The Lehigh & Hudson River will probably purchase six or eight freight locomotives to weigh ready for service 143 tons.

The Cincinnati, New Orleans & Texas Pacific has ordered five consolidation locomotives from the American Locomotive Co.

The Pennsylvania Steel Company, Steelton, Pa., has purchased one 45-ton six-wheel switching locomotive from the East St. Louis Locomotive & Machine Shop Co.

The Grand Trunk, as reported in our issue of Jan. 19, has ordered 55 compound consolidation (2-8-0) locomotives and 10 simple 10-wheel (4-6-0) passenger locomotives from the Locomotive & Machine Co., of Montreal; 15 consolidation and the 10 passenger locomotives are to be completed in June, and the 40 consolidation locomotives are to be completed in November; and 10 simple 10-wheel (4-6-0) passenger locomotives from the American Locomotive Co., to be completed in August. The consolidation locomotives will weigh 200,000 lbs., with 174,000 lbs. on the drivers; cylinders, 22½ in. and 35 in. x 32 in.; diameter of drivers, 63 in.; extended wagon top boiler, with a working steam pressure of 210 lbs.; heating surface, 2,912 sq. ft.; 353 charcoal iron tubes, 2 in. in diameter and 15 ft. long; firebox, 96⅛ in. x 75¼ in.; grate area, 50.62 sq. ft.; tank capacity, 7,000 gallons of water, and coal capacity, 14 tons. All passenger locomotives will weigh 152,700 lbs., with 115,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 73 in.; extended wagon top boiler, with a working steam pressure of 210 lbs.; heating surface, 2,077 sq. ft.; 270 charcoal iron tubes, 2 in. in diameter and 13 ft. 6 in. long; firebox, 108½ in. x 40¾ in.; grate area, 30.5 sq. ft.; tank capacity, 6,000 gallons of water, and coal capacity, 10 tons.

CAR BUILDING.

The Great Northern has ordered 25 coaches from the Pullman Co.

The Georgia Southern & Florida, it is reported, is in the market for 400 flat cars.

The Canadian Pacific will build additional stock and flat cars in its own shops.

The Missouri, Kansas & Texas, it is reported, is in the market for 2,500 box cars.

The Chicago & Eastern Illinois will probably in the near future order some dining cars.

The Ocean Shore Railway Company (Electric) has ordered 40 passenger cars from W. L. Holman & Company, San Francisco, Cal.

The Chicago & Illinois Western will shortly be in the market for upwards of 2,500 cars, including flat cars, coal cars, box cars and stock cars.

The Lehigh & Hudson River contemplates purchasing about 300 steel underframe coal cars, 75 steel underframe box cars and 10 low flat bottom cars.

The Western Maryland has ordered 50 Rodger ballast cars from the Rodger Ballast Car Co. These cars will be built by the American Car & Foundry Co.

The Chicago & Milwaukee Electric cars reported in our issue of Jan. 19 are to be equipped with Forsyth curtain fixtures instead of Hartshorn, as reported.

The Nevada Northern is figuring on the purchase of 10 steel ore cars of 100,000 lbs. capacity. Address the Nevada Consolidated Copper Co., San Francisco, Cal.

The Missouri, Kansas & Texas has ordered 100 Rodger ballast cars from the Rodger Ballast Car Co. These cars will be built by the American Car & Foundry Co.

The Chicago, Rock Island & Pacific Improvement Company has ordered 250 ballast cars from the Rodger Ballast Car Co. These cars will be built by the American Car & Foundry Co.

The Grand Trunk has ordered 250 standard box cars of 60,000 lbs. capacity from Rhodes, Curry & Co., to be completed May 1, and is building 10 standard baggage cars at its Montreal shops for July delivery.

The Interborough Rapid Transit Co., New York, has ordered 12 flat cars from the Pressed Steel Car Co., but denies that it is figuring on material for 10 passenger cars to be built at its own shops, as reported in our issue of Dec. 29.

The Allis-Chalmers Company is having built at the West Milwaukee shops of the Chicago, Milwaukee & St. Paul two special steel flat cars of 100 tons capacity each. These cars will measure 41 ft. long and will be fitted with 16 wheels each.

The Pennsylvania, as reported in our issue of January 19, has ordered 52 high-speed electric cars for its West Jersey and Sea Shore line, which is now being electrified. The order was distributed as follows: Eighteen cars to the J. G. Brill Co., 17 cars to the American Car & Foundry Company and 17 cars to the Wason Manufacturing Co. The cars will be 54 ft. 8 in. long over all, and are to be delivered in the early part of July.

The Seaboard Air Line, as reported in our issue of January 19, has ordered 500 plain box cars and 500 ventilated box cars, from the American Car & Foundry Co. These cars will be of 80,000 lbs. capacity and will weigh 38,600 lbs. each. They will be 36 ft. long x 8 ft. 6 in. wide x 7 ft. 6 in. high, all inside dimensions. The bodies

will be of wood and the underframes will be of metal. The special equipment will include pressed steel bolsters, solid I-beam, brake-beams, cast-iron brake-shoes, Westinghouse air-brakes, Dayton door fasteners, Seaboard Air Line standard doors, S. A. L. twin spring draft rigging, Symington journal boxes, Chicago roofs, and S. A. L. standard trucks. The S. A. L. has also ordered three 60-ft. café dining cars and two 65-ft. combination passenger and baggage cars, as reported in our issue of Jan. 12, from the American Car & Foundry Co. The special equipment for both includes: National-Hollow brake-beams, Westinghouse air-brakes, Janney couplers, Forsyth curtain fixtures, Pantasote curtain material, Seaboard Air Line standard door fastenings, doors, draft rigging, dust guards, paint, platforms, springs, trucks and wheels; Safety Car Heating & Lighting Co.'s heating system, Symington journal boxes, Pintsch light, and Pullman standard vestibules.

BRIDGE BUILDING.

Chicago, Ill.—The plans of the bridge department for improvements to be made during this year, include the building of two new movable bridges and four new stationary bridges, besides the completion of four bridges now under construction.

Enterprise, Ind.—The Chicago, Indianapolis & Evansville, it is said, is locating the site for building a bridge over the Ohio river at this place on its proposed road towards Owensboro, Ky.

Florida.—A bill is before the Committee on Interstate and Foreign Commerce of the House of Representatives authorizing the Birmingham, Columbus & St. Andrews to build a bridge over the navigable waters of St. Andrews Bay, Florida.

Galveston, Tex.—The Gulf, Colorado & Santa Fe has given contracts to Kohmann & McMurry, of Kansas City, for the substructure, and to the American Bridge Company for the superstructure of a steel bridge to consist of one 100-ft. through girder, one 215-ft. fixed span, and one 215-ft. truss draw span, to be built over the Sabine river 17 miles northeast of Kirbyville, Tex. The estimated cost of the structure will be $110,000.

Lewisburg, Pa.—The Commissioners of Northumberland County have been directed by the County Judge to build the bridge over the Susquehanna river, between this place and Chillisquaque township. The building of this bridge has been under consideration for a long time. The work will cost about $100,000.

Michigan City, Ind.—Bids are wanted February 6 by the Board of Commissioners for building abutments for six iron bridges in Laporte County.

Minneapolis, Minn.—This city, it is said, will build a new bridge over the Mississippi river. The plans for the structure have been approved by the War Department. It will probably take two years to complete the work.

Mississippi.—Bills have been introduced in Congress authorizing the Counties of Washington and Holmes to build a bridge over the Coldwater river, and the Counties of Yazoo and Holmes to build a bridge over the Yazoo river, both in Mississippi.

Norfolk, Va.—The Norfolk & Western has filed plans with the Harbor Board asking permission to build two bridges over the Elizabeth river. The one over the southern branch is to be a drawbridge with an opening of 75 ft. with two tracks, to replace the present single track structure, and the one over the eastern branch is to be a similar structure, also to have an opening of 75 ft., to replace the present structure, which has two 73-ft. openings. A special meeting will be held to consider the application. Contract for the superstructure is reported let to the Pennsylvania Steel Company, Philadelphia.

Pine Bluff, Ark.—A commission has been appointed by County Judge, E. J. Kerwin, to arrange for building a combined highway and railroad bridge over the Arkansas river at this place. The County Court has appropriated $20,000 for making soundings.

Smith Center, Kan.—Bids are wanted March 6, by H. A. Clark, County Clerk, for building a steel bridge over the Solomon river at Cedarville, in Smith County, Kansas. J. E. Kern, Kensington, Kan., is County Commissioner.

Van Buren, Ark.—A bill has passed the U. S. Senate and is before the Committee on Interstate and Foreign Commerce of the House of Representatives authorizing the Fort Smith & Van Buren Bridge & Traction Co. to build a bridge over the Arkansas river at or near Van Buren, Ark. (Dec. 22, 1905, p. 200.)

Washington, D. C.—On Jan. 16 the U. S. Senate passed the bill authorizing the Memorial bridge across the Potomac river from the most convenient point in Washington to Arlington Cemetery, in Virginia. The bill limits the cost of the bridge to $5,000,000 and appropriates $500,000 to secure plans and commence construction work. (Dec. 15, 1905, p. 192.)

Wenatchee, Wash.—The bill authorizing the Washington Bridge Company to build a bridge across the Columbia river, at or near Wenatchee, Wash., has been passed by both Houses of Congress. (Jan. 12, p. 12.)

Other Structures.

Chattanooga, Tenn.—A new passenger station is to be built in this city by the Chattanooga Station Company. Work is to be started about the first of May.

Fort Atkinson, Wis.—Plans, it is said, are being made by the Chicago & Northwestern, to build a passenger station here to cost $30,000.

Galveston, Tex.—The Galveston Wharf Company is planning to build new warehouses and sheds, at a cost of about $100,000.

Glassport, Pa.—The Pittsburg & Lake Erie has given a contract to the Harris-Adams Company, of Pittsburg, for putting up a 10-stall roundhouse. Additional contracts are shortly to be let for other improvements, to include new buildings costing about $100,000.

Little Rock, Ark.—The St. Louis, Iron Mountain & Southern, it is reported, is having plans made for a passenger station here, to cost about $200,000.

Pine Bluff, Ark.—The St. Louis Southwestern will extend its inbound and outbound freight house at this place at a cost of $12,000. Other improvements are to be made to cost about $60,000 additional. The plans include the enlargement of the repair shop, and putting up an additional shed.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alabama Great Southern.—Contract is reported let by this company to W. J. Oliver & Co., of Knoxville, Tenn., for reducing the grade at different points between Chattanooga, Tenn., and Birmingham. Work is to begin at a point 23 miles south of Chattanooga, where is the heaviest grade on the line. A second track will be built between Irondale and Birmingham, a distance of seven miles, and the grade reduced.

Atchison, Topeka & Santa Fe.—The Denver, Enid & Gulf, which was recently bought by this company, is to be extended from its northern terminus at Kiowa, Kan., north through Barber County, for a distance of about 35 miles, to a connection with the existing line of the A., T. & S. F.

Augusta & Elberton.—This company, which has projected a line from Augusta to Elberton, Ga., a distance of 60 miles, it is reported, will resume construction work, and expects to have the first 15 miles completed this spring. F. E. Verdery, of Augusta, Ga., is President.

Baltimore & Ohio.—To obtain connection with Roanoke and the southwestern section of Virginia this company, it is said, will build 75 miles of railroad through Shenandoah and Rockingham counties. The proposed line would parallel the Southern between Strasburg and Harrisonburg, Va. From the latter point to Lexington, 60 miles, the Southern's present line will be used, and from Lexington to Salem, 40 miles, a new line will be built. At Salem, which is within six miles of Roanoke, connection will be made with the Tidewater, now under construction, and the Norfolk & Western.

Birmingham, Columbus & St. Andrews Bay.—This company, it is reported, has completed grading for a distance of 45 miles, and has laid six miles of track on its proposed road from Chipley, Fla., south to St. Andrews Bay, a distance of 50 miles.

Boston & Rhode Island (Electric).—Application has been made for a charter in Massachusetts by a company under this name, with a capital of $1,500,000. This is said to be the same company which last year asked for a charter and was refused. The petition was made by Charles H. Blood, of Fitchburg, and others.

Burrs Ferry, Browndel & Chester.—H. G. King and associates of Austin, Texas, have applied for a charter under this name to build a railroad from a point near Burrs Ferry, on the Sabine River, in Newton County, northwest through Newton, Jasper, Sabine, San Augustine and Tyler counties to a point near Peachtree Village, in Tyler County, and to a junction with the Missouri, Kansas & Texas, a distance of about 80 miles. The incorporators include: J. S. Bonner, John H. Kirby, K. H. Cawthorn and J. R. Burns, of Houston; A. C. Averill and W. Weiss, of Beaumont; J. L. Kirby, of Kountze; J. W. Link, of Orange; E. I. Kellie and James Irvine, of New York.

California Roads.—According to the newspapers F. L. Evans, a Civil Engineer of Ureka, Cal., representing an eastern railroad capitalist, is planning to build a railroad from Ureka, Cal., east into Wyoming. The proposed line runs east via Delta, Trinity

river, and along Pitt river through the Sierra Nevada mountains, touching Alturs, thence through Lakeview and Vale in Oregon, and through southern Idaho to Casper, Wyo.

CANADIAN PACIFIC.—Announcement has been made by this company that it will extend the Manitoba and Northwestern branch from the present terminus at Sheho west to Edmonton, a distance of 500 miles.

CANANEA, YAQUI RIVER & PACIFIC (SOUTHERN PACIFIC).—Work is under way on this road from Batamotal, on the Sonora line of the Southern Pacific, down the Pacific coast to Guadalajara. Track will soon be laid as far as the delta of the Yaqui river, and it is expected to have the road completed at Torin, in the Yaqui Indian country, about Feb. 1. The line will run through Alamos to Mazatlan, and from that port to Guadalajara. It will probably cross the river at Chumapaco, ten miles above Torin. The bridge to be built over the Yaqui river will take some time to complete, and will be a costly structure. Engineers of the Southern Pacific are also making the final survey for a road which is to be built through Guzman on the Mexican Central, in the State of Chihuahua, to Agua Prista, in the State of Sonora, which will connect with the Cananea, Yaqui River & Pacific. (December 15, p. 194.)

CHICAGO, INDIANAPOLIS & LOUISVILLE.—A contract is reported let by this company to the Dickerson Construction Co., of Chicago, Ill. Work is to be commenced next month, beginning at a point on the main line near Quincy, Ind., and running southwest for a distance of 50 miles, to a connection with the Illinois Central.

CHICAGO, MILWAUKEE & ST. PAUL, OF WASHINGTON.—See Pacific Railway below.

DENVER, ENID & GULF.—See Atchison, Topeka & Santa Fe above.

DETROIT TERMINAL RAILROAD.—An officer writes that the prospects of building this proposed road are first rate, and the contracts will be let during the coming spring. The proposed route is from the Detroit river at Connor's Creek to Ecorse, crossing a number of steam and suburban electric roads. Joseph H. Berry is President, and E. French, Chief Engineer, both of Detroit. (December 15, p. 193.)

GREAT NORTHERN.—This company, it is said, is planning to build an extension from Grand Forks, N. Dak., north on the east side of the Red river to Drayton, passing between Olson and Alvarado, Minn.

HARRISBURG & OHIO RIVER.—Local capitalists are organizing a company under this name, to build a railroad from Galatia, Ill., southeast via Harrisburg to a point on the Ohio river at or near Rosiclare, traversing rich coal fields in southern Illinois. F. M. Pickett is President; T. E. Bell, Vice-President; George Ledford, Secretary, and A. P. Dorris, Treasurer. Rights-of-way have been secured, and it is the intention of the company to begin construction work early this spring.

HOLLY, HOLBROOK & BIG BEND.—This company proposes to build a road from Swink, Colo., east along the Arkansas river to Holly, a distance of about 90 miles. A contract is reported let to the Holly Construction Co., of Holly, for building the first 10 miles of the proposed road. W. M. Wiley, of Holly, is interested, and W. Howe is Chief Engineer. Such a line would parallel the Atchison, Topeka & Santa Fé, which touches both these points.

IOWA TRANSFER RAILWAY.—Representatives of the Wabash, the Chicago, Burlington & Quincy, the Chicago, Rock Island & Pacific, the Chicago Great Western, the Des Moines, Iowa Falls & Northern, the Chicago, Milwaukee & St. Paul and the Des Moines Union railroads have organized a company under the above name, with a capital of $300,000, to build a union freight yard in Des Moines. The company has bought ground in East Des Moines as a site for the yard. The directors of the new company include G. T. Ross, of the Chicago, Burlington & Quincy; Carroll Wright and C. W. Jones, of the Chicago, Rock Island & Pacific; S. C. Stickney, of the Chicago Great Western, and F. C. Hubbell and J. A. Wagner, of the Des Moines Union.

KANSAS CITY VIADUCT & TERMINAL RAILWAY.—This company is selling bonds to secure funds to carry out the work of building a viaduct between Kansas City, Mo., and Kansas City, Kan. The company has been granted a franchise to build a viaduct on a private right-of-way from Kansas City, Mo., at Bluff and Sixth streets, to Kansas City, Kan., at Fourth street and Minnesota avenue, a distance of 1 6-10 miles. The proposed structure will be of steel and concrete 60 ft. wide. Work is under way, and it is expected it will be completed in about two years.

LOUISVILLE & KNOXVILLE.—Contract has been let by this company to Edington, Griffiths & Company, of Knoxville, Tenn., for building a cut-off from Four Mile, Ky., on the Cumberland Valley division, to Williamsburg on the Knoxville division.

MINNEAPOLIS & ST. LOUIS. See Minnesota, Dakota & Pacific below.

MINNESOTA, DAKOTA & PACIFIC (MINNEAPOLIS & ST. LOUIS).—Incorporation has been granted a company under this name in Minnesota, to build a railroad from Watertown, S. Dak., northwest about 150 miles, and surveys are now being made. Incorporators include L. F. Day, G. W. Sweever and Frederick Wing, of Minneapolis; W. D. Morris and G. W. Case, of Watertown, S. Dak.

NEWTON & NORTHWESTERN.—This company has decided to build an extension from a point on its present line in Webster County, Iowa. Negotiations have been completed to buy the street railroad system and the power, heat and light plants of the Fort Dodge Heat, Light & Power Co., and utilize the Fort Dodge lines as an extension to be used for both freight and passenger service, steam being used as a motive power for freight. The proposed extension will be built from a connection with the existing street railroad tracks at Central avenue and Sixteenth street, Fort Dodge, south, crossing the Great Western & Illinois Central tracks on overhead bridges to the gypsum fields near the Des Moines river. After crossing the river the road will be built south to a connection with the main line of the Newton & Northwestern, near the town of Lanyon.

NORTHERN PACIFIC.—Western papers report that this company controls the North Yakima & Valley Railroad, and that it will build a short line from its main line at North Yakima, Wash., to Tacoma, reducing the curvature and grades.

OAXACA & PACIFIC, OF HARTFORD.—Incorporation has been asked for by a company under this name in Connecticut, with a capital of $40,000,000, to build and operate railroads in the republic of Mexico. Samuel B. Howard, of Millbrook, N. Y.; A. W. Britton, of East Orange, N. J., and J. D. Baker, of Yonkers, N. Y., are incorporators.

PACIFIC RAILWAY (C., M. & ST. P., OF W.)—This company, as reported last week in the *Railroad Gazette*, has amended its articles of incorporation and changed its name to the Chicago, Milwaukee & St. Paul, of Washington. The company is to build a railroad from some point not yet determined in Seattle, and in Tacoma east and southeast, to a point on the eastern boundary of Washington approximately 300 miles.

PENNSYLVANIA.—Contracts are reported let by this company to the Drake & Stratton Co. for building the Third street branch of the Duquesne Way Elevated, at Pittsburg. The cost of the work will be about $125,000. The work includes the building of two bridges, one over Tenth avenue and one over Third street. Other contracts reported let by this company in connection with the four-tracking of its system and straightening the lines on the middle division include the following: Masonry for the bridge to be built over the Juniata at Mount Union, and for the masonry, grading and change of the line between that place and Newton Hamilton, about three miles, to the Drake & Stratton Co.; from the latter place to Vineyard, a distance of four miles, to P. McManus, of Philadelphia; and from Vineyard to Ryde, not quite two miles, to the Thomas McNally Co., of Pittsburg; and for building a stone arch over the Juniata at Ryde, to Sparks & Evans, of Philadelphia.

PENINSULA (ELECTRIC).—Incorporated in California with a capital of $5,000,000 to build an electric railroad from San José by way of Stanford University, Palo Alto, Redwood City and San Mateo to San Francisco, with a branch line to Los Gatos and a number of other branches, aggregating 204 miles. The directors are O. A. Hale, F. E. Chapin, G. Lyon, W. C. Andrews and A. E. Wilder. It is expected that the San José & Los Gatos Co., of which O. A. Hale is President, and also the Mt. Hamilton Exploitation Co., will be merged into the new corporation. The latter has completed two surveys to the summit of Mt. Hamilton, one by way of Evergreen and the other by way of Alum Rock. The plans of the new organization include reaching the upper portions of the valley with electric lines, with San José as a center, and roads on both sides of the southern extension of the bay, terminating at San Francisco on one side and at Oakland and Alameda on the other. It is believed that the Southern Pacific is interested in the new company.

PHILADELPHIA & READING.—A grading contract has been given by this company to Smith & Campton for work on its road from Pottstown, Pa., to Linfield, on which work is now under way. The cut at Linfield, which is one of the longest on the division, will be widened 32 ft. to accommodate two additional tracks. Grading is also under way between Topton and Alburtis. Six miles of track will be laid early this spring.

ROGERS SOUTHWESTERN.—An officer writes that this company has given a contract to the W. R. Felher Construction Co., and work is under way on its proposed road, to run from Rogers, Ark., on the St. Louis & San Francisco, to a point on the Kansas City Southern, either at Gentry or Siloam Springs, Ark., about 30 miles. W. R. Felher, of Rogers, Ark., is President.

ST. LOUIS & NORTH ARKANSAS.—This road, operating a line from Seligman, Mo., where connection is made with the St. Louis & San

Francisco to Leslie, Ark., a distance of 130 miles, is planning to build an extension southeast to Judd Knob, Ark., to make a connection at that point with the St. Louis, Iron Mountain & Southern from Memphis, Tenn. An extension is also under consideration from the other end of the line.

St. Louis Southwestern.—This company, it is said, is planning to make improvements on its road during the present year at a cost of $2,000,000. The most important include the completion of the bridge over the Red river at Shreveport, La., and building a terminal system at that place which will require eight miles of road. This work is to be finished about May 1, at a cost of about $500,000 for the bridge and $150,000 for the terminals. Construction work will also be carried out improving the line in Louisiana and Texas. Between Texarkana and Mt. Pleasant, the grade will be reduced and the curves eliminated. New 75-lb. rails will be laid between Noell Junction and Dallas, also between Tyler and Waco, and between Louisville and Shreveport. The improvements include the building of a number of steel bridges and concrete arches, and the widening of embankments. The drainage condition will also be improved.

San Francisco, Idaho & Montana.—A contract is reported let by this company to the Pacific Development Company, which has been formed by persons interested in this railroad, to build its proposed road from Caldwell, Idaho, to Winnemucca, Nev. (Dec. 15, p. 193.)

Southern Pacific.—See Cananea, Yaqui River & Pacific.

Sugar Creek & Ohio Northern.—Incorporation, it is said, has been granted a company under this name in Ohio, with a capital of $10,000, to build a railroad from Lorain, Ohio, to Bolivar. Incorporators include F. S. Whitcomb, C. T. Brooks and others of Massillon, Ohio.

Wheeling & Lake Erie.—This company, it is said, has plans completed for building a cut-off from Bolivar northwest to Orrville, Ohio, a distance of 25 miles. This will form part of the Wabash double-track line into Pittsburg, and will shorten the distance from that point to Toledo by about five miles. The Sugar Creek & Ohio Northern recently incorporated to build from Wellington, Ohio, on the Wabash, north to Loraine, will furnish the latter another outlet to a lake port.

Windsor, Essex & Lake Shore (Electric).—This company has completed grading between Windsor, Ont., and Kingsville on its projected road, and tracks are now being laid. The proposed route is from Windsor, Ont., via Essex, Kingsville, Leamington, Wheatley, Tilbury and Chatham, and thence to Buffalo.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—The gross earnings for the six months ending December 30 were $38,610,407, an increase of $4,065,674, and net earnings were $14,187,739, an increase of $1,287,632. On the basis of these figures it is estimated that during the current fiscal year the road will earn 10.7 per cent. on its common stock, as compared with 9.07 per cent. last year.

Chicago & Alton.—A meeting of the stockholders of the C. & A. Railway Company has been called for March 8, to act upon a proposition to merge that company with the Railroad Company. The Railway Company was organized in 1899 and acquired 98 per cent. of the stock of the Railroad Company, besides the property of the St. Louis, Peoria & Northern, which operates 58 miles of road. The remaining 2 per cent. of the stock, which has been held by the public, has now been acquired by the company, so that this merger is possible. The proposed move will make the C. & A. Railway 3½ per cent. bonds a direct lien on the property, instead of being secured by only a collateral mortgage. The Railway Company has $19,542,800 common stock and $19,544,000 non-cumulative preferred stock outstanding.

Cleveland & Pittsburg.—The New York Stock Exchange has been asked to list $2,216,500 additional special guaranteed 4 per cent. betterment stock of this company.

Cleveland, Cincinnati, Chicago & St. Louis.—The gross earnings (partly estimated), for the six months ended Dec. 31, 1905, were $12,286,700, an increase of $145,413, and the net earnings were $34,247,400, a decrease of $358,380. The gross earnings for the year (also partly estimated) ended December 31 were $22,517,800, an increase of $376,690, and the net earnings for the same period were $5,659,100, a decrease of $350,898.

Delaware & Hudson.—A meeting of the stockholders has been called for February 19, to authorize the issue of $14,000,000 4 per cent. debenture bonds. These bonds are to be issued at par to stockholders at the rate of $1,000 for each thirty shares of stock held. Each $1,000 bond can be exchanged at any time within the next five years for five shares of capital stock. There is at present $48,990,000 capital stock outstanding and $7,000,000 more will be issued for the conversion of the new bonds. At 223, which is the present market price of D. & H. stock, the "right" are worth about $3.84 per share. The $14,000,000 is to be used as follows: $10,000,000 to pay for the United Traction Company of Albany and for a half interest in the Schenectady Railroad Company; $2,400,000 for new equipment; and $1,600,000 for the construction of a line around Wilkesbarre, Pa.

Interborough Rapid Transit.—The plans for the merging of the Metropolitan Street Railway with the above company have been modified; each share of Interborough stock will be exchanged for two shares of the 4½ per cent. collateral trust bonds and $99 in common stock of the new holding company; Metropolitan Street Railway stock will be exchanged for 100 per cent. five cumulative preferred stock, and 55 per cent. common stock of the new company, and Metropolitan Securities stockholders will receive 95 per cent. in common stock of the new company. (Dec. 29, p. 208.)

The Interborough-Metropolitan Company on Wednesday filed a certificate of incorporation at Albany, N. Y., with $5,000 preferred and $10,000 common stock, and P. A. B. Widener, W. G. Oakman, James Jourdan, M. F. Plant and J. B. McDonald, directors. An announcement from the office of August Belmont & Co. is as follows: "This is the first move officially taken in the consolidation of the great traction companies. In many respects it may be considered preliminary. It fixes, however, the name of the new corporation, the names of its incorporators and the objects sought to be attained by the merger."

Kansas City Viaduct & Terminal Company.—A syndicate headed by Fisk & Robinson, of New York, has contracted to purchase $2,600,000, first mortgage 4½ per cent. bonds of this company, which is building an elevated road from Kansas City, Mo., to Kansas City, Kan. This is part of an authorized issue of $3,500,000 of which $1,548,000 is outstanding, $1,052,000 to be issued from time to time and $900,000 reserved for future requirements.

Lackawanna & Wyoming Valley.—According to a newspaper report, the Lackawanna & Wyoming Valley Rapid Transit Company, controlled by the Westinghouse Electric & Manufacturing Company, and itself controlling the Lackawanna & Wyoming Valley Railroad, has been sold. The Lackawanna & Wyoming Valley Railroad is a standard gage, third rail electric line, from Scranton, Pa., to Wilkes-Barre, 20 miles, with a branch from Scranton to Dunmore.

Missouri, Kansas & Texas.—A meeting of the stockholders has been called for March 3 to authorize an issue of $20,000,000 general mortgage 4½ per cent. sinking fund bonds of 1936. Speyer & Co., New York, have underwritten the $10,000,000 which is to be issued; the remainder is reserved. The $10,000,000 already underwritten is to be offered to stockholders at 87½ and accrued interest to the extent of 13 per cent. of their holdings.

Northern Pacific.—It is reported that this company has bought the Astoria & Columbia River for $4,000,000. The A. & C. R. operates 81 miles of road between Goble, Ore., and Seaside, and has $1,619,000 capital stock and $3,280,000 4 per cent. bonds of 1996 outstanding.

Pere Marquette.—The gross earnings, for the eight months ended August 30, were $9,012,352, and the net earnings $2,409,797. The total income was $2,569,458, and it is estimated that the net earnings for the twelve months will be $3,854,187, which will mean a deficit of $757,528.

Pittsburg & Lake Erie.—The gross earnings for the year ended December 31, 1905, were $12,837,735, an increase of $2,802,226, and the net earnings were $2,950,111, an increase of $636,244. These figures show that the gross earnings were at the rate of $67,500 per mile.

Toledo & Ohio Central.— Potter, Choate & Prentice, New York, are offering at par $448,000 4½ per cent. equipment notes of this company. These notes mature in blocks of $32,000, semi-annually July 1, 1906 to 1913, and are secured by 500 steel cars costing $557,150, of which 20 per cent. was paid in cash and the rest by the above notes.

Union Pacific.—There is now outstanding $190,145,900 common stock and $5,884,000 convertible bonds.

Vandalia.—Speyer & Company, of New York, have bought $3,000,000 Vandalia consolidated 4 per cent. bonds of 1955. This is part of the $25,000,000 authorized, and completes the first $10,000,000 known as series A of that issue. The $3,000,000 will be used to retire the $600,000 second mortgage 5 per cent. bonds of the Terre Haute & Indianapolis, maturing Jan. 1, 1906, and for various improvements.

GENERAL NEWS SECTION

NOTES.

Mr. F. A. Delano, President of the Wabash, has been elected President of the Union League Club of Chicago.

In the United States Court for the Eastern District of Virginia the President of the Suffolk & Carolina has been indicted for giving illegal rebates on freight.

Press despatches from Boston say that the Boston & Maine has increased the pay of 20,000 employees by percentages varying from 10 per cent. to 15 per cent., and that the total increased annual expenditure will be $1,825,000.

Mr. Henry M. Flagler, President of the Florida East Coast Railway, is to build at St. Augustine a handsome building for the Young Men's Christian Association connected with the road. The building will be 180 ft. by 200 ft., three stories high.

A press despatch from Tacoma, Wash., says that the Northern Pacific has paid six fines of $100 each for violation of the Safety Appliance law. Four offences were running defective coupling apparatus, and two were the running of locomotives with drawbars which were higher or lower than the legal height.

According to a Chicago reporter, one railroad president in that city says that he has tried in vain to find 3,000 men for work on new construction in the Northwest. He says that the railroads are offering from $1.75 to $2.50 a day without attracting workmen. Not for twenty-five years has he known labor to be so scarce.

The running of an "educational train" by the Illinois Central to teach the farmers of Illinois how to raise corn was noticed in a recent issue of the *Railroad Gazette*. The Chicago, Milwaukee & St. Paul is going to do a similar service for the wheat raisers of Minnesota, Iowa and South Dakota, and arrangements have been made for starting a train with lecturers from Chicago on February 2.

By the completion of the Indiana Harbor Railroad from Indiana Harbor, Ind., on the Lake Shore & Michigan Southern, southward to Danville, Ill., where connection is made with the Cleveland, Cincinnati, Chicago & St. Louis, the "New York Central Lines" are now enabled to run through passenger trains between Chicago and Cairo, Ill., and a night express with sleeping cars has already been put on. The southbound train leaves Chicago at 8:15 p. m. and reaches Harrisburg, Ill., 70 miles north of Cairo, at 9 a. m.

A car record office for the Pittsburg district has been established by the Pennsylvania lines, east and west of that city, and it will be under the direction of Edward Pitcairn, Freight Train Master of the Pittsburg division of the Pennsylvania Railroad. The purpose is to combine the records of the different division superintendents' offices, which control freight terminals in and near that city, and save the labor and delay of sending to the head car record offices of the several roads when information is needed concerning cars.

A Montreal paper prints a fac simile of a ticket for a passage around the world, and it is all on one card 2¼ in. by 4½ in., with no coupons. This remarkable ticket has been issued by the Canadian Pacific, and it is Form 4130. It reads from Montreal to Montreal by way of St. John (N. B.), Liverpool, Cape Town, Singapore, Hong Kong, Yokohama and Vancouver. The passenger goes by Canadian Pacific Railway trains or ocean steamships all the way. This will be a fine advertisement for the passenger department of the road, but the cynical reader will wonder how many tickets of this kind have been or will be sold. Thus far it appears that two have been used, but the fact that one of the passengers was the son of Sir Thomas G. Shaughnessy, President of the road, raises a suspicion that perhaps full rates were not paid. Another reason for doubting whether it will be necessary to print a very large supply of this form is the fact that the C. P. R. steamer (the Monteagle), which is to carry these two passengers from Liverpool to Hong Kong, is making this trip because another vessel is needed in the Pacific trade; she is not likely to serve as a common carrier for future aspirants for the distinction of going around the world on one ticket. It is proposed to sail around the Cape of Good Hope, so the total distance to be traversed by the two passengers will be 29,112 miles, as follows:

Montreal to St. John, N. B. (C. P. R. train)	481 miles
St. John, N. B., to Liverpool (C. P. R. steamship)	3,224 "
Liverpool to Hong Kong (C. P. R. steamship)	15,249 "
Hong Kong to Vancouver (C. P. R. steamship)	7,254 "
Vancouver to Montreal (C. P. R. train)	2,904 "
Total	29,112 miles

Rates on Cotton Piece Goods to Denver.

The Interstate Commerce Commission, in opinions by Commissioner Clements, has announced its decisions in cases against the Boston & Albany and the New York, New Haven & Hartford and others. In the case against the Boston & Albany the Commission rules that the fact that a carload rating has been established on cotton piece goods from the east to Pacific Coast points because of water competition, and the fact that duck and denims have been given carload rates to Salt Lake City and Denver to encourage manufacturing industries at those points, while elsewhere throughout the country the rate on cotton piece goods is the same for any quantity, does not indicate that the action of the carriers in denying a carload rating on tickings, drills and sheetings to Denver is unlawful.

The carriers' rates per 100 lbs. on cotton piece goods in less than carloads from New York, Boston and other eastern points are $2.24 to Denver and $1.50 to San Francisco. The charge to Denver is a combination of rates from the point of shipment to the Mississippi river, Mississippi river to Missouri river, and Missouri river to Denver. From New York to Chicago, from Chicago to Denver, and from St. Louis to Denver for a long period of years cotton piece goods have been given rates substantially below the rates on first class articles, and throughout the United States greater or less differentials on cotton piece goods under first class have been maintained with one notable exception, namely, from Missouri river points to Denver. Transcontinental rates from eastern points to San Francisco are made in competition with water rates, and are in no sense a measure of the value of the service; but that situation does not justify the carriage of goods to San Francisco at a loss, thereby placing additional burdens on other traffic. The rate of $1.50 on cotton piece goods from the east to San Francisco, about 3,400 miles, is assumed to cover the actual cost of the service, and that rate for the 1,400 to 1,600 miles less distance to Denver, and saving the haul of that distance over mountain ranges where fuel and labor are counted more expensive, is found to be reasonable for the transportation from New York, Boston and other eastern points to Denver. Under the present combination rate to Denver no reduction from local charges is made on account of the through haul of 2,000 miles. Such application of combined local charges to a long distance shipment places a wrongful burden upon the shipper. The exaction of first class rates on cotton piece goods between Missouri river points and Denver in view of the long prevailing differentials in other parts of the country and other existing conditions is unjust and unreasonable. The Commission decides that the result of the excessive rates on cotton piece goods between the Missouri river and Denver, and the application of the full locals in making up the through combination rate from New York, Boston and other eastern points taking the same rates to Denver, is to make the through rate excessive, and that such through rate to Denver to be reasonable should not exceed $1.50 per 100 lbs.

The principles of the New York, New Haven & Hartford case are decided in the foregoing case. For reasons stated in the decision, reparation on the shipment involved in this case is denied.

United States Steel Earnings.

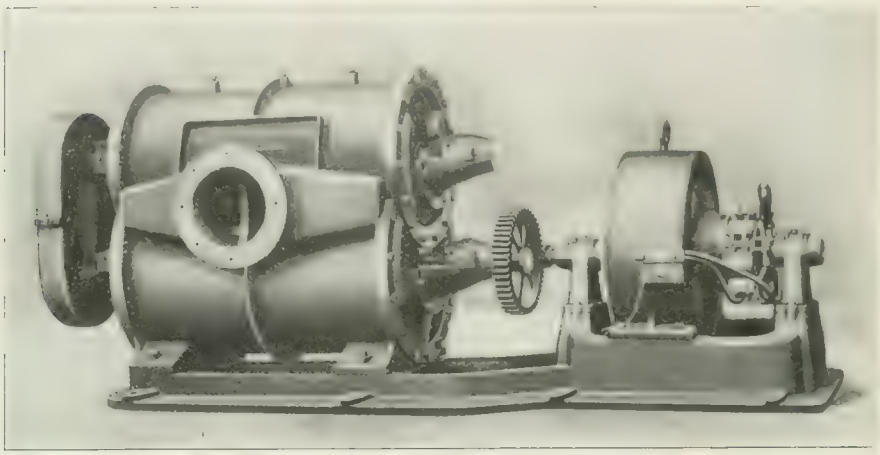
The net earnings of the United States Steel Corporation for the last quarter of 1905 were $35,278,688. This is about $4,000,000 greater than the figure for the previous quarter, and about $14,000,000 more than for the corresponding period in 1904. The net earnings for the entire year were about $120,000,000—$47,000,000 over 1904, when the earnings were the smallest in the history of the company, and $13,000,000 less then in 1902, which was the record year. The balance, after charges, in the last quarter of 1905 was $22,721,482, out of which was paid $6,304,919, the quarterly dividend of 1¾ per cent. of the preferred stock. This left a surplus of $16,416,563. From this sum $9,000,000 was appropriated for improvements and discharge of capital obligations, making the net surplus $7,416,563. The unfilled orders on hand on December 31 amounted to 7,605,086 tons, nearly 2,000,000 tons more than the highest corresponding figure in any previous quarterly statement.

Abolition of P. & R. Grade Crossings in Philadelphia.

Announcement has been made that the plan to eliminate grade crossings on the New York division of the Philadelphia & Reading has been agreed upon by the railroad and the Philadelphia city authorities. The plans call for the elevating of the tracks from Spring Garden street, near the terminal, north through Ninth street for a distance of about one mile on an elevated steel structure. This is to a point just south of Columbia avenue station. Thence north the line will be on an earth embankment, crossing about ten streets on bridges, to Cumberland street. At this point the tracks will be depressed, reaching the low grade at the Huntingdon street station, and remain depressed, crossing Germantown Junction to about Seventeenth street, where they will again be raised, with a grade of 1.06 per cent. and continued on an elevated structure to Wayne Junction, crossing about seven streets on elevated structures.

The Sturtevant High-Pressure Blower.

The accompanying illustrations show a new high pressure blower made by the B. F. Sturtevant Co., Boston, Mass. This blower is made in two types: a the horizontal, the two shafts lie in a horizontal plane, while in the vertical, one shaft is above the other. The blower consists of a cast-iron shell or housing in which are two rotating members or "rotors." One of these, the impeller, revolves in the larger portion of the casing which in the vertical type is the lower. It does the real work of compression. The other rotor, known as the idler, does no work; it successively provides spaces or chambers of proper shape at the desired points in the revolution, so that the impeller blades may return to the suction side of the blower without allowing the escape of compressed air. The idler or drum, revolving in the smaller part of the casing, which in the vertical type is above the impeller, is symmetrical and has a periphery nearly a complete circle. It consists of three hollow vanes or blades cast in one piece with the shaft, which is of cast-iron. The idler, revolving with large clearance, is turned at the same speed as the impeller by means of two spur gears.



The Sturtevant High-Pressure Blower, Vertical Type with Motor Drive.



Interior View of the Sturtevant High Pressure Blower.

The impeller, mounted on the driving shaft, is made up of three diamond-shaped bars or blades and a central web which is keyed to the steel shaft. Being symmetrical it is perfectly balanced at all speeds. As it revolves three separate pockets are formed in the annular space between the shell and a core extended lengthwise of the lower part of the casing. In reality the core is in two parts, each cast in one piece with the end plates, the space between them allowing the web to revolve. The ends of the cast-iron shell or casing, which consists of two hollow cylinders partially intersecting, are finished to receive the four cover plates in which are cast chambers or passages for lessening the noise, and increasing the efficiency of the machine. On either side of the housing are openings for the intake and the discharge of the air, flanged, and tapped for standard gas pipe fittings; the small sizes have openings at the sides, and the large blowers openings at the top and bottom. In every respect the casing and rotors are symmetrical, permitting the blower to run in either direction.

When it is desired to maintain absolutely constant pressure, the blower is provided with a relief valve, or automatic governor. For transferring gases and air at high-pressure, stuffing boxes are provided for the shafts, and a drain in the bottom removes tar and other distilled liquids.

The method of operation is as follows: Air at atmosphere pressure entering the blower at the intake is successively imprisoned in the three pockets formed by the three blades of the revolving impeller, and discharged at any desired pressure up to 10 lbs. per sq. in. The volume of free air delivered varies directly with the number of revolutions, the pressure varies with the resistance met in the delivery pipe. The principle upon which the blower operates is clearly shown by the accompanying diagrams which are sectional views of the rotors and casing. In the explanation it is assumed that the blower is running at a speed to produce average pressure, and that this pressure exists in the discharge outlet. While the rotating members were in the positions shown in Fig. 1, air entered freely and completely filled chambers X and D, while pockets E and Z were discharging air to the delivery pipe. From the previous movement of the rotors, the pressure in Y, filled with air carried over by the revolving idler, had been increased slightly by air flowing through the leakage passages N as will be explained later. The space between the blades A and C, just above the concave portion of the core, was practically filled by the wing of the idler, and consequently while in this position it took no part in the action.

While revolving from the position of Fig. 1 to that shown in Fig. 2, the air in pocket D has been carried along, and the communication between the chamber D and the inlet has been cut off. Space Z is filled with compressed air which further movement will carry toward the suction end, where it will flow back to the inlet and in escaping cause noise. But this loss and noise is prevented by the leakage chamber O which allows the pressure to be transmitted to the air in space Y, thereby increasing its density just before it is discharged.

Continued rotation carries the rotors to the position shown in Fig. 3; atmospheric air is now entering pocket F; the air in D is being carried around between the blades A and B in the annular space, and E is discharging. Above the impeller the remaining pressure in Z is being transmitted to the air in X by means of the leakage passage N provided for the purpose, thereby making its pressure a little greater than atmospheric. The air in space Y under slight pressure from previous leakage is imprisoned, and being carried around by the idler. When the fourth position is reached, pocket F will be filling, the pressure in chamber Z will have been reduced to atmospheric by leakage, space Y will discharge and a little compressed air from the delivery pipe will flow back through leakage passage M and increase the pressure in D, which will result in a quieter discharge when further movement brings B into the discharge passage.

The purpose and advantage of the leakage passages is now apparent; they make it possible to recover the pressure tending

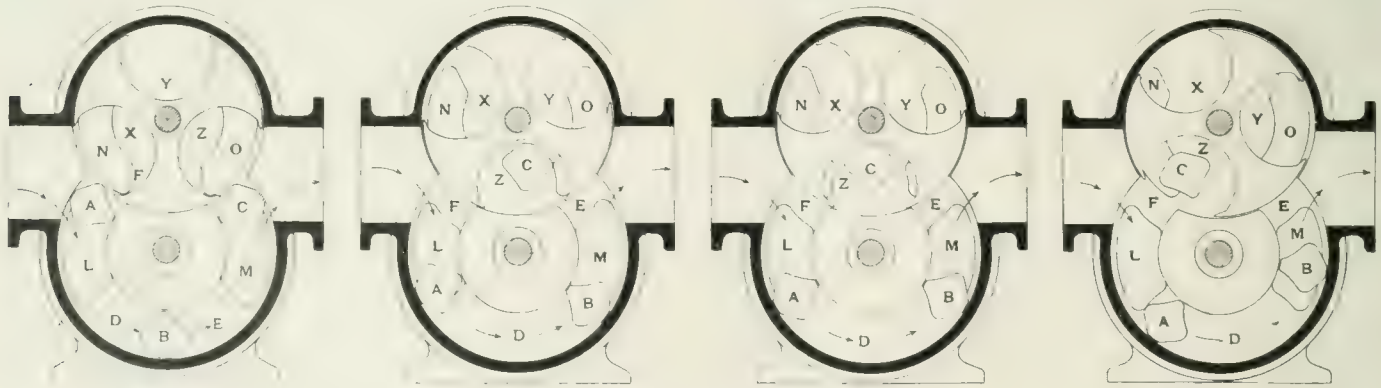


Fig. 1 Fig. 2 Fig. 3. Fig. 4.

Diagrams Showing the Principle of Operation of the Sturtevant High Pressure Blower.

to escape from the impeller pockets and by making the increase in pressure gradual cause the blower to run with less noise. Leakage passage L has little effect when the blower runs in the direction shown here; it is made to allow the blower to be reversible.

It will be noticed that the impeller carries three blades, set at equal distances around the periphery, thus causing three admissions of air at each revolution. Upon leaving the position shown in Fig. 4 the rotors quickly reach a position in which the conditions are exactly the same as those shown in the first figure, the operation continuing as explained.

The Ritter Horizontal Folding Door.

The Ritter horizontal folding door shown in the accompanying illustration is a new design of door intended for use in freight houses, shops, warehouses and other places where a free and unrestricted door opening is required. The door is made in three horizontal panels extending the full width of the opening. The panels are attached to three steel bars on each side, forming a lazy-tong arrangement. The heels of the two lower bars slide on a vertical rail at the side of the door opening, while the inner end of the upper bar revolves on a fixed pivot. The lower corners of the bottom panel have lugs with rollers running on the vertical rails and the operating chains are attached to these lugs. The chains



Ritter Horizontal Folding Door.

pass over grooved sheaves fastened to the wall and have a counterweight suspended from the ends which moves up and down on the door post. The sheave on one side of the door has a toothed sprocket mounted on the same shaft, and this sprocket is driven by an endless chain as in an ordinary chain hoist. As the chain is operated the door is hauled up from the bottom as shown in the illustration. The three panels swing inward and upward, finally folding close together in a horizontal plane at the top of the door opening out of the way.

The doors can be made of wood, sheet iron, glass or concrete. The Terminal Warehouse Co., Kansas City, Mo., has recently ordered 73 doors to be made with steel frames and the panels filled with reinforced cinder concrete. The Cincinnati, Hamilton & Dayton has put in a number of wood panel doors in its new Gest street freight house in Cincinnati, and several will be used in the company's new shops at Ivorydale. The operating parts are simple and not easily damaged even though the door panels may be broken. As they are entirely under cover inside the house they will not freeze in winter. In summer the doors may be partly opened for ventilation and will stay in that position without fastening. When partly open the leaves act as louvres and shed the rain to the outside. This type of door has many advantages over swinging or sliding doors and is superior in some ways to the rolling lift door. It is made and sold by J. W. Walker, Lewis Block, Pittsburg, Pa.

Collision in Spite of Automatic Stop.

The British Board of Trade has encountered its first collision under automatic block signals, and it occurred on an electric railroad—a rear collision on November 7 near Mill Hill Park, on the Metropolitan District Railway of London. This was a slight collision, causing only two trifling injuries and no damage to the track. It occurred at about 9:30 p. m. during a dense fog. The report is by Major J. W. Pringle. The signals (Westinghouse electropneumatic) had been in use about six months. The signal which was passed has a train-stop apparatus, which did not effectively act. The train which wrongfully passed the signal was running very slowly (though not at the low speed of five miles an hour claimed by the motorman) and the motorman claims that he saw both the semaphore arm and the light, the arm down and the light green. The conductor, standing in the baggage compartment at the head of the train, confirms the statement of the motorman. But a signalman a short distance away has an illuminated diagram which automatically indicates the occupancy of track sections by trains, and he testifies that the signal was at stop. The arm is 30 ft. above the ground. Moreover, a trainman of the train went back after the collision, having to go only about 200 ft., and he climbed up the ladder and found both the arm and the light indicating danger. The inspector thinks, therefore, that the signal was at danger when the train passed it. As to the train stop, it appears that the trigger probably came in contact with the stop, but that it, or its attachment, was twisted on its axis so as to prevent it from fully opening the air-brake valve. There is no evidence to show how or when the brake trigger became twisted. It is quite possible, says Major Pringle, that the air valve was partially opened, but as the train was moving down grade and the motorman was occasionally applying the brake, he might not notice any small automatic application. Immediately after the collision the brake trigger was in position as though it had not been moved; but Major Pringle thinks that either it rebounded or that some person moved it back into the vertical position. In conclusion, Major Pringle says that the triggers should not be on the side frames of the cars, but should be attached directly to the axles; that there should be a second trigger on the train, both, perhaps, on the same car; and that when brakes are tested the examiners as well as the motorman should actually test the movement of the striking triggers by moving them until the air valves are fully opened.

A Week's Sales of Stock.

According to the *Wall Street Journal* in the week ending January 27 there were dealings in 19 stocks listed on the New York Stock Exchange to the extent of more than 100,000 shares each. Union Pacific headed this list with more than a million shares. Its outstanding capital is $190,213,900, and the sales of stock aggregated $109,529,000 par value. The following table shows the totals of shares for the week of the 19 companies, and the outstanding capital stock:

Stock.	No. of shares — Sales, week ended Jan. 27.	Stock outstanding
American Locomotive	145,950	250,000
American Smelting & Refining	152,500	500,000
Anaconda Copper	296,600	75,000
Atchison, Topeka & Santa Fe	114,025	1,020,000
Brooklyn Rapid Transit	340,235	450,000
Chesapeake & Ohio	126,800	627,937
Chicago, Milwaukee & St. Paul	183,310	581,839
Colorado Fuel & Iron	327,610	301,000
Denver & Rio Grande	154,150	380,000
Erie	130,800	1,123,789
Norfolk & Western	162,425	460,000
Pennsylvania R. R.	367,700	3,027,500
Reading	898,200	700,000
Southern Pacific	452,300	1,978,492
Southern Ry.	400,400	1,199,000
Union Pacific	1,095,200	1,902,139
U. S. Steel com.	450,950	5,081,952
U. S. Steel pf.	163,321	3,603,141
Wabash	118,620	380,000

On Tuesday, January 30, total sales of stocks on the Exchange were 2,023,810 shares.

Pass Gossip.

It is not such a very unusual sight to see well dressed persons flash one of those new white annual passes at the ticket examiners of the Pennsylvania Railroad as they pass through the gates of the Jersey City station. There are few, if any, trip passes being flashed, but still there are quite some annuals. No one so far has seen the number of President Cassatt's pass, and the boys say they heard that the "old man" and his son, R. K. Cassatt, are each paying their fare like gentlemen in order to show a good example to the army of grafters who have had "cards." The same care is being given to the pass question as would generally occupy the official mind when a great bridge was being constructed over a broad and swift flowing river. The Reading has issued an order to employees riding on passes that they must vacate their seats to put one holding tickets. These surely are strenuous times from a railroad pass standpoint, and hundreds of people are guessing who never guessed before.—*Jersey City Evening Journal.*

The new Pennsylvania rules prohibit the giving of passes to wives and children of deceased employees, which has been in practice for many years and has been helpful to many widows and

orphans, some of whose breadwinners have been killed while performing their duties. Pensioned railroad men will rank, as heretofore, with the employees as far as free transportation is concerned. *Coming Events.*

It is stated that the strong lines, some of them at least, are distributing passes to get contracts for the coming season. Even without the open rupture between the big and little railroads of Chicago, putting the anti-pass legislation out of business, it is now apparent that the same end would have been reached sooner or later through natural causes, as it is asserted positively that passes have been issued to big shippers, especially coal operators. The operators have been short of cars for the last year, and it is stated that promises of passes have been made and that big contracts for carrying coal have been placed since the first of the year. In addition there is a current report that several prominent politicians have received their passes on schedule time, but it is understood that the annuals are not to be delivered as promiscuously as heretofore, and each railroad has suspicions of the others.—*Indianapolis Star.*

Manufacturing and Business.

The Pedrick & Ayer Company, Plainfield, N. J., maker of portable tools, has been bought and will be operated by the Railway Appliances Company, of Chicago.

The American Steel Dredge Works, which was organized by James P. Karr and John D. Rauch, now has its complete plant at Logansport, Indiana, in operation.

The Delaware, Lackawanna & Western recently ordered from the Sprague Electric Co., New York, a motor equipment for driving the heating and ventilating apparatus at its Hoboken terminal.

The Abner Doble Company, of San Francisco, has opened a branch office in Los Angeles, Cal., at 447 Pacific Electric building. The company's business in the water wheel and machinery supply line had increased to such an extent that it became necessary to have better representation in the southwest. The new branch will have for its field southern California, Arizona and New Mexico and parts of Nevada and Mexico. Mr. L. Cummins will have charge of the office.

Richard L. Thomas, for some years connected with the National Lock Washer Co., of Newark, N. J., and now Second Vice-President of B. M. Jones & Co., Inc., Boston, Mass., with office at 143 Liberty street, New York City, has severed his connection with the former concern. Mr. Thomas for some time represented both the National Lock Washer Co. and B. M. Jones & Co., but owing to increased duties in connection with the new corporation of B. M. Jones & Co., Inc., Mr. Thomas has found it necessary to give all of his time to the latter concern.

What is said to be the largest order ever given for oil engines has recently been awarded to the De La Vergne Machine Co., New York, by Burnham, Williams & Co. (Baldwin Locomotive Works), Philadelphia, Pa. This is for engines aggregating over 3,300 actual h.p. Some of these are to be installed in the company's Philadelphia works, and the remainder at its steel works at Burnham, Pa. The installation will consist of 125 and 250 h.p. "Hornsby-Akroyd" oil engines, and they are to be used for direct connection to electric generators and to air compressors, while others will be used for operating machine tools by belt.

Mr. W. G. Hovey, the representative in New York City of the General Railway Signal Co., has been appointed Construction Manager of the company, and a new commercial agent will be appointed. The enormous amount of work to be done in connection with the signaling of the electrified lines of the New York Central, and the intricate problems involved in the work have evidently imposed on the signal company the necessity of making this use of Mr. Hovey's unusual ability and experience. Mr. Hovey was born in Maine in 1860, and entered railroad service in 1889 on the New York, New Haven & Hartford. In 1890 he went to the Hall Signal Company, and in 1892 to the Chicago & North-Western as Superintendent of Signals. In 1900 he left the railroad service to become Superintendent of the shops of the Taylor Signal Co., now merged in the General Railway Signal Company, and on the consolidation of the Taylor and Pneumatic Signal Companies in the G. R. S. Company, he was sent to New York.

Iron and Steel.

The Missouri, Kansas & Texas has given an order for 1,200 tons of bridge steel. Negotiations are pending for 100,000 tons of steel for railroad and building construction work. Contracts will soon be let for 60,000 tons of fabricated and structural steel for the new Manhattan bridge, the former award having been canceled by the Supreme Court.

The Atikokan Ore Company, which has a capital of $2,000,000, is planning to put up large blast furnaces at Port Arthur, Ont. Contracts for the steel structural work and machinery have been let to the Canada Foundry Company, of Toronto; the Canada Bridge Company; the Caledonia Iron Works, of Montreal, and to concerns in the United States.

It is stated that the United States Steel Corporation has been given one of the largest contracts ever let in this country for rails for shipment abroad. The contract is for 20,000 tons of rails for the Rio de Janeiro Tramway Light & Power Company. This company is capitalized at $25,000,000, and proposes to build 200 miles of electric railroad in the Brazilian Capital. The existing mule lines, about 125 miles long, have already been bought, and the work of converting the roads will begin immediately. Among the directors and officers of the company are Sir William Van Horne, William L. Bull and F. S. Pearson.

OBITUARY NOTICES.

Mr. Marshal L. Bacon, Auditor of the New York Central & Hudson River Railroad, died on January 28, in New York City, after an operation for appendicitis. Mr. Bacon was 43 years old. His whole railroad service had been with the New York Central. He began as office boy in the General Superintendent's office, and later was transferred to the Treasurer's office at the time when the Treasurer's duties included many of those of the present Accounting Department. When, in 1889, the Accounting Department was created, he was transferred from the Treasurer's office, later becoming Assistant Comptroller. Early in 1903, with the reorganization of the department and the discontinuance of the office of Comptroller he was made Auditor of the New York Central and subsidiary lines, with supervision over disbursements, freight, passenger and general accounts. Under his administration the scope of the Accounting Department has been greatly broadened. Mr. Bacon was a man, to whom, outside of his immediate duties, responsibilities were delegated as a matter of course. He was Treasurer of the Transportation Club and of the Railroad Young Men's Christian Association. He was also a Railroad Branch Representative on the State Executive Committee of the latter organization. At his home, Tarrytown, he was always a leader in efforts of benevolence and public benefit. As a man, Mr. Bacon inspired to an exceptional degree the love and admiration of his associates of every rank. To the interest and friendly advice which he always found time to give, many a man to-day owes the foundation of a successful career. His death comes as a personal sorrow to those who have been fortunate enough to know and work with him. He was the kind of man whom the world can ill afford to lose.



Marshal L. Bacon.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chicago & North-Western.—The duties of the Vice-Presidents are now defined as follows: H. R. McCullough in charge of freight and passenger traffic; M. M. Kirkman in charge of auditing in connection with operation and proprietary interests; J. M. Whitman in charge of new construction, the operation of coal companies and the maintenance of bridge companies, and W. A. Gardner, hitherto General Manager, has been elected Vice-President in charge of operation and maintenance. Mr. Gardner began railroad work in 1872 as telegraph operator on the Chicago & Alton. In 1878 he went to the North-Western as Clerk and Operator in the office of the Superintendent, remaining there until 1885, when he was made Assistant Superintendent of the Wisconsin division. Five years later he became Superintend-



W. A. Gardner.

ent of the same division, and in 1896 was appointed Assistant General Superintendent. In 1899 he was appointed General Manager, where he has remained until his present promotion.

New York Central & Hudson River.—R. A. White, Auditor of Disbursements, has been appointed Auditor, succeeding M. L. Bacon, deceased. C. H. Chambers, Assistant Auditor of Disbursements, succeeds Mr. White.

Operating Officers.

Chicago & North-Western.—Richard H. Aishton, Assistant General Manager of the lines east of the Missouri river, has been appointed General Manager, succeeding W. A. Gardner, promoted. Mr. Aishton's first railroad service was in 1878, in an engineering corps of the Chicago & North-Western. He later became Assistant Engineer, then Superintendent of Bridges and Buildings, and afterward Division Engineer. In 1895 he was appointed Assistant Superintendent, and two years later was made Division Superintendent. In 1891 he was appointed General Superintendent, and in 1902 was promoted to be Assistant General Manager, which position he has held until his present appointment. W. D. Cantillon, General Superintendent of the lines east of the Missouri river, has been appointed Assistant General Manager, with office at Chicago, Ill., succeeding Mr. Aishton. W. E. Morse, Superintendent at Baraboo, Wis., succeeds Mr. Cantillon, with office at Chicago. W. D. Beck has been appointed Superintendent of the Madison Division, with office at Chicago, Ill., succeeding Mr. Morse; E. G. Schevenell has been appointed Superintendent of the Minnesota division, succeeding Mr. Beck; F. H. Hamill has been appointed Superintendent of the Sioux City division, succeeding Mr. Shevenell; A. F. Reiner, Trainmaster at Boone, Iowa, has been appointed Assistant Superintendent of the Madison division, succeeding Mr. Hamill.



R. H. Aishton.

Indiana Harbor.—Frank Beckwith, who was recently appointed General Superintendent of this road, graduated in 1892 from the Civil Engineering Department of the University of Illinois. Before that time he had worked on surveys and construction work for the United States Government, for the Colorado Railway, and for the Missouri Pacific. After graduation he went into the Engineering Department of the Chicago, Burlington & Quincy, and rose to be Engineer of the Iowa Lines of that company. In 1903 he went to the Lake Shore & Michigan Southern as Bridge Engineer, and was promoted to Principal Assistant Engineer of the same road.

Lake Erie & Western.—W. J. Davis, Superintendent at Muncie, Ind., has been appointed Superintendent of the Peoria division, succeeding F. T. Bowles, resigned.

Missouri Pacific.—J. W. Dean, Superintendent of Little Rock Terminals, has been appointed Superintendent of the Central division, with office at Van Buren, Ark., succeeding J. F. Harnit, resigned. H. L. Hungerford succeeds Mr. Dean, with office at Argenta, Ark. F. W. Green, Superintendent of the Arkansas division, has been appointed Superintendent of the Memphis division, with office at Wynne, Ark. A. J. Alexander, Superintendent of the Illinois division, succeeds Mr. Green, with office at Little Rock, Ark. B. G. Fallis succeeds Mr. Alexander with office at Chester, Ill

Pittsburg & Lake Erie.—J. B. Yohe, General Superintendent, has been appointed General Manager

Traffic Officers.

Atlantic & North Carolina.—The authority of H. C. Hudgins, Freight and Passenger Agent of the Norfolk & Southern, has been extended over the A. & N. C.

Chicago, Cincinnati & Louisville.—T. H. Gurney, formerly Chief Clerk to the General Passenger Agent of the Cincinnati, Hamilton & Dayton, has been appointed General Passenger Agent of the C., C. & L.

Mexican Central.—J. C. McDonald has been appointed Assistant General Passenger Agent at Mexico City, succeeding W. K. MacDougald, resigned.

Engineering and Rolling Stock Officers.

New York Central & Hudson River.—Francis Boardman has been appointed Division Engineer of the Electric division, with office at New York. Mr. Boardman has been for a short time Designing Engineer, previous to which he was Assistant Engineer in the Maintenance of Way department. He graduated from the Academic Department of Yale University in 1897, and afterwards took a post-graduate course in the School of Mines at Columbia.

New York, Chicago & St. Louis.—E. E. Hart, Engineer, has been appointed Chief Engineer.

Pennsylvania Lines West.—W. R. Hillary, Assistant Engineer, at Fort Wayne, Ind., has been transferred to the same position at Newcastle, Pa., succeeding A. W. Grosvenor, who succeeds Mr. Hillary, at Fort Wayne.

Pittsburg & Lake Erie.—The authority of J. F. Deems, General Superintendent of Motive Power of the New York Central & Hudson River, has been extended over the P. & L. E.

LOCOMOTIVE BUILDING.

The Intercolonial will build four locomotives in its Moncton shops.

The Alaska Central will shortly be in the market for one 70-ton locomotive.

The Chicago Junction has ordered five switching locomotives from the American Locomotive Co.

The Missouri, Kansas & Texas is reported to have ordered 20 mogul, 10 passenger and five switching locomotives from the Baldwin Locomotive Co.

The Duluth, Rainy Lake & Winnipeg, formerly the Duluth, Virginia & Rainy Lake, has, it is reported, ordered eight locomotives. W. H. Cook, President, Duluth, Minn.

The Chesapeake & Ohio has ordered one switching locomotive from the American Locomotive Co., and one additional 150-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Chicago & Eastern Illinois has ordered 30 consolidation and four six-wheel switching locomotives from the Baldwin Locomotive Co. The specifications for the consolidation locomotives are exactly the same as for the last 28 consolidation locomotives reported in our issue of January 15. The specifications for the switching locomotives are exactly the same as for the 10 switching locomotives reported in our issue of December 15.

The Evansville & Terre Haute, as reported in our issue of January 26, has ordered six consolidation (2-8-0) and two six-wheel switching locomotives from the Baldwin Locomotive Co. The consolidation locomotives will weigh 182,500 lbs., with 160,000 lbs. on drivers; cylinders, 21 x 28 in.; diameter of drivers, 55 in.; straight boiler, with a working steam pressure of 200 lbs.; 268 tubes, 2¼ in. in diameter and 14 ft. 6 in. long; firebox, 101⅞ x 66⅞ in.; tank capacity, 7,500 gallons, and coal capacity, 12 tons. The switching locomotives will weigh 142,000 lbs.; cylinders, 20 x 26 in.; diameter of drivers, 50 in.; straight boiler, with a working steam pressure of 180 lbs.; 279 tubes, 2 in. in diameter and 15 ft. ⅝ in. long; firebox, 65⅛ x 62¼ in.; tank capacity, 5,000 gallons, and coal capacity, eight tons.

The Illinois Central, as reported in our issue of January 26, has ordered 40 simple consolidation and five simple Pacific locomotives from the American Locomotive Works, all for August and September delivery. The consolidation locomotives will weigh 203,500 lbs., with 181,000 lbs. on drivers; cylinders, 22 in. by 30 in.; diameter drivers, 63 in.; wagon top boilers; working steam pressure 200 lbs.; heating surface 2,946 sq. ft., 344 tubes, 2 in. in diameter and 15 ft. 6 in. long; wide firebox, 107 in. by 67¼ in.; grate area, 50 sq. ft.; tank capacity, 7,000 gallons of water and coal capacity, 15 tons. The Pacific type locomotives will weigh 224,000 lbs., with 140,500 lbs. on drivers; cylinders, 22½ in. by 26 in. diameter, drivers, 75 in.; straight boiler with a working steam pressure of 210 lbs.; heating surface, 3,332 sq. ft., 302 tubes, 2 in. in diameter and 20 ft. long; wide firebox, 102 in. by 71⅛ in.; grate area 51 sq. ft. tank capacity, 7,000 gallons of water, and coal capacity, 15 tons.

The Kansas City Southern, as reported in our issue of January 26, has ordered 15 simple consolidation locomotives from the American Locomotive Company. The locomotives will weigh 205,000 lbs., with 185,000 lbs. on drivers, cylinders 22 in. by 30 in., diameter of drivers, 55 in.; straight boiler with a working steam pressure of 200 lbs.; 380 Tyler charcoal iron tubes 2 in. in diameter and 14 ft. 6 in. long; Otis steel firebox 120 in. by 41 in.; tank capacity,

6,000 gallons of water and coal capacity, 10 tons. The special equipment will include Westinghouse air-brakes, Taylor axles, Keasbey and Mattison Manufacturing Company's boiler lagging, Perfecto brake-shoes, Climax couplers, Handlan Buck headlights, Ohio injectors, Sullivan piston and valve rod packings, Consolidated safety valves, Baltimore sanding devices, Chicago sight feed lubricators, Railway Steel-Spring Company's springs, Asheroft steam gages and Midvale driving and truck wheel tires. Two of these locomotives are to be equipped with Allfree-Hubbell valve gear.

The New York Central Lines, as reported in a previous issue, have ordered 357 locomotives, from the American Locomotive Company as follows: New York Central & Hudson River, 20 Atlantic type, for June and November delivery; 45 consolidation type, for September, October and December delivery; 20 combination passenger and freight locomotives, for December delivery, and 25 switching locomotives for December delivery. Lake Shore & Michigan Southern, 37 consolidated type, for February, September and December delivery; 10 Atlantic type, for December delivery, and three decapods and 25 switching locomotives for October and December delivery. Indiana Harbor, 25 consolidation and 15 switching locomotives. Cleveland, Cincinnati, Chicago & St. Louis, 50 consolidation locomotives, for February, September and December delivery; 10 Pacific type locomotives, for May delivery, and 20 switching locomotives, for September delivery. Michigan Central, 24 consolidation locomotives; 11 ten-wheel combination locomotives, for September and December delivery; eight Pacific type locomotives, for June delivery, and 10 switching locomotives, for December delivery.

CAR BUILDING.

The Boston & Maine has ordered six café cars from the Pullman Co.

The Pennsylvania has ordered 16 passenger cars from the Pullman Co.

The Georgia Southern & Florida is in the market for additional freight equipment.

The New York Central & Hudson River has ordered 55 electric cars from the St. Louis Car Co.

The Boston Elevated, it is reported, will shortly be in the market for 45 elevated and 37 surface cars.

The Colorado Midland is building additional equipment in its own shops, including three dining cars.

The Missouri, Kansas & Texas, it is reported, will shortly purchase additional baggage and passenger equipment.

The Illinois, Iowa & Minnesota has ordered 300 furniture cars and 200 box cars from the American Car & Foundry Co.

The Birmingham Railway Light & Power Co., Birmingham, Ala., is building a few cars at its own shops as a matter of experiment.

The Kanawha & West Virginia is in the market for 200 to 250 coal cars and for about 75 to 80 box cars, all of 80,000 lbs. capacity.

The Chicago & Alton, as reported in a previous issue, has ordered 200 refrigerator cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Minneapolis & St. Louis has ordered six first-class chair cars from the American Car & Foundry Co., for August delivery. These cars will be equipped with Pintsch light.

The Alaska Central will build at its Seward shops 35 Hart convertible coal and ballast cars of 80,000 lbs. capacity. Prices are also being asked for fifteen 60,000 lbs. capacity, 36-ft. flat cars.

The Norfolk & Western has ordered 1,000 gondolas of 100,000 lbs. capacity from the Western Steel Car Co., and 2,500 hopper cars of 100,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co.

The Allis-Chalmers Company is having built at the West Milwaukee shops of the Chicago, Milwaukee & St. Paul two special steel flat cars of 100 tons capacity each. These cars will measure 41 ft. long and will be fitted with 16 wheels each.

The Syracuse Rapid Transit Company has ordered 10 semi-convertible cars from the Kuhlman Car Company, for May delivery. These cars are to be of wood and will measure 45 ft. long x 8 ft. 3 in. wide over all. They will be equipped with air-brakes.

The Oregon Railroad & Navigation, as reported in our issue of Jan. 19, has ordered 45 tank cars of 100,000 lbs. capacity (12,500 gallons) from the Pressed Steel Car Co. These cars will weigh 46,600 lbs., and measure 44 ft. 3¼ in. long, 9 ft. 8 in. wide, and 12 ft. 11⅛ in. high, over all. The special equipment includes: Simplex bolsters, Damascus brake-beams, Congdon-Christie steel back brake-shoes, Hewitt brasses, Climax couplers, Miner draft rigging, Railway Steel Spring Co.'s springs, and arch bar type rigid trucks.

The Interborough Rapid Transit Company, New York, as reported in our issue of January 26, has ordered 12 steel cars from the Pressed Steel Car Company for May delivery. These cars will weigh 30,800 lbs., and will have a capacity of 28,000 lbs. each. They will measure 43 ft. 5 in. long x 8 ft. 4 in. wide x 3 ft. 11 in. high. The bodies and underframes will both be of steel. The special equipment will include the Standard Steel works axles, Pressed Steel Car Company's body bolsters, Interborough Rapid Transit Company's brake-beams, American Brake-Shoe & Foundry Company's brake-shoes, and Van Dorn couplers and draft rigging.

The Kansas City Southern is in the market for 1,000 coal cars of 80,000 lbs. capacity, 50 tank cars of 10,000 gallons capacity, and 10 cabooses. The coal cars will measure 39 ft. long, 9 ft. 6½ in. wide and 48 in. high, all inside measurements. The tank cars will measure 39 ft. long and 92½ in. wide, inside measurements. The cabooses will measure 27 ft. 5 in. long, 8 ft. 1 in. wide, and 11 ft. 2 in. high, inside measurements. The special equipment for all will include: Damascus brake-beams, Westinghouse air-brakes, Hewitt brasses, Climax couplers, Miner draft rigging, Harrison dust guards, McCord journal boxes for coal and tank cars, and Kansas City Southern journal boxes for cabooses, Kansas City Southern trucks for coal cars and cabooses, and arch bar trucks for tank cars.

BRIDGE BUILDING.

Americus, Ga.—The commissioners will build a steel bridge, 192 ft. long, consisting of one span of 60 ft. and steel trestle work 132 ft. long, over Muckaleo creek to replace the present Guerry bridge.

Arkansas.—A bill has been introduced in the Lower House of Congress authorizing the Campbell Lumber Co. to build a bridge over the St. Francis river, in Clay County, Ark.

Atlanta, Ga.—City Engineer R. M. Clayton expects to complete plans for the Washington street viaduct, so as to ask for bids for this proposed structure on February 17.

Fairburn, S. Dak. Bids are wanted by the County Commissioners at Custer, April 3, for building a steel bridge 40 ft. long over French creek, in Custer County. W. A. Nevin is County Auditor.

Florida.—The bill authorizing a bridge over the navigable waters of St. Andrews Bay, in Florida, has been passed by the House of Representatives. (Jan. 26, p. 284.)

Fort Frances, Ont.—Application will be made to the government authorities for permission to build a combined highway and railroad bridge over Rainy river near Pithers' Point.

Fremont, Ohio.—The Lake Erie & Western, which has been planning for a long time to build a bridge over the Sandusky river, has agreed with the state authorities where it shall be located, and, it is said, will at once put up the new structure to cost $90,000.

New Haven, Conn.—The New York, New Haven & Hartford is having plans made and will soon ask for bids for a number of steel bridges.

Pennsylvania.—The Lower House of Congress has passed a bill extending the time for beginning construction of the bridge across the Monongahela river by the Counties of Washington and Westmoreland, Pa.

Tampico, Mex.—Plans are being made by the Mexican Central to build a drawbridge to cost about $500,000 over the Panuco river near this place.

Texas.—The bill authorizing the Jasper & Eastern Ry. Co. to build and operate a railroad bridge over the Sabin river, in Texas and Louisiana, has been passed by the House of Representatives. (Dec. 29, 1905, p. 207.)

Other Structures.

Corning, N. Y.—According to newspaper reports the Erie is planning to put up a new station here.

Harrisburg, Pa.—Announcement has been made that the Pennsylvania will begin work about April 1 on a new freight house 650 ft. long, to accommodate 175 cars; also a new brick office building three stories high, adjoining the freight house, at a cost of about $350,000 for both structures.

New York, N. Y.—Plans have been filed by the Pennsylvania with the building department, for its proposed mammoth passenger station to be built at Seventh and Eighth avenues and Thirty-first and Thirty-third streets. The building is to be 433.5 ft. wide north and south, and 771.6 ft. long on the streets, and will cost about $4,000,000.

Springfield, Ohio.—The Cleveland, Cincinnati, Chicago & St. Louis has plans ready for building car shops in this city.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AMERICAN RAILROAD OF PORTO RICO.—This company, which operates 160 miles of road in Porto Rico, is building an additional 25 miles. August Duval, of San Juan, is Manager.

ASHEVILLE SOUTHERN (SOUTHERN RAILWAY).—An officer writes that this company, recently chartered in North Carolina, has been formed for the purpose of local development, in the interest of the Southern Railway. A. B. Andrews is President and W. H. Wells Engineer of Construction, Washington, D. C. (January 12, p. 13.)

BALTIMORE & OHIO.—This company, through the Schuylkill East Side Railroad, has bought 30 acres of land in Philadelphia, Pa., which will be used to increase the company's freight facilities.

BOSTON SUBWAYS.—The report submitted to the Massachusetts Legislature, by the Boston Rapid Transit Commission, for the future development of the subway system favors an extension to Copley Square, and suggests that a new line be built under Commonwealth avenue. A plan has been submitted for an east side subway, and two methods are suggested of reaching South Boston. The city authorities of Cambridge recently passed an order favorable to the company, authorizing negotiations for the building of a two-track subway from Craigie bridge, Cambridge, through Cambridge to Harvard Square, and from Cambridge street at Webster avenue to the Somerville line.

BROWNSVILLE, HIDALGO & NORTHERN. This company has been incorporated in Texas, with a capital of $600,000, to build a railroad from Brownsville, Tex., to Houston, a distance of 330 miles, also a branch from a point on the main line about ten miles from the southern corner of Lavaca County, to San Antonio, an additional 90 miles; also a branch from a point six miles from Brownsville, through Hidalgo County for a distance of 50 miles, and a branch from a point three miles from Brownsville in an easterly direction to the northern side of the Brazos river, 25 miles, making a total distance of about 500 miles. The offices of the company will be at Brownsville. Uriah Lott is President; James A. Browne, Vice-President, and John D. Hill, Secretary.

CANADIAN MIDLAND.—Incorporation has been granted this company, in Oklahoma, with a capital of $40,000,000, to build a railroad from Kansas City to El Paso, Tex., passing through the counties of Pottawatomie, Cleveland, Comanche, Kiowa and Greer, in Oklahoma. The office of the company will be at Lawton. Incorporators include: G. R. Robertson, C. F. H. Barber, G. McPaschal, all of Lawton; Milfred Steele, of Chicago; I. B. Hampton, of Hampton, Ind. T.; A. S. McKennon, of Wekoka, Ind. T.; E. A. Hill, of Muskogee, and others.

CHATTANOOGA, ANDERSON & ATLANTIC.—Charters have been granted this company, in the states of Georgia and South Carolina, to build a railroad from Chattanooga, Tenn., east via Clayton, Ga., and Westminster and Anderson, S. C., to the seaboard at Charleston. Offices of the company will be opened in Chicago, Ill., and at Anderson, S. C. Albert R. Morton, Chicago, Ill., is President; Capt. P. K. McCully, Treasurer; J. E. Breazeale, Secretary; Mayor M. F. Whitner, of Anderson, S. C., General Counsel.

CHESTERFIELD & LANCASTER.—Contracts are reported being let by this company, which operates a line from Cheraw, S. C., to Ruby, a distance of 21 miles, for extending the road to Lancaster. The proposed route will be through a valuable timber region.

CHICAGO, KALAMAZOO & EASTERN (ELECTRIC).—Incorporation has been granted this company in Michigan with a capital stock of $250,000 to build an electric line from Kalamazoo to Paw Paw and Marcellus, a distance of about 30 miles. The incorporators are Fred F. Bennet, M. H. Lane, Frank H. Melham, Glenn L. Shipman, Victor L. Palmer, Frank B. Lay, of Kalamazoo, and George W. Greenway, of Grand Rapids.

CHICAGO, MILWAUKEE & ST. PAUL. This company, it is said, is double-tracking its line from Milwaukee to La Crosse, and within a few months work will be commenced on double-tracking from the latter point northward. Grades will also be reduced and the lines straightened.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Bids are wanted by William M. Duane, Superintendent, Cincinnati, Ohio, for grading and masonry work in connection with the double tracking and relocation of the Cincinnati division of this road. The work calls for the removal of two million cubic yards of earth, divided into sections, ranging from 200,000 to 800,000 cubic yards, and for about 20,000 cubic yards of masonry work, as mentioned on advertising page 22.

COLUMBUS CITY & OCONEE. Incorporation has been granted a company under this name in Georgia, with a capital of $100,000, to build a railroad from Columbus, Ga., to the Oconee river, a distance of 12 miles. The incorporators include L. F. Henson and others, of Felher County, and Uriah & Sears, of Montgomery County, and others.

CUBA RAILROAD.—This company is planning to build an extension from its main line at Cacocum, in the State of Santiago, north to Holguin, a distance of about 15 miles.

ERIE.—Announcement has been made by this company that it will double-track its lines from Carrollton, N. Y., to Cuba, a distance of 25 miles. This work will be done in connection with the low grade line being built from Cuba to Hunts, N. Y., on the Buffalo division.

GRAND TRUNK PACIFIC.—This company, it is said, is asking bids (February 20) to build the section of its proposed road from Touchwood Hills west to Edmonton, a distance of about 450 miles, and intends to have work begun as soon as the weather permits. The company has now under construction 210 miles from Lake Superior to the main line to the north, and 275 miles from Portage la Prairie to the Touchwood Hills west of Winnipeg.

GREEN RIVER VALLEY (LOUISVILLE & NASHVILLE).—This company, it is said, is planning to build a line from Scottsville, Allen County, Ky., to Stanford in Lincoln County. Contracts are to be let about April 1. This is supposed to be a Louisville & Nashville project.

GUANTANAMO.—This company is building 40 miles of railroad in Cuba. E. A. Brooks, of Santiago de Cuba, is President, and Richard Brooks, of Guantanamo, Chief Engineer.

INDIANAPOLIS & LOUISVILLE (ELECTRIC).—Incorporation has been granted this company, in Indiana, with a capital of $3,000,000, to build an electric road between Indianapolis and Louisville via Franklin, Edinburg, Columbus, Seymour, Crothersville, Scottsburg, Sellerburg, and Jeffersonville. The offices of the company will be at Indianapolis. The directors include: John E. Geeley, of Jefferson; S. A. Miller, of Indianapolis; Robert Candee, of Chicago, and others.

INTEROCEANIC.—This company, which belongs to the Mexican government system of railroads, is completing financial arrangements to secure funds to change its gage from narrow to standard. The road runs from Mexico City east to Vera Cruz. The cost of straightening the line and converting it will be about $6,000,000. An additional $2,000,000 will be spent for rebuilding and for new equipment.

LOUISVILLE & NASHVILLE.—Bids, it is reported, are to be opened by this company early in March for building a line from Williamsburg, Ky., north to Beattyville, about 75 miles. Rights-of-way were secured several years ago by the old Louisville & Atlantic, and are now controlled by the Louisville & Nashville. The proposed extension will traverse rich coal and timber sections in Knox, Clay, Jackson and Owsley counties.

MANILA RAILWAY.—This company, operating about 186 miles of road in the Philippine Islands, is reported to be building an additional 50 miles. H. L. Higgins, of Manila, is Chief Engineer.

MEXICAN ROADS.—Oscar J. Braniff has obtained a railroad concession from his hacienda in the State of Vera Cruz to the cities of Leon and Salamanca. Rafael Davila and Salvador Cardenas Peña, of Monterey, have obtained a concession to build a railroad between Allende and Zaragoza. A. H. McKay, who represents Canadian lumbermen, is applying for a concession to build a 30-mile railroad from the Blalock colony, State of Tamaulipas, to connect with the Mexican Central at Aguelles.

MICHIGAN CENTRAL.—At the final hearing of the special Federal commission to pass upon the plans of this company for tunneling the Detroit river, there was no opposition to the plans proposed, and they were adopted; and work is to be commenced about March 1.

NORTH CAROLINA ROADS.—Henry C. Bridgers, of Tarboro, N. C., writes us that he is in the market for spikes, switches, steam shovels, angle bars, grading outfit, scrapers, etc., for building a proposed railroad from Farmville, N. C., for a distance of 15 miles into Green County.

PAN-AMERICAN. A narrow-gage line is projected by this company between San Geronimo and Juan Felipe, State of Vera Cruz, 26 miles.

PENNSYLVANIA LINES WEST. In connection with the double-track work on the Cleveland & Pittsburg from Steubenville to Bellaire, the company has bought 25 acres of land in the town of Burlington, Ohio, a mile north of Wheeling, W. Va., on the west side of the Ohio river. It is said that the town has about 250 houses, and that the company will remove all these buildings this summer and establish large yards on the site.

The work to be carried out by this company and its controlled lines, including the Vandalia, during the present year, includes double tracking at a cost of $1,200,000. Track elevation in Indianapolis at a cost of $270,000, and a new freight

house at the same place $380,000, for which bids are about ready to be asked.

Philippine Railroads.—The Philippine commission at Washington, D. C., has accepted the bids of J. G. White & Company, of New York, for building railroads in the Islands of Cebu, Panay and Negros. No contracts have been let for the other proposed roads, for which bids were recently opened. (See issue of January 26, p 25.)

Shreveport, Jonesboro & Natchez.—This company has been organized in Louisiana, with a capital of $1,500,000, and with offices at Jonesboro in Jackson Parish, to build a railroad from Jonesboro southeast through the Parishes of Winn, Caldwell, Catahoula and Concordia, to Natchez, Miss.; also from Jonesboro north through Jackson, Bienville, Bossier, and Caddo Parishes, to Shreveport. Incorporators include: C. E. Neeley, of St. Louis; W. W. Brown and W. W. Ramsey, of Camden, Ark.; W. D. Hutchinson; J. S. Craigie, of Jonesboro, La.; R. N. Garrett, of Eldorado, Ark.; C. A. Henderson, of Arkadelphia, Ark.

Sierra & Eastern.—Incorporated at Bakersfield, Cal., with Los Angeles as the principal place of business, to build a railroad from Tehachapi, Cal., east to Searchlight, Lincoln County, Nev., a distance of 200 miles. The company is capitalized at $250,000. J. A. Chanslor and C. A. Canfield, of the Associated Oil Company, are interested. H. M. McIntosh, of Chicago, is a director.

Southern.—See Asheville Southern above.

Toluca & Zihuatanejo (Electric).—A concession from the Mexican Government has been asked for by Henkel Brothers, of Toluca, who own short lines from Mexico City to San Juan de los Huertas, and to Tenango, to build an electric railroad from San Juan to Temascaltepec, Tejuplico, and Cotzumala, thence along the valley of the Rio Balsas, to a point where it emerges from the Sierra Madre, thence along the coast to Zihuatenjo. Surveys have been completed and subsidies granted by the States of Mexico and Michoacan. This line when completed will furnish a route from the gold and silver mines of Sultepec and Temascaltepec, and the copper country of the Balsas.

Tonopah & Tidewater.—An officer writes that this company is building, with its own forces, its proposed road from Ludlow, Cal., to Bullfrog, Nev., a distance of 158 miles. Thirty miles have been graded, and track is laid for a distance of 13½ miles. The work is easy, the maximum grades being 2 per cent. with easy curves. F. M. Smith, of San Francisco, Cal., is President, and John Ryan, of Stagg, Cal., is Chief Engineer. (Jan. 12, p. 14.)

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—The gross earnings of this company for the six months ended December 31 were $38,500,793, an increase of $3,985,705, and the net earnings were $14,908,369, an increase of $2,338,006.

Central of Georgia.—The gross earnings of this company for the six months ended December 31 were $5,880,090, an increase of $396,029, and the net earnings were $1,850,644, an increase of $149,560.

Chicago Great Western.—A dividend of 2½ per cent. was, on Wednesday, declared on the $11,336,000 preferred "A" stock, covering the half year ended Dec. 31, 1905. No dividend had been paid on this stock since February, 1904; from 1900 to 1904, 5 per cent. was paid annually.

Chicago, Milwaukee & St. Paul.—The gross earnings for the half year ended December 31 were $29,046,884, an increase of $2,425,502. The increase in net earnings for the same period was $352,611.

Chicago, Rock Island & Pacific.—Speyer & Company, of New York, have bought $11,784,000 first and refunding mortgage 4 per cent. bonds of 1934 of this company. This is part of an authorized issue of $163,000,000, of which amount $82,025,000 is reserved to retire bonds of the company, and its auxiliary roads $38,500,000 for future acquisitions of property, $27,475,000 for betterments, and $15,000,000 issuable in 1904 for general corporate purposes. Of the amount just sold $3,500,000 is for additions and improvements, $6,500,000 for refunding Burlington, Cedar Rapids & Northern first mortgage 5 per cent. bonds, and the remainder for retiring C., R. I. & P. serial 4 per cent. bonds, Choctaw division bonds and equipment notes.

See Rock Island, Arkansas & Louisiana.

Interborough Metropolitan.—According to an advertisement to the holders of stock of the Interborough Rapid Transit, the Metropolitan Street Railway and the Metropolitan Securities Company, the Interborough-Metropolitan, whose incorporation was announced in the *Railroad Gazette* last week, is to authorize $55,000,000 5 per cent. cumulative preferred, $100,000,000 common stock and $70,000,000 4½ per cent. collateral trust bonds of 1956. Dividends on the preferred stock will begin April 1, 1906, but this stock will have no voting power except in case of default in the payment of dividends thereon. The common stock will be deposited under a voting trust agreement, the following being the voting trustees: August Belmont, W. G. Oakman, T. F. Ryan, Cornelius Vanderbilt and P. A. B. Widener. The collateral trust bonds are to be secured by the pledge and deposit of all the capital stock of the Interborough Rapid Transit Company with the Windsor Trust Company as trustee, and are to be issued only against such deposit and pledge at the rate of $1,000 in bonds for each five shares of stock. The date by which deposit of the securities of the three old companies must be made in order to exchange them for new securities is given as March 1, 1906.

Lehigh Valley.—The Common Pleas Court of Pennsylvania has decided that this company must pay 100 per cent. in back dividends to the holders of the $106,300 of 10 per cent. cumulative preferred stock. Last August another court held that the company must pay 70 per cent., since no dividends had been paid for the 10 years ending July, 1904, 30 per cent. in extra dividends having been paid before that. The case was appealed and the court in the trial just closed held that since this 30 per cent. was in the shape of stock dividends, and was paid to common and preferred alike, such payment should not affect the claims of the preferred stockholders to the full 10 per cent. yearly.

Manila Electric.—William Salomon & Company, of New York, are offering at par a block of the first lien and collateral trust sinking fund 5 per cent. bonds of 1953 of this company, of which $4,635,000 are outstanding. The bonds are subject to redemption on any interest day on or after March 1, 1928, and to purchase for the sinking fund on or after March 1, 1908, at a price not to exceed 105 and interest. They are secured by a first lien on the entire property of the Manila Electric Railroad & Light Company through the deposit of $3,000,000 first mortgage 6 per cent. bonds on the entire capital stock of the company, as well as by the stock of other subsidiary companies in Manila. The Manila Electric controls the street railway, light and power business of Manila, P. I. It has in operation 40 miles of road and considerable additional mileage under construction.

New York, Chicago & St. Louis.—The gross earnings (partly estimated) for the year ended December 31, were $9,108,730, an increase of $463,355, and the net earnings increase $285,705. The surplus, after charges, was $294,926, as compared with $38,916 in the previous year.

Pacific Coast.—It is reported that E. H. Harriman has, by the transfer of $10,000,000 of stock, gained control of the Pacific Coast Co.

Pennsylvania.—In response to a Congressional resolution President Roosevelt has called on the Interstate Commerce Commission for a report regarding the alleged existence of a combination between the Pennsylvania, the Baltimore & Ohio, the Chesapeake & Ohio and other railroads in violation of the Anti-Trust law. According to the last annual report of the Pennsylvania, its stock holdings in the other companies in question, with their total stock issues in common and preferred and the percentage held by the Pennsylvania, are as follows: Baltimore & Ohio, total stock outstanding, $184,258,524; Pennsylvania holdings, $67,678,300, $36^{7}/_{10}$ per cent.; Chesapeake & Ohio, total stock outstanding, $62,790,400; Pennsylvania holdings, $15,630,000, $24^{9}/_{10}$ per cent.; Norfolk & Western, total stock outstanding, $87,457,000; Pennsylvania holdings, $38,830,000, $36^{9}/_{10}$ per cent.; Northern Central, total stock outstanding, $17,193,425; Pennsylvania holdings, $9,401,950, $54^{6}/_{10}$ per cent. The Northern Central is not a competitor of the Pennsylvania proper.

Reading.—The gross earnings of the Philadelphia & Reading Company for the year ended December 31 were $20,822,904, an increase of $2,651,653, and the net earnings were $8,884,024, an increase of $203,636. The net earnings of the Railway Company, the Coal & Iron Company, and the Reading Company were $10,813,249, and the surplus after charges was $5,602,249, an increase of $331,958.

Rock Island, Arkansas & Louisiana.—The stockholders of this company have ratified the lease of all its property to the Chicago, Rock Island & Pacific. (November 24, p. 166.)

Youngstown & Ravenna.—The stockholders have authorized an increase in the capital stock from $10,000 to $1,000,000. This road is the Ravenna cut-off, 26 miles long, which was built jointly by the Baltimore & Ohio and the Pennsylvania, and is used by both for a more direct route between Cleveland & Pittsburg.

GENERAL NEWS SECTION

NOTES.

The Cleveland, Akron & Columbus is to put telephones in use on one of its telegraph wires between Columbus and Akron, 131 miles.

The Maine Central has increased the wages of a large number of employees, evidently taking the same action as that reported on the Boston & Maine, the parent of the Maine Central, last week.

Press despatches from Chicago say that the Wabash has made a rate of 23 cents on grain from the Missouri river to the Atlantic seaboard, and that the Grand Trunk and the Erie will make the same rate.

A press despatch from Omaha says that all of the mail cars on the Union and Southern Pacific lines are to be equipped with electric lights, current to be furnished by dynamos connected with the axles of the cars.

The New York Passenger and Freight Agency of the London & North-Western has moved uptown about fourteen blocks; that is to say, from 852 Broadway to 287 Fifth avenue. Mr. Wand, the General Agent, announces that his new quarters are much larger and better than the old.

The Buffalo, Rochester & Pittsburg and the Grand Trunk are going to establish a car-ferry between Port Hope and Charlotte, N. Y. A company with a capital of $500,000 has been formed to operate this ferry. The first steamer will be built to carry 25 freight cars, and it is expected to be in operation by July of this year.

The Chamber of Commerce of Norfolk Virginia, has asked the legislature of that state to empower the Corporation Commission to permit perishable freight to be moved on Sunday. This move is taken in consequence of the presentation in the legislature of a bill seeking to prohibit the movement of any kind of freight on the railroads of the state on Sunday.

According to New York City papers, a towerman at a junction on the elevated railroad in Brooklyn, N. Y., was recently incapacitated by epilepsy twice in the same day. After being revived by a physician at one o'clock in the afternoon the man continued at his post and was again stricken at 7 p. m., causing serious delays to the very heavy traffic of the line.

The Illinois Central now has in service about 3,000 refrigerator cars of its own, 500 new ones having just been built. The company carries northward from the Gulf of Mexico about 18,000 cars of bananas yearly; from Omaha 3,000 cars of oranges, and northward from the Ohio river 3,000 cars of berries and vegetables; and it carries about 8,000 cars of fruit and vegetables in various directions from other territories.

The Middle division of the Pennsylvania Railroad has again broken its freight train record, moving past Mifflin in the month of January 193,929 cars, which is equal to an average of 6,256 cars a day, or a train about 45 miles long. Assuming that the westbound and eastbound movements are equal in length, this means 22½ miles of cars moved each way, or nearly a mile of cars each hour. This division is a four-track road for the larger part of its length.

The Chairman of the Committee on Territories in the Lower House of Congress has introduced a bill to change the method of taxing railroads in Arizona and New Mexico. It provides that, beginning next year, such property must be taxed in the same way as other property. At present, it is claimed that the railroads pay less than their share, and that in consequence of the easy tax conditions the railroads are opposing the bills now before Congress to convert these two territories into a state.

A shipment of books belonging to the United States government, valued at $1,000, was spoiled in the flood at Kansas City in 1903, and, according to a press dispatch from Washington, the Missouri Pacific Railway, in whose charge the freight was at the time, asked to be relieved from responsibility on the ground that the damage was due to an act of God; but the treasury department insists that the railroad shall pay the damage, because the books were allowed to go unattended to for about a month after flood had subsided.

Mr. K. L. Martin, the Engineer of New York City, in charge of Brooklyn Bridge, reports that by improving the supervision over the trolley (surface) cars running over the bridge, the number of cars per hour has been increased from 285 to 305. The average time of a trip across the bridge has been reduced from 18 minutes to 12 minutes. Inspectors watch the progress of the cars across the bridge and also take charge of the loading, unloading and management of the cars at the loop terminus on the Manhattan side.

The Canadian Pacific has decided to make Quebec the terminus for the present of the new fast steamers of its Atlantic fleet. The company feels that the danger and risk involved in bringing the "Empress of Britain" and "Empress of Ireland" up to Montreal would be so great that it does not feel justified in assuming the responsibility. The President of the company says that there is no port in the Dominion of Canada which has proper facilities for ships of such size as these, and that it will take some months to prepare even temporary terminals at Quebec.

From a Chicago paper we learn that the President of the Chicago, Burlington & Quincy has received a protest from a cheese manufacturer, who says that his sales of cheese to saloonkeepers, who furnish liberal free lunches with drinks have been seriously diminished by the action of the road in forbidding its employees to patronize saloons. According to the veracious reporter's version, the freight department of the Burlington is liable to lose heavy and profitable shipments of cheese unless the paternalistic operating department stops taking such an active interest in what the employees do when off duty.

The passage of a two-cent fare bill by the legislature of Ohio is regarded as now assured, and the committees in charge of transportation matters are proposing to report other measures; one to make the giving or acceptance of a pass about the same as bribery and subject to the same penalties; one to require the carrying of 150 lbs. of baggage with every passenger; one to require at least two passenger trains each way daily on every railroad; one to require sign posts at every highway crossing, and one to require all farm crossings to be better protected by fences and cattle guards.

The employees of the Pennsylvania Railroad at the Greenville (N. J.) freight terminal have formed a mutual benefit association for the purpose of supporting members when they are sick or disabled. The plan is to provide a benefit of $10 a week, which is said to be the rate paid by a similar association of the company's employees at Trenton, N. J. Most of these railroad men are presumably members of the volunteer relief department, which is managed under the care of the railroad company, but this department pays only 40 cents a day to sick members and 50 cents to those disabled by accidents, sums which many of the men believe to be smaller than they ought to be.

The railroad committee of the Massachusetts Legislature this week considered the proposition of E. Alden Dyer, a member of the House from Whitman, Plymouth County, that all passenger cars shall be equipped with chemical fire extinguishers of a kind to be approved by the railroad commissioners, with a penalty of from $100 to $1,000 for violation of the law. Mr. Dyer is a physician and he argued that the horrors of fires in railroad accidents had made it clear that if chemical fire extinguishers were at hand it was probable that lives would be saved. The only speaker in reply was Woodward Hudson, counsel for the Boston & Albany, who argued that the proposition was impracticable. If the apparatus were provided, it would be liable to be destroyed by the collision which wrecked the cars, and, if not, it would not be adequate for the occasion when a furious fire is raging.

The Cape to Cairo Railroad.

Sir Charles Metcalfe, Consulting Engineer of a number of African railroads, who has just returned to England after a journey from the Zambesi to the Congo Free State border, said in an interview discussing the progress of the Cape to Cairo railroad: "A fortnight ago the rails reached the Kafue river, 260 miles beyond Victoria Falls, and at this point a bridge 1,600 ft. long is being built to cross the stream. Beyond the Kafue, grading is nearly finished for 70 miles more, so that we hope that the line will reach the Broken Hill zinc and lead mines by June. There will then be continuous communication from Cape Town to a point 374 miles north of the Zambesi. The line is progressing at the rate of one mile a day. While nothing has yet been definitely decided as to further extension, it is probable that the next section of the line will go from Broken Hill due north to Bwone Macubwa, a point on the Congo border and the center of a rich copper area in northwest Rhodesia.—*London Times*, Jan. 20, 1906.

Isn't This Oppression?

The Interstate Commerce Commission in the case of W. Scheidel & Co. against the Chicago & North Western and the Union Pacific in an opinion by Commissioner Prouty has decided against Scheidel. It appears that the "Scheidel outfit" is an electrical apparatus consisting of a Ruhmkorff coil, an interrupter, a small rheostat and

two switches fitted to a strong table. The parts are detachable and are shipped in separate boxed packages, except the table, which is crated. This outfit, which transforms an electrical current of low voltage into one of extremely high voltage, is used in medical and scientific work, including the use of the X-ray, and also in wireless telegraphy and electrical works. The western classification places X-ray apparatus and scientific or medical instruments in double first class, and electrical apparatus, not otherwise specified, in first class. The complainant contended that its outfit should be treated as an ordinary electrical appliance and carried at first class rates. The decision of the Commission is that under the conditions now governing the manufacture and use of complainant's outfit, that outfit is properly classified by the carriers with the X-ray and medical or scientific apparatus as double first class, and is not entitled to a first class rating with dynamos, transformers and other electrical machinery; but no opinion is expressed upon the justice of the first class rates for such machinery.

Railroad Courses at New York University.

The School of Commerce, Accounts and Finance, of New York University, announces several new railroad courses for the second term of the current year, beginning February 5. These include: Railroad accounting, conducted by Mr. M. P. Blauvelt, Comptroller of the Erie Railroad, and Mr. C. E. Forsdick, of Haskins & Sells, certified public accountants; Legal problems of railroad operation, by Roberts Walker, LL.B., Assistant to the General Counsel of the Chicago, Rock Island & Pacific; Principles of American rate making, and Rate problems, by W. H. Lough, Jr., A. M.; Railroad finance, by T. W. Mitchell, Ph.D., and Industrial geography, by W. C. Webster, Ph.D.

New Railroads Planned for South America.

Consular Reports show that many new short railroads are projected in South America, some of which are as follows:

ARGENTINE.

The Argentine Government has decided, says the French Bulletin of Buenos Ayres, on the construction of railroads between the following points: Villa Mercedes and Rosario, Cordoba and Rio Cuarto, Holmberg and Dolores, Dean Funes and Rosario, with a branch line to Villa Maria, Barranquera, and Tintina, via Otumpa, Formosa, and Embarcación, Soto and Dolores, San Juan and Jachal. These lines will form part of the state railroad system. The Argentine Congress has sanctioned the following concessions: To Señor Santiago J. Duhalde for a railroad from Rufino (Santa Fé Province) to Catriló (Pampa Central), and to Señores Taglioni for a railroad from Mar del Plata to Azul via Tandil.

CHILE.

The German consul at Valparaiso reports the following concessions for railroads in Chile: Mauro Lacalle, Valparaiso, between the saltpeter works, Pepita, and Castilla. Edwardo Caballero and the Progreso Saltpeter Company, Antofagasta, for a line from kilometer 133 of the Antofagasta-Bolivia Railroad to Ansonia Saltpeter Works. The Compañia Commercial y Ganadera Chile-Argentina, Valparaiso, for a suspension railroad, about four miles long, from Casa Pangne to the Argentine frontier. The Valparaiso Saltpeter Company, for a line five miles long, from the Aguas-Blancas-Caleta Coloso Railroad to La Valparaiso Saltpeter Works. The Leonor Saltpeter Company, Santiago, to their works from the Antofagasta-Bolivia Railroad.

BOLIVIA.

The British chargé at Buenos Aires reports that an Argentine syndicate has obtained a concession from Bolivia to construct a railroad of one-meter gage from Santa Cruz eastward to Pedro Suarez, where a port is to be made on the Bolivian side of the River Paraguay, opposite Corumba, Brazil. The line would be 385 miles long entirely in Bolivian territory. The Bolivian and the Argentine governments are negotiating for a connection in Bolivia, from Potos, with the Argentine Central Northern Railroad, a Government line which is being built northward from Jujuy to the Bolivian frontier. This will offset to some extent the new line from Arica to La Paz, which will give Bolivia a direct outlet westward to the Pacific coast. When the Panama Canal is completed, the Arica-La Paz Railroad will be in a stronger position to compete with trade routes via the River Plate and South Atlantic.

URUGUAY.

The British chargé at Montevideo reports that an agreement has been made by the Uruguayan Central Railroad and the Government for the extension to Centurion, a place on the River Yaguaron, forming the boundary of Uruguay and Brazil, of the road terminating at Nico Perez, Province of Minas. Also for a branch line to Treinta y Tres. The length of the lines will be from 250 to 300 miles, to be completed in three years at an expenditure of $7,500,000 gold.

PARAGUAY.

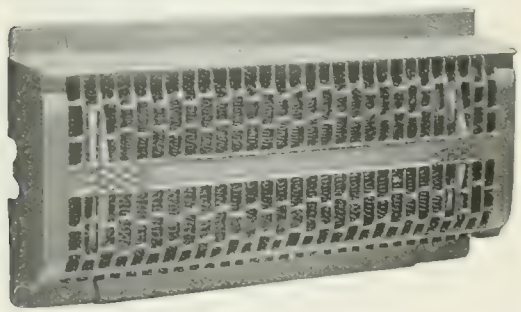
The Paraguayan Government intends building a meter gage railroad from a point on the River Paraguay near San Pedro, through rich forest lands and through the yerba-maté district, with the intention of ultimately extending to the frontier of the Brazilian State of Matto Grosso.

The Manila & Dagupan.

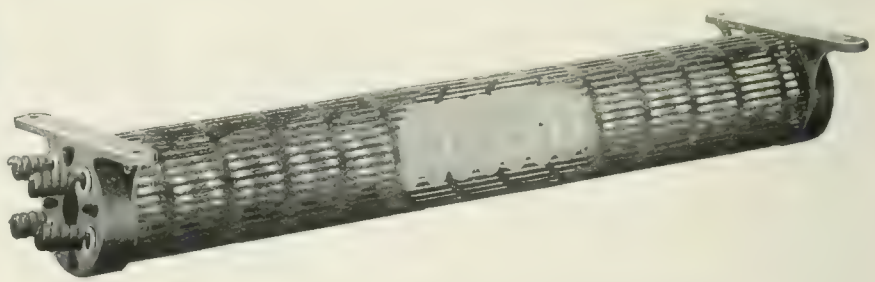
The branch of this road from Bigaa, on the main line, north to Cabanatuan, 45 miles, was officially opened last month, it having been completed on December 18. The franchise for this branch was granted in 1903, and it has been built without government aid. It is narrow gage, like the main line; 66-lb. rails are used, and there are 2,200 hardwood ties to the mile. There are 22 masonry culverts, 266 pile bridges and 41 steel bridges. The maximum grade is 2 per cent., and the maximum curvature is 4⅝ degrees. The Manila & Dagupan, 120 miles long, was the only steam road in the Philippines when the Americans took possession. The road and rolling stock were almost entirely destroyed during the insurrection of 1899, but the line was soon put in shape, and during the next year its earnings were nearly as high as they had been under Spanish rule. Since then they have increased rapidly, and in 1903 both gross and net earnings amounted to more than twice the figures for 1898.

Electric Heaters for New York Central Suburban Cars.

The New York Central has just contracted with the Consolidated Car Heating Company, New York, for furnishing electric heaters for 180 steel cars for its suburban service. The accompanying illustration shows a new type of double coil cross-seat heater for use under the cross seats. It has a single porcelain spindle with a double groove, and all lead wires are carried out of the heater case at one end. The truss-plank heater, which is also illustrated herewith, is to be used for saloons and motormen's cabs, one for each saloon and two for each cab. Each car will be fitted with 30 cross-seat and six truss-plank heaters, and in the coils of one car equipment 4,212 ft. of wire will be used, or 144 miles of wire in the 180 equipments. The heaters will be arranged for 4 deg. of heat. The Consolidated Car-Heating Company reports sales of 51,815 electric heaters for use in 4,259 cars during the year 1905.



Consolidated Car Heating Co.'s Truss-Plank Heater.



Consolidated Car Heating Co.'s New Type Double-Coil Cross-Seat Heater.

Crops in the Canadian Northwest.

The *Wall Street Journal* reports that there have already been shipped out this season from the Canadian Northwest more than 62,000,000 bushels of grain. Canadian Pacific figures show 46,163,000 bushels of wheat and 2,771,000 bushels of other grain received compared with only 21,523,000 bushels of wheat and 1,014,000 bushels of other grain received in the corresponding period last season. The Canadian Northern figures are 12,350,000 bushels of wheat and 750,000 bushels of other grain. This gives 58,513,000 wheat and 3,521,000 other grain or 62,034,000 in all. The seed and bread requirements of the country are at least 17,000,000 bushels, so that already 75,000,000 bushels of the last crop may be figured upon as having come into sight. Minneapolis grain firms, who maintain branch offices in Winnipeg, say that there are from 12,000,000 to 15,000,000 bushels of wheat yet in the hands of Canadian farmers unsold. The quantity in store at terminal elevators on Lake Superior is a little over 4,550,000 bushels. The region produced a magnificent crop of oats last year, but receipts at terminal points have not been as large as grain men had expected from the crop promise. This is due in part to the immensity of the work of new development in the country, and the heavy railroad construction.

It is believed that during the coming summer so many horses will be sent into the interior for work that the consumption of oats will be still more largely increased.

Railroads and the Weather.

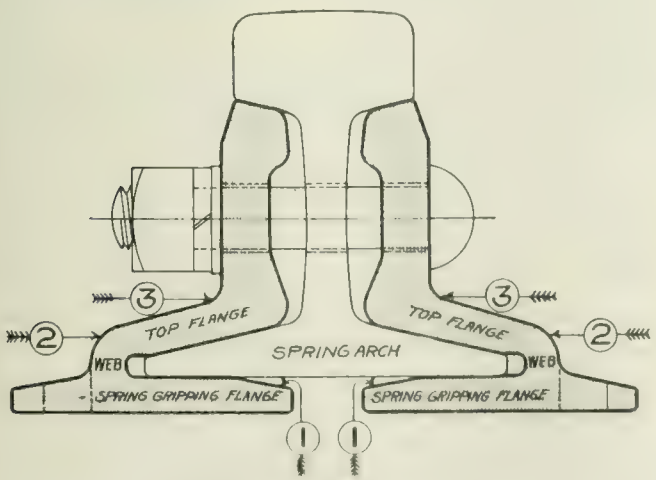
According to the *Wall Street Journal* the railroads of the northern states and Canada made record earnings during the month of December. The weather has not been so mild in the territory of these roads in years as in December and January of the current fiscal year. Not all roads have reported their monthly earnings for the full December as yet, but some have published weekly gross earnings. In every instance in the case of the northern roads there has been shown a substantial advance. The increase as indicated by the weekly earnings of such of these roads as made weekly reports is shown in the following table, which gives the total of gross earnings for the month of December, compared with the gross earnings of December, 1904:

	Gross		
Railroads.	1905.	1904.	Increase.
Canadian Pacific	$5,568,000	$4,517,000	$1,051,000
Great Northern	4,357,842	3,710,297	647,545
Canadian Northern	437,800	384,600	53,200
Duluth, S. S. & Atlantic	213,548	191,913	21,635
Grand Trunk	3,401,472	3,185,857	215,615
M., St. Paul & S. S. M.	931,749	700,586	231,163
Northern Pacific	5,110,632	4,362,637	747,995
New York Central	7,746,083	6,893,934	852,149

The uniformity of the increases and their size tells the story. Every road which is specially affected by the bad weather during the winter has an increase to show. This is due partly to the magnificent business of the country at large, but it is also true that the weather has been the most important factor affecting earnings. It will be noticed that there are different kinds of roads included in the table. The bulk are western roads, but the great increase scored by the New York Central indicates what the trunk lines as a whole are doing. It is quite characteristic. The list does not confine itself either to great or small roads, and all show similar results. The effect of the weather during the month of January will be more marked when the returns are complete than is the exhibit for December, if conditions continue favorable until the end of the month. The earnings for the second week of January are the largest since June, 1903, when the increase of gross earnings for the week over the corresponding week of 1902 was equal to 23.38 per cent. The total gross earnings of 25 roads for the second week of January were $6,644,513. This was an increase over the second week of 1905 of $1,193,945, or 21.9 per cent. While the gross earnings results are remarkable owing to the fact that the roads have been able to handle a larger traffic, it is to be expected that the net earnings will show larger proportionate gains for December, and for January, also, if the fair weather holds.

The Stanford Rail Joint.

The rail joint illustrated herewith was designed and patented by Mr. Arthur L. Stanford, Chicago, who describes the device substantially as follows: Railroad men know the great advantage of forming the standard angle bar to have no contact with the web



The Stanford Rail Joint.

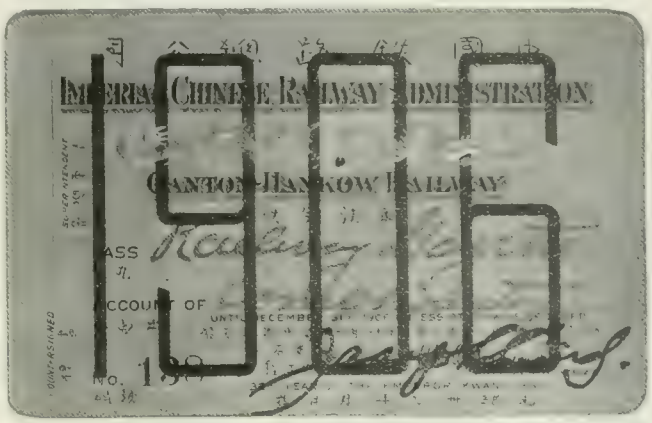
of the rail. This reduces vibration and consequent wear, and increases the holding power. The rail joint shown herewith secures these results by so forming the splice bars that they have no contact with the base of the rail over more than half its width. The bottom flange of both splice bars is beveled at 1 as shown in the drawing. This deprives the rail base of any central support and converts it into a spring arch, also converting the bottom flange of each splice bar into a spring-gripping flange. The result is a resilient rail joint which will greatly reduce lamination of rails, cutting by rail base into joint ties, noise, and destruction of rolling stock.

The Stanford joint comprises two rail joints in one. Above 2 in the drawing is the standard angle bar. Below 3 is another powerful rail joint. Both the bottom flanges being beveled at 1, as already mentioned, become gripping levers, and each, together with the top flange and connecting web, constitutes a friction clutch, which becomes operative by the weight of the train and support of joint ties, to grip the base flanges of the rails. The splice bars are thus in great measure unified with the rails themselves, the joint is greatly strengthened, and accurate alinement of rails, both vertical and lateral, is secured.

The standard angle-bar joint has only about one-third the vertical strength of the rail. The Stanford joint has equal vertical and lateral strength with the rail itself, showing neither more nor less deflection than the rail, and giving, therefore, a close approximation to a continuous rail. The two halves of the joint are duplicates. Mr. Stanford's office is in the Railway Exchange.

Still a Few Left.

We have received an annual, sent us in defiance of the Interstate Commerce Commission, President Roosevelt, the trunk lines and other



We Are Not Without Honor Save in Our Own Country.

foes of this kind of a rebate. The annual is an instance of wicked favoritism, nothing less; but we show it herewith by way of asking well-informed travelers if they can advise us how we can use this pass without first having some other passes.

British Locomotive Engineering in 1905.

While the year 1905 was productive of many interesting developments in locomotive engineering in England, it also shows that in the majority of cases designers still favor the employment of simple rather than compound locomotives. In the development that has taken place it has been brought about that types of engines considered novel for British railroads as recently as 1900 have now become commonplace enough, not only on one, but on several lines. Thus in standard passenger locomotive design we have the Atlantic (4-4-2) and 4-6-0 wheel arrangements, while on nearly all of the principal systems we may find eight-wheels-coupled goods engines. On two railroads, *i.e.*, the Great Western and London & North-Western, Consolidation or 2-8-0 type locomotives are employed, and the first named company also has a large stock of Mogul (2-6-0) type engines in freight service. The 2-6-2 and 4-6-2 passenger types and ten-wheels-coupled goods locomotives (with and without extra wheels) such as are freely used in the United States are as yet untried in this country.

Mr. Ivatt's compound on the Great Northern presents something of a novelty in its cylinder arrangement. In this engine the four cylinders, viz., two high and two low-pressure, are carried in line at the bogie center, two (the high-pressure) being outside the frames, while the low-pressure are between them below the smoke-box. So far as the actual disposition of the cylinders themselves goes, there is nothing new in this, of course, but it is the only locomotive yet built with four cylinders arranged in transverse alinement to drive separate axles. This plan has undoubted advantages, especially where the wheel arrangement is extended to the Atlantic and 4-6-0 types. It permits of a restricted length of wheel-base while employing the separate axle method of driving. Thus Mr. Ivatt has succeeded in keeping the total wheel-base of his engine down to 26 ft. 4 in., which is very short for an Atlantic type locomotive with 6-ft. 8-in. diameter drivers; indeed, it is the shortest wheel-base of any 4-4-2 type engine in Great Britain, simple or compound.

On the London & South Western Railway, Mr. Dugald Drummond, Chief Mechanical Engineer, has introduced an entirely new type of locomotive for working fast and heavy passenger traffic. In the engines of this series, four single-expansion cylinders and three pairs of coupled wheels are employed. This combination of cylinders and wheels is entirely new on British railroads. In it, the cylinder capacity is unusually large, as is also the boiler. There has been a constantly greater disposition to adopt Walschaert valve

gear. New locomotives on the Great Northern, London & South-Western and Great Western have been fitted with this gear; in each case the engines have four cylinders.

The boilers have been getting larger and larger during the past year, and any developments to be effected will shortly have to be wholly confined to improvements in detailed design rather than in seeking still further to increase the general proportions which in many cases have reached the maximum permissible under the existing loading gage restrictions.

The experiment, if such it can be called, of throwing open to competition among outside firms the designing of a locomotive for special service on the main line of a railroad company possessing its own locomotive engineer and workshops, was tried for the first time in modern circumstances during 1905. The Great Northern Railway Company accepted the plans for an express locomotive prepared by the Vulcan Foundry Company, Limited, of Newton-le-Willows.

On the Great Western Railway, Mr. G. J. Churchward, M. Inst. C. E., introduced a new type of tank locomotive having the 4-4-2 wheel arrangement with outside cylinders. This is an entirely new type on the railroad in question, and the engines are specially noteworthy on account of their having the largest diameter of coupled wheels of any tank engines in this or probably any other country. A new type of passenger locomotive appeared on the London & North-Western Railway. This has the 4-6-0 wheel arrangement and two inside cylinders.

The Cincinnati-Philadelphia Air-Line.

On January 25 a consignment of 150 tons of walnut logs for export was shipped to Philadelphia from Washington Court House, Ohio, in a solid train of nine cars. The shipment was routed via the Cincinnati, Hamilton & Dayton, Nickel Plate, Lehigh Valley and the Reading. It has been loaded on a steamer, which is to sail at once for Hamburg.—*Exchange.*

A Better Corn-Crop Train.

The Illinois Central is going to run a special train of six cars over 2,000 miles of its lines in Illinois, to stimulate interest in better corn crops—quantity and quality. The train will stop at 126 cities, towns, villages and crossroads stations. Each stop will be of 40 minutes duration, during which there will be a lecture on seed and soil. The tour will be in charge of Professor Hopkins of the University of Illinois, and he will be assisted by professors from agricultural schools. Representatives of the Illinois Central will accompany the train and will tell of the results in the way of increased shipments that have come from improved methods of farming. The train will leave Chicago February 20. The day lectures will be in the cars, and evenings, halls, where available, will be used.

Manufacturing and Business.

The D. F. Holman Tracklayer Co., Chicago, has received an order for two tracklaying machines from the Tidewater Railway.

The Enterprise Railway Equipment Co., Chicago, has an order for 4,000 cast-steel bolsters for cars recently ordered by the Wabash.

Richard D. Jackson, Jr., 96 Warren street, New York, has been appointed as New York representative of the Keystone Lubricating Co., Philadelphia, Pa.

The McClintic-Marshall Construction Company has opened an office in the Missouri Trust Building, St. Louis, Mo., in charge of G. I. Finley, Contracting Engineer.

G. H. Hutchinson, who recently resigned as Road Foreman of Engines on the Central of New Jersey, is now with the locomotive department of Norman B. Livermore & Co., San Francisco, Cal.

H. M. Cryder, formerly Principal Assistant Engineer of the Wabash, has been appointed Manager, in charge of the Western district, of the Wm. P. Carmichael Co., Engineer and Contractor, of St. Louis.

Wilbur H. Traver, formerly manager of the Railroad Department of the Ingersoll-Rand Company, with headquarters in Chicago, is now with the Chicago Pneumatic Tool Co. as manager of its Mining and Contract Department.

The Westinghouse Electric & Mfg. Company has received an order from the United Railways & Electric Company, Baltimore, for 100 No. 101-B four-motor equipments complete with all details. This is in addition to a recent order for 200 motors of the same type.

The Railway Appliances Company announces having taken the sales agency for the "elastic nut" made by the National Elastic Nut Co., Milwaukee, Wis. All inquiries in regard to price, etc., should be addressed to the former at 1175 Old Colony Building, Chicago, or 114 Liberty street, New York.

A. B. Newell, for the past five years Vice-President and General Manager of the White Pass & Yukon Railroad, and previous to that Superintendent of the Chicago division of the Lake Shore & Michigan Southern, has accepted a position with McCord & Company, Chicago, in charge of the manufacture and sale of the McCord draft gear.

The Western Elaterite Roofing Co., Denver, Colo., reports a good business for 1905 and an encouraging outlook for the current year. The good qualities and desirability of this roofing are evidenced by its constant use during the past ten years by many of the largest railroads and mining companies in the west. This company also makes "Elaterite" paints, for which it has a constantly increasing demand.

Sheldon E. Bent became connected with the Railway Appliances Co. Feb. 1st, in the track department. He is a railroad man of considerable acquaintance, having been located in Mexico the last six or seven years as Superintendent of Transportation of the Oceanic of Mexico and as General Superintendent of the Vera Cruz and Pacific. Previous to that he was at one time Superintendent and then Purchasing Agent of what is now a part of the Brooklyn Rapid Transit Co.

The H. W. Johns-Manville Company has recently established two new departments at its head offices in New York. One of these is the Railroad Department, devoted to railway supplies, of which the company makes a large variety. J. E. Meek has been appointed manager of this department. The other is an export department which has been organized under the management of William Angevine. This department has been organized in order to facilitate the handling of the immense foreign business of the company.

W. H. Marshall, General Manager of the Lake Shore & Michigan Southern, has been elected President of the American Locomotive Co., effective February 15. Mr. Marshall was born in 1864 and became Assistant Superintendent of Motive Power of the Chicago & North-Western in 1897. Two years later he went to the Lake Shore & Michigan Southern as Superintendent of Motive Power. He was appointed General Superintendent of that company in 1902, and later had his jurisdiction extended over the Lake Erie & Western, and the Indiana, Illinois & Iowa. In 1903 he was made General Manager of these three roads. Mr. Marshall has had much to do with designing locomotives for the Lake Shore. The Class J locomotives of the Lake Shore (2-6-2) were built from designs original with Mr Marshall. He was also one of the first, if not the first, to use 19-ft. tubes. As an executive officer Mr. Marshall displayed the same ability that he had shown in the motive power department of the Lake Shore; and, in fact, his ability was well recognized before he became Superintendent of Motive Power.



W. H. Marshall.

Mr. Henry M. Sperry has been appointed Resident Manager of the General Railway Signal Company at New York in place of Mr. Hovey, whose promotion was noted last week, and has resigned his position as Consulting Engineer with the Hudson Companies, to take the new place. Mr. Sperry is already well-known to the readers of the *Railroad Gazette* by reason of his prominence in the signaling world and by his writings. A sketch of his life was given in the *Railroad Gazette* of March 3, 1905. He will continue to be consulting engineer to the Kinsman Block System Company.

The Rail Joint Company, New York, is the corporate name of the company recently organized under the laws of the State of New York, which has acquired the business and property of the Continuous Rail Joint Company of America, the Weber Railway Joint Manufacturing Company and the Independent Railroad Supply Company, and it will carry on the business of the three companies substantially as it has been conducted in the past. The Board of Directors are: President, Frederick T. Fearey; Chairman of Executive Committee, George G. Frelinghuysen; Vice-Presidents, L. F. Braine and Percy Holbrook; Treasurer, F. C. Runyon; Secretary, Benjamin Wolhaupter. The other Directors are: Mark T. Cox, George A. Weber, Edward Y. Weber, Marcus L. Ward and Charles P. Wheeler. The bringing together of these several interests will, it is hoped, enable the Rail Joint Company to supply more promptly and satisfactorily the demands of the customers of the several companies, and put the new company in a position to develop any improvements that can be made in any of the several types of joints manufactured by it.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Railway Club of Pittsburg.

At the meeting of this club to be held at the Monongahela House, February 23, a paper on reinforced concrete will be presented by Mr. R. H. Cummings.

American Society of Civil Engineers.

At the regular business meeting of this society, February 7, a paper on "Test of a Three-Stage Direct-Connect Centrifugal Pumping Unit," by Philip Harrison, was presented for discussion. This paper was printed in the *Proceedings* for December, 1905.

Iowa Railway Club.

At the recent annual meeting of this club the following officers were elected: President, W. B. Foster, Superintendent of the C., M. & St. P.; Vice-President, W. H. Gibbon, Superintendent of the C., R. I. & P.; Secretary, W. B. Harrison, of the C. G. W. A paper was also presented at this meeting on the variation in height of couplers, by J. J. Hennessey, of Milwaukee, Wis.

Canadian Society of Civil Engineers.

The first annual convention of this society was held Jan. 29-Feb. 2, at the King Edward Hotel, Toronto. Vice-President C. H. Rust presided and the address of welcome was delivered by Frank Summerville on behalf of the city of Toronto. The Council reported the present membership as 1,389, as against 1,261 in 1904. Presentations were made of the Gzowoski medal awards for 1904 as follows: Five to C. B. Smith, M. E., for his paper on the construction of the Canadian Niagara Power Co.'s 100,000 h.p. hydro-electric plant, at Niagara Falls, Ont., and two in the students' class; one to F. H. Schwitzer, on mining, and one each to G. S. Cole and C. R. Young. There were no papers submitted by the electrical section. The Treasurer's report showed $1,320 on hand. Professor Porter, Chairman of the Committee, submitted the library report, which showed that 150 new books have recently been added. The total number of volumes at present is upward of 2,000. At the evening session an interesting address on diamond mining in Kimberly, South Africa, was delivered by J. B. Porter, D.Sc. This lecture also included illustrations of the Victoria Falls, which has power equal to one-tenth of Niagara in the dry season, and more than double that of Niagara in the wet season. On Jan. 31 the members of the society visited Niagara Falls, and the power plants at that place. Visits were also made to the Electrical Developing Company's tunnel and power house. Visits were also made to the Canadian Niagara Company's power house.

H. D. Lumsden, of Ottawa, was elected President, and M. J. Butler, Ottawa; C. B. Smith, Toronto, and W. McL. Walbank, Montreal, Vice-Presidents. On February 1 papers were presented on "Hydraulic Locks on the Trent Canal," by W. J. Francis; on "Tide Levels and Datum Planes on the Pacific Coast of Canada," by Dr. W. Bell Vawson, and another on "Dam Construction," by Charles P. Baillairge. At the afternoon session resolutions were unanimously passed looking to an agreement with the Dominion Government to secure permanent records of surveys, and for the establishment of a general topographical and geodetic survey scheme for the Dominion of Canada. The retiring President, Ernest Marcean, presented a paper on the "Origin of Our Canal System." Another paper on "Toronto's Experience with Conduits" was presented by C. L. Fellowes, Assistant City Engineer of Toronto. The annual banquet was held in the evening at the King Edward Hotel, at which addresses were made by the Hon. Mr. Emerson, Minister of Railways; Mr. Francis, City Engineer, and others. On February 2, visits were made to points of interest in the city of Toronto, under the auspices of the Toronto Engineers Club.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Erie.—G. N. Orcutt has been appointed General Claims Attorney, with office at New York City, succeeding O. F. Georgi.

Rock Island Company.—W. B. Leeds has resigned as Chairman of the Board, member of the finance committee and director.

Western Pacific.—The general offices of this company are at the Safe Deposit Building, San Francisco, Cal.

Operating Officers.

Chicago, Burlington & Quincy.—W. G. Sharretts, Superintendent at Burlington, Iowa, has resigned.

Chicago, Rock Island & Pacific.—A. E. Sweet, heretofore General Manager of the Arkansas Southern, has been appointed Assistant to the Second Vice-President of the C., R. I. & P. J. B. Smalley, Superintendent at Herrington, Kan., has been appointed Superintendent of the Illinois division, with office at Rock Island, Ill., succeeding L. B. Allen, resigned. T. H. Beacom, Superintendent at St. Louis, Mo., succeeds Mr. Smalley. J. F. Sugrue, Trainmaster at Little Rock, Ark., succeeds Mr. Beacom.

Chicago & North-Western.—W. D. Cantillon, who was recently appointed Assistant General Manager, was born in 1861. His first railroad service was in 1878 as a brakeman on the Chicago & North-Western, and he has been on that road ever since. He was made trainmaster at Milwaukee in 1891, and Assistant Superintendent at that place in 1893. Four years later he was appointed Superintendent at Winona, Minn., and in 1901 he was promoted to be General Superintendent, which position he held at the time of his recent appointment.



W. D. Cantillon.

W. E. Morse, who succeeds Mr. Cantillon as General Superintendent, was born in 1864, and graduated from Wayland University. His first railroad service was on the Chicago & North-Western in 1881 as telegraph operator. He was made agent next year and chief train despatcher in 1883. After five years he was appointed Trainmaster and was promoted to be Assistant Superintendent in 1891. In 1898 he was made Division Superintendent at Chicago, where he remained for five years. He then went to the Chicago, Rock Island & Pacific as General Superintendent of Construction, at St. Louis, but returned to the Chicago & North-Western in February, 1905, as Superintendent of the Madison division, which position he left on Jan. 24 of this year to become General Superintendent.



W. E. Morse.

Denver, Enid & Gulf.—M. Worthington, Car Accountant, has been appointed General Superintendent, with office at Enid, Okla. T.

Lake Shore & Michigan Southern.—W. H. Marshall, General Manager, has resigned to become President of the American Locomotive Co., effective February 15. E. A. Handy, Assistant General Manager, succeeds Mr. Marshall.

New York, Chicago & St. Louis.—A. W. Johnston, General Superintendent, has been appointed General Manager, and the office of General Superintendent has been abolished.

Traffic Officers.

Chicago, Rock Island & Pacific.—T. H. Simmons, Assistant General Freight Agent at Chicago, has been appointed General Freight Agent of the lines east of the Missouri river, with office at Chicago.

Des Moines, Iowa Falls & Northern.—S. L. Strauss has been appointed General Freight and Passenger Agent, with office at Des Moines, Iowa, succeeding R. H. Bebbins.

Southern Pacific-Atlantic System.—H. A. Jones, hitherto Traffic Manager of the Galveston, Harrisburg & San Antonio, has been promoted to be Passenger Traffic Manager of the Atlantic System. T. J. Anderson, General Passenger Agent of the Texas & New Orleans, has been appointed General Passenger Agent of the G., H. & S. A. Joseph Hellen, Assistant General Passenger Agent of the Texas & New Orleans, has been appointed General Passenger Agent, succeeding T. J. Anderson.

Engineering and Rolling Stock Officers.

Cleveland, Cincinnati, Chicago & St. Louis.—G. G. Davis has been appointed General Foreman of the Car Department, with office at Indianapolis, Ind.

Halifax & Southwestern.—L. H. Wheaton, who was recently appointed Chief Engineer of this road, entered railroad service in 1885 in the department of railways and canals, serving successively until June, 1890, as instrument man, Resident Engineer, and Division Engineer. In 1890 he was appointed Chief Engineer of the Phillips & Rangeley, later becoming Superintendent. In 1892 and 1893 he was Chief Engineer in charge of construction of the Laurel River & Hot Springs, and then became Chief Engineer of the Coast Railway, of Nova Scotia, becoming also General Superintendent of that road in 1897. In 1901 he was appointed Locating Engineer on the Halifax & Southwestern, later being made Division Engineer, which position he held until his recent appointment.

Illinois Central.—L. E. Hassner, General Foreman at East St. Louis, has been appointed Master Mechanic at Clinton, Ill., succeeding M. J. McGraw, resigned.

Lehigh Valley.—L. L. Bentley, Mechanical Engineer, has resigned to become Vice-President and General Manager of the Oswego Boiler & Engine Co., Oswego, N. Y.

Pennsylvania.—G. W. Strattan, Master Mechanic at Altoona, Pa., has been retired on a pension, being 70 years old. I. B. Thomas, Master Mechanic at Pittsburg, succeeds Mr. Strattan. W. B. Elmer, Jr., Assistant Engineer of Motive Power at Altoona, succeeds Mr. Thomas.

Pere Marquette.—J. F. Deimling, Division Engineer at Grand Rapids, Mich., has been appointed Chief Engineer, with office at Detroit, Mich., succeeding F. H. Alfred. W. J. Long succeeds Mr. Deimling at Grand Rapids. J. Tuthill, Bridge Engineer, has been appointed Engineer of Bridges and Buildings, with office at Detroit.

Philadelphia & Reading.—H. J. Beck, Road Foreman of Engines at Reading, Pa., has been appointed to the new office of General Locomotive Inspector, with office at Reading.

Wabash.—E. K. Woodward, Engineer of Maintenance at Peru, Ind., has been appointed Principal Assistant Engineer, with office at St. Louis, succeeding H. M. Cryder, resigned.

Purchasing Agents.

Colorado & Southern.—F. S. McNamara, Purchasing Agent, has resigned.

LOCOMOTIVE BUILDING.

The Norfolk & Western has ordered 75 locomotives from the American Locomotive Co.

The Chicago Heights Terminal Transfer is having two locomotives rebuilt by F. M. Hicks & Co.

The Mexican Central, it is reported, has ordered 20 locomotives from the American Locomotive Co.

The Wabash, it is reported, has ordered 60 locomotives from the Baldwin Works, for delivery during the current year.

The Minneapolis, St. Paul & Sault Ste. Marie is considering the purchase of 25 locomotives. The details have as yet not been decided upon.

The Central Vermont, it is reported, has ordered 14 locomotives. Ten of these will be compound consolidation freight engines, and the remaining four will be for passenger service.

The Kansas City Southern, as reported in our issue of January 26, has ordered 15 simple consolidation (2-8-0) locomotives from the American Locomotive Co., for July, 1906, delivery. These engines weigh 200,000 to 205,000 lbs., with 180,000 to 185,000 lbs. on drivers. Cylinders, 22 in. x 30 in.; diameter of drivers, 55 in.; straight radial stayed boiler with a working steam pressure of 200 lbs.; 375 to 380 2 in. tubes, 14 ft. long; firebox, 120 in. long x 40 to 41 in. wide. The tender will have a capacity of 6,000 gallons of water and 10 tons of coal.

The Chesapeake & Ohio, as reported in our issue of January 26, has ordered one eight-wheel simple switching locomotive from the American Locomotive Company. These engines will weigh 171,175 lbs.; diameter of cylinders, 21 in. x 28 in.; diameter of drivers, 51 in.; wagon top boiler, with a working steam pressure of 200 lbs.; total heating surface, 2,737 sq. ft.; 351 Shelby steel tubes, 2-in. in diameter x 14 ft. long; firebox, 80 in. x 70 in.; tank capacity, 5,000 gallons of water and seven tons of coal. The special equipment will include the Westinghouse air-brakes, Golmar bell ringer, Franklin magnesia boiler lagging, Climax couplers, Hancock injectors, Chesapeake & Ohio standard journal bearings, Jerome and Elliott piston rod and valve packings, Consolidated safety valves, Leach sanding devices, Nathan sight feed lubricators, and Latrobe driving wheel tires.

The Chicago Junction, as reported in our issue of Feb. 2, has ordered five simple six wheel (0-6-0) switching locomotives from the American Locomotive Co., for June delivery. These locomotives will weigh 142,500 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; working steam pressure, 180 lbs.; heating surface, 2,315.15 sq. ft.; 279 National tubes, 2 in. in diameter and 15 ft. long; firebox, 65⅛ in. x 62¼ in.; grate area, 28.15 sq. ft.; tank capacity, 5,000 gallons of water, and coal capacity, eight tons. The special equipment includes: Westinghouse air-brakes, Golmar bell ringers, Franklin boiler lagging, National Hollow brake-beams, Perfecto brake-shoes, Tower couplers, Monitor injectors, Jerome metallic piston and valve rod packings, Consolidated safety valves, Watters sanding devices, Pittsburg Spring & Steel Co.'s springs, Ashcroft steam gages and Midvale driving wheel tires.

The Cincinnati, New Orleans & Texas Pacific, as reported in our issue of Jan. 26, has ordered five simple consolidation (2-8-0) locomotives from the American Locomotive Co., for September delivery. These locomotives will weigh 199,875 lbs., with 176,750 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 56 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 3,517 sq. ft.; 437 Detroit steel tubes, 2 in. in diameter and 14 ft. 6 in. long; carbon steel firebox, 108 in. x 72½ in.; grate area, 54 sq. ft.; tank capacity, 6,000 gallons of water, and coal capacity, 12½ tons. The special equipment includes: Westinghouse air-brakes, Simplicity bell ringers, Keasbey & Mattison magnesia boiler lagging, Buffalo metal brake-beams, Perfecto brake-shoes, Tower couplers, Schroeder headlights, Monitor injectors, Ajax journal bearings, Jerome piston and valve rod packings, Hayden safety valves, Potts sanding devices, Chicago sight-feed lubricators, Pittsburg Spring & Steel Co.'s springs, Ashton steam gages, standard driving and truck wheel tires, and cast-steel wheel centers. Other specialties are: Walschaert valve gear on one locomotive.

The Chicago, Rock Island & Pacific has ordered 33 simple consolidation (2-8-0) locomotives from the Baldwin Locomotive Works, and, as reported in our issue of Jan. 26, 11 simple Pacific (4-6-2) locomotives from the American Locomotive Co. The consolidation locomotives will weigh 201,000 lbs., with 180,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 63 in.; extended wagon top boiler, with a working steam pressure of 185 lbs.; heating surface, 2,923 sq. ft.; 340 National charcoal iron tubes, 2 in. in diameter and 15 ft. 6 in. long; Worth firebox, 107 in. x 67¼ in.; grate area, 50 sq. ft.; tank capacity, 7,000 gallons of water, and coal capacity, 15 tons. The Pacific locomotives will weigh 212,000 lbs., with 143,500 lbs. on the drivers; cylinders, 22 in. x 26 in.; diameter of drivers, 69 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 3,353.9 sq. ft.; 328 National charcoal iron tubes, 2 in. in diameter and 18 ft. 7 in. long; Otis steel firebox, 96 in. x 67¼ in.; grate area, 44.8 sq. ft.; tank capacity, 7,500 gallons of water, and coal capacity, 15 tons. The special equipment for both includes: Golmar bell ringers, Franklin boiler lagging, Buffalo brake-beams for consolidation locomotives, and National-Hollow brake-beams for Pacific locomotives, Major couplers, Hancock injectors, Magnus journal bearings, U. S. and Jerome piston and valve rod packings for consolidation locomotives, and U. S. piston and valve rod packings for Pacific locomotives, Consolidated safety valves, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashcroft steam gages, and standard driving, truck and tender wheel tires.

The Great Northern, as reported in our issue of Dec. 22 last, has ordered 50 simple Prairie (2-6-2) locomotives, 20 simple Pacific (4-6-2) locomotives, 10 compound Atlantic (4-4-2) locomotives, and five compound Mallet locomotives from the Baldwin Locomotive Works. The Prairie locomotives will weigh 215,000 lbs., with 151,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 69 in.; Belpaire boiler, with a working steam pressure of 210 lbs.; Great Northern Ry. standard steel tubes, 2¼ in. in diameter and 18 ft. 6 in. long; Great Northern Ry. specification steel firebox, 127 in. x 67 in.; grate area, 59.3 sq. ft.; tank capacity, 8,000 gallons of water, and coal capacity, 13 tons. The Pacific locomotives will weigh 227,000 lbs., with 151,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 69 in.; Belpaire boiler, with a working steam pressure of 210 lbs.; Great Northern Ry. standard steel tubes, 2¼ in. in diameter and 21 ft. long; Great Northern Ry. specification steel firebox, 127 in. x 67 in.; grate area, 54.6 sq. ft.; tank capacity, 8,000 gallons of water, and coal capacity, 13 tons. The Atlantic locomotives will weigh 208,000 lbs., with 103,000 lbs. on the drivers; cylinders, 15 and 25 in. x 26 in.; diameter of drivers, 73 in.; Belpaire boiler, with a working steam pressure of 210 lbs.; heating surface, 3,439 sq. ft.; 300 steel tubes, 2¼ in. in diameter and 18 ft. 6 in. long; Great Northern Ry. standard steel firebox, 127 in. x 67 in.; grate area, 54.4 sq. ft.; tank capacity, 8,000 gallons of water, and coal capacity, 13 tons. The Mallet locomotives will weigh 335,000 lbs., with 316,000 lbs. on the drivers; cylinders, 23 and 35 in. x 32 in.; diameter of drivers, 55 in.; Belpaire boiler, with a working steam pressure of 210 lbs.; heating surface, 5,700 sq. ft.; 442 steel tubes, 2¼ in. in diameter and 21 ft. long; Great Northern Ry. standard steel specification firebox, 117 in. x 96 in.; grate area, 78 sq. ft.; tank capacity, 8,000 gallons of water, and coal capacity,

13 tons. The special equipment for all includes: Golmar bell-ringers, Sterlingworth brake-beams, Ross-Mehan brake-shoes, Tower couplers, Adams & Westlake headlights for Prairie and Mallet locomotives, Ohio injectors, Great Northern Ry. standard journal bearings, piston and valve rod packings, Ashton safety valves, Leach sanding devices, Detroit sight-feed lubricators, Simplex springs, Crosby steam gages, and Standard Steel Co.'s driving, truck and tender wheel tires.

CAR BUILDING.

The Atlanta & West Point will shortly be in the market for dining cars.

The St. Louis & San Francisco has ordered five postal cars from the Pullman Co.

The Virginia & Southwestern is reported as in the market for 500 coal and box cars.

The Mobile, Jackson & Kansas City is in the market for additional freight equipment.

The Central of Georgia, it is reported, is soon to be in the market for additional cars.

The Chicago, Rock Island & Pacific has ordered three dining cars from the Pullman Co.

The Toledo & Ohio Central is reported to be figuring on the purchase of 1,000 coal cars.

The Atchison, Topeka & Santa Fe has ordered two café cars from the Pullman Company.

The New York Central & Hudson River has ordered 55 trailer cars from the St. Louis Car Co.

The Chicago, Peoria & St. Louis is reported in the market for freight cars, including dump cars.

The Detroit, Toledo & Ironton, it is reported, will shortly be in the market for passenger equipment.

The Gainesville Midland is having three coaches and one combination car rebuilt by F. M. Hicks & Co.

The Norfolk & Western, it is reported, has ordered 3,000 hopper cars and gondola cars of 100,000 lbs. capacity each.

The Pennsylvania, it is reported, is building at its Altoona shops 100 specially designed cars for carrying automobiles.

The St. Louis, Rocky Mountain & Pacific has ordered 10 box cars of 60,000 lbs. capacity from F. M. Hicks & Co.

The Louisville & Nashville, it is reported, has placed orders with its own shops for the building of upwards of 2,000 cars.

The Midland Valley has ordered four cabooses from the Mt. Vernon Car Co. Address Henry Wood, Vice-President, Girard Building, Philadelphia, Pa.

The Hocking Valley has ordered 20 passenger cars from the Pullman Company, and, it is reported, will soon be in the market for additional box cars.

The British Columbia Electric Railway Company, New Westminster, B. C., is to build 17 passenger cars and 10 work cars in its New Westminster shops.

The Kanawha & West Virginia has ordered 40 gondola cars of 60,000 lbs. capacity from F. M. Hicks & Co., and is having three coaches rebuilt by the same company.

The Richmond, Fredericksburg & Potomac will build 100 box cars of 80,000 lbs. capacity each in its own shops at Richmond. The details of these cars have as yet not been settled upon.

The Camden Interstate Railroad Company, Huntington, W. Va., has ordered 10 interurban cars from the Jewett Car Company. These cars will be mounted on standard steel 0-50 trucks furnished by the car company.

The Lehigh & Hudson, as reported in our issue of Jan. 26, has ordered 250 hopper cars, and 10 low side gondola cars from the South Baltimore Steel Car & Foundry Co., and 100 box cars from the Standard Steel Car Co.

The Hudson Companies, New York, have ordered 50 passenger cars for the North River tunnel service. Forty of these are to be made by the American Car & Foundry Co., and the remaining ten are to be built by the Pressed Steel Car Co.

The Boston Elevated, as reported in our issue of February 2, has ordered 50 Brill groove posts semi-convertible cars from the J. G. Brill Co. The bodies of these cars will measure 33 ft. 4 in. long, and they will be 45 ft. 10 in. long over vestibules. The special equipment will include the "easy access doors." Thirty-seven of these cars are for use on the East Boston tunnel division, and will have steel bottom framing and the rest are for surface operation.

The Chicago & Alton, as reported in our issue of February 2, has ordered, it is reported, 200 refrigerator cars of 60,000 lbs. capacity each, from the American Car & Foundry Company for April delivery. These cars will be 40 ft. long over end sills, 9 ft. wide over side sills, and 7 ft. 5 in. high. The special equipment will include the American Steel Foundries bolsters, Damascus brake-beams, Climax couplers, Miner draft rigging, National Malleable Castings Company's journal boxes, and American Car & Foundry Company's wheels.

The Boston & Maine has ordered six café cars from the Pullman Company for July, 1906, delivery. These cars will have a capacity for 24 dining and 40 passengers. They will measure 72 ft. 6 in. long over end sills by 9 ft. 8 in. wide over side sills by 14 ft. 4 in. high. The bodies and underframes will be of wood. The special equipment includes National Hollow brake-beams, Westinghouse air-brakes, Magnus Metal Company's brasses, Gould couplers, M. C. B. standard journal boxes, Pintsch light, Gould steel platforms, Monitor roofs, Railway Steel Spring Company's springs, and Pullman vestibules and standard six-wheel trucks.

The Mexican Central, as reported in our issue of Jan. 19, is in the market for 750 box cars of 60,000 lbs. capacity, 160 single deck stock cars of 60,000 lbs. capacity, and 75 flat cars of 80,000 lbs. capacity. The box cars will weigh 31,500 lbs., and measure 37 ft. 6½ in. long, 9 ft. 7 in. wide, and 13 ft. 3 in. high, over all. The stock cars will weigh 29,500 lbs., and measure 34 ft. 10 in. long, 8 ft. 9 in. wide, and 12 ft. 7¾ in. high, over all. The flat cars will weigh 26,500 lbs., and measure 34 ft. 10 in. long, 9 ft. wide and 4 ft. 2½ in. high, over all. The special equipment for all will include: American Steel Foundries' bolsters, National-Hollow brake-beams, Westinghouse air-brakes, Mexican Central brasses, Tower couplers, Wagner doors for box cars, and Mexican Central doors for stock cars, Westinghouse friction draft rigging, Soule dust guards, McCord journal boxes, Sherwin-Williams paint, Mexican Central corrugated iron roofs for box and stock cars, Pittsburg Steel & Spring Co.'s springs and Mexican Central trucks.

The Great Northern has ordered 3,000 box cars of 80,000 lbs. capacity and 500 flat cars of 80,000 lbs. capacity from Haskell & Barker; 15 non-vestibule first-class coaches, 12 second-class coaches, and three dining cars from Barney & Smith; 10 combination baggage, mail and express cars of 60,000 lbs. capacity, 10 baggage cars of 60,000 lbs. capacity, and eight mail cars, as reported in our issue of Jan. 12, from the American Car & Foundry Co.; and 25 first-class coaches, as reported in our issue of Jan. 26, and 10 sleeping cars from the Pullman Co. The box cars will weigh 35,700 lbs., and measure 40 ft. 7⅝ in. long, 9 ft. 1⅝ in. wide, and 12 ft. 9½ in. high, over all. The flat cars will weigh 27,400 lbs., and measure 40 ft. long, 8 ft. 6 in. wide and 3 ft. 9 in. high, over all. The non-vestibule first-class coaches will weigh 94,000 lbs. and the second-class coaches will weigh 93,350 lbs., both the non-vestibule first-class and second-class coaches will measure 60 ft. long, 8 ft. 10 in. wide and 9 ft. 6 in. high, inside measurements. The dining cars will weigh 56,000 lbs., and measure 54 ft. 2½ in. long, 9 ft. 9 in. wide, and 14 ft. 2 in. high, over all. The combination baggage, mail and express cars will weigh 106,000 lbs., and measure 73 ft. 8⅝ in. long, 9 ft. 10 in. wide and 14 ft. 2½ in. high, over all. The baggage cars will weigh 102,000 lbs., and measure 68 ft. 8½ in. long, 10 ft. ¼ in. wide, and 14 ft. 2 in. high, over all. The mail cars will weigh 56,000 lbs., and measure 54 ft. 2½ in. long, 9 ft. 9 in. wide, and 14 ft. 4 in. high, over all. The first-class coaches will weigh 117,750 lbs., and the sleeping cars will weigh 121,000 lbs., both first-class coaches and sleeping cars will measure 72 ft. 6 in. long, 8 ft. 10 in. wide, and 9 ft. 6 in. high, inside measurements. The special equipment for box and flat cars will include: Haskell & Barker steel bolsters and brake-beams, Great Northern Ry. brasses, Tower couplers, Haskell & Barker door fastenings, doors, draft rigging, dust guards, journal boxes, inside metal roofs for box cars, steel trucks and wheels. The special equipment for the rest of the cars will include: American Steel Foundries bolsters, National-Hollow brake-beams, Great Northern Ry. solid brasses, Tower couplers, Forsyth curtain fixtures and Pantasote curtain material for non-vestibule first-class, second-class, dining, first-class and sleeping cars; Great Northern Ry. standard draft rigging, Harrison dust guards, Haskell & Barker journal boxes, Pullman paint, Standard Steel Car Co.'s platforms for non-vestibule first-class, second-class, dining and first-class coaches, and Pullman platforms and seat for sleeping cars; Simplex springs, Great Northern Ry. standard trucks, Pullman vestibules for second-class, dining, first-class and sleeping cars and Standard Steel Car Co.'s wheels.

BRIDGE BUILDING.

BRAZIL, IND.—Bids are wanted February 9 for building an iron bridge in Clay County.

BROOKLYN, N. Y.—Bids were recently opened by the Brooklyn

(N. Y.) Grade Crossing Commission for a large number of steel railroad and highway bridges to be built on the line of the proposed Brighton Beach improvements. The lowest bid for the bridges was from Milliken Brothers, of New York, and for the fences from the Wayne Iron Works, of Philadelphia. The road will run about four miles on an embankment, and one and one-half miles in a cut.

CARTHAGE, TENN.—Bids will be asked some time this spring by L. A. Ligon, Mayor, for building a steel bridge 500 ft. long, across the Cumberland river, to cost $50,000. W. M. Johnson is County Clerk.

CHESTER, S. C.—Bids are wanted by J. O. Darby, County Supervisor, for building a small steel bridge over Sandy river, in Chester County.

CLAY CENTER, NEB.—Bids are wanted February 13 by the Board of County Commissioners, for all the bridges that may be wanted in Clay County for one year. W. F. Griess is County Clerk.

EASTPORT, ME.—The Washington County Railroad has commenced placing a draw in the bridge which crosses the channel separating this place from Perry, Me.

FALL RIVER, MASS.—A bill has been introduced in the State Legislature providing for a new commission to build a bridge to replace the present Slade's Ferry Bridge. It is proposed that the New York, New Haven & Hartford Railroad shall pay 60 per cent. of the cost, other electric roads 10 per cent., and the balance to be paid by the city of Fall River, by Bristol County, and by a number of other towns which will be benefited by the new structure; the remaining 30 per cent. not to exceed $500,000.

FLORIDA.—On February 1 the United States Senate passed the bill, previously passed by the House of Representatives, authorizing a bridge across the navigable waters of St. Andrew's Bay, Florida. (Feb. 2, p. 36.)

HALLISON, N. C.—Bids will be asked early in the summer by the County Commissioners for putting up a steel bridge 600 ft. long, over Deep river, in Moore County. Gilbert McLeod, of Carthage, can give information.

LEBANON, O.—Bids are wanted February 28, at the County Auditor's office, for building a steel bridge, 175 ft. long, over Little Miami river, at Morrow, in Warren County. Walter Hinkel is County Surveyor.

LOUP CITY, NEB.—Bids are wanted March 6, by C. F. Beushausen, County Clerk, for building all the bridges that may be needed in Sherman County for one year.

MOBILE, ALA.—On January 29 the House of Representatives passed the bill, previously passed by the United States Senate, authorizing the Mobile Railway & Dock Company to build a bridge or viaduct across the water between Cedar Point and Dauphin Island in Mobile Bay.

NASHVILLE, TENN.—Residents are agitating the question of building two new bridges over the Cumberland river, one at Jefferson street and one in the central part of the city. The County Court at its April meeting will be asked to decide whether they shall be built or not.

OLIVET, S. DAK.—Bids are wanted April 3, by J. W. Wipf, County Auditor, for putting up a number of steel bridges in Hutchinson County, each from 40 ft. to 150 ft. long, over the James river.

OSHKOSH, WIS.—The Lake Superior & Southern will ask bids early this spring for putting up a number of bridges on its proposed road, from Huron Bay on the Northern Peninsula of Michigan southwest, via Lake Michigamme. George A. Young, of Oshkosh, Wis., is Construction Engineer.

PARKERSBURG, W. VA.—Bids are being asked by C. H. Shattuck, President of the Parkersburg, Marietta & Interurban Railway, for building an iron bridge 2,500 ft. long, to carry street car tracks over the Little Kanawha river. W. E. Stout is County Clerk.

PENNSYLVANIA.—The United States Senate on February 1 passed the bill, previously passed by the House of Representatives, extending the time for commencing construction of a bridge across the Monongahela river, by the Counties of Washington and Westmoreland, Pa. (Feb. 2, p. 36.)

SELKIRK, MANITOBA.—The Canadian Pacific is considering plans for building a steel swing bridge over the Red river, which is about a half mile wide at this place.

SHARPTOWN, DEL.—Residents of this place are agitating the question of building a bridge over the Nanticoke river.

SHREVEPORT, LA.—A bill extending the time for commencing construction of a bridge across the Red river by the city of Shreveport, La., was passed by the House of Representatives on January 29, and by the United States Senate on January 31.

SPRING GREEN, WIS.—Bids are being asked by R. F. Mercer for building a steel drawbridge, to cost about $16,000, over the Wisconsin river. Charles Junge is County Clerk, Baraboo, Wis.

TORONTO, CAN.—The City Engineer estimates the cost of a bridge to connect Wellesley street with Sparkhall street, over the Donn Valley, at between $150,000 and $200,000.

WAYNE, NEB.—Bids are wanted February 20 by Charles W. Reynolds, County Clerk, for some steel bridge work.

YANKTON, S. DAK.—On January 29 the House of Representatives passed two bills, both previously passed by the United States Senate, extending the time for commencing and completing combined railroad, highway bridges across the Missouri river at this place, one to be built by the Yankton, Norfolk & Southern Railway Company, and the other by the Winnipeg, Yankton & Gulf Railroad Company. (December 29, 1905, p. 207; January 19, p. 20.)

Other Structures.

BIRMINGHAM, ALA.—Bids are asked February 2 for building the proposed union passenger station for the Birmingham Terminal Company.

GUADALAJARA, MEX.—Plans have been approved by the government officials for the proposed central station for La Electra, S. A., of Guadalajara, at a cost of about $300,000, and which will take about one year to complete. The Chief Engineer is Manuel de la Mora.

HATTIESBURG, MISS.—Plans, it is reported, are being made by the Mississippi Central to put up large car shops at this place.

JOHNSON CITY, TENN.—The Southern, it is said, is about to let a contract for building a new passenger station at this place.

LOS ANGELES, CAL.—The Southern Pacific is planning to put up a large freight house, with rooms to hold general offices, to cost about $200,000.

NEW YORK, N. Y.—The Long Island road has bought 50 acres of land near Hunters Point, which will be used for a site for a large freight yard. The plans which have been filed show that a creek running through the property is to be widened to 150 ft. and dredged to a depth of 40 ft., and stone bulkheads will be built on each side. About $200,000 will be spent for tracks and new buildings.

TRENTON, N. J.—The Pennsylvania, it is reported, has completed plans for putting up a freight house and office building three stories high.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA WESTERN.—See Illinois Central.

ALASKA RAILROAD.—Andrew F. Burleigh, of New York, who represents a syndicate, is in Washington seeking a subsidy for a railroad from Cordova into the interior of Alaska.

AUGUSTA & COLUMBIA.—Application has been made by a company under this name, in South Carolina, for a charter to take over the Augusta-Aiken Electric Railroad, operating 23 miles of road connecting Augusta, Ga., and Aiken, S. C., and to build 52 miles of road to Columbia; also for permission to operate the entire line with either steam or electric motive power. It is proposed to enter Columbia over the Seaboard Air Line bridge.

BALTIMORE & OHIO.—An officer writes that there is no truth in the report that this company will build an extension of its Valley branch to connect with the Norfolk & Western, nor will the company build a line paralleling the Southern between Strasburg and Harrisonburg. Negotiations are in progress with the Southern by which the B. & O. will be able to run through trains from Harper's Ferry, where the Valley branch connects with the main line of the B. & O., to Lexington, Va., instead of making the change at Strasburg as at present. (January 26, p. 28.)

BESSEMER & LAKE ERIE.—The Western Allegheny branch of this road, which originally extended from Kaylor to Queen Junction, is to be extended, it is said, eastward from Kaylor to East Brady, where connection is to be made with the Buffalo & Allegheny Valley division of the Pennsylvania. Work is under way from Rosepoint west to Newcastle, a distance of eight miles. At Rosepoint a large steel viaduct 900 ft. long and 100 ft. high over Slippery Rock creek has just been completed. The road is to be ultimately extended from Newcastle to Youngstown and Girard, Ohio.

BOSTON & RHODE ISLAND ELECTRIC.—An officer writes that this company, which was recently incorporated in Massachusetts, is to build an electric line from Boston through Hyde Park, Foxboro, Mansfield, North Attleborough, and Attleborough to Providence. Charles H. Blood, of Fitchburg, is interested. (January 26, p. 28.)

CANADIAN PACIFIC.—This company, it is reported, will build a

branch from its line near Woodstock, N. B., southwest to Bancroft, Me., about 28 miles.

This company has been authorized by the Dominion Government to build an additional line through to Georgian Bay from Peterboro. This will give the company another terminal on the upper Canadian lakes. The new line runs right through Grand Trunk territory.

CARDENAS & JUCARO.—This company, which operates about 185 miles of railroad in Cuba, is building an additional 38 miles.

CARUTHERSVILLE & WESTERN.—A charter has been granted this company, in Missouri, to build a railroad from Caruthersville to Derring, in Pemiscot County, a distance of 12 miles. The offices of the company will be at Caruthersville, and the incorporators include J. M. Blower, of Chicago, and H. C. Schultz and S. F. Reynolds, of Caruthersville.

CENTRAL CALIFORNIA TRACTION.—Bonds have been issued by this company to secure funds to build its proposed road from Stockton, Cal., to Lodi and Woodbridge. Eight and one-half miles of track has been laid in Stockton.

CHARLESTON, PARKERSBURG & WESTERN.—An officer writes that this company, which was recently chartered in West Virginia, will build a railroad from Charleston, W. Va., north via Sissonville, Spencer and Elizabeth to Parkersburg, a distance of 60 miles. The line has been located for a distance of eight miles, and contracts are to be let this year. A. S. Alexander is President and C. P. Peyton, Chief Engineer, both of Charleston, W. Va. (January 19, p. 21.)

CHICAGO & SOUTHERN TRACTION.—This company is planning to operate an electric line from Chicago to Kankakee, 56 miles, and proposes to take over the Chicago Electric Traction.

CHICAGO, BURLINGTON & QUINCY.—This company has filed amended articles of incorporation in Wyoming. It is understood that the Burlington will not use its Alliance-Guernsey branch as a main line through Wyoming, but will extend its Holdrege-Cheyenne line west through southern Wyoming to Salt Lake City. Branches from a point on this line near Laramie, south to connect with the Denver-Lyons line, and north to a connection with the Frannie-Thermopolis now under construction south toward the Wind River Indian Reservation, would fill out this general scheme of development. The Guernsey line could then be extended to a connection with the Denver-Frannie north and south line in Wyoming at a point in the coal and iron fields about 50 miles north of Laramie, and eventually southwest to a connection with the main line running from Holdrege through Cheyenne and southern Wyoming. With the completion of this work the Burlington would have direct connection from Denver to the Pacific northwest, and also from the east to Salt Lake City.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—See Indianapolis & Louisville below.

CUBA EASTERN.—In connection with this road there has been organized the Northeastern Cuba, to build an extension of 65 miles in Santiago County, starting from the present eastern terminus at La Maya on the Ponupo branch and running through a section at present without railroad facilities.

DELAWARE, LACKAWANNA & WESTERN.—An officer writes concerning the proposed cut-off, to be built by this company between Delaware, N. J., and Portland, Pa., that surveys are being made to determine the most feasible route for bettering the grade. The line is being run by way of the Stanhope-Netcong meadows. The distance is about 20 miles. Nothing has as yet been determined upon. (December 29, p. 207.)

This company is asking bids on a double track through Bergen Hill. The tunnel is to parallel the present tunnel at about 50 ft. between centers. We understand bids will be closed February 17.

DOVER & SOUTH BOUND.—This company, it is said, has rails ready to be laid on the extension of the Dover & South Bound. Work is under way from the present southern terminus at Richlands to a point on the Atlantic Coast line between Wilmington and Goldsboro.

ERIE.—Bids are asked for building a four-track road through Bergen Hill, Jersey City, N. J., to parallel the present two-track tunnel. An open cut is to be made through the rock of Bergen Hill, with an average depth of 70 ft. and about 4,500 ft. long. The material excavated is to be moved to the west end to form embankments for passenger connections to existing lines operated by the Erie. There will be about 120,000 cu. yds. of earth and 180,000 cu. yds. of rock to be excavated, and 15,000 cu. yds. of concrete masonry to be built. A company to be known as the Penhorn Creek has been incorporated to build this short line.

ILLINOIS CENTRAL.—Announcement is made by W. J. Harahan of this road, that the contract for building the new line between Corinth, Miss., and Haleysville, Ala., about 80 miles, has just been let. The cost of the work will be $5,000,000, and the contract calls for completion of the extension by January 1, 1907. The Alabama Western was incorporated by I. C. interests some time ago to build this extension. Contracts reported let to C. D. Smith & Company, of Memphis, Tenn., and to John Scott & Sons, of St. Louis, Mo., for building 42 miles of this line from Corinth, Miss., south. The contractors have opened an office at Corinth, Miss., and they will sublet some of the work, which is very heavy.

INDIANA HARBOR.—This company has opened its line from Indiana Harbor, near Chicago, south to Danville, Ill., a distance of 108 miles. Grading has been completed on the branch from Indiana Harbor southeast to Dune Park, Ind., 18 miles, and track will be laid shortly.

INDIANAPOLIS & LOUISVILLE (C. I. & L.).—An officer writes that grading contracts have been let to Williams & MacRitchie; to the Pound Construction Company, and to Thomas Glynn, for building this company's lines from a point on the main line of the Chicago, Indianapolis & Louisville one mile north of Quincy, Ind., southwest through Cataract, Jordan, Patricksburg, Clay City, Howellsville and Midland, to Victoria on the Illinois Central. Work is to be commenced at once, and other contracts will be let shortly. Maximum grades will be 0.9 per cent. There will be two steel bridges. L. W. Parker is President, and W. A. Wallace, Chief Engineer, both of Chicago.

INTERBOROUGH (NEW YORK CITY).—It is announced that by March 1 the express trains of the Subway will be run as far north as the Ship Canal, thus giving through service from the Battery to American League Park. The three-track road is now complete up to the Kingsbridge station of the New York & Putnam division of the New York Central at Bailey avenue, the Bronx. Until the bridge over the canal at 225th street is completed the terminal will be at 215th street. The first station north of the present terminal at 157th street is 167th street, St. Nicholas avenue, and Broadway, directly opposite the entrance to American League Park. The tracks there are 110 feet underground, and the station and tunnel were hewn out of solid rock. The station has been built to handle big crowds, and two elevators, with capacities of 100 persons each, will carry passengers to the surface. Subway tickets will be put on sale at the box office windows at the ball park to avoid congestion at the subway ticket offices when people are going home from a game.

KETTLE VALLEY.—Surveys are being made by this company for an extension from Grand Forks, B. C., to Franklin, a distance of 40 miles, and work is to be started early in the spring.

MIDLAND AIR LINE RAILWAY & NAVIGATION.—This company, recently organized in Arizona, to build a railroad from Des Moines, Iowa, to Port Arthur, Tex., has filed its incorporation papers in Iowa. It is claimed that the company has secured about 80 per cent. of the right of way from Texas to the Missouri line, and is negotiating for the balance. The company is incorporated for $1,000,000. J. W. Crawford, J. O. Bleaksley, J. N. Brown and D. F. Keeler, of Lamoni; M. L. Temple, of Osceola, and A. W. Davis and M. C. Betts, Pleasanton, Iowa, are incorporators.

MONTANA, TABOR & EDMONTON.—Incorporation has been asked by L. M. Johnson, of Lethbridge, Alberta, for a company under this name, to build a number of branch lines from the international boundary through that Province.

NEVADA NORTHERN.—An officer writes that the line of this proposed road is from Cobre, Nev., a point 140 miles west of Ogden, south to Ely, a distance of 138 miles. Grading has been completed for 70 miles and 17 miles of track laid. The road is being built to carry copper from the mines around Ely, and is owned by the Nevada Consolidated Copper Co. The contractor for this work is the Utah Construction Company, of Ogden, Utah. The work will be light, maximum grades being 0.7 per cent., and maximum curvature six degrees. The company is planning to build 10 miles of road connecting the mines with the smelter. This work will be much heavier than that on the main line. It is expected to have the road completed about May 1, and the branch to the mines about July 1. (January 12, p. 13.)

NEW YORK, OKLAHOMA & PACIFIC.—A charter has been granted a company under this name in Arkansas to build a railroad from Rogers, Ark., west to Folsom, N. Mex. The company is capitalized at $20,000,000, and will have its general office at Alva, Okla. and Rogers, Ark. The proposed route is from Rogers to Pryor creek and Claremore, Ind. T., thence through Hominy, Blue, Lamont, Jefferson, Alva, Beaver City and Mineral City to Folsom, N. Mex. The proposed road will traverse the coal fields of Indian Territory, the wheat belt of northern Oklahoma and reach the copper mining section of New Mexico.

NORTHEASTERN CUBA.—See Cuba Eastern above.

PENNSYLVANIA ROAD.—Charters have been granted to Pennsylvania to the following companies, of all of which Edson Ripley of Sherman, N. Y., is President: Northern Middlesex Street Rail-

way; Chenango Northern Street Railway, Midland Street Railway, Central Newcastle Street Railway; Chenango Street Railway, and the Newcastle Northern Street Railway.

Rio Grande, Sierra Madre & Pacific.—An officer writes that the proposed extension of this road will run from Nueva Casas Grandes, Mexico, southeast to Santa Maria Valley, up this valley and south, [illegible] Galiana, El Valle, Cruces, Namiquipa, Santana and Temosachic to San Pedro, through a timber section owned by W. C. Greene, of New York, a distance of 180 miles. Fifty miles of the work will be heavy. The maximum grades will be 1 per cent. There will be four steel bridges and five tunnels. W. C. Greene, New York, is President, and J. P. Hallehan, of El Paso, Tex., Chief Engineer. (January 19, p. 31.)

St. Louis Manufacturers' Railway.—According to a St. Louis newspaper, the lines of this company are to be extended so as to make a St. Louis entrance for the Kansas City Southern. The principal business of the road at present is switching and transfer service, and it is controlled by interests connected with the Anheuser-Busch Brewing Association. Adolphus Busch is President. According to the report, the brewers are dissatisfied with their existing railroad connections, and they propose to branch out in such a way as to have competition in all directions. They propose to bridge or tunnel the Mississippi so as to connect with the railroads terminating at East St. Louis; and in the other direction their plans do not stop short of the Gulf of Mexico and, apparently, Puget Sound.

Southern of Alberta.—Incorporation has been asked for by a company under this name, in Alberta, to build a number of railroads in that Province. J. J. Hill is said to be back of this project.

Southern Railway.—This company, it is reported, has asked bids for building yards at Cumberland Gap. The work includes the laying of five miles of track, also building a round-house and a new turn-table.

Spartanburg & Northern.—Announcement has been made by this company that its proposed road will be built from Spartanburg, S. C., to the North Carolina state line, where connection will be made with the South & Western, now under construction from the coal fields of Kentucky, Tennessee and Virginia. Application for a charter for the S. & N. is to be made at Columbia, S. C., by Ralph K. Carson, of Spartanburg, who is attorney for the road, and who has bene securing rights-of-way. G. L. Carter, of the S. & W., is President.

Sugar Creek & Northern (W. & L. E.).—An officer writes that this proposed road will be almost an air line from Bolivar, Ohio, northwest to Orrville, via Sugar Creek, a distance of 26 miles. Contracts are to be let this week, and work will be commenced at once. The maximum grade will be 0.4 per cent. The work includes the building of several large bridges over Tuscarawas river and Sugar creek. F. A. Delano, of Chicago, is President; B. A. Worthington, Vice-President; H. T. Douglas, Jr., Chief Engineer, both of Pittsburg.

Susquehanna Central.—A charter has been granted this company, in Pennsylvania, with a capital of $1,000,000, to build 100 miles of railroad through Clearfield, Center and Clinton Counties, Pa. James K. Gardener, of Ridgeway, is President.

Tampa Northern.—Under this name a company has applied for a charter in Florida to build a railroad from Tampa north. Financial arrangements are said to have been made and the first 45 miles of road is to be built at once. Contracts are being let for the material needed for construction. It is supposed that the road will cross the state line into Georgia and form a connection with the Atlanta, Birmingham & Atlantic. Benjamin Thompson, of Tampa, is Chief Engineer.

Wheeling & Lake Erie.—See Sugar Creek & Northern above.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—Potter, Choate & Prentice, New York, are offering at 96 and interest $1,250,000 adjustment 4 per cent bonds of 1995. This block is part of an authorized issue of $51,728,000, and makes $51,346,000 now outstanding. They are secured by a mortgage upon nearly all the property of the A., T. & S. F., being subject only to the $146,634,500 general mortgage 4 per cent bonds outstanding.

Atlantic Coast Line.—The gross earnings for the half year ended December 31 were $11,524,970, an increase of $1,020,150, and net earnings $3,859,869, an increase of $91,546.

Buffalo, Rochester & Pittsburg.—The gross earnings for the six months ended December 31 were $4,589,491, an increase of $401,408; net earnings $2,145,250, an increase of $404,215.

Central of Georgia.—This company has sold to Blair & Company, New York, $1,020,000 4½ per cent. equipment notes.

Chicago & Alton.—The gross earnings for the six months ended December 31 were $6,230,203, a decrease of $451,263; net earnings $1,961,111, a decrease of $559,928.

Chesapeake & Ohio.—This company has sold to Kuhn, Loeb & Company $1,000,000 first mortgage 4 per cent. guaranteed bonds of 1944, of the Big Sandy Railroad Co. The proceeds of the sale will be used to redeem the C. & O. 5 per cent. collateral notes maturing April 1, 1906, which were secured chiefly by the above Big Sandy bonds.

Chicago, Cincinnati & Louisville.—The President of this company says that the earnings are now sufficient to meet operating expenses, and that the line is earning as much as it did when it was leased to the C., H. & D.

Cincinnati, New Orleans & Texas Pacific.—The gross earnings for the six months ended December 31 were $4,032,506, an increase of $312,797; net earnings $951,831, an increase of $92,424.

Erie.—The gross earnings for the half year ended December 31 were $25,859,999, an increase of $2,107,451; net earnings were $7,858,689, an increase of $480,406.

Illinois Central.—The gross earnings for the half year ended December 31 were $25,319,222, a decrease of $551,381; net earnings $7,626,167, a decrease of $1,158,536.

Lehigh Valley.—The gross earnings for the six months ended December 31 were $17,472,248, an increase of $1,768,132; net earnings $7,227,676, an increase of $678,211.

Long Island.—Kuhn, Loeb & Company, New York, have bought $4,500,000 refunding 4 per cent bonds of 1949. These are part of an authorized issue of $45,000,000, of which $17,891,000 are outstanding. They are guaranteed by the Pennsylvania and will be used to pay for construction.

New York, New Haven & Hartford.—The shareholders of the Naugatuck R. R. have voted to sell the entire property to the N. Y., N. H. & H. The Naugatuck consists of 57 miles of road between Naugatuck Junction, Conn., and Winsted, and four miles between Watertown and Waterbury. The N. Y., N. H. & H., which owns three-fourths of the $2,000,000 capital stock, will assume all liabilities and pay $6,016,575 cash, being $300 per share plus accrued dividends.

New York, Ontario & Western.—The gross earnings for the six months ended December 31 were $4,023,779, an increase of $364,311; net earnings, $1,225,150, an increase of $69,157.

Norfolk & Western.—Brown Brothers & Company, Philadelphia and New York, have bought $3,000,000 divisional first lien and general mortgage bonds of 1944, making $11,000,000 now outstanding of the $35,000,000 authorized. The proceeds will pay for improvements on the Cincinnati division. The same bankers have also bought $3,000,000 equipment trust certificates, being series D, E and F of this issue. Series A, B and C, previously sold, amounted to $3,800,000. The new certificates are secured by 23 locomotives and 2,800 cars, now under construction or being delivered.

The gross earnings for the half year ended December 31 were $13,886,878, an increase of $2,108,588; net earnings $5,584,327, an increase of $812,156. The average mileage operated was 1,834, an increase of 65 miles. The largest proportionate increase in expenses was in maintenance of way; the operating ratio, 60 per cent., is the same as last year.

Pennsylvania.—The gross earnings of the lines east of Pittsburg for the year ended December 31 were $126,760,212, an increase of $16,730,200; net earnings, $38,860,762, an increase of $5,142,800. The lines west, directly operated, show increases of $2,021,200 and $2,139,500, respectively, in gross and net earnings.

Pennsylvania Company.—Kuhn, Loeb & Company, New York, have bought $20,000,000 collateral trust 4 per cent. bonds, issued by the Pennsylvania Company, and guaranteed by the Pennsylvania Railroad Company. The proceeds of the sale of these bonds will be used to pay for construction already carried out, and to be carried out during 1906.

St. Louis & San Francisco.—Hallgarten & Company, New York, have bought $3,300,000 4 per cent. refunding bonds of 1951, making $63,404,000 now outstanding of the $85,000,000 authorized. Of the $3,300,000, $3,300,000 will be used to retire $2,050,300 6 per cent. second mortgage. Series A, B and C, maturing November 1, 1906, and the remaining $1,000,000 is the amount available this year for improvements under the terms of the mortgage.

Southern.—The gross earnings for the half year ended December 31 were $26,604,444, an increase of $1,674,610; net earnings $8,016,681, an increase of $406,135.

Wheeling & Lake Erie.—The gross earnings for the six months ended January 31 were $2,900,293, an increase of $578,245; net earnings $829,981, an increase of $28,810.

GENERAL NEWS SECTION

NOTES.

The Delaware, Lackawanna & Western is having 27,000 signal flags made at the Old Ladies' Home at Elmira.

The gravity freight yards of the Missouri Pacific in the East Bottoms, Kansas City, have just been put into use.

A bill has been introduced into the legislature of New York to require two motormen on each train of the Elevated roads in Brooklyn.

The Committee on Railroads of the Massachusetts legislature has rejected the petition of Representative Dyer that the use of chemical fire extinguishers on passenger cars be compulsory.

A Chicago press despatch says that on February 5th and 6th 25,000 passengers were carried to the Southwest on tourist or other low-rate tickets. The movement has been delayed on account of the absence of cold weather.

Increases in wages are reported of conductors on the Pensacola division of the Louisville & Nashville; enginemen on the Norfolk & Western; track laborers on the New York Central, and track and bridge men on the Chesapeake & Ohio.

According to a Harrisburg paper, the Pennsylvania will, after the first of July next, require all cars in all trains to be equipped with air brakes; and after Jan. 1, 1907, the company will accept no cars from connections which are not suitable to be moved in heavy train service.

The Railroad Commission of Texas has compiled a statement which shows that during the calendar year 1905 earnings of 12 Texas railroads were divided as follows: Texas local traffic, $10,456,180.39; Texas interchange traffic, $7,721,191.98; interstate and international traffic, $26,169,597.47.

In a suit for $10,000 damages brought at Philadelphia by a man who was run over by a Pennsylvania Railroad cab, it appeared that the railroad company, while acknowledging ownership of the cabs, denied liability for damages, because each individual cab is leased daily to the man who drives it.

According to the report of the Secretary of State of Pennsylvania, the street railroads of Pennsylvania earned during the year of 1905, $37,889,000, and their surplus, after $9,554,296 in dividends was paid, was $123,072. The total capitalization of these roads was $387,112,703, and their mileage was 3,169.

The superintendent of the Indian school at Carlisle, Pa., asks for an appropriation for traveling expenses for members of the school of $19,000, instead of $13,000 as in former years, for the reason that the railroads have discontinued the reduced rates heretofore given for transportation of pupils and employees of the school.

A press despatch from Hazleton, Pa., says that the fashion of carrying funeral parties in trolley cars, which has been common in that region, has been seriously interfered with by a new law of the state, under which the Health Department forbids the transportation of coffins in cars, except when they are encased in the regulation boxes, and these boxes are too large to be taken in the usual trolley cars.

At Montreal last week ten passengers were admitted to a train of the Canadian Pacific on one ticket and a half. The party consisted of a little French Canadian woman with nine children, only one of whom was old enough to pay half fare. This beats Arkansas. When this story last appeared in print it came from St. Louis, and the heroine, who hailed from Arkansas, boasted of only eight children.

The two-cent fare bill, passed by the legislature of Ohio, was signed by the Governor on February 8 and goes into effect 30 days after the date of signing. The two-cent requirement applies to all passengers on the railroads of Ohio, for all distances over five miles. Officers of the Pennsylvania, the Erie, the Wabash and the New York, Chicago & St. Louis are quoted as saying that the railroads will not contest the constitutionality of the law.

The Railway Commission of Canada has issued a code of rules regulating car service (demurrage) on the railroads of the Dominion. In a preamble to the rules the commissioners say that demurrage is reasonable and affords only a fair and just distinction between shippers or consignees who exercise diligence and those who do not. The commission has not had time to decide on the merits of the claim that the railroads ought to be penalized for delay in supplying cars or in transporting goods. The board also refuses to recognize the "average" method of charging for demurrage, by which a consignee who unloads a large number of cars promptly thereby earns an allowance on other cars which he may detain. Objection has been made to demurrage bureaus, but the commission holds that as long as they are only bureaus they are unobjectionable. The board "hopes that railroad companies will endeavor to secure the fair and impartial administration of the rules; in case it is found that the giving of preferences cannot be otherwise prevented, it may be necessary to abolish the car service toll entirely." The new rules are in several respects more liberal to the public than the old. Where unloading is hindered by inclement weather the local agent must decide whether or not to make allowances therefor, instead of referring the case to some distant authority after the full bill has been paid. If the railroad cannot tell the consignee at 7 a. m. where to find his car, he is free to go away and come again at noon, and the period of free time will then begin at noon. Additional free time is allowed on coal and lumber and other building material.

Anthracite Coal Shipments.

The *Wall Street Journal* gives the following figures of shipments of anthracite coal by months for the last three calendar years. The shipments during the month of January, 1906, were 5,458,048 tons.

	1905.	1904.	1903.
January	4,408,578	4,134,245	5,964,950
February	3,922,601	4,326,269	5,070,608
March	5,258,537	4,375,033	5,211,450
April	5,278,401	5,407,786	5,044,998
May	6,005,158	5,285,079	5,156,449
June	5,844,052	5,728,795	5,436,497
July	4,546,743	4,623,527	5,577,495
August	5,041,838	4,331,854	5,169,402
September	5,082,232	3,967,600	4,654,444
October	5,205,364	5,131,542	3,925,642
November	5,421,584	5,419,878	4,091,148
December	5,395,113	5,063,144	4,259,748
Total	61,410,201	57,492,522	59,362,830

The Canadian Railway Commission.

The Canadian Railway Commission has amply justified itself and, in spite of the detractions of political opponents, has become established as one of the indispensable institutions of the country. Since February 1, 1904, it has issued over 1,500 orders and held hearings in 350 cases. At present, the applications to the court average about 35 a day, although three-quarters of these will be privately settled.

The officers of a railroad passing through the property of a farmer in Ancaster applied to the court for leave to fill up a trestle bridge. The farmer used the passage under the bridge for his cattle, and objected to exchanging this safe method of going to and fro for the level crossing the company offered him. Under the old dispensation he would have had to go to Ottawa to look after his rights. As it was, he was able to drive into his neighboring town, where the commission sat, and after a short hearing he got a decision that his objections were well founded, and the application of the railroad was disallowed

A. Scobell, a farmer on the line of the Kingston & Pembroke Railway, has a cedar grove. The freight rate quoted to Mr. Scobell on cedar, whether in the form of ties or poles, was twice as high as the rate on other poles. Mr. Scobell appealed against the rate, and appeared before the commission in person. He got an order from the court reducing the rates to the level of the general rates for that class of freight, the court holding that the rates in force obstructed instead of encouraging business, and that the railroad was restricting output with the obvious design of making sure that the road's future needs in the way of ties would be provided for. *Toronto (Can.) Globe.*

Diversion of Cars.

A circular requesting information regarding diverted cars has been issued by the Committee on Car Service of the Association of Transportation and Car Accounting Officers. The month of November, 1905, is taken as a representative period, and the committee is endeavoring to secure information regarding a series of 1,000 consecutive numbers in box-car equipment of each railroad in order to obtain a basis from which to judge of the prevalence of the practice referred to.

The present car situation appears to be that of a practically pooled equipment, without the power being possessed by any central authority to order cars from one territory to another. The result is that the flow of equipment is governed largely by the flow of the traffic; and it is extremely difficult for lines that are essentially originating lines to obtain that proportion of the return flow of the equipment upon which they must necessarily depend for a constant and equable supply. The whole subject of the requirements of the

traffic and the car supply in connection therewith, equally distributed, is a problem which must be met sooner or later. A step in the right direction was taken at the time that per diem was adopted, but further steps must be taken before full advantage may be obtained from the advance already made. Under the per diem plan an incentive has been provided to induce more prompt release and handling of equipment, but so long as The American Railway Association Code of Car Service rules are not observed there appears to be no incentive to induce the flow of equipment in accordance with the ownership of the cars, rather than along the lines of the flow of traffic.—*Equipment Register.*

Canadian Grain Shipments.

The total shipments of grain by water from Fort William, Ont., and Port Arthur, during the navigation season just closed, amounted to 37,063,000 bushels, of which 30,235,000 bushels were wheat; 828,000 oats, barley, etc., and 6,000,000 bushels, last year's crop. Of this amount, 10,600,000 bushels went to Buffalo, and 600,000 to Erie, 10,000,000 bushels being carried in United States vessels. The largest single cargo was 351,017 bushels, which is the record for the Great Lakes. There are about 40,000,000 bushels of wheat left in the Canadian West to be exported, of which perhaps one-tenth will be shipped by railroad during this winter and the remainder by water next year.—*Consular Report.*

Contesting Rate Reductions in Kansas.

On December 20, the Railway Commission of Kansas, using as a basis rates in states of comparatively dense traffic, ordered a reduction of 5 per cent. in grain rates from all points in the state to Atchison and Kansas City, Kan. On December 21 an order was issued for a reduction of 1 mill a ton mile in rates on lump coal from the principal coal fields, except where the existing rate was not in excess of 7 mills a ton mile or 50 cents a ton to destination. Considerable reductions were made in carload rates on syrup, hardware and paper, and in less than carload rates on coffee, sugar, beans, canned goods and syrup from Wichita, Hutchinson, Salina, Independence and Coffeyville. Substantial reductions in salt rates accompanied the placing of those rates on a distance basis, and other cuts threaten to follow. Representatives of Kansas lines, having decided that the reduced rates did not net a fair return upon the capital invested, decided at a meeting on January 17 to carry their case to the courts. As proof of the confiscatory character of the present reductions and of similar reductions which might be made in the future each road is preparing at great expense, estimated on one line alone at $10,000, four statements showing gross and net earnings on commodities carried within the state, on all traffic carried across the state. The suits, which have been filed in the United States circuit court at Topeka by the Chicago, Rock Island & Pacific, Atchison, Topeka & Santa Fe, Missouri Pacific, Union Pacific, and practically all other lines operating in Kansas, ask to have the acts of the commissioners and the laws giving them authority to fix rates set aside as null and void because those acts and laws are repugnant to the fourteenth amendment to the constitution of the United States, requiring that no one may be deprived of property without due process of law. The commission having executive, administrative and legislative duties is not a court, and therefore the adjudication of a rate to be unreasonable by such a body, the decision going into effect in thirty days, is not due process of law, and the requirements that a rate once fixed by the commission shall remain in force until changed by it, no provision being made for a rehearing, gives that body arbitrary power.—*Kansas City Journal.*

The Trans-Andine Railroad.

The first section of this road, from Santiago to the foot of the Andes, was opened recently. This project was approved by the Chilian Congress in 1903, and the government was authorized to call for bids for the construction of the road on the basis of a guaranty of 5 per cent. interest on the cost of the work. The total amount of the bids was $6,750,000. The contracts for the work were divided between Clark & Co., and S. Pearson & Son, of London, and William R. Grace & Co., of New York, and were formally accepted by the Chilian government on June 9, 1904. The line will shorten the time to Buenos Ayres by six hours.

The Nub.

A press despatch from Chicago quotes the representative of the General Managers' Association as saying:

"The nub of the railroads' contention is that rate regulation will be in the hands of men not qualified to exercise such great power without damage and danger to the railroads and the country. Control of rates is too much power to be entrusted to any body of men. But a rate regulation measure of some kind will become a law and the railroads are concentrating their efforts not to defeat the President's program, but to secure the most favorable legislation.

"It is generally supposed that the essential objection to all the bills introduced is the maximum rate clause, giving the proposed bureau power immediately to enforce its rulings. That is a very objectionable feature, but not as bad as the failure of these bills to provide for the right kind of a bureau, because in the last analysis Congress itself cannot deprive the railroads of their constitutional right of appeal by injunction. The injunction is an unpopular instrument, however, and there should be some means of staying the enforcement of maximum rates other than that of injunctions.

"The worst feature of the Hepburn bill is that nothing is said of the personnel of the interstate commission. It would seem incongruous to pay an interstate commissioner more salary than a supreme court chief justice gets. But even though salaries sufficient to get the right men be provided, what assurance is there that the right men will be chosen? The last selections of commissioners were by no means happy ones. One of them was outrageous."

Iron and Steel in Canada.

The year 1905 has been prosperous for the iron and steel industries in Cape Breton. The output of pig iron was 162,000 tons, and of steel 163,500 tons; of 80-pound rails since June, 1905, 44,000 tons, and rods for the year 47,100 tons. The balance of the steel output has been made into blooms and billets, most of which material has found a market in Canada. A shipment of 30 tons of rails has been made to the Boston Elevated Railway for experimental purposes on the sharp curves of that road. During the year two blast furnaces were continuously in operation, and in November a third was placed in use. The Nova Scotia Steel and Coal Company (Ltd.), had a prosperous year, with an output of 120,000 tons of coke, 58,000 tons of pig iron, and 22,000 tons of steel.—*Consular Report.*

Fire and Acid Proof Smoke Stacks.

The accompanying illustration shows a "Transite" asbestos smoke jack made by the H. W. Johns-Manville Co., New York. These jacks are made of "Transite" asbestos lumber, which material is absolutely fire, gas and weather proof. It weighs about one-fifth as much as cast-iron, can be worked and handled in the same manner as wood, and can be adapted to various slopes and conditions. A number of large railroads, it is claimed, have already adopted these jacks.



A Transite Asbestos Smoke Jack.

The material from which the jacks are made has a large field of usefulness, not only in railroad work but in every line of construction. It was originally designed for fireproofing flooring and insulation of electrically propelled cars, and was first used by the Interborough Rapid Transit Company, of New York City, both in their elevated and subway cars. The lumber, as its name indicates, is made of asbestos, varying in thickness from ⅛-inch to 1-inch, and is offered in standard size sheets of 40 inches by 40 inches or 42 inches by 48 inches.

Refrigerator Cars in Arkansas and Georgia.

All of the strawberry shipping associations along the Frisco lines in Arkansas have received notice during the last few days that the Armour Refrigerator Company will make no contract with the Frisco this year, and will withdraw all its refrigerator cars from service on that road. It is thought probable that the Frisco will use Rock Island refrigerator cars. These are said to be good ones, but the test will come when the season is at its height, when icing and inspection are the necessary points for success. While there has been much complaint along the Frisco that the Armour charges for icing were too high, there has been little or no complaint as to the quality of the service rendered. * * * If the new service proves satisfactory the retirement of the Armours will not be regretted.—*Memphis Commercial Appeal.*

Senator Clay, of Georgia, has presented in Congress a petition of the Fruit Growers' Association of Marshallville and Montezuma, Georgia, praying for the enactment of legislation which will place the private car lines under the control of the interstate commerce commission. This petition is a radical departure from the general run of the fruit growers' addresses to Congress, the majority of which in the past few months have been asking Congress to let the private car lines alone. It has been strongly suspected, however, that agents of the private car lines have secured the former petitions through promises and threats and altogether against the wishes of the fruit growers.—*Atlanta Journal.*

An Instrument of Transportation.

"While sitting in the smoking room of a sleeper the other day between Porfirio Diaz and Torreon, I was introduced to a familiar character, a Chinaman named Foonchuck. He is naturalized, wears short hair and talks better English than a great many Americans. He owns all the railway eating houses between Diaz and the City of Mexico, and is estimated to be worth over a million in gold. He came to Mexico from California 20 years ago, with less than $20, and went to work as cook for the railway construction company. He now owns three truck farms and raises all vegetables used in his line of hotels. He also owns a farm of 11,000 acres in the state of Tamaulipas. He employs 100 Mexicans and 25 Chinese coolies. He says the average pay to the Mexicans is 44 cents a day, and the Chinese 75 cents. When I asked him why he paid the Chinese more than the Mexicans, he said he could work the Chinese 18 hours a day if necessary, and that it was like pulling teeth to get four hours a day out of the peons. He says the peons live on 72 cents a week."—*Hobart (Ok.) News.*

The Railroad Literary Bureau in Chicago.

"The railroad campaign is in the hands of President Spencer, of the Southern Railway, who is looking after things in Washington. The literary section, so-called, began business last May and has cost about a quarter of a million dollars. Formerly there were eight men on the staff. Now I am doing what little is to be done. We circulated scores of documents—statistics, arguments, addresses, etc., and millions of copies of them. We sent out 10,000,000 copies of the little circular, 'What are the facts?' * * * Our next campaign will be in connection with the 2-cent fare agitation in many of the western states. I do not think the railroads will have much difficulty defeating such measures." The 2-cent fare agitation is worst in Ohio, Indiana, Illinois, Michigan and Iowa.—*Slason Thompson.*

Manufacturing and Business.

The Miller-Collins Co., Constructing Engineers, will, after February 15, occupy its new offices in the Columbia building, 29 Broadway, New York.

Dodge & Day, Mechanical, Electrical and Architectural Engineers, Philadelphia, Pa., will on March 1st move into their new offices in the Drexel Building, Philadelphia.

About 150 Branch Managers and Salesmen of the H. W. Johns-Manville Co., New York, attended the annual convention of the company, which included a banquet at the New York Athletic Club on the evening of February 2.

The American Car & Foundry Company has purchased for its works at Manchester, England, 100 tools consisting of "Boyer" hammers and drills from the Consolidated Pneumatic Tool Company, London, which is a foreign branch of the Chicago Pneumatic Tool Company.

The Pilling Air Engine Co., Detroit, Mich., announces that J. L. Pilling, formerly Vice-President and Sales Manager, severed his connection with the company the first of the year and is no longer concerned in the business in any way. The company is sole owner of Pilling and Kruse patents, Mr. Kruse being the mechanical engineer.

James A. Milne, who has for a number of years been Comptroller of the Allis-Chalmers Company, Milwaukee, has accepted the position of General Manager of Allis-Chalmers-Bullock, Limited, Montreal, Canada, to become effective on or before May 1, 1906. Mr. Milne's place as Comptroller will be filled by L. F. Bower, heretofore manager of the Allis-Chalmers electrical works at Cincinnati.

The Interborough Rapid Transit Company has just given an order to the Electric Cable Company, of New York, for 15 miles of cables insulated with voltax, the new potential insulating compound. This compound, which for the past eight years has been given severe tests, offers advantages over rubber insulation and is rapidly coming into prominence. Recent tests show that this material has withstood high potential insulation, resistance and melting point tests that no other compound yet discovered has withstood. The cost of this material is about 20 per cent. less than rubber insulation.

Iron and Steel.

The Denver, Enid & Gulf is in the market for 50 miles of No 1 60-lb. relaying rails.

Orders for 50,000 tons of rails recently let include about 30,000 for the New York, New Haven & Hartford, 12,000 for the Pacific Electric, and in the Central states 10,000 for electric roads.

A recent shipment of 5,000 tons of rails for the Harriman lines in Mexico has been delivered at Galveston. It was the first consignment of an order for 14,000 tons for Mexican extensions which was given to Altos Hornos de Bilboa, and is being shipped direct to Galveston from the Spanish port of Bilboa. These rails, it is said, have been shipped direct to Mexico at a saving in price of $5 per ton, under the cost of rails at American mills. The Harriman lines have also ordered from Altos Hornos de Vixcaya, also of Spain, 21,000 tons of rails, which will also be shipped via Galveston for use in Harriman projects. Other large orders are said to be pending with European firms, owing to the better deliveries and better prices obtainable.

The Pennsylvania has placed a supplementary order for 12,500 tons of standard rails with the Cambria Steel Company. This makes the total tonnage 242,500 tons placed by this company for 1906 delivery. Other contracts let include 5,000 tons for the New Orleans Great Northern Railroad; also about 4,000 tons for electric lines, including 2,000 tons for the St. Louis Traction Company, 500 tons for an electric line on the Pacific Coast and 500 tons for an eastern company. Contracts have been let for 2,100 tons of steel for the Brighton Beach extension of the Brooklyn Rapid Transit, and a small order for the Florida East Coast Line, with the American Bridge Company. Twelve thousand tons of plates and structural shapes for lake vessels have been let to the Illinois and Carnegie Steel Companies.

OBITUARY NOTICES.

Alexander B. Coxe, Director of the Lehigh Valley, of Coxe Bros. & Co., and of other companies, died recently in Philadelphia. Mr. Coxe was one of the most influential men in the coal trade.

J. W. Thomas, President of the Nashville, Chattanooga & St. Louis, died in Nashville, Tenn., on February 12. Mr. Thomas was born in 1830, and from 1858 to 1863 was an agent of the Nashville & Chattanooga. For the next two years he was in charge of rolling stock, and then was made Auditor and Paymaster. He was appointed Superintendent in 1868 and General Superintendent in 1872. He was promoted to be General Manager in 1883, and the next year was elected also President. Since 1899 he has been President only.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Engineers' Club of Cincinnati.

At the regular monthly meeting of this club, February 15, a paper was read on "Some of the New Bridges on the Queen & Crescent Route," by A. W. Owen.

International Congress of Applied Chemistry.

The sixth International Congress of Applied Chemistry is to be held in Rome from April 25 to May 3. One of the sections of the Congress is devoted to metallurgy, and among the excursions will be one to the iron works of the Island of Elba. The subscription to the Congress is $4.

Iron and Steel Institute.

The annual general meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers on Thursday and Friday, May 10 and 11, 1906. In place of the ordinary autumn meeting, a joint meeting of the American Institute of Mining Engineers and of the Iron and Steel Institute will be held in London on July 23-29. The Lord Mayor of Lodon has consented to act as Chairman of the London Reception Committee, and will give a Conversazione at the Mansion House on the evening of July 24. The annual dinner will be held in the grand hall of the Hotel Cecil on Friday, July 27. A programme of the visits and excursions to be made during the meeting will be issued when the arrangements are sufficiently matured.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atchison, Topeka & Santa Fe (Coast Lines).—G. A. Davidson has been appointed Auditor, with office at Los Angeles, Cal., succeeding W. G. Taylor.

Buckhannon & Northern.—W. H. Newman, President of the New York Central & Hudson River, has been elected also President of the B. & N.

Chicago, Cincinnati & Louisville.—F. D. Hodgson, Acting Auditor, has been appointed Auditor.

Colorado Southern, New Orleans & Pacific.—J. H. Lauderdale, Chief Clerk to the Vice-President, has been appointed Assistant to the Vice-President.

Colorado Springs & Cripple Creek District.—The office of Frank Trumbull, President, has been removed from Denver, Colo., to New York. A. B. Parker, Vice-President of the Colorado & Southern, has been elected Vice-President, with office at Denver.

succeeding J. M. Herbert. J. S. Mackie has been elected Secretary, with office at New York.

Denver, Northwestern & Pacific.—D. H. Moffat is President; W. G. Evans, Vice-President; Thomas Keely, Treasurer, and F. B. Gibson, Secretary. The general offices are at Denver, Colo.

Des Moines, Iowa Falls & Northern.—W. A. Bradford, Jr., President of the Chicago, Cincinnati & Louisville, has been elected also President of the D. M., I. F. & N., with office at Cincinnati, Ohio. G. A. Fernald is Vice-President, with office at Boston, Mass. G. A. W. Dodge is Secretary and Treasurer, with office at Iowa Falls, Iowa.

East Tennessee & Western North Carolina.—F. P. Howe has been elected President, with office at Philadelphia, Pa., succeeding R. F. Hoke, resigned. G. W. Hardin, Superintendent, has been elected also Vice-President.

Fort Worth & Denver City.—J. S. Mackie has been elected Assistant Secretary, with office at New York, succeeding H. Bronner, resigned.

Great Northern of Canada.—F. Nicholls has been elected First Vice-President, succeeding James McNaught.

Louisiana & Northwest.—G. W. Hunter, Treasurer, has been elected also President, with office at St. Louis, Mo., succeeding J. J. Nelson, resigned.

Missouri Southern.—F. D. Stout has been elected President, with office at Chicago, Ill., succeeding J. H. Coulter.

New York & Harlem.—M. S. Barger has been elected Treasurer, succeeding W. S. Crane, resigned to engage in other business.

New York Central & Hudson River.—Louis Bender has been elected Assistant Treasurer, succeeding W. A. Greer, resigned to engage in other business.

Peoria & Pekin Terminal.—E. A. Burrill has been elected Vice-President and General Manager.

Richmond, Fredericksburg & Potomac.—W. D. Duke, General Manager, has been appointed Assistant to the President.

Rock Island Company.—James Campbell has been elected Director, Robert Mather, Member of the Finance Committee, and B. F. Yoakum, Chairman of the Board, all succeeding W. B. Leeds, resigned. Mr. Yoakum was also elected a member of the Finance Committee, succeeding Marshall Field, deceased.

St. Louis & San Francisco.—W. B. Leeds has resigned as a Director and member of the Executive Committee.

St. Louis, Rocky Mountain & Pacific.—The officers of this company are as follows: Henry Koehler, Jr., President; T. B. Harlan, Vice-President, both with offices at St. Louis, Mo.; J. H. Thompson, Vice-President and Consulting Engineer, with office at New York; J. van Houten, Vice-President and General Manager, with office at Raton, N. M.; C. Springer, Treasurer, with office at Cimarron, N. M.; H. P. Roseberry, Assistant Treasurer; A. H. Officer, Secretary and Auditor, both with offices at Raton, and W. H. Irvine, Assistant Secretary, with office at New York.

Tennessee.—H. S. De Vault has been appointed Auditor, with office at Oneida, Tenn.

Tionesta Valley.—F. K. Bradley, Assistant Treasurer, has been elected Treasurer.

Toledo & Western.—C. M. Stone has been elected President, succeeding Luther Allen, deceased.

Tonopah & Goldfield.—W. W. Keith, Assistant Treasurer, has been appointed Auditor, succeeding T. Thornton, deceased. W. L. Carden succeeds Mr. Keith.

Operating Officers.

Annapolis, Washington & Baltimore.—J. G. Masterton, Secretary and Treasurer, has been appointed General Manager, with office at Baltimore, Md.

Atchison, Topeka & Santa Fe.—C. H. Gaunt, Superintendent of Telegraph, has been appointed also Assistant General Manager, with office at Topeka, Kan.

Atlantic & Birmingham.—C. B. Wilburn has been appointed General Superintendent, with office at Waycross, Ga.

Central New England.—O. M. Laing has been appointed Assistant Superintendent, with office at Hartford, Conn.

Chicago, Burlington & Quincy.—See Michigan Central.

Cincinnati, Hamilton & Dayton.—J. W. Anderson has been appointed Superintendent at Wellston, Ohio, succeeding T. A. Sweeney, transferred. J. M. Scott has been appointed Superintendent at Indianapolis, Ind., not at Wellston, as formerly reported.

Indiana Harbor.—F. T. Bowles, who was recently appointed Superintendent of this road, began railroad service in 1878 as a messenger in the office of the Master Mechanic of the Pittsburg, Cincinnati, Chicago & St. Louis, at Logansport, Ind. After three years he went to the Chesapeake & Ohio, where he served successively as locomotive fireman, engineman and conductor. In 1892 he went to the Chesapeake & Ohio Southwestern, now part of the Illinois Central, where, after five years, he was made road foreman of engines. In 1900 he went to the Lake Erie & Western in the same capacity, being appointed Superintendent of the Fort Wayne division of that road in 1902. The next year he was transferred to the Peoria division, where he was at the time of his recent appointment.

Lake Shore & Michigan Southern.—D. C. Moon, General Superintendent, has been appointed Assistant General Manager, succeeding E. A. Handy, promoted. H. A. Worcester, General Superintendent of the Michigan Central, succeeds Mr. Moon.

Michigan Central.—H. C. Nutt, General Superintendent of the Missouri district of the Chicago, Burlington & Quincy, has been appointed General Superintendent of the Michigan Central, succeeding H. A. Worcester. See Lake Shore & Michigan Southern.

Missouri, Kansas & Texas.—J. W. Walton, Superintendent at Denison, Texas, has been appointed Superintendent at Parsons, Kan., succeeding C. L. Harris. W. E. Williams succeeds Mr. Walton.

Ohio River & Western.—W. R. Crumpton has been appointed General Manager, succeeding J. K. Geddes, assigned to other duties.

Quebec Central.—J. H. Walsh, General Freight, Passenger and Baggage Agent, has been appointed General Manager.

Richmond, Fredericksburg & Potomac.—C. W. Culp, Assistant General Manager, has been appointed General Superintendent. The offices of General Manager, Assistant General Manager, and Superintendent have been abolished.

Santa Fe Central.—S. B. Grimshaw, General Manager, Assistant to the President, and General Freight and Passenger Agent, will also perform the duties of Car Accountant, hitherto under the charge of C. W. Fay.

Seaboard Air Line.—J. M. Shea, Trainmaster at Richmond, Va., has been appointed Superintendent of the Sixth division, with office at Jacksonville, Fla.

Tionesta Valley.—P. M. Newman, Traffic Manager, has been elected General Manager, and the office of Traffic Manager has been abolished.

Traffic Officers.

Chicago, Cincinnati & Louisville.—T. C. Beyland has been appointed Acting General Freight Agent, with office at Cincinnati.

Chicago, Rock Island & Pacific.—S. H. Johnson, Assistant General Freight Agent at Little Rock, Ark., has been transferred to Chicago.

Des Moines, Iowa Falls & Northern.—S. L. Straus has been appointed General Freight and Passenger Agent, with office at Des Moines, Iowa.

Georgetown & Western.—A. Campbell has been appointed General Freight and Passenger Agent, with office at Georgetown, S. C.

Great Northern.—H. S. Jones has been appointed Assistant General Freight Agent at Seattle, Washington.

La Crosse & Southeastern.—A. L. Eidemiller has been appointed General Freight and Passenger Agent, with office at La Crosse, Wis., succeeding H. L. Chadwick, resigned.

Quebec Central.—E. O. Grundy has been appointed General Freight and Passenger Agent, succeeding J. H. Walsh, promoted.

White Pass & Yukon.—J. H. Rogers has been appointed Traffic Manager, with office at Vancouver, B. C., and Skaguay, Alaska.

Engineering and Rolling Stock Officers.

Atlanta & West Point.—W. N. Cox, Superintendent, has been appointed Superintendent of Transportation and Machinery, with office at Montgomery, Ala., and the office of Superintendent has been abolished.

Chicago, Anamosa & Northern.—D. M. McKey, Chief Engineer, has resigned.

Chicago, Cincinnati & Louisville.—J. K. Sroufe has been appointed Engineer of Maintenance of Way, with office at Peru, Ind. Geo. Dickson has been appointed Master Mechanic, with office at Peru, Ind.

Erie.—C. H. Morrison, formerly Signal Engineer, has been appointed Acting Electrical Engineer, with office at New York.

Lehigh Valley.—J. N. Mallory, formerly in the Department of Tests of the New York Central, has been appointed Mechanical Engineer of the Lehigh Valley, succeeding L. L. Bentley, resigned.

Ohio River & Western.—J. K. Geddes, General Manager, has been appointed Chief Engineer in charge of construction. J. F. Scott has been appointed Master Mechanic at Zanesville, Ohio, succeeding V. B. Stubbins.

LOCOMOTIVE BUILDING.

The Lehigh & Hudson is in the market for six locomotives.

The Virginia & Carolina Coast has ordered seven locomotives from the American Locomotive Co.

The Marion & Rye Valley, Marion, Va., has ordered one 16-in. x 24-in. 10-wheel locomotive from the Lima Locomotive & Machine Co.

The Burrs Ferry, Browndell & Chester, Houston, Texas, has ordered one 37-ton and one 45-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Genesee & Wyoming has ordered one simple Mogul locomotive from the American Locomotive Company for April, 1906, delivery. This locomotive will weigh 110,000 lbs., with 95,000 lbs. on drivers; cylinders, 18 in. x 24 in.; diameter of drivers, 50 in.; straight top boiler with a working steam pressure of 170 lbs.; total heating surface, 1,530 sq. ft.; 240 tubes, 2 in. in diameter by 11 ft. 2 in. long; firebox, 96 in. x 34½ in.; grate area, 22.9 sq. ft.; tank capacity, eight tons of coal and 4,000 gallons of water. The special equipment will include Westinghouse air-brakes, Nathan injectors, and sight-feed lubricators.

CAR BUILDING.

The Kanawha & Michigan is receiving bids for additional rolling stock.

The Norfolk & Southern is in the market for 300 box and 50 flat cars.

The Danbury & Harlem Traction Company will soon order additional cars.

The Columbus & Lake Michigan is in the market, it is reported, for freight equipment.

The Portland & Rumford Falls has ordered 25 flat cars from the Pressed Steel Car Co.

The Cumberland Railway & Coal Co. has ordered 100 coal cars from Rhodes, Curry & Co.

The Canadian Pacific has ordered 200 steel coal cars from the Dominion Car Co., of Canada.

The Long Island, it is reported, is about to place orders for upwards of 60 passenger cars.

The Western Maryland is in the market for 13 passenger cars and additional freight equipment.

The Union Railroad has ordered 500 hopper cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The Mexican Central is in the market for upwards of 1,500 stock and box cars of 60,000 lbs. capacity each.

The Wells Fargo Co., New York, has ordered 10 express cars from the American Car & Foundry Company.

The Ingoldsby Automatic Car Company, St. Louis, Mo., it is reported, is asking bids on a large number of dump cars.

The Birmingham Paint & Roofing Co., Birmingham, Ala., has purchased one tank car from O. R. Whitney, New York, for immediate delivery.

The Hocking Valley, as reported in our issue of February 9, has ordered 12 coaches, eight baggage cars and two parlor cars from the Pullman Co.

The Nevada Northern, San Francisco, Cal., is in the market for 10 steel hopper ore cars. It has already asked for proposals from several car builders.

The Midland Valley, in addition to the four cabooses reported as ordered from the Mt. Vernon Car Company, in a previous issue, has, it is reported, ordered 300 gondola cars of 80,000 lbs. capacity from F. M. Hicks & Co.

The Mississippi Central has ordered 40 Hart convertible cars of 80,000 lbs. capacity from the Rodger Ballast Car Co. for May and August, 1906, delivery. These cars will measure 36 ft. long and will be equipped with Westinghouse brakes, Tower couplers, Common Sense bolsters and Miner tandem draft rigging. It is also reported that this company has ordered upwards of 200 freight cars, to be built in its own shops.

The Fairmont Coal Co., Baltimore, Md., has ordered 3,000 composite hopper coal cars of 100,000 lbs. capacity each, from the South Baltimore Steel Car & Foundry Co. These cars will be fitted with steel underframes; 2,000 will be used by the Fairmont Coal Co., and 1,000 by the Somerset Coal Company. The aggregate cost of these cars is between three million and three and a half million dollars. Delivery is to begin in May.

The Los Angeles & Redondo is building 10 interurban cars and 10 flat cars of 80,000 lbs. capacity at its Redondo shops. The interurban cars will be 44 ft. 6 in. long and 8 ft. 3 in. wide, over all. The special equipment will include: Jones & Laughlin axles, Westinghouse air-brakes, Keeler curtain fixtures, Pantasote curtain material, Sherwin-Williams paint, Monitor roofs, Heywood Bros. & Wakefield seats and Griffin wheels. The flat cars will be 40 ft. long, 9 ft. wide and 4 ft. 2 in. high, over all. The special equipment will include: Jones & Laughlin axles, Simplex bolsters and brake-beams, Tower couplers, Miner draft rigging, McCord journal boxes, Farist Steel Co.'s springs and Griffin wheels.

The Norfolk & Western, as reported in our issue of Feb. 2, has ordered 2,500 hopper bottom class H J gondola cars of 100,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co., and 1,000 drop bottom class G I gondola cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co. The class H J gondola cars will weigh 38,000 lbs. and measure 34 ft. 6 in. long, 9 ft. 6 in. wide and 10 ft. ½ in. high, over all. The class G I gondola cars will weigh 38,100 lbs., and measure 38 ft. 2½ in. long, 8 ft. 11½ in. wide and 4 ft. high, inside measurements. The special equipment for both includes Norfolk & Western standard brake-beams, Christie brake-shoes, Westinghouse air-brakes, Ajax brasses, Major couplers and Butler draft rigging for G I cars, Major and Melrose couplers for H J cars, McCord journal boxes, Railway Steel Spring Co.'s springs, and "Diamond" trucks.

BRIDGE BUILDING.

BIRMINGHAM, ALA.—The Board of Revenue is planning to build a steel bridge over the Warrior river, to cost $20,000.

CARLYLE, ILL.—Bids are wanted February 15 by H. H. Santel, at Trenton, for building a bridge. B. J. Rensing is County Clerk.

CITY OF MEXICO, MEXICO.—Engineers of the National of Mexico have reported favorably on the proposition to build a bridge over the Rio Grande River at Metamoras to connect with the St. Louis, Brownsville & Mexico railroad at Brownsville, Texas. Its cost is estimated at about $500,000.

COLORADO SPRINGS, COLO.—Bids will be asked this spring by the Board of County Commissioners for putting up a bridge 75 ft. long, over Fountain creek, in El Paso County. The proposed structure, if built of concrete, will have two spans, and if of steel only one span. Henry McAllister is Deputy County Clerk.

KEARNEY, NEB.—Bids are wanted February 27 by E. H. Miller, County Clerk, for building all the bridges that may be needed in Buffalo County for one year.

MARYVILLE, TENN.—A committee has been appointed to determine when bids shall be asked for building a bridge over Little river, near Rockford, in Blount County, Tenn. C. F. Broady can give information; Clay Cunningham is County Clerk.

MENASHA, WIS.—The Chicago, Milwaukee & St. Paul is building a steel bridge, 100 ft. long, at a cost of $15,000, over the river at this place.

MINNESOTA.—On Feb. 7 a bill was introduced in the House of Representatives and referred to the Committee on Interstate and Foreign Commerce, authorizing the Wisconsin & New Duluth Bridge Co. to build a bridge across the St. Louis river between the states of Wisconsin and Minnesota.

MONTICELLO, GA.—Bids are wanted this spring by E. H. Jordan for building a steel or wood bridge, 800 ft. long, over Murder creek, in Jasper County.

MONTREAL, QUE.—Bids are wanted by the Grand Trunk Pacific March 12, for building a steel bridge at Cap Rouge.

OTTAWA, ONT.—Application will be made to the Dominion Parliament for the incorporation of the Minnesota-Canadian Bridge Company to build a highway bridge over the Rainy river at Pitchers' Point.

Owensboro, Ky.—The Chicago, Indianapolis & Evansville is making plans for building a bridge on the line of its proposed road over the Ohio river, at this place.

Paris, Ont.—The overhead steel bridge to be built by the Grand Trunk Railway will be commenced early in the spring.

Pembroke, Ont.—The following bids were received for the construction of the Clay Bank bridge: Substructure, low level and high level—Bourke & Wilson, $14,308—$16,490; Moran & Lynn, $11,-7.0—$1.3.4.; For the superstructure: Dominion Bridge Co., $10,-470—$14,225; Dickson Bros., $13,453—$16,737; Locomotive & Mach. Co., $17,370—$16,640. Contract awarded to Dickson Bros., of Campbellford, for the complete bridge, at $22,022.

Pine Bluff, Ark.—Bids will soon be asked by the Bridge Commissioner for building a steel bridge over the Arkansas river in Jefferson County. E. J. Kerwin, County Judge, is Chairman; Jesse R. Core is County Clerk.

Richmond, Va.—The Richmond & Chesapeake Bay Railway will build a viaduct 2,900 ft. long on its proposed road from this place north to Ashland. C. P. E. Burgwyn, Mutual Building, Richmond, is Chief Engineer.

Roswell, N. Mex.—The Chicago, Rock Island & Pacific, it is said, will build a bridge here.

St. Paul, Minn.—The Northern Pacific will build two bridges on the line of its proposed cut-off to Portland, Ore. The plans for the main bridge over the Columbia River and slough call for 17 spans with a total length of 3,540 ft. There will be six spans of 265 ft. each over the Columbia slough and nine spans 169 ft. each over the Columbia River on the Washington side, with a river draw 465 ft. long, allowing 200-ft. channels on each side of the pivot pier. This bridge and the one to span the Willamette will cost $3,000,000. Both bridges will be double-tracked. The Willamette bridge will have 21 concrete or stone piers, including the old pivot pier built by the Union Pacific in the Columbia River in 1889 which will be utilized by the Northern Pacific. The large steel bridge at Bismarch, N. Dak., for the Northern Pacific has just been completed.

St. Thomas, Ont.—For the proposed subway under the Michigan Central tracks at Ross street the road will erect the retaining walls and abutments and street and bridge work, while bids for excavating, paving, etc., will be asked for by the city.

Seebert, W. Va.—Bids are wanted March 6 by S. L. Brown at Marlinton, County Clerk, for building a steel bridge 40 ft. long over Stamping creek in Pocahontas County.

Victoria Harbor, Ont.—The Canadian Pacific will build terminals here. In connection with its proposed line from this place to Peterboro, three overhead bridges will be built at crossings of the Grand Trunk.

Waynesville, N. C.—Bids will be asked this spring by W. N. Noland for building an iron bridge 200 ft. long over Pigeon river, in Haywood County.

Other Structures.

Athens, Ga.—The Gainesville Midland has bought a site on which it will build new freight terminals.

Cleveland, Ohio.—According to newspaper reports officers of the Pittsburg & Lake Erie, the Baltimore & Ohio, the Wabash, and the Erie Railroads have reached an agreement and completed the plans for jointly putting up a union passenger station here to cost about $2,500,000. An option has been taken for a site.

Dallas, Texas.—According to the newspapers, plans are being made to at once put up a union passenger station and terminal. The arrangements are in the hands of Messrs Yoakum & Conner.

Jacksonville, Fla.—The Seaboard Air Line, it is said, will soon start work on extensive improvements in its freight yards here. The plans call for the building of two brick warehouses and the elevation of the yard to secure better drainage.

Justus, Ohio.—The Sugar Creek & Northern, which is part of the Wheeling & Lake Erie, will build shops at this place on its proposed line from Bolivar to Orrville.

New Westminster, B. C.—The Vancouver, Westminster & Yukon is planning to build large wharves and docks at this place.

Niagara Falls, N. Y.—The New York Central instead of enlarging its roundhouse at this place, it is said, will build a new one to hold 75 engines, and will also enlarge its yards.

Opelousas, La.—The Colorado Southern will build a new passenger station, and also a freight house, at this place.

Quebec, Que.—The improvements to be made here by the Canadian Pacific include crib work from Prince Edward street to connect direct with the north wall of the Louise docks, and two freight sheds, one 40 x 90 ft. and the other 60 x 90; also a new station.

Winnipeg, Manitoba.—The freight sheds of the Canadian Pacific at this place, recently damaged by fire at a loss of $10,000, will be rebuilt this spring.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Abilene Railroad.—This company has filed a charter in Texas with a capital of $200,000 to build a railroad from Hamlin, in Jones County, Tex., to Brady, about 100 miles; also to build a branch line from Anson to Stamford, 15 miles. The office of the company will be at Abilene. The incorporators include E. S. Hughes, W. G. Swenson, H. James, of Abilene; B. W. Fonts and C. C. Sanford, of Fort Worth, and others.

Albuquerque & Eastern.—Announcement is made that this company is to be built at once from a point on the Santa Fe Central to Albuquerque, and that the branch line to the Hagan coal fields will be completed within the next twelve months.

Apalachicola & Northern.—A contract is reported let to Richard Morey, of St. Louis, for building this company's proposed road from Apalachicola, Fla., to River Junction. Work has been begun at each end of the line, which will be about 83 miles long and will pass through a rich timber section. R. V. Coleman, formerly of the Georgia, Florida & Alabama, is General Manager.

Big Fork & Northern (Minnesota & International).—An officer writes that this road has been completed from North Home via Mizpah, Gemmell and Margie to Ripple, a distance of 31.3 miles. A. Guthrie & Co., of St. Paul, Minn., were the contractors.

Birmingham & Southwestern.—Application has been made by a company under this name, in Mississippi, with a capital of $5,000,-000, to build a railroad from Birmingham, Ala., via Hattiesburg, Miss., to Baton Rouge, La. Incorporators include: Former Governor A. H. Loningo, former Secretary of State J. J. Coleman, A. J. Hackett, of Jackson, Miss.; G. G. Gibson, of Birmingham; J. C. Dunlap, of Chicago; R. C. Oliver, of Hattiesburg; E. F. Ballard, of Waynesboro, Miss., and others.

Buffalo Subway.—Incorporation has been granted a company under this name, with a capital of $1,000,000, to operate an electric line through subways in the city of Buffalo, N. Y. The proposed route is from a point on Carolina street to the grounds of the New York Central & Hudson River, thence easterly beyond the city line to a point about 2,000 ft. beyond the Terminal Railroad of Buffalo, in the town of Cheektowaga, with a branch from the main line, at William street and Fillmore avenue to the intersection of Curtiss and Lovejoy streets. The directors include: Albert W. Bonynge and T. B. Chancellor, of Hoboken, N. J.; F. B. Bard, H. Peick, R. P. Peck, E. McInness and H. M. Spencer, of New York city, and F. S. McGraw and W. B. Cutler, of Buffalo.

California Roads.—According to Western papers, E. H. Harriman, A. W. Foster and E. P. Ripley, of the Sante Fe, have agreed upon a general plan for railroad extension into the northern territory. A new company is being organized, which is to take over the San Francisco & Northwestern (A., T. & S. F.), with its valuable Eureka terminals, also to take over Harriman and Foster's California & Northwestern line between Willits and Tiburon and San Francisco, and probably the North Shore road; and also to build 100 miles of road from a point north of Willits to the southern end of the San Francisco & Northwestern road, 31 miles south of Eureka. The proposed new company will form the nucleus of a northwestern California system, which, besides giving Eureka a rail outlet, will eventually extend along the coast to Portland, Ore., forming two trunk lines between Los Angeles and Portland. The immediate object of Messrs. Harriman, Foster and Ripley in wanting a joint rail line to Eureka, it is said, is to build up a big lumber traffic from the red wood forests.

Canadian Pacific.—Bids for track-laying, bridging and ballasting the Sudbury branch of this road between Romford and French River Crossing (40 miles), are wanted March 10 by J. W. Leonard, Manager of Construction, 112-118 King street, West, Toronto.

An officer writes that bids have been asked for extending the Manitoba & Northwestern section of this road from the present terminus, at Sheho, northwest, a distance of 16 miles, and thence west 27 miles.

This company has extended its Wetaskiwin branch on the Western division of its road from Camrose, Alberta, east to Daysland, 25.5 miles. On the same division the Lacombe branch has been extended from Alix, Alberta, east to Stettler, 24.4 miles.

Chesterfield & Lancaster.—An officer writes that grading has been commenced by A. H. Page & Son, who have the contract for building this proposed road from Ruby, S. C., via Hornsboro and Dudley to Lynches river, 18 miles. A. H. Page, of Cheraw, S. C., is President, and C. H. Scott, of Ruby, is Chief Engineer.

CHICAGO, MILWAUKEE & ST. PAUL.—A contract is reported let by this company to H. C. Henry for building that section of its Pacific coast extension which is to extend from Puget Sound to the eastern boundary line of the State of Washington. Contracts have already been given to MacIntosh Brothers, of Milwaukee, for building westward from the present terminus in South Dakota.

DELAWARE & HUDSON.—This company proposes to build a line around Wilkesbarre, Pa., to relieve the pressure on the tracks in the city and to secure more favorable grades.

GRAND TRUNK PACIFIC.—Bids are wanted by F. W. Morse, of Montreal, General Manager of this company, for building the section of the proposed road from Touchwood Hills to Edmonton, Alberta, about 450 miles. Application has been made to the Dominion Parliament by the company to organize the Grand Trunk Pacific Branch Lines Company, with authority to build branch lines as follows: From Moncton to Halifax; from the main line to St. Johns, N. B.; from various points on the main line to Montreal, to Ottawa and to North Bay; from the main line on the northeast of Fort William to a junction with the Grand Trunk north of Toronto, with the privilege of building a line to Sault Ste. Marie or Sudbury; from Winnipeg to the boundaries of Manitoba; from Brandon to the Grand Trunk Pacific main line, and to the international boundary; to Calgary from the G. T. P. main line; to Yorkton, Regina, Prince Albert, Battleford, Dawson City and Hudson Bay; from Calgary to the international boundary; from Vancouver to the Grand Trunk Pacific main line, and to a junction with the Pacific Northern and American Railway; and from the north shore of Vancouver island south, or southeast along the west side of the island to Victoria. The company also asks for authority to operate its own steamships and hotels, and to develop water power along the lines of its various roads.

Bids are wanted by this company, March 12, at the office in Ottawa, for building a section of its proposed road from Winnipeg to Superior Junction, and from Quebec to St. Maurice, the work to be completed by September 1, 1907.

IOWA TRANSFER.—An officer writes that this company, recently incorporated in Iowa, proposes to build a clearing yard in Des Moines for the purpose of expediting the interchange of car load freight between the various roads in that city. C. F. Hubbell is President; T. G. Ross, Vice-President; J. A. Wagner, Secretary and Treasurer. The company will not let any contracts, but will do the work with its own forces. The plans include the laying of two miles of track. This will be built early this spring. (January 26, p. 29.)

MEXICAN ROADS.—William Niven, an American of Balsas, state of Guerrero, Mexico, is promoting the organization of a company to build a railroad from Balsas down the valley of the Balsas river to Cayuca de Catalan, a distance of about 100 miles, through a section rich in mineral resources.

Surveys have been completed for a railroad which Carlos Romero, of Guadalajara, Mexico, will build from Taquesquite, state of Jalisco, to his mines. Contracts for the work will soon be let. Mr. Romero also owns a concession which he obtained from the federal government for the construction of a railroad from Etzatlan to Hostotipaquillo, in the same state.

MONONGAHELA SOUTHERN.—This company has given a contract to Foley Brothers for building a line seven miles long to connect with the Wabash-Pittsburg Terminal. The company is building a yard at the point of connection with the W. P. T., to hold 2,000 cars, and expects to have it completed by May of this year.

MORGAN'S LOUISIANA & TEXAS.—An officer writes that this company, which has completed grading for about one mile, at La Fayette, and one-half mile at Port Allen on its proposed extension from LaFayette, La., to Baton Rouge, asked for bids February 7 for building from LaFayette via Vuaux and Rosedale to Port Allen, La., 54.4 miles. The work includes the building of seven or eight bridges, the largest of which will be at the Chafalaya river. This is to have a 300 ft. draw span and a 200 ft. fixed span. C. G. Vaughn, 511 Natchez street, New Orleans, is Construction Engineer.

NORTH COAST.—This road is projected to run northwest across the State of Washington from Walla Walla, to Seattle. Most of the right of way has been bought and the necessary terminal facilities secured. The new road will be a considerable distance south of the proposed extension of the St. Paul to the Pacific coast. Its nearest point to that line will be probably in eastern Washington, where the North Coast will pass to the south of the Rattle Snake Mountains, while the St. Paul extension will run immediately to the north of these mountains.

PITTSBURGH & LAKE ERIE.—Contracts are reported let by the Vanderbilt interests to build a railroad from Beaver, Pa., to East Liverpool, O., 24 miles, with the intention of ultimately extending the line to Steubenville, O.

RICHMOND & CHESAPEAKE BAY.—This company, which has let contracts for building 10 miles of its proposed road from Richmond, Va., to Ashland, 15 miles, will have one viaduct 2,900 ft. long. Additional contracts will soon be let for building the remainder of the road. The company is planning also to build an extension from Ashland to Tappahannock. (December 22, p. 201.)

ROCHESTER, SCOTTSVILLE & CALEDONIA (ELECTRIC).—A charter has been granted this company in New York State, with a capital of $500,000, to build an electric railroad from Rochester, N. Y., to Caledonia in Livingston County. Among the directors are H. U. Brewster, J. N. Beckley and Senator Morton Lewis, of Rochester.

SAN FRANCISCO, IDAHO & MONTANA.—Work is reported already under way on this proposed road from Boise, Idaho, to Winnemucca, Nev. The proposed road passes through a rich timber section. An agreement has been made between the railroad and the city of Boise by which the road is to secure the right of way and a bonus of $250,000, half of which is to be paid on the completion of that portion of the proposed road from Boise over the Snake river, a distance of about 50 miles, and the balance when the road has reached San Francisco, 625 miles, either by direct line or by satisfactory connection at Winnemucca. The Pacific Construction Company, which is doing the work, has already 40 miles of ties laid, and has 3,000 tons of rails.

SEABOARD AIR LINE.—The Tallahassee Southeastern branch of this company has been opened from Tallahassee Southeast Junction, a point about three miles south of Tallahassee, Fla., south to Wacissa, a distance of 20 miles.

SEWARD PENINSULA.—This company, which is being financed by New York and Nevada capitalists, and which was organized under the charter of the Nevada Trust Company, proposes to build during the coming summer a line from Nome, Alaska, to Kougarok, a distance of 125 miles.

TEXAS CENTRAL.—An officer writes that a contract has been let to J. H. Owens, of Galveston, Texas, for building the proposed extension from Stanford, Tex., to a point 44 miles west, and that the contract called for the beginning of work by February 10. The work includes the building of one 75-ft. bridge. (January 5, p. 8.)

VIRGINIA & CAROLINA COAST.—Contracts are reported let by this company to the Hedges-Gosney Construction Company, and to the Farratt Construction Company, of Springfield, Mo., for building its proposed line from Roanoke, Va., south 123 miles. More than 20 miles of the line will be over water ways, covered either by trestles or by transfer boats.

WABASH PITTSBURG TERMINAL.—An officer writes that this company is building a branch from Long View, Allegheny County, Pa., to Millers Grove, four miles, for which a contract has been let to J. G. Corcoran & Co. Connection will be made at the latter place with the Monongahela Southern, which is owned by the United States Steel Corporation.

WASHINGTON NORTHERN (UNION PACIFIC).—This company, which was recently incorporated in the state of Washington, with $500,000 capital, probably in the Harriman interest, projects a railroad from Portland to Seattle and Everett, crossing the Colorado river at Kelso. The incorporators include: Jacob Furth, J. C. Trenhome and F. K. Stuverne, through the last named of whom extensive lands have been bought. According to the newspapers, negotiations have been completed whereby the Union Pacific has secured at a cost of about $1,000,000, 70 acres of tide lands for railroad terminals at Tacoma, Wash., the company agreeing to build terminals and warehouses within 20 months.

WESTERN MARYLAND.—Connection has been made on the Cumberland extension of this road completing the connection between the Western Maryland and West Virginia Central, and establishing a through line from the West Virginia coal fields to tidewater at Baltimore.

WESTERN TEXAS & GULF.—This company, recently incorporated with a capital of $500,000, proposes to build a railroad from San Angelo, Texas, to Big Springs and to Stanton, with the intention of ultimately extending the road north to Amarillo, Texas. E. H. D. Caston, J. T. Witt and E. P. Speers, all of Dallas, W. P. Edwards and J. W. Pinson, of Big Springs, are interested.

WHEELING & LAKE ERIE.—An officer writes that the line that is to be built in Ohio from Bolivar to Orrville, 22 miles, and known as the Sugar Creek & Northern, is being built to avoid curves and grades in the present line, and to effect a saving of about six miles. Contracts for the work have been let, it is said, to J. C. Carland & Co., of Toledo, Ohio.

This company will soon begin work building a yard at Huron, Ohio, to hold 1,200 cars. Contracts have already been let for building a slip 1,400 ft. long and 200 ft. wide, and for four ore conveyors and car dumpers. The company is now building 20 passing sidings at various points from Jewett to Toledo, to hold 80 cars each. The

company is also extending its yards at Ironville and South Toledo to hold 700 additional cars.

According to newspaper reports, arrangements have been completed for building a branch of this road from Steubenville to Toronto, Ohio, 10 miles, and construction work is to be begun at once. From Toronto the company can easily secure an entrance into East Liverpool. An officer writes denying the report that the company is making surveys for extensions in Greene County, Pa. The engineers have made a number of surveys to secure easier grades and curves, but none of these are now being seriously considered.

Yazoo & Mississippi Valley. This company is building a line from Helem, Miss., west and north, a distance of 12.8 miles towards Arnold. Grading is almost completed, and about half the track has been laid.

On the line from Silver City to Kelso grading has been completed for about 20 miles, and track laid for about 10. This line will be about 41 miles long, and will run via Midnight.

This company has completed its extension from Mattson, Miss., south for a distance of three miles.

On the Yarbough-Swan Lake cut-off this company has completed about 12 miles of road south from Yarbough, Miss. The line is projected to Swan Lake, an additional eight miles.

No action has been taken by this company on its projected cut-off from Etter, Tenn., to Lake View, Miss., six and one-half miles.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio. See Washington Branch.

Canadian Pacific. A meeting of the stockholders has been called for March 19 to approve an increase in the authorized capital stock from $110,000,000 to $150,000,000. There is now $101,400,000 outstanding and it is proposed to issue $20,280,000 more as soon as the new $40,000,000 is authorized. Shareholders are to have the right to subscribe to this issue at par at the rate of one share of new stock for every five shares of record of April 20. With Canadian Pacific selling at 174, the rights of this new issue are worth about $15 a share.

The C. P. has sold all its land in the vicinity of Edmonton, Alberta, amounting to about 500,000 acres, to an English syndicate, at a price said to be $4 an acre.

The gross earnings for the six months ended December 31 were $31,381,976, an increase of $4,229,954; net earnings $12,187,399, an increase of $3,042,651. Surplus after charges and dividends was $4,869,816, an increase of $2,417,285.

Colorado & Southern.—Hallgarten & Co., New York, are offering at 93¾ $17,000,000 4½ per cent. refunding bonds of 1935. These bonds are part of a total issue of $100,000,000 authorized last June, when the block above referred to was sold to these bankers. The proceeds of the sale are to be used to refund $8,000,000 of equipment trusts, to buy the Trinity & Brazos Valley, the Colorado & North-western, to build shops, to extend the Trinity & Brazos Valley to the Gulf, and for general additions and improvements.

Cumberland Valley.—See Dillsburg & Mechanicsburg.

Detroit United (Electric).—This company has bought the Detroit, Monroe & Toledo Short line at a price of about $40 per share. The D., M. & T. S. L. operates 50 miles of road from Toledo to Detroit and 4 miles from Monroe, Mich., to Lake Erie. It has outstanding $2,000,000 capital stock and $2,000,000 5 per cent. first mortgage bonds of 1933.

Dillsburg & Mechanicsburg.—The property of this company has been bought by the Cumberland Valley at a foreclosure sale for $50,000. The D. & M. has eight miles of road between Dillsburg Junction, Pa., and Dillsburg, and a two-mile branch. It has been, since 1873, operated by the Cumberland Valley, which holds the total outstanding $100,000 first mortgage 6 per cent. bonds of 1895 of the smaller company. It is said that the road will soon be operated by electricity.

Great Northern.—The 600,000 acres of ore lands belonging to this company are to be developed by a separate organization. The *Wall Street Journal* says that they have been leased to the U. S. Steel Corporation, on terms providing for a rising minimum production beginning with about 3,000,000 tons a year, and that a holding company with $120,000,000 capital will take over the property. The Great Northern Development Company, incorporated in Maine with $100,000 capital, is mentioned in this connection by another paper. It is understood that the stock of the new holding company will be offered to Great Northern stockholders at a figure which will give them valuable rights.

Intercolonial.—The gross earnings for the six months ended December 31 were $3,853,960, an increase of $232,697; the deficit was $71,259, comparing with a deficit of $482,755 at the end of the same period of 1904.

Minneapolis, St. Paul & Sault Ste. Marie. The gross earnings for the six months ending December 31 were $6,132,668, an increase of $1,492,972, net earnings, $3,451,749, an increase of $987,410.

Missouri, Kansas & Texas. The $10,000,000 4½ per cent. general mortgage bonds recently sold to Speyer & Co., New York, for $8,750,000, will be used as follows: $4,000,000 for reduction of grades and new alinements from the northern termini to the Red River, Texas, and other improvements; $1,000,000 for rail renewals, and the remainder to pay off equipment notes which would otherwise have to be paid out of future net earnings. (Jan. 26, p. 30.)

New York Central & Hudson River. The gross earnings for the month of January were $7,185,768, an increase of $1,141,310.

Panama. The United States Senate Committee on Appropriations has reported to the Senate the Urgent Deficiency bill, among the items of which is one of $650,000 "to be used as an advance to the Panama Railroad Company to pay for re-equipment of the company."

Rio Grande Western.—Spencer Trask & Company are offering at about 100 and interest a block of the $15,200,000 first mortgage 4 per cent. bonds of 1939 of this company. The bonds are a first lien on the main line and several branches, about 434 miles in all.

St. Louis & San Francisco. On February 9, the directors of this company decided to pass the quarterly dividend of 1 per cent. on the $16,000,000 4 per cent. non-cumulative second preferred stock. In 1898, 1 per cent. annually was paid on this stock. In 1899 and 1900 2 per cent., in 1901 3½ per cent., and since then 4 per cent.

Southern.—This company is to issue $200,000,000 development and general mortgage 4 per cent. 50-year bonds. Of the total amount, $15,000,000 is to be issued immediately for the following purposes: $4,962,774 to refund payments for equipment heretofore made and charged to capital; $3,501,000 to refund investments in securities of, and advances to, subordinate companies and for the acquisition of property not heretofore funded; and $6,536,220 for construction. Of the remaining $185,000,000, $31,158,000 is to be reserved to retire divisional prior lien bonds on property acquired for which no provision is made by the consolidated mortgage; $16,000,000 to retire, not later than April 1, 1909, collateral trust 5 per cent. bonds; $10,000,000 to pay, not later than July 1, 1908, for the Eastern division of the Tennessee Central and for immediate improvements; $18,008,000 to retire equipment capital obligations as they mature in the next 15 years; $10,000,000 to acquire capital stocks of certain leased lines, and, finally, $99,834,000 to provide for future acquisitions and betterments, bonds for the latter purpose to be issued in amounts not exceeding $5,000,000 each year. J. P. Morgan & Co. will purchase the $15,000,000 of bonds to be issued immediately and also the first $5,000,000 to be issued thereafter.

Southern Pacific.—Gross earnings for the six months ended December 31 were $53,603,179, an increase of $4,133,045; net earnings, $19,112,463, an increase of $1,817,684.

Toronto Railway (Electric).—The dividends on the $7,000,000 outstanding capital stock will be at the rate of 6 per cent. annually, beginning in April. From 1898 to 1900 the rate was 4 per cent.; it was 4½ per cent. in 1901, and since then 5 per cent. annually.

Union Pacific.—This company has declared a semi-annual dividend of 3 per cent. on its $190,145,900 common stock. In February, 1900, a first semi-annual dividend of 1½ per cent. was paid; from that time, 2 per cent. was paid semi-annually until October, 1905, when one of 2½ per cent. was declared. U. P. stock declined one point on Wednesday following the announcement of the increased dividend.

The gross earnings for the half year ended December 31 were $35,817,084, an increase of $4,283,715, and net earnings $17,195,844, an increase of $1,981,133.

Wabash.—Gross earnings for the six months ended December 31 were $12,688,651, a decrease of $1,117,333; net earnings, $3,941,915, an increase of $782,047.

Washington Branch.—A 6 per cent. dividend has been declared on the $622,000 outstanding stock of this company, being the first since 1896, when 5 per cent. semi-annually was being paid. The State of Maryland owns $550,000 of this stock and the Legislature recently charged the Baltimore & Ohio, which owns $1,028,000 of the $1,650,000 authorized stock, with diverting the earnings of the subsidiary road to the parent company instead of paying dividends on W. B. stock.

GENERAL NEWS SECTION

NOTES.

The Northern Pacific is the last road reported as sending missionaries to the farmers. A "seed grain special" is scheduled to make a tour through western Montana and North Dakota in March.

The shipments of potatoes from stations on the Bangor & Aroostook in the month of January amounted to 965,787 bushels. The total shipments of last year's crop, up to February 1, from the Aroostook region amounted to 4,086,085 bushels, an increase of 786,215 bushels over the same months of the previous year.

The Railroad Commission of Texas has ordered a reduction of about 7½ per cent. in the rates on lumber throughout that state. Commissioner Colquitt dissented from the decision because he believed that a more radical reduction should be made; and in a published interview he has severely criticized his associates.

At Louisville, Ky., last week the movement of freight became so congested that the three principal railroads in that city put an embargo on all freight except live stock and perishable fruit for 48 hours. Besides an unusually large volume of freight there was much delay in consequence of the bad weather which prevented teamsters from hauling full loads.

The Railroad Commission of Florida has fined the Seaboard Air Line $300 for three violations of Rule 6 of the Commission, which requires station agents to post notices of delayed passenger trains. It appears that the offences occurred during the Christmas holidays, when there was unusually heavy travel and all trains were late, and therefore the fine is imposed mostly for an example. The Commission says that the sum ($100) is not to be taken as a precedent.

There were 7,328,607 bushels of grain carried on the 62 steamers clearing from New Orleans during January. Of this amount, 6,770,573 bushels were corn, 128,034 bushels wheat, 280,000 bushels oats, and 150,000 bushels barley. The increase, as compared with the corresponding month in 1905, was 2,225,070 bushels, and the total grain exported since September 1, 1905, amounted to 12,923,024 bushels, an increase of 6,178,985 bushels, as compared with the same period of 1904 and 1905.

The Delaware, Lackawanna & Western now has telephones, working on metallic circuits, throughout 600 miles of its lines, and it is said that the remainder of the road, about 370 miles, will be fully provided with telephones by May 1. For three years past the officers of the road have sent more communications by telephone than by telegraph. The wrecking cars of the company are equipped with telephones, and with "fish-poles," by which to make connections with the wire lines at any point on the road.

The Canadian Pacific Railway's immense irrigation scheme in the Calgary and Lethbridge districts is being rapidly pushed to completion by a large force of men. The canals already completed are capable of irrigating 110,000 acres, and the company expects to irrigate 400,000 acres this year. The system will finally include 3,000,000 acres. The example of the C. P. R. in establishing an irrigation system is being extensively followed by individual owners and ranching companies

Among the news items concerning the enforcement of the non drinking rule among railroad employees which go the rounds, irregularly but pretty constantly is one from Portland, Me., that is slightly different from the usual run. A local agent there has notified his men that drinking will not be tolerated; and also, "that any member of the staff who does not appear for work on pay day, or the day after pay day, will be considered as being unable to be present on account of drunkenness, and will be discharged." It would seem to be up to a man in that situation to hustle for a physician's certificate of sickness.

A railroad often proves a good neighbor, as was illustrated recently in the use of 20 Westinghouse air brake pumps to raise the lake steamer "Corey," which went aground on the shores of Gull Island, Lake Superior, last November. Two of the railroads sent men and pumps to help raise the vessel. Ten 11 in. pumps and ten 9½-in. pumps were distributed along the deck of the steamer and arranged to force air into 13 of the air tight compartments in the vessel. Leaks were repaired by boiler makers as fast as they were discovered, and on December 9 all of the pumps were set to work forcing air into the compartments in order to displace the water and raise the vessel. On the following morning or in 16½ hours it was found that the boat had been raised four feet and sufficient water removed by the compressed air to allow the vessel to be pulled into deep water. It is estimated that in the 16½ hours about 6,000 tons of water were forced out by the pumps.

Telephones on the Bavarian State Railroads.

From an article in the Bulletin of the International Railway Congress, reprinted from the *Zeitung des Vereins*, it appears that all of the main lines of the state railroads in Bavaria have telephones, as well as some of the secondary lines, the total length of road thus equipped being 3,850 miles. Connection is made to every station, signal cabin and gatekeeper's cabin. Many of the lines have only one through conductor, the return going through the earth. The telephone wire is of silicon bronze, .08 in. in diameter, strung on poles on the opposite side of the railroad from that on which the telegraph poles are fixed. The telephone wires are only 13 ft. above the level of the track, so that portable telephones, carried on the trains, can be easily connected. The poles all along the road are marked with arrows pointing in the direction of the nearest telephone. These arrows are burned in with an iron brand, at a cost of 12 cents a pole. This is said to be less than the cost of the metal arrows which are used on some railroads.

Electric Traction in St. Petersburg.

The Russian Westinghouse Company has secured the contract for building and equipping an electric traction system in St. Petersburg, which is to be operated by the municipality. St. Petersburg is the only European capital in which horse cars have not been replaced by electricity as a motive power. The contract calls for the conversion of the horse car lines in the Nevsky Prospect—the Broadway of the Russian capital—and other important streets. Twenty miles will first be reconstructed, at an expense of nearly $6,000,000. Later 30 miles more will be placed in operation at a cost of about $4,000,000. Power will be generated in a plant to be built on the outskirts of the city. Its initial capacity will be 10,000 h.p., to be ultimately increased to 30,000 h.p. Turbines are to be used—the first in Russia. Work on the first section of 20 miles is to be begun immediately, and it is expected that these lines will be in operation within a year.

Clyde Steamship Lines.

The Clyde Line Company, operating a fleet of 20 coastwise steamships, has been sold to C. W. Morse, who controls the Eastern Steamship Company, Metropolitan Steamship Company, and a line of steamers plying between New York and Albany. The Clyde Steamship Company, which will be the new name, has been incorporated in Maine with an authorized capital of $14,000,000. The funded debt will consist of $4,000,000 bonds. It is understood that the new company is to be operated separately under much the same management as heretofore.

What Next?

A manufacturer of journal boxes has sent us the following letter from an enthusiastic inventor, with the brief comment: "Isn't this good enough to print?" We think it is.

"You will please find enclosed printed matter relative to an alarming device for railroad cars, and one that will be highly appreciated by the railroad companies, because the care and notice for the overheating of journal boxes has been a problem for the train men, knowing the trouble that hot-boxes give on roads, caused by trainmen not performing their duty in the inspecting. I have endeavored to make a box that will speak before it is too late and one that will annoy the trainmen so that they will be compelled to attend to it before it gets beyond control

"A train of cars equipped with these alarms does not need inspection, for boxes that need oiling as they will alarm if the temperature is too rapidly increasing by the sounding of a gong as the train rolls by. Please read the printed matter and note the simplicity of the device and the advantage of equipping cars with the same. I also wish you to note its important parts all of which is enclosed in the inside of the journal box casting. It therefore cannot get out of order, and when once built will wear a car a lifetime without a single repair. It is entirely automatic and does not require any attention whatever

"Knowing that you are manufacturers of journal boxes I therefore write you to know if you will use this device in the construction of your boxes for all services. I will therefore be pleased to hear from you in regard to the rights of using the same."

(The inventor failed to mention in his letter that his device is actuated by a thermometer and a few other indestructible parts.)

A Pneumatic Wrench.

A. E. Hoermann, New York, dealer in pneumatic and other machinery, has just put on the market a tool designed to be used in connection with an ordinary air or electric drill to perform the

work of screwing up, tightening and also unscrewing nuts. The idea of using a pneumatically-operated tool for this purpose is not new, but so far no satisfactory one has been placed on the market. Tests have been made with solid chucks in drills, but the sudden jar caused at the moment the nut was drawn up on the surface soon put the drill out of commission. To overcome the difficulty this new tool is provided with an adjustable friction arrangement, which enables the operator to regulate the tension for the largest nut to be tightened. The nuts to be tightened are placed on the bolt with about 1½ turn, the tool will run them up to the surface and tighten them, then the friction arrangement will take up the jar and allow the drill to continue rotating while the wrench chuck remains stationary.

This tool has been thoroughly tested at the shops of the Central Railroad of New Jersey at Elizabethport and found to work remarkably well. It has been found, however, that a ¾ in. nut is the maximum capacity, not of the tool itself, but of the drill, as the largest drill is not strong enough to develop enough power to sufficiently tighten a 1 in. nut.

Valuation of Michigan Railroads.

Professors Cooley and Adams, of the University of Michigan, report to the Governor that they find the actual cash value of Michigan railroads is $284,710,659. They fix the value of the Michigan Central lines at $65,081,503, compared with the state tax commission's assessment of $49,885,000; the Pere Marquette at $49,450,157, compared with $28,000,000; the Grand Trunk at $31,123,801 compared with $25,250,000; the Chicago & North-Western at $18,643,928, compared with $12,250,000; and the Wabash at $3,839,413, compared with $4,650,000, the only road of importance where a lower assessment is recommended. The physical value of the railroads aggregates $228,784,468. To get the non-physical value the average net earnings for five years are taken, and a certain percentage allowed for the support of the physical condition of the road. Any earnings in excess of that per cent. are capitalized as indicating a value above purely physical value. Different rates of percentage were used for different roads, based on estimates of market quotations and similar information. The non-physical value of the railroads is $36,114,681. Cash and current assets amount to $15,980,668, and stores and supplies $3,830,842, making a total, above all physical value, of $55,926,191.

Prince Rupert.

Miss Eleanor H. Macdonald, of Winnipeg, secures the $250 prize from the Grand Trunk Pacific for the name, Prince Rupert, proposed by her for the Pacific terminus of the road. Over 12,000 suggestions were sent in. Prince Rupert was a promoter of the Hudson's Bay Company and its first Governor, in 1670. In that year Charles II. granted a charter to the Prince and 17 other noblemen and gentlemen, incorporating them as "The Governor and Company of Adventurers of England," trading into Hudson's Bay; and the concern, the Hudson's Bay Co., is still doing business. Under the terms of the competition that the name should contain not more than three syllables, nor exceed 10 letters, the name suggested which complied with the conditions and most clearly resembled that selected was Port Rupert, this having been suggested by two ladies in Ontario; and with the desire to accord fair treatment to all, the company awarded $250 to each of the two who suggested Port Rupert, as well as to the one who suggested the name which has been adopted. The town will be about 30 miles south of the southern extremity of Alaska.

Destruction by Fire of Electric Roads in Poughkeepsie, N. Y.

A fire, which started in the drawing-room adjoining the engine room, in the three-story brick car sheds of the Poughkeepsie City & Wappingers Falls Electric Railroad, was destroyed by fire February 11, at a loss of about $500,000. The building was 60 ft. x 200 ft. The entire power plant and all the rolling stock (except one car) of the four electric lines in this city were destroyed, also 22 cars which were being built.

California Fruit Traffic.

Representatives in New York of Pacific fruit interests have been requested by the shippers and growers in California to cooperate in efforts to secure legislation placing private car lines under the direct control of the Interstate Commerce Commission. The fruit men claim that the Armour interests being engaged in the fruit business have, through the operation of their car lines, inside information (all loads in Armour cars being inspected by their employees from time to time) as to the condition, variety and destination of the fruit of their competitors. At a meeting at Los Angeles resolutions were adopted by the Board of Directors of the California Fruit Growers' Exchange, a co-operative organization representing over 3,000 growers and shipping yearly more than 14,000 cars, or approximately 50 per cent. of the citrus fruits of California, to the effect that the private car line system as it now exists is one of the greatest menaces to the prosperity of the fruit and perishable product interests of the United States. Senators and Representatives in Congress are asked to take immediate action, so that such legislation may be had by the present Congress as will bring relief to the producer from the present intolerable condition. *—Journal of Commerce, New York.*

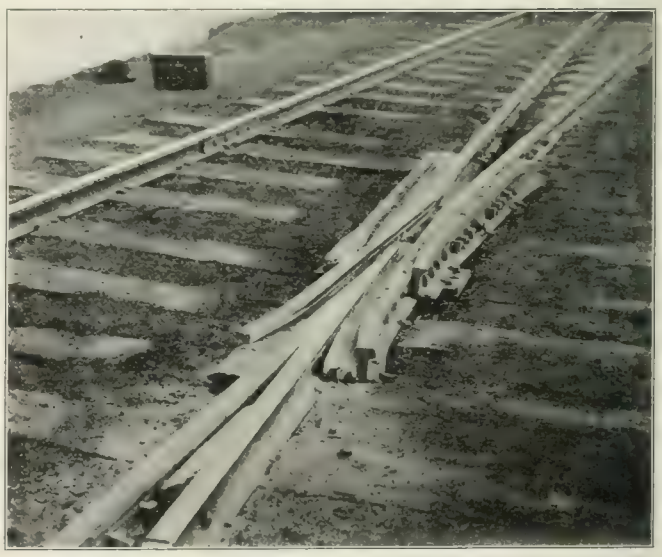
The Conley Frog.

The accompanying illustrations show a frog designed by J. E. Conley, Arcola, Ill., by which the wheels of a truck are guided directly over the frog point by guard rails bolted thereto, which engage the rim of the wheel while the tread is passing over the wing rails. This arrangement is intended to do away with the use of a guard rail along the opposite rail, as being much more effective in



The Conley Frog.

guiding the wheels by the frog point and thereby minimizing danger from sprung axles, loose wheels or broken flanges, by directly guarding the wheel when it comes to the point. The views herewith are of one of these frogs in the East St. Louis yards of the Illinois Central on the outside of a 12 deg. curve on a switching lead, where it has been for about two months. The guard or guide rails are bolted through the frog with 13 bolts. Suitable filler blocks are provided between track and guard rails and the ends of the latter are beveled



The Conley Frog.

to come level with or slightly below the track and wing rails. The guards can be made from cast-steel, cast-iron, flat bar iron or steel, or rail section as desired. Mr. Conley states that ordinary frogs in the location where his frog now is, last but three or four months because of the sharp curve and continuous switching, and that his frog is giving entire satisfaction without any cost for maintenance. He has applied for a patent on it.

Manufacturing and Business.

The Independent Pneumatic Tool Co., Chicago, has leased a large building adjoining its works at Aurora, Ill., in which it will shortly install upward of $50,000 worth of machinery. The company's domestic as well as foreign business is increasing to such an extent that the capacity of its present plant is inadequate. An order for

300 "Thor" piston air drills, reversible flue rolling, reaming, tapping and wood boring machines and pneumatic hammers has just been received from London, England.

The California Gas & Electric Corporation has ordered from the Abner Doble Co., San Francisco, Cal., a Doble tangential water wheel which will have a capacity of 13,000 h.p. This when completed will be the largest tangential water wheel yet built.

Iron and Steel.

Orders have recently been given for rails aggregating about 50,000 tons. The New York Central orders were for 36,000 tons, and an additional order is soon to be given by this company for a similar amount. Four thousand tons were ordered for Pittsburg electric roads, and 2,000 tons for a Kansas City road.

The United States Steel Corporation, it is said, is refusing to take orders in certain departments, except for delivery far in the future. It now has orders on its books for about 8,000,000 tons, which is within 2,000,000 tons of its entire capacity. The various rail mills have unfilled orders for rails for delivery during the present year amounting to about 2,500,000 tons. The total production of rails last year was over 3,300,000 tons, and it is probable that the output this year will far exceed that amount. In January over 14,000 tons of rails were rolled for the Canadian Pacific, at the Consolidated Lake Superior Company's Works, at Sault Ste. Marie. Since September the company has delivered to Canadian roads rails valued at about $5,000,000.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At the meeting of this society February 21, a paper on the "Economical Design of Reinforced Concrete Floor Systems," by John S. Sewell, was presented for discussion. This paper was printed in the *Proceedings* for December of last year.

Traveling Engineers' Association.

The Secretary of this association, W. O. Thomson, Oswego, N. Y., has sent out five requests for information, to be used in reports and papers to be presented at the next annual meeting.

The committee on "The Future Engineer" desires information from all members as to the best methods of increasing the engineman's efficiency and also as to the best class of men to employ as firemen. D. L. Eubank, Chairman, Hinton, W. Va.

The committee on the care of boilers presents a list of 12 questions, among which are the following: Are boilers washed regularly or only when reported by engineers? What success with soda ash or other chemicals in feed water? What success with the Kennicott water softener? What success with Talmage system of cleaning? F. P. Roesch, Chairman, 1433 Chicago Road, Chicago Heights, Ill.

The committee on regularly assigned vs. pooled engines asks the usual questions, and also one which is not quite so common, namely, "would having a regular crew on a locomotive for 75 per cent. of her mileage be preferable to a pool?" C. F. Richardson, Chairman, Frisco Building, St. Louis, Mo.

Lubricators. Frank Burke (D., M. & N.), Proctor, Minn., who is to write on this subject, wants information on all the latest makes, hydrostatic and mechanical.

Walschaert Valve Motion. O. H. Rehmeyer, 559 Elm street, Blue Island, Ill., who is to write on this subject, wants each member to send all the information that he can give.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Nashville, Chattanooga & St. Louis.—E. C. Lewis has been elected Acting President, succeeding J. W. Thomas, deceased.

New York, New Haven & Hartford.—F. C. Fiske has been appointed Commissioner of the Real Estate Department, succeeding C. M. Ingersoll, resigned.

Operating Officers.

Canadian Northern.—J. R. Cameron, who was recently appointed Superintendent at Port Arthur, Ont., entered railroad service in 1882 as a brakeman on the Canadian Pacific. In 1886 he went to the Northern Pacific as conductor, where he remained until 1898, when he was appointed trainmaster at Grand Forks, N. Dak. When, in 1901, the Northern Pacific lines in Manitoba were leased to the Canadian Northern, Mr. Cameron remained on these lines under the new management. In 1904 he was appointed Assistant Superintendent at Kamsack, Sask., and in May, 1905, was appointed to a temporary position in the McKenzie & Mann Company, Ltd., which he held until he received his recent appointment.

Chicago, Burlington & Quincy.—G. T. Ross, General Superintendent at Burlington, Iowa, has been appointed General Superintendent at St. Louis, Mo., succeeding H. C. Nutt, resigned to go to the Michigan Central. W. B. Throop, Superintendent at Aurora, Ill., succeeds Mr. Ross. F. H. Ustick, Superintendent at Brookfield, Mo., succeeds Mr. Throop. J. E. Votaw, Trainmaster at Brookfield, Mo., succeeds Mr. Ustick. C. W. Ling, Trainmaster at Creston, Iowa, has been appointed Superintendent at Beardstown, Ill., succeeding L. W. Berry, transferred.

Wheeling & Lake Erie.—A. P. Titus has been appointed to the new office of Car Accountant.

Traffic Officers.

Chicago & Alton.—S. D. Parkhurst, formerly Commercial Agent of the Chicago Great Western, has been appointed Coal Traffic Agent of the C. & A.

Pan-American.—D. W. Flint has been appointed General Freight and Passenger Agent.

Pennsylvania.—E. P. Bates, General Freight Agent, has been appointed General Freight Agent, in charge of through traffic. R. C. Wright, Assistant General Freight Agent, has been appointed General Freight Agent, in charge of local traffic. G. D. Ogden, Division Freight Agent at Buffalo, succeeds Mr. Wright.

Engineering and Rolling Stock Officers.

Canadian Pacific.—W. F. Tye, Chief Engineer, has resigned.

Missouri Pacific.—W. C. Smith, Master Mechanic at Fort Scott, Kan., has been appointed Master Mechanic at Kansas City, succeeding William Naughton, resigned. M. J. McGraw succeeds Mr. Smith.

Pere Marquette.—The authority of O. C. Lesner, Division Engineer of the Buffalo division, has been extended to Grand Rapids, Mich., with office at Detroit, taking over the territory of W. J. Long, promoted.

St. Louis & San Francisco.—M. C. Byers has been appointed to the new office of Assistant General Manager in charge of Maintenance of Way.

Southern Pacific and Oregon Short Line.—D. J. Malone, Master Mechanic at Salt Lake City, has been appointed Master Mechanic at Ogden, Utah, succeeding E. M. Luckett, resigned.

Trinity & Brazos Valley.—W. C. Burel has been appointed Master Mechanic at Cleburne, Tex.

LOCOMOTIVE BUILDING.

The Rogers Southwestern, it is reported, is in the market for two locomotives. Address W. R. Felher, Rogers, Ark.

The Intercolonial, Canada, has ordered 16 Pacifics type (4-6-2) passenger locomotives from the Locomotive & Machine Co. of Montreal.

The Louisville & Nashville, as reported in our issue of Sept. 29 last, is building six consolidation (2-8-0) and six Pacific (4-6-2) locomotives at its Louisville shops.

CAR BUILDING.

The Erie has ordered 25 passenger coaches from the St. Louis Car Co.

The Chicago & North-Western, it is reported, is building 600 steel ore cars.

The Cincinnati, New Orleans & Texas Pacific is rebuilding 19 flat cars at its own shops.

The Queen & Crescent has purchased 40 Hart convertible cars from the Rodger Ballast Car Co.

The Toledo & Ohio Central has ordered three cafe cars and seven first-class coaches from the Pullman Co.

The Colorado & Southern has ordered 161 wooden cars of 80,000 lbs. capacity from the Ingoldsby Automatic Car Co., to be built by the Pullman Co.

The Chicago Great Western is asking bids on additional freight equipment, including 380 box cars and 320 stock cars, all of 60,000 lbs. capacity each.

The Portland & Rumford Falls has ordered 25 steel flat cars of 100,000 lbs. capacity from the Pressed Steel Car Co. These cars will measure 40 ft. long by 10 ft. wide. The special equipment will include Westinghouse air brakes and Tower couplers.

The Louisville & Nashville, as reported in our issue of Feb. 9

is building 750 box, 200 coal, 50 ore and 50 flat cars at its New Decatur shops, and 250 coal, steam gondola, 100 refrigerator, 100 stock, four vestibule combination, coach and baggage, three straight vestibule coaches with smoking compartments, two baggage and mail and two baggage cars at its Louisville shops.

The Huntington & Charleston Ry. Co. (Camden Interstate of Huntington, W. Va.,) has ordered 10 closed double truck cars from the Jewett Car Co. for April 15 to June 15 delivery. These cars will weigh 72,000 lbs., and measure 37 ft. long and 8 ft. 2 in. wide. The special equipment includes: General Electric air-brakes and Peacock hand-brakes, Forsyth curtain fixtures, Pantasote curtain material, Gold electric heating system and Weight seats.

The Chicago, Rock Island & Pacific, as reported in our issue of Feb. 9, has ordered three 70-ft. dining cars from the Pullman Co. The special equipment includes: National Hollow brake beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Janney couplers, Waugh draft rigging, Safety Car Heating & Lighting Co.'s heating system, Symington journal boxes, Pintsch light, Murphy paint, Railway Steel Spring Co.'s springs, and Pullman trucks and vestibules.

The Cudahy Packing Co., South Omaha, Neb., is building 100 refrigerator cars of 60,000 lbs. capacity at its South Omaha shops. These cars will be 36 ft. 10 in. long, 8 ft. 10 in. wide, and 12 ft. 4 in. high, over all. The special equipment includes: Standard Forge Co.'s axles, American Steel Foundries' bolsters, Simplex brake-beams and springs, American Brake-Shoe & Foundry Co.'s brake-shoes, Westinghouse air-brakes, More-Jones brasses, Major couplers, Farlow draft rigging, Cudahy Packing Co.'s dust guards, Woodman journal boxes, F. W. Bird & Son's torsion proof roofs, arch-bar trucks and Griffin wheels.

The Lehigh & Hudson, as reported in our issue of January 26, has ordered 75 box cars from the Standard Steel Car Company for July, 1906, delivery, and 10 lowside gondola cars of 80,000 lbs. capacity from the South Baltimore Car & Foundry Co., for April, 1906, delivery. The lowside gondola cars will measure 38 ft. 4 in. long x 8 ft. 6 in. wide x 18 in. high, all inside measurements. The bodies will be of wood and the underframes will be of metal. The company has also ordered 250 hopper gondola cars of 80,000 lbs. capacity from the South Baltimore Car & Foundry Co. These cars will measure 33 ft. 6 in. long & 10 ft. wide x 10 ft. 2 in. high, all outside measurements. The bodies will be of wood and the underframes will be of metal.

BRIDGE BUILDING.

ALBANY, N. Y.—A bill has been introduced in the State Legislature to incorporate the Niagara Frontier Bridge Company for the purpose of building a bridge over the Niagara river from a point in the State Mile Reservation to the Canadian side. G. W. Knox and William C. Edwards, of New York, and A. E. Osler, of Ontario, and others, are named as a commission to locate the site.

ARICHAT, N. S.—The County Council has appropriated $25,000 toward the cost of building the Lennox bridge. The structure, when completed, will cost between $55,000 and $60,000.

ARKANSAS.—Both Houses of Congress have passed bills authorizing the Campbell Lumber Co. to build two bridges across the St. Francis river, in Clay County, Ark.

ASHLAND, VA.—Bids are wanted February 28 by J. D. Saunders, Chairman of the Board of Supervisors of Hanover County, for building a steel bridge 290 ft. long over the Pamunkey river, the cost to be paid jointly by Hanover and Caroline counties.

BIRMINGHAM, ALA.—A new steel bridge is to be built over Warrior river at Jasper's Ford, which will be the largest in Jefferson County. It will have a total length of 638 ft.

Bids are wanted March 3 by the Board of Revenue of Jefferson County for building seven steel bridges. P. S. Miner is County Engineer.

CAMDEN, N. J.—Bids are wanted by the Board of Freeholders, February 28, for building a Strauss Trunnion Bascule bridge over the creek at Federal street. Separate bids are also asked for a temporary structure.

CLARKSVILLE, TENN.—A bill was introduced in the Lower House of Congress on Feb. 12 authorizing a bridge across the Cumberland river at or near this place.

HAMILTON, ALA.—Bids are wanted by M. Pearce, April 2, for building two steel bridges, one 290 ft. long and one 75 ft., over the Butthattchie and New rivers in Marion County.

JEFFERSON, IOWA.—Bids are wanted March 7 by E. S. Gose, Auditor, for building a steel bridge 220 ft. long over the Coon river in Greene County.

LAWRENCE, MASS.—A bill is before the legislature petitioning for authorization to build an additional bridge over the Merrimac river at a cost of about $250,000.

NASHVILLE, TENN.—On Feb. 12 a bill was introduced in the Lower House of Congress authorizing two bridges across the Cumberland river at or near this place.

NEWARK, N. J.—The Erie has completed plans and surveys for abolishing all grade crossings in this city by elevating the tracks both on the Newark branch and on the Greenwood Lake division. The estimated cost of the work will be $1,500,000.

NEWPORT, IND.—Bids are wanted March 12 by H. T. Payne, Auditor, for building a steel bridge 720 ft. long over the Wabash river at Cayuga, in Vermillion County.

OGDEN, UTAH.—The Oregon Short Line is planning to build a viaduct over its tracks at this place.

OMAHA, NEB.—Announcement has been made that the Union Pacific will build a new bridge over the Platte river at Central City.

OTTAWA, CANADA.—Bids are wanted by the Trans-Continental Railroad Commission March 12 for building a steel bridge to carry two tracks.

OWEN SOUND, ONT.—A steel bridge is to be built over Powlett street to cost about $10,000.

PINE BLUFF, ARK.—On Feb. 14 a bill was passed by the Lower House of Congress authorizing Jefferson County to build a bridge over the Arkansas river at this place.

ST. CATHERINES, ONT.—The City Council has decided to at once build a high level bridge over the Welland Canal, to cost about $100,000.

SAN BERNARDINO, CAL.—According to reports a steel viaduct will be built on Mt. Vernon avenue at a cost of $20,000.

TENNESSEE.—Bills were introduced in the Lower House of Congress Feb. 12 authorizing the Cairo & Tennessee River R. R. Co. to build bridges across the Tennessee and Cumberland rivers.

TORONTO, ONT.—The following suggestions have been submitted to the city authorities, and to the railroads interested, for building the proposed Yonge street bridge: The railroads to pay the city $100,000 and the city build the bridge, or that the railroads build the bridge and the city pay for all land damages.

VANCOUVER, B. C.—A combined traffic and street railroad bridge, 42 ft. wide, will be built over False creek and Granville streets. A. L. D. Odlum may be addressed.

WATERS' FERRY, ALA.—A bill is before the Committee on Interstate and Foreign Commerce of the Lower House of Congress authorizing the Commissioners' Court of Baldwin County, Alabama, to build a bridge across the Perdido river at this place.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARKANSAS VALLEY.—This company, which was recently incorporated in Colorado by officers of the American Beet Sugar Company, proposes to build a railroad through the Arkansas Valley in the same section through which the Holly & Swink is projected. The company has a capital of $1,000,000, and the directors include F. Weitzer, C. M. Ward, and others, of Colorado; Robert Oxnard, of San Francisco, and H. R. Duval, of New York.

CANADIAN PACIFIC.—This company, it is said, has filed plans for a branch line from Woodstock to Niagara Falls via Brantford and Hamilton, about 10 miles.

CANADIAN ROADS.—Application has been made to the Dominion Government by Tupper & Griffen, of Vancouver, B. C., for permission to incorporate a company to build a railroad from Osoyoos, on the international boundary north to Enderby, B. C., about 130 miles.

CENTRAL ARKANSAS.—A charter has been granted a company in Arkansas, with a capital of $2,600,000, to build a railroad in Yell, Perry and Scott Counties, about 130 miles. The incorporators include: T. W. McLoud, of the Midland Valley Railroad; W. R. Abbott of Fort Smith, and others.

CENTRAL ONTARIO RAILWAY.—An officer writes that grading work is under way by Little & Culvertson, of Mamaora, Ont., for grading seven and one-half miles of road on its proposed extension from Bancroft, Ont., via Maynooth to Whitney, a distance of 40 miles. Grading from Bancroft has been completed for a distance of three and one-half miles and track laying is finished to York river, one mile. A bridge is being put up at this place to have a 100-ft. span. Other contracts will be let shortly. John D. Evans, Trenton, Ont., is Chief Engineer.

CHICAGO, ROCK ISLAND & PACIFIC.—It is reported that this company is going to ask for a concession from the Mexican Government

to extend its lines from El Paso, Tex., through Mexico to a port on the Pacific Coast.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—This company is planning to begin work early this spring, building a five-mile cut-off near Lebanon, Ind., to reduce grades.

CRAWFORDSVILLE & NORTHWESTERN.—Incorporation has been asked for in Indiana by this company, with a capital of $100,000, to build railroads. The directors are: S. J. Hunt and John F. McFarland, of Crawsfordsville, and Augustus L. Mason, of Indianapolis.

DENVER, NORTHWESTERN & PACIFIC.—An officer writes that grading has been completed on this road from Sulphur Springs, Colo., to Kremmling, a distance of 18 miles. The line is being built from Denver via Utah Junction, Plain View, Rollinsville, Tolland, Corona, Arrow, Vasquez, Tabernash, and Granvy to Sulphur Springs, a total of 109.3 miles. Orman & Crook and Dunphy & Nelson have contracts to build the line from Sulphur Springs to Toponas, 68.4 miles. Track laying will be started in April of this year from Sulphur Springs to Kremmling. Additional contracts will shortly be let for building from Toponas to the Pallas coal fields.

DENVER TERMINAL.—Incorporation has been granted a company under this name in Colorado, with a capital of $500,000, to build a line north from Denver. The incorporators include: Thomas J. Milner, W. N. Vaile, J. E. O'Connor and others, of Denver. This is said to be a project of the Burlington.

DESCHUTES.—Incorporation has been granted a company under this name in Oregon, with a capital of $100,000, to build a railroad from the Oregon Railroad & Navigation Company's line, near Deschutes station, south, through a valley of the same name to Bend. The office of the company will be at Portland, and the incorporators include: J. P. O'Brien, William Crooks and W. W. Cotton, of Salem, Ore.

EAST LIVERPOOL TRACTION.—Plans have been completed by this company to build an electric railroad from Chester, W. Va., to Wellsburg, W. Va., opposite Brilliant, O. Surveys are being made. The distance is about 60 miles. The corporation, which was organized in Ohio, is being financed in the East. Construction work is to start early this spring. The road will be a competitor of the P. C. C. & St. L.

GRAND TRUNK.—This company is planning to build a line from Weston to Toronto, and from Weston, east, beyond the heights to a connection with the main line. The proposed line is to be built to avoid the heavy grade at Scarboro Heights, Toronto, and will be used for through freight, both east and west. The local freight and passenger traffic will continue to be carried over the present route.

GREAT SOUTHERN.—Surveys are reported being made by this company for building 15 miles of road from Dufur, Ore., in a southerly direction.

HOLLY & SWINK.—An officer writes that work has been started by Mischau & Whitescarver, contractors, on its proposed road, from Holly, Colo., west to Swink, a distance of about 90 miles. J. Weidell, of Lajunta, is Chief Engineer. (See Holly, Holbrook & Big Bend, January 26, p. 29.)

INDIANAPOLIS & LOUISVILLE TRACTION.—Incorporation has been granted this company, in Indiana, with a capital of $3,000,000, to build an electric railroad from Jeffersonville, north, to Franklinville, Ind. John E. Greely, of Jeffersonville, Ind., has charge of the preliminary work.

JOHNSON CITY SOUTHERN (SOUTHERN).—An officer writes confirming the report that a contract has been given to W. J. Oliver, of Knoxville, Tenn., for building this road from Embreeville, Tenn., to the North Carolina line 11.25 miles, and from thence to Marion, N. C., 77.75 miles. The proposed route is via Erwin and Poplar, Tenn., and Huntdale and Sprucepine, N. C. W. H. Wells is Chief Engineer.

KLONDIKE MINES.—The financing of this road has been arranged in London by T. W. O'Brien, of Yukon, for building 84 miles from Dawson to Stewart crossing. Five miles of track have been laid and 30 miles additional will be completed this year.

LAKE SHORE & MICHIGAN SOUTHERN.—Contracts are reported let by this company to the Ferguson Contracting Company for building 34 miles of second track from Franklin to Brookville, Pa.

LINARES & GULF.—An officer writes that this Mexican road, which is being built from Linares, State of Nuevo Leon, on the Mexican Central via Rio Conchos and San Miguel, San Jose and Tamaulipas to the Gulf of Mexico, has its track laid to San Jose, about 38 miles. The work includes a number of heavy cuts and fills between post 46 and 51, covering a distance of about three miles. Edward D. Self is Chief Engineer.

MCCORMICK & COLUMBIA RIVER.—Incorporation has been granted a company under this name in the state of Washington, with a capital of $100,000, to build a railroad from McCormick, in Lewis County to Gray's river and Gray's Bay. The incorporators include: F. L. Hale, H. McCormick and A. N. Riggs.

MEMPHIS & NEW ORLEANS (ST. L. & S. F.).—A charter has been granted this company in Arkansas, with a capital of $6,265,000, to build a railroad paralleling the Mississippi river in Eastern Arkansas, from Marion, in Chitman County to the Louisiana state line, a distance of about 180 miles. The incorporators include: L. F. Parker and C. R. Gray, both of whom are officials of the Frisco.

MEXICAN ROADS.—According to recent consular reports, work is under way on a Mexican Pacific coast trunk line between Guaymas, Sonora and Guadalajara, in the state of Jalisco. The new line will pass through rich mineral and agricultural sections of the state of Sinaloa, Territory of Tepic and state of Jalisco, the ports of which will be put in direct communication with the City of Mexico. Several miles of rails have been laid and the grading finished on an additional stretch of several miles. It is predicted that 180 miles will be completed and in operation by August, 1906. Construction north and south from the port of Mazatlan, state of Sinaloa, is to be pushed, surveying parties now being in the field.

NEW YORK, NEW HAVEN & HARTFORD.—The company is planning to dig a tunnel from the Union Passenger Station in Providence, R. I., to East Providence, where connection will be made with the company's east side lines to Boston, Worcester and Fall River. The cost of the tunnel, which will be about two miles long, will be about $2,000,000.

NEW YORK ROADS (ELECTRIC).—Local papers state that E. H. Harriman has completed plans for building a private electric road to his residence at Forest Lake, N. J. The proposed line will run from Newburg Junction, N. Y., on the Erie, through Tuxedo, Arden and the mountains above Greenwood Lake, a distance of 10 miles. Work is to be commenced early this spring.

NORFOLK & WESTERN.—Contracts are reported let by this company for double-tracking 18 miles of its road from Montvale, Va., to Lowery, as follows: Quinn & Harmon, Philadelphia; Moran-Pheton Contract Company, Pittsburg; Vaughn Construction Company, Roanoke, Va.; J. F. McCabe Company, Baltimore, and E. G. Nave Brothers, of Portsmouth, O.

OKANOGAN CENTRAL.—Incorporation has been granted this company in the state of Washington, with a capital of $2,000,000, to build railroads. The directors include: Frank Grogan, J. S. Jurey, W. R. Bell, J. J. McCafferty and M. G. Riley. Office at Loomis.

PACIFIC & GULF TERMINAL.—Under this name a company has been organized by J. R. Crawford, C. T. Crawford, D. A. Southerland, M. E. Rives and S. J. Lazarus, of San Francisco, with a capital of $1,500,000, to build a railroad from San Pedro to Los Angeles, about 25 miles.

PEARL RIVER VALLEY.—Incorporation has been granted this company to build a railroad from Jackson, up the Pearl River Valley, through the Counties of Rankin, Scott, Leake, Neshoba, Noxubee, Kemper, Winston and Lowndes to Columbus, Miss., or to a point south of Columbus and crossing the state line into Alabama. Incorporators include: Roy Hogue, of Biloxi, Miss.; W. D. Harrington, Fulton, Ala., and F. Herrick, of Milwaukee, Wis.

PENNSYLVANIA.—Contracts are reported let by this company at about $5,000,000 for the grading and masonry work in connection with the change of line and additional tracks to complete the four-track work on the Pittsburg division. The contract includes the digging of a new channel, 4,000 ft. long, for the Conemaugh river to change its course so as to avoid building two bridges. The contracts let are as follows. For grading and masonry from Sang Hollow, Pa., to Seward, to H. S. Kerbaugh (Incorporated), Philadelphia; from Seward to N F tower, at New Florence, to McMemanin & Sims, Philadelphia; from that point to the Coke Ovens east of Lockport (to include changing the course of the Conemaugh) to the Eyre Construction Company, of Philadelphia; and from the Coke Ovens to Bolivar, to Thomas F. Kerns & Son, of Pottsville. The work covers a distance of about 16 miles, and is to be completed this year.

PENSACOLA, ALABAMA & WESTERN.—According to newspaper reports this company is being backed by a French syndicate, and has already spent $60,000 for preliminary surveys for its proposed road from Memphis, Tenn., to Pensacola, Fla., with a branch to Birmingham. The cost of the entire road will be about $25,000,000. W. K. Allen, of Connellsville, Pa., has made some of the surveys.

ST. LOUIS & SAN FRANCISCO.—See Memphis & New Orleans.

SANTA FE & EASTERN.—This road is to be extended from Sugarite, N. Mex., for a considerable distance through a rich mineral country.

SOUTHERN.—See Johnson Southern above. (January 19, p. 21.)

SPOKANE & INLAND (ELECTRIC).—An officer writes that this company, which secured incorporation in the state of Washington last

year, with a capital of $3,500,000, is building an electric railroad south from Spokane to Palouse and Colfax. The proposed route is from Spokane via Moran, Prairie, Freeman, Mt. Hope and Waverly to a point in Spring Valley to be known as Spring Valley Junction. At this point the road will divide into two branches, the east arm extending via Oakesdale and Garfield to Palouse, and the West arm via Rosalia and Thornton to Colfax, a total length of 102 miles. The company intends ultimately to extend the road to Pullman, Wash., and to Moscow, Idaho. Preliminary surveys have been made and part of the right of way secured. From Spokane, south, grading has been completed to Waverly, 33 miles, and track is laid for 12 miles. Contracts have been let for building the entire road. The work includes the building of a number of bridges and tunnels. J. P. Graves, of the Spokane Traction Company, is President, and Alex. Lupfer, Chief Engineer.

Urbano de Tampico.—At a meeting of the board of directors of this road in Tampico, Mexico, it was decided to extend its railroad to La Barra, passing through the towns of Talleres, Arbol Grande and Dona Cecilia. The company owns the street railways in Tampico. The motive power will be either steam or electricity. Angel S. Trapaga is President.

Vandalia.—An officer of this road is quoted as saying that the company will spend about $2,000,000 during this year for double-track work between Indianapolis and the Illinois state line.

West Pittsburg & Ellwood City (Electric).—Incorporation has been asked for by a company under this name, in Pennsylvania, in which Charles A. Maxwell, G. H. Ulig, C. L. Dunham and others, of West Pittsburg, and C. H. Aiken, of Newcastle, Pa., are interested, to build an electric railroad from Newcastle south to Ellwood City via West Pittsburg, about 14 miles. This, it is believed, is a part of the project to build a road from Cleveland, Ohio, to Pittsburg, Pa. The Shenango & Mahoning Valley Company, which recently merged several lines, is the prime mover. An additional company to be known as the Crescent Line has also applied for a charter to build over the same route from West Pittsburg to Newcastle. In this Frank S. Hurt, James R. Martin, C. H. Aiken and others, of Newcastle, are interested.

Wolfe, Megantic & Lotbiniere.—An officer writes that this company has had its charter extended, and subsidies promised for its proposed road from Lime Ridge in the County of Wolfe, north to Quebec, about 100 miles. Right of way secured and contract let to W. G. Orcutt, of Boston, for the construction of the road. W. H. Lamby, Inverness, Que., is Secretary.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—Preferred and common stockholders are offered the right, during the period from April 9 to April 12, to subscribe, to the extent of 8 per cent. of their holdings, for an amount of the $50,000,000 four per cent. convertible bonds of 1955. Of the total authorized, $32,420,000 was sold last fall. The proceeds of the sale of the remaining $17,580,000 will reimburse the treasury for $12,000,000 spent on improvements and acquisitions, and the rest, $5,580,000, will be used to meet unexpected emergencies during 1906 and 1907. (Oct. 20, p. 128.)

Atlantic Coast Line.—A meeting of the stockholders has been called for March 8 to approve the proposed increase of common stock from $50,000,000 to $60,000,000. There is now outstanding about $43,980,000 of common stock and about $1,700,000 preferred stock. About $4,568,000 of the new stock is to be issued at once at par to both common and preferred stockholders to the extent of 10 per cent. of their present holdings. The proceeds of the sale are to be used to pay for new equipment.

Chicago & North Western.—An issue of $16,267,400 additional common stock is to be offered at par to stockholders of record of April 2, to the extent of 20 per cent. of their holdings. C. & N. W. stock is now quoted at 233, at which figure the rights of this new issue are worth $22.17. The total common stock authorized is $77,601,045, of which $58,949,900 is already outstanding.

Delaware & Hudson.—The stockholders have authorized the issue of $14,000,000 convertible debenture bonds and also the increase of the capital stock from $48,940,000 to $55,940,000 to provide $7,000,000 for conversion of the bonds. The bonds are to pay for the United Traction Co. of Albany, other electric lines, equipment and construction. (Jan. 26, p. 30.)

Duluth, South Shore & Atlantic.—Gross earnings for the half year ended December 31 were $1,593,246, an increase of $231,774; net earnings $573,269, an increase of $103,336. The surplus after charges was $77,991, as compared with a deficit during the same period of the previous year of $89,970.

Great Northern.—Gross earnings for the month of January were $3,647,661, the largest January earnings ever reported, being an increase of $700,526 over the figure for 1905.

Hocking Valley.—Gross earnings for the six months ended December 31 were $3,421,821, an increase of $124,879; net earnings $1,323,787, an increase of $90,144. Surplus after charges was $1,121,279, an increase of $5,333.

Interborough Rapid Transit.—Gross earnings of the Subway division for the quarter ended December 31 were $1,887,317, an increase of $1,075,227 over the figure for the 65 days ending December 31, 1904; net earnings were $1,142,340, an increase of $789,504. The surplus after charges was $803,679, an increase of $611,485. The gross earnings of the Manhattan Elevated division for the quarter ended December 31 were $3,294,284, a decrease of $366,480; net earnings $1,901,907, a decrease of $330,024. The surplus after charges was $159,602, a decrease of $87,772.

Lake Shore & Michigan Southern.—J. P. Morgan & Company have bought $35,000,000 4 per cent. 25-year debenture bonds, part of an authorized issue of $50,000,000 recently authorized. There are already outstanding $50,000,000 similar bonds issued in 1903. It is announced that the proceeds of the sale of the $35,000,000 will be used for anticipated betterments and improvements, including equipment.

Gross earnings for the quarter ended December 31 were $10,364,613, an increase of $1,118,787; net earnings $1,133,595, a decrease of $58,071. Gross earnings for the year ended December 31 were $38,600,809, an increase of $3,439,757; net earnings $7,269,300, a decrease of $707,472. The surplus after charges was $4,467,963, an increase of $10,222.

Louisville & Nashville.—J. P. Morgan & Company have bought $10,000,000 Atlanta, Knoxville & Cincinnati division 4 per cent. 50-year bonds of 1955. This amount is part of $14,543,000 issued in June of last year to reimburse the L. & N. for the purchase and construction of this division, and which have since that been held in the company's treasury. The total authorized issue is $50,000,000. The proceeds of this recent sale will be used for new equipment, reduction of grade, redemption of certain prior lien bonds, and for the completion of the A. K. & C. division, which will run when finished, from Atlanta, Ga., to Cincinnati, 485 miles.

Mexican Central.—Ladenburg, Thalmann & Company, Hallgarten & Company, and several German banks are to underwrite $33,000,000 5 per cent. notes of 1910 and 1911, recently authorized by the Mexican Central. This issue is for the purpose of refunding $20,000,000 short term obligations outstanding, also an issue of $9,000,000 collateral trust notes of 1908, and for other purposes.

Missouri, Kansas & Texas.—Gross earnings for the half year ended December 31 were $11,336,412, an increase of $418,906; net earnings were $3,491,089, an increase of $100,893. Surplus after charges, $1,304,530, an increase of $27,208.

New York City Railway.—Gross earnings for the quarter ended December 31 were $4,453,875, an increase of $167,600; net earnings $1,982,413, an increase of $50,545. The deficit after charges was $515,631, as compared with a deficit of $540,944 for the same period of 1904.

New York, New Haven & Hartford.—Gross earnings for the quarter ended December 31 were $13,546,069, an increase of $1,162,742; net earnings $3,959,799, an increase of $1,083,582. The net income was $2,083,570, an increase of $1,164,457.

Northern Pacific.—Gross earnings during the month of January were $4,511,063, an increase of $1,198,063.

Philadelphia Company.—The United Railways Investment Co. of San Francisco, will issue $12,000,000 5 per cent. collateral trust bonds and $6,400,000 capital stock for the purpose of acquiring $16,000,000 of the $30,000,000 authorized common stock of the Philadelphia Company. Each share (par value $50) of the Philadelphia Co. may be exchanged for $37.50 U. Rys. I. Co. new bonds and $20 new stock. The shareholders may exchange sixteen-thirtieths of their holdings in this manner. The Philadelphia Co. owns 365 miles of street railroads in Allegheny County, Pa., as well as oil wells and natural gas. (Dec. 1, p. 176.)

Union Pacific.—The Union Pacific Coal Company, a subsidiary of the Union Pacific Railroad, has bought the coal mines of the Porter Fuel Company, which are about four miles from Durango, Colo., and include about 15,000 acres of land. The purchase price is said to have been about $1,000,000.

United Railways Investment Co. of San Francisco.—See Philadelphia Company.

GENERAL NEWS SECTION

NOTES.

The Philadelphia & Reading is putting up wires for a telephone line between Philadelphia and Tamaqua.

The Northern Pacific has notified its connections that it will no longer receive freight cars not equipped either with air-brakes or with train pipes for air-brakes.

The Canadian Pacific, besides building a great hotel at Winnipeg, is to spend this year $500,000 in making additions to its hotels at Banff, and other places in the Rocky Mountains.

Chicago papers report a speed war between that city and Cincinnati. The Big Four and the Chicago, Indianapolis & Louisville now run trains through, about 300 miles, in 8 hrs. 15 mins.

A press despatch from St. Paul says that Mr. J. J. Hill is to offer cash prizes to farmers along the line of his railroad for progress and improvement in various kinds of farming, including cattle raising.

A press despatch from Chatham, Va., says that Eanes and Gipson, tried there for wrecking a freight train near Franklin Junction, Va., have been sentenced to 10 years each in the penitentiary.

Philadelphia papers say that there was a conference of railroad officers in that city last week at which it was decided to contest the validity of the new two-cent fare law of Ohio. According to the reports, most of the principal roads doing business in Ohio were represented at the conference.

The Ontario Central Despatch fast freight line has been formed, succeeding a number of fast freight lines in which the N. Y., O. & W. was interested. It is to operate over the Michigan Central; Rome, Watertown & Ogdensburg division of the New York Central; New York, Ontario & Western, and New York, New Haven & Hartford.

A press despatch from Minneapolis says that large quantities of oats have been taken from that city to New Orleans for export at about 18 cents per 100 lbs. One account gives the total sales in a week as 2,000,000 bushels. Some went by the Chicago & North-Western and the Illinois Central, and some by the Burlington to East St. Louis and thence by the Illinois Central.

"Humboldt is hot," we are informed by the *Nashville American*, over the high prices which the fruit shippers there have to pay for refrigeration in Armour cars. The Armour cars, says the reporter, are no better than those handled by the Illinois Central. The fruit shippers of Humboldt claim to have been overcharged by the Armour Company $30,000 or more in one year.

The State Railroad Commission or Georgia has been restrained, by temporary injunction, issued by Judge Pardee in the United States Circuit Court at New Orleans, from enforcing the order recently made to reduce by about 10 per cent. the freight rates on the Southern, the Central of Georgia, and the Atlantic Coast Line; and the case is to be heard by the Federal Court in Atlanta this week.

The railroads from St. Louis to Texas have recently been running their mail trains at very high speeds, apparently in an effort to show the government what they can do; and the St. Louis, Iron Mountain & Southern, in connection with the Texas & Pacific and the International & Great Northern, recently ran a train from St. Louis, Mo., to Austin, Tex., 849 miles, in 21 hrs. 15 min., which is equal to 40 miles an hour.

All members of the Oklahoma Supreme Bench have returned their railroad transportation and will hereafter pay fare. As the action of the judges followed so closely their conference with President Roosevelt, it might be concluded that the return of the passes was a result of the conference. From an official source it was also learned to-day that Governor Frank Frantz recently returned his Rock Island pass. Judge Luman F. Parker, the newly appointed Indian Territory judge, has also returned his pass.—*The Oklahoman, Oklahoma City.*

The Supreme Court of Texas has decided that exclusive contracts made between railroads and express companies are in violation of the Anti Trust act of 1903. The suit was against the Missouri, Kansas & Texas Railway and the American Express Company. That the contract was made and entered into prior to the passage of the Anti Trust act of 1903 is held to be without weight. The penalty provided for under the act is $50 a day from the date the law became effective, April 1, 1903. The four express companies operating in Texas are the American, the Wells-Fargo, the United States and the Pacific. Reports say that the railroads and the express companies will join in carrying the case to the United States Supreme Court.

A sub-committee of the Philadelphia City Council dealing with the smoke nuisance, is to recommend an amendment to the present ordinance which will put the penalty in the cases of smoke emitted from locomotives on the engineer and firemen. The sub-committee will confer with the officers of the Pennsylvania Railroad Company in regard to framing the amendment. A member of the committee is reported as saying: "Officers of the Pennsylvania Railroad Company are in sympathy with the public demand, but the company prefers that City Councils place the penalty for a violation of the ordinance on the fireman and engineer of the locomotive that is reported. If the company is held responsible it must punish the offending engineers and firemen. Such a course, the company fears, might be resented by the Brotherhood of Locomotive Engineers and kindred labor organizations, and cause trouble for the road. This could be obviated by Councils fixing the blame and penalty where it belongs." As a means of allaying a spirit of resentment, the proposal to make an engineman appear in court on a criminal charge, certainly deserves the prize.

After a series of conferences extending over more than a month the officers of the New York, New Haven & Hartford have advanced the pay of a number of classes of trainmen, as follows: Conductors on through trains betweeen Boston and New York to receive $5 a day and two uniforms a year. Electric conductors from $2.50 to $2.60 a day; ticket collectors from $2.75 to $2.85; train baggage masters from $2.15 to $2.25 a day; rear brakemen from $2 to $2.10 a day; brakemen $2 a day; through freight flagmen from $2 to $2.20 a day; freight brakemen from $2.10 to $2.30 a day; way freight flagmen from $2.35 to $2.60 a day; way freight brakemen from $2.25 to $2.50 a day; day yard conductors, 10 hours, from $2.80 to $3 a day; night yard conductors, 10 hours, from $2.90 to $3.10 a day; day brakemen, 10 hours, from $2.35 to $2.50; night brakemen, 10 hours, from $2.45 to $2.60. The yard conductors and brakemen at Springfield and Providence have had their workday reduced from 10 hours to eight hours. . . . The newspapers say that the Superintendent's order containing the rules about neatness of personal appearance has been re-issued and that traveling inspectors are to be employed to see that the rules are obeyed. According to one reporter, the order says that a plain black necktie is "preferable." This is a decided relaxation from the former rule, which, we believe, said that plain black ties were required.

Lehigh Valley Industrial Book.

"Industrial Opportunities Along the Line of the Lehigh Valley Railroad" is the title of a new book just issued by the industrial department of the road. Its object is to call attention to the variety of raw materials and the desirability of locations for industrial enterprises in Lehigh Valley territory. The supplies of coal, clays, cement, slate, salt, gypsum, sand, stone and timber available are separately described as well as agricultural possibilities along the line. In regard to this last, it is argued that, prospective farmers, instead of going West, can, with the aid of modern expert agricultural knowledge, invest money more profitably in some of the well situated but run-down farms of the East.

The book includes alphabetical lists of the principal shippers and receivers of freight at each station on the 1,344 miles of Lehigh Valley main and branch lines, and a new industrial map of the territory in colors indicating the location of the various raw materials available.

Panama Canal Purchases.

D. W. Ross, General Purchasing Agent of the Panama Canal Commission, testified before the Senate interoceanic canal committee that he had bought steel rails at from $1.60 to $2.50 a ton less than was charged to the railroads in this country. The Commission paid the export price on the rails. Mr. Ross, who was formerly Purchasing Agent of the Panama Railroad, said that he was entirely familiar with the fact that rails were sold abroad at lower prices than for domestic use. He asserted that the railroads were content to pay the extra charge because they believed that the market for steel products abroad served to maintain the balance of trade, and for that reason tolerated it. Senator Taliaferro suggested that this was very magnanimous on the part of the railroads. Questioned as to the contracts for 100 switching engines in which the lowest bidder, the Lima Locomotive & Machine Co., failed to secure the contract, Mr. Ross explained that there were three bidders, the Baldwin Locomotive Works, at $12,000, the American Locomotive Works at $11,100, and

the Lima firm at $9,850. The reason the Lima firm did not get the contract was that Chief Engineer Stevens decided that the firm had not complied with the specifications in any particular, and that the type of engines it offered was too small for work on the isthmus.

Single-Phase Alternating Current Equipment for Milwaukee Electric Railway and Light Company.

The Milwaukee Electric Railway and Light Company, Milwaukee, Wis., is about to equip two suburban extensions of its lines with the alternating current apparatus made by the General Electric Company, Schenectady, N. Y. One of these lines will extend from Waukesha to Oconomowoc, 20 miles, and the second will operate between Hale's Corners and Mukwonago, 16 miles. Both lines will be operated at a potential of 3,300 volts, and in addition the motors are designed to run on the existing seven miles of 550-volt direct trolley line between West Allis and Milwaukee.

The motors to be furnished for this equipment are the standard General Electric alternating type. Each of the 10 cars comprising the initial equipment for the road will be furnished with four motors of 75 h.p. each, known as the GEA-605. They are of the compensated type, comprising an armature similar to the ordinary standard direct current bar wound form with mica insulated coils. The motor fields consist of laminated pole pieces over which are slipped the spools of the exciting winding. The compensating winding consists of a bar winding inserted in the pole faces and permanently connected in series with the armature winding. The 75 h.p. motor is wound for four poles, and has a maximum speed of about 140 r.p.m.

These equipments will in general be operated as single cars but occasionally will be run in two-car trains. For the flexible control of these train combinations the Sprague-General Electric system of multiple-unit control will be used, adapted for operation on alternating current. Further details of this interesting adaptation of the system which has been so widely used for direct current work will be published later.

The compensator for use in these cars is of the oil cooled type, and is wound for 3,300 volts on the primary, with five different secondary taps for controlling the speed of the motor. In order that the acceleration may be smooth, special devices are employed so that there will be no break in the circuit from one tap to the next during a change in speed. The speed regulation is so devised that the running speed will be the same on both the alternating and direct-current portions of the line.

Distribution to the various transformer sub-stations on this line will be at 33,000 volts. At the stations the current will be fed to the trolley line at 3,300 volts. The General Electric catenary construction for the trolley line will be used. It is proposed to have these roads in operation during the fall of 1906.

Resignation of Kuhn-Loeb Partners from Railroad Boards.

The members of the banking firm of Kuhn, Loeb & Co. have resigned from all railroad directorships held by them. The list of roads in which the members of the firm have been directors follows:

Jacob H. Schiff—Union Pacific; Chicago & Alton; Chicago, Burlington & Quincy; Denver & Rio Grande; Baltimore & Ohio; Northern Securities Company.

Otto H. Kahn—Baltimore & Ohio Southwestern; Union Pacific; Southern Pacific; Oregon Railroad & Navigation; Oregon Short Line; Pacific Mail Steamship Company; Railroad Securities Company; Leavenworth, Kansas & Western, and Louisiana Western.

Mortimer L. Schiff—Chicago, Burlington & Quincy; Chicago & Alton; Denver & Rio Grande; Rio Grande Western, and Southern Pacific.

Paul M. Warburg—Oregon Short Line and Pacific Mail Steamship Company.

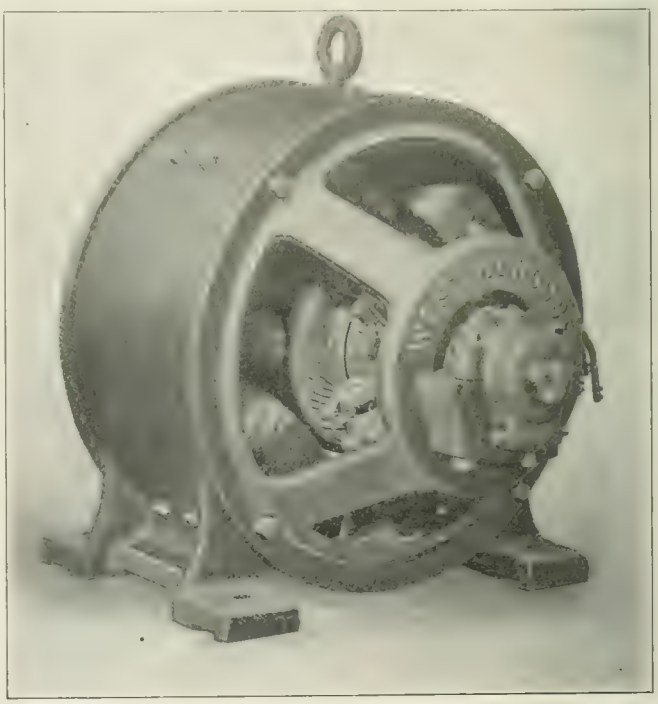
Only a Dream.

Lulled by the motion of the car, the lanky passenger with the bundles was almost across the border of dreamland, when he became dimly conscious that the train was slowing up. Presently it came to a dead stop, half way between stations. The long cars of the train were filled with suburbanites on their way home, and all of them had that absurd, unreasoning anxiety to get there that is so incomprehensible to conductors and brakemen. That is why, after the train had stood still five or ten minutes, they began to grow restive and to inquire what was the trouble. Some of them even went so far as to leave the cars and walk ahead in the darkness to try to find out. But the lanky suburbanite with the bundles kept his seat and waited patiently. Presently his meditations were disturbed by the loud, clear voice of the conductor, who called out: "On account of an accident to a train ahead of us this train will be delayed here about forty minutes. A Wabash dummy is off the track. Passengers who do not care to wait or have not far to go will get home quicker by walking ahead a few blocks and taking the crosstown cars." Then the lanky passenger gave himself a violent wrench and woke up. Even in his sleep he recognized the absurdity of the incident and knew it to be a dream. Conductors don't act that way.—*Chicago Tribune.*

The Westinghouse Direct-Current Variable-Speed Auxiliary-Pole Motors.

In many classes of work a wide speed variation is required, and to meet the demands of such service the Westinghouse Electric & Manufacturing Company has developed a line of direct-current motors having a speed range of 4 to 1 on a single voltage. This wide speed variation in this new type of motor, which is known as the S A type, is obtained by field control, and it is claimed they compare favorably in every respect with the best direct-current constant-speed machines. The new motors are exactly similar mechanically and electrically to the Westinghouse type S motors, except for the addition of auxiliary poles and coils. These are introduced in order to control the field form during the variation of field strength necessary to obtain so wide a range of speed. The cast-steel poles with machine-formed coils are placed midway between the main poles and securely bolted to the frame. The construction is very simple, and introduces no complications whatever, nor does it make difficult the removal of the main poles and field coils, as is evidenced by the fact that an auxiliary pole and coil can easily be taken out, without in any way disturbing the main field winding, by simply disconnecting the coil connections, withdrawing the bolts which hold the pole to the frame and sliding the pole and coil out parallel to the shaft.

The auxiliary field winding is connected in series with the armature and therefore produbes a magnetizing effect which is proportional to the armature current. The auxiliary coils are placed



The Westinghouse Type S. A. Direct-Current Variable-Speed Auxiliary Pole Motor.

as close to the armature surface as mechanical consideratinos will permit, and their turns are concentrated at that point. This arrangement adds materially to the performance of the motor as it applies the corrective influences of the auxiliary winding directly at the points where the distorting effect of the armature current is strongest. This arrangement, it is claimed, is much more effective than the distribution of the ampere turns along the length of the auxiliary poles. The magnetic field of the auxiliary winding acts in direct opposition to that produced by the armature current. The resultant field is made up of three components—that due to the shunt winding, that due to armature reaction, and that due to the auxiliary windings. The field distortion usually produced by armature reaction is therefore overcome, and the shape of the magnetic field at the point of commutation is maintained as formed by the main poles, and good commutation is made possible over a wide range of speed.

These motors are shunt wound, which gives a definite speed for each point of the controller, which is nearly constant for all loads. Heavy overloads may be momentarily developed without injurious sparking. The motors are reversible without danger and without readjustment o fthe brushes,and, as the armature and auxiliary windings are connected permanently in series, it is only necessary to change the external armature connections to reverse the directions of rotation.

These motors develop their full rated output throughout their entire range of speed. They will carry full rated load at any speed within their range for six hours with a temperature rise not ex-

ceeding 40 degrees Cent. in armature and field, and not exceeding 45 degrees Cent. on commutator, as measured by thermometer. At all loads and all speeds commutation is excellent, and an overload of 25 per cent. may be carried for one hour without injurious sparking. All motors are thoroughly ventilated, running cool and at a uniform temperature. Their efficiency is high and their speed regulation practically exact. With the exceptions noted, type SA motors are mechanically identical with the type S, and corresponding parts are interchangeable.

Freight Traffic on English Tramways.

Not content with taking away from railroads their short distance passenger traffic and making them as taxpayers help to support this competition with themselves, some English municipalities have also turned their attention to the carriage of freight on their electric tramcars, and have practically become common carriers. The largest municipal venture of the kind was at Manchester. This competition with Sutton & Co., a big firm of carriers, who were large ratepayers, was so manifestly unjust that they took the matter to the High Court of Justice with a view to ascertaining exactly how far the corporation could go units its Electric Tramway Powers Acts. The matters was considered very fully by Mr. Justice Farwell. Sutton & Co. asked the court to declare that the municipal Tramway Department had no power to convey, collect or deliver for reward any parcels or goods by means of road vans, hand carts or messengers, or otherwise than by their tramways. The Department had, in a pamphlet, published its rates and arrangements "for conveyance of parcels traffic from Manchester to all parts of the United Kingdom and abroad," and announced itself as agent for all railway companies, and even accepted traffic "for abroad." Mr. Justice Farwell, in his judgment, says that there is nothing *ultra vires* in delivering by cart such goods as have been carried over its lines; they must be allowed to use horses and carts to get the goods to their depots, and to convey them to the consignees' addresses. So far as this arose out of the tramways undertaking there was no objection to it, but the Manchester Corporation is not entitled to spend any part of the city funds or the receipts of the tramway undertaking for the purpose of establishing or maintaining business as carriers, except as part o fthe regular tramway business. The corporation, it should be mentioned, proposed to collect and deliver parcels outside the radius of their tramway system, and parcels which had never traveled and were not intended to travel over thetramways. A large expenditure had been made for horses, vans and plant for this purpose.

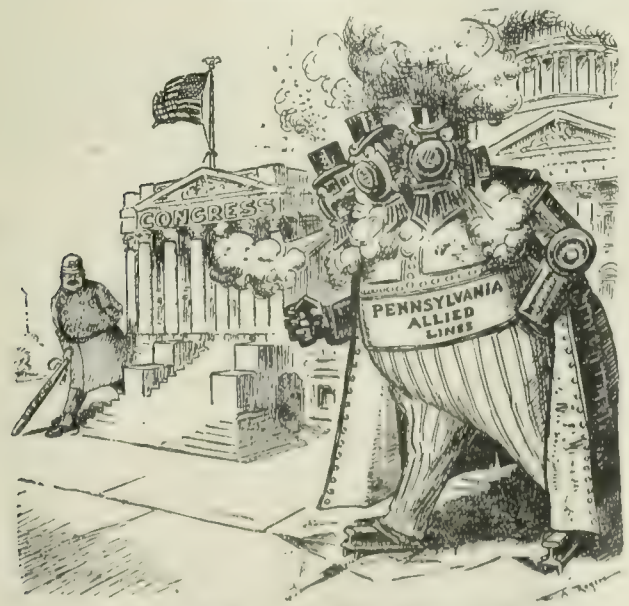
Results Under Electrification in England.

The North Eastern Railway reports that both operating and financial results under electric traction on the suburban lines in the Newcastle district have been entirely favorable. The following comparative figures are given:

	1903, steam.	1905, electric.
Passengers (half year)	2,844,000	3,548,000*
Earnings (year)	$626,940	$733,860
Running expenses (year)	207,818	232,206‡
Running cost per train mile	35 cts.	18 cts.

*Increase, 25 per cent.
†Double the number of trains.
‡Including repairs to rolling stock and depreciation.

By running smaller trains and more of them the company has both pleased the public and made better profit.



A Policeman's Lot Is Not a Happy One.

Rogers in *New York Herald*

A Collision at Cleckheaton.

Colonel Druitt has reported to the British Board of Trade the circumstances of a collision on the Lancashire & Yorkshire, last Christmas day, in which there was a curious combination of a green signalman, a careless signalman who was not green, and a mystifying juxtaposition of a Sunday and a holiday which appears to have led some one to forget that a local freight train would need attention Monday morning. There were no very serious injuries. Col. Druitt's conclusion says:

The causes of this collision are clearly indicated in the evidence of signalman Wright, on duty at Cleckheaton South signal-box, and of porter signalman Dawson, who was on duty at Cleckheaton station at the time, both breaking the rules of block working.

Cleckheaton North signal-box is open on Sundays up to 8 a. m., and is then closed till the following morning. The notice circulated for working the traffic on Christmas Day stated that the 2.50 a. m. goods train from Wakefield to Bradford would work as on Sundays.

On Sundays, the North box being open till 8 a. m., this train puts off any wagons for Cleckheaton at this signal-box, but Christmas day falling on a Monday, it followed that the North box was not open, as it was closed after 8 a. m. on Sunday and was not reopened. When the goods train approached Cleckheaton the men in charge say they expected to find the North box open, and to run through the station to that signal-box. Finding it closed the guard, after consultation with the driver, walked back to the station and after some conversation with porter signalman Dawson, the latter agreed to open the North box, so that the wagons for Cleckheaton could be put off the train. All this took some twenty minutes, and by the time Dawson got to the North signal-box, the 6.40 a. m. passenger train from Mirfield to Bradford had arrived at the station, viz., at 6.54 a. m.

Dawson having opened the North box, immediately switched in and gave the bell signal for opening, first to the South box and then to Low Moor No. 2, the box in advance, without first giving notice to the signalman by telephone, as required by Rule 24. As soon as he had done this, signalman Wright, at the South box, although he had not received the "Train out of section" signal for the goods train, offered Dawson the passenger train, and Dawson, without thinking, at once accepted it, although the goods train was still standing just in front of his signal-box, so Wright lowered his starting signal for the passenger train to proceed. As soon as Dawson had accepted this train he recognized his error and at once called up Wright on the telephone, saying the goods train was at his box and asking Wright to stop the passenger trains. * * * When the passenger train left Cleckheaton, driver Sykes states that seeing the North box distant signal "off" and unlighted he assumed that the North box was closed and that he had a clear road to Low Moor, so he did not look for the North box home signal as it was unlighted, and as he had turned round to attend to the injector (the engine being bunker first) he did not notice the tail lamps of the goods train until the guard of that train, who had run back a short distance with his red hand-lamp to try and stop the passenger train, shouted out to him. Driver Sykes had only time to shut his regulator and apply the brakes when the collision occurred.

Porter signalman Dawson was not, I consider, justified in opening the North signal-box at the request of guard Marks. Although qualified, he had little experience, and had only previously worked in the North box under supervision.

He opened the box without first telling the signalmen on either side of him what he was doing, and according to the Rule he should have had the signal lamps lighted before dealing with any train.

Although Dawson may have somewhat misled signalman Wright, nothing can justify the latter for offering the passenger train, and then lowering his starting signal for it, without first obtaining the "Train out of section" signal for the goods train; and the very fact of the North box being opened unexpectedly should have made him enquire of the man there if the goods train had cleared.

Signalman Wright had been on duty 13 hours at the time of the collision, as he had arranged without permission to work an extra hour for the signalman next on duty. The tour of duty at Cleckheaton South box is usually 10 hours, but is 12 hours on Sunday when there is little traffic on the branch line between Mirfield and Low Moor.

Good Thunder Potatoes.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced its decision in the case of Hoerr against the Chicago, Milwaukee & St. Paul. On potatoes c. l. from Mankato and Good Thunder, Minn., to Washington, D. C., and Scranton, the rates are 46 cents from Good Thunder to Washington and 47 cents from Mankato to Scranton. At the same time rates have been in force a number of years from St. Paul and Minneapolis of 37 cents to New York, 40 cents to Boston, 35 cents to Philadelphia, and 34 cents to Baltimore. These rates govern those to Washington and Scranton from St. Paul. The rates from St.

Paul, though the result of competition, have been long in force as normal rates, and are found to be reasonable. The Commission holds that the rates from Mankato and Good Thunder to Washington, Scranton and other Eastern destinations are unjust; also that the St. Paul rate may be used here as a standard of comparison; and that reasonable rates from Mankato and Good Thunder to Washington and Scranton would be 39 cents to Scranton and 38 cents to Washington, which rates would be 4 cents above the rates from St. Paul; and the carrier is recommended to put in corresponding rates from Mankato and Good Thunder to the various eastern destinations. Complainant is awarded reparation.

The B. & O. and the West Virginia Coal Shippers.

Replying to criticisms made in the United States Senate, the Baltimore & Ohio Railroad has sent to Senator Rayner, of Maryland, an explanatory statement, which the Senator has presented in Congress. The complainant, the Red Rock Fuel Company, purchased mines in Upshur County, knowing that the railroad could not enlarge its facilities until it could secure additional cars and engines. The Red Rock tipple was 4,000 ft. from the railroad, and the connection to the main line was half-way between two stations. No coal is hauled over that part of the B. & O. lines. Continuing, the statement says:

"Where there is a coal field sufficiently developed to require special service, the Baltimore & Ohio furnishes special coal switching service to place empty cars at the coal tipples and to take away loaded cars. Where such a special service exists the railroad company can switch cars to a tipple located away from the company's track even as far as four thousand feet, although such a distance would be unusual. Without such special switching service the railroad company cannot switch to and from a tipple so located. To attempt it in connection with regular trains would involve leaving the train on the main track, while the locomotive and crew were gone a mile away. To perform the service demanded by the Red Rock Company, therefore, would require a special switching service for twenty miles each way. The answer of the railroad company to the demand of the Red Rock Company was the same that had been given to their predecessors in title, as they well knew, namely, that until the railroad company could enlarge its equipment it could not provide special service to develop a new coal territory, but must stop at the discharge of its legal obligations as a carrier. They were told at the same time that the railroad company was taking steps to make large additions to its equipment. Thereupon the Red Rock Company filed its complaint before the Interstate Commerce Commission."

The Red Rock lands are in an undeveloped region; and the B. & O. has no switching service within 20 miles either way. The B. & O. has no interest in coal companies in the Fairmont district, but it owns a majority of the stock of the Consolidated Coal Company which, in 1903, acquired a bare majority of the stock of the Fairmont Coal Company; but the road denies that its refusal to comply with the wishes of the Red Rock Company is due to its ownership in other mines. Continuing, the statement says:

"The Baltimore & Ohio has recognized that its duty as well as its interests requires the development of the natural resources of West Virginia as rapidly as possible. The coal production has doubled in five years largely because of its efforts. The vast area of undeveloped coal lands in West Virginia cannot all be developed immediately without reference to the situation or the railroad's facilities and equipment. The Baltimore & Ohio has endeavored to apply common-sense business principles to the handling of a situation forced upon it by circumstances largely unforeseen and beyond its control."

Elephant Power.

A correspondent in India has sent us a copy of the following inquiry that has been received from a native public works department: "We have a number of elephants in the State. I propose to utilize them in working dynamos for six hours every day and generating electricity, to store it in batteries and use it at night for lighting streets. I shall feel obliged if you will please give me the information required in the statement accompanying: (1) How many electrical units will an elephant of ordinary strength, working six hours, produce? (2) Cost of dynamos required. (3) Cost of gear required to work it by elephants. (4) Cost of battery to store the electricity."

The mechanical equivalent of the power of an elephant is probably known in India, but we have not been able to find it in textbooks published here. Probably, as compared with that of a horse, it varies as their respective weights. A central station containing a score of elephants walking round like mill horses, or climbing ramps that slipped away under their feet, would be rather a painful spectacle. It would be a degradation to put such intelligent animals to tread-mill work. Apart from this, however, we see no way in which the enterprising department in question could utilize the source of power at their disposal. We do not suppose elephants could be trained to raise water in their trunks and spurt it on a Pelton wheel; and as we have no means of calculating the force of a jet of this kind, we are not able to recommend this means. We fear, however, that the word "elephant" will hardly ever achieve further recognition in the industrial world than which has already fallen to its lot, in being coupled with that of "boilers" to designate a type of Continental stationary steam-raising apparatus; and, in this case, it is the bulk of the mammal that has been considered, not its intelligence.—*Engineering* (London).

Proposed Bolivian Railroads.

During the past year surveys were made over a distance of 500 miles by American engineers for new railroads in Bolivia at a cost of $120,000, which was paid by the Government under contract with a New York firm, which, in the event of its receiving the concession to build and operate the railroads, will refund the money to the Government. Other surveys will be made for an additional 550 miles. Having rejected a proposition of this firm, the Government has asked Congress for authority to contract for the simultaneous construction, if possible, of the following lines:

From Viacha (La Paz) or Corocoro to Oruro, from Oruro to Cochabamba, from Uyuni to Potosi, from Potosi to Tupiza, and the first section of 100 miles of the line from La Paz to Puerto Pando, employing the funds provided by the Brazilian indemnity. It is proposed also that, for the construction of the line from La Paz to Puerto Pando (the "Yungas" line), there shall be assigned, in addition, the funds to be derived from the increase of duties to be imposed upon cocoa, this line being of special importance to the "Yungas" section, which is the principal cocoa-producing district of the country.—*Consular Report.*

News from Albany.

Once not so long ago a kindly government of the New York Central Railroad was prodigal in the distribution of passes over its lines from here to Albany. This generosity was not wholly unknown to the legislators. Then came a season of much talk wherein it was set forth that an important law was being violated. Following came a widely announced agreement on the part of the railroads of the east that the pass privilege had been abolished. It cannot be said that a particular class of travel has shown any heavy decrease, and it is a matter of speculation as to whether the receipts would tally identically with the number of fares. If they didn't there is but one answer. In other times Mr. Moses Dinkelspiel, not entirely unknown at the Hoffman House in this city and the Hotel Ten Eyck in Albany, commanded apparently inexhaustible resources in the way of transportation. If a man were "right" he needed but ask and it was given him. Recently, it is whispered, Mr. Dinkelspiel has been appearing in his former haunts and it is said that, through a strange coincidence, methods of riding on the railroad without first observing the preliminary of buying a ticket have been discovered. Those fortunate enough to enjoy this favor have been furnished a little stiff pasteboard card in place of the flimsy, double jointed ticket which the conductor formerly took up and turned in. . . .—*New York Herald.*

One to Each 4,257 Miles.

The Burlington will pay more attention to the movement of fast freight and has appointed two inspectors, who will travel over the system investigating all delays and making suggestions where improvement can be effected. These inspectors are J. W. Cunningham, a locomotive engineer of Aurora, and G. E. Wilkinson, assistant to General Manager Gruber.—*Exchange.*

Disastrous Fire at Moncton.

The Intercolonial shops at Moncton, N. B., were almost totally destroyed by fire on February 25, and the cost of replacing them will approximate $1,000,000. In addition to the buildings destroyed there were over 100 passenger and freight cars, together with a large amount of machinery.

The Right to Route Your Freight.

A press despatch from Washington says that the "citrus fruit" cases have been decided favorably to the railroads by the Supreme Court of the United States, in an opinion by Justice Peckham. The cases involved the right of the railroad companies to designate the route for fruit shipped east after leaving their own lines. The proceeding was begun by the Interstate Commerce Commission to test the legality of a joint order issued by the Southern Pacific and the Atchison in 1899 making a through rate of $1.25 per 100 lbs. on oranges from Southern California points to the Missouri river and further east. In this order the railroads reserved the right of routing the freight east of their own terminals. The commission held that the routing provision was virtually a contract for pooling, and also violated the provision of the law requiring stable and open rates. The Supreme Court holds that the routing agreement aided in preventing rebates and that the only question was whether the carrier that takes the fruit from the shipper in California has the right to insist upon the rule permitting it to route the freight at the time it is received from the shipper.

Justice Peckham said: "We think there is nothing in the act

which clearly prohibits the roads from adopting the rule in question. The common carrier need not contract to carry beyond its own line. If it agrees to transport beyond its own line it may do so by such lines as it chooses, and may guarantee the through rate on condition that it has the routing. Having the right to agree on a joint through tariff on terms mutually satisfactory, we think that the agreement does not violate any provision of the commerce act, and there is no evidence in this case which shows that there has been any such violation."

The Selection of a Commission.

Much has been heard lately of a plan for appointing the prospective new members of the Interstate Commerce Commission in a way that they may represent various "interests." A representative of railway employes, another of railroad managers, another of shippers, are some of the favorite suggestions for places on the Interstate Commerce Commission. The assumption seems to be that the commission will make rates as the outcome of a process of pulling and hauling among the interests represented upon it. What kind of work would be expected of a court or an administrative body under such conditions? Experience shows what sort of management must be anticipated in a business establishment whose board of directors is concerned with anything rather than the welfare of the enterprise itself. Judges are selected presumably because of their legal ability in the first instance; directors should be because of their serviceability or attachment to the enterprise at hand; members of administrative commissions, because of the similarity of ideas and their ability to act in harmony, supplementing one another's good and weak points. It is by no other method that the Interstate Commerce Commission can be given the best chance to show what it can do. To select its members because of their connection with different interests, or on a purely geographical basis, as now proposed by the Senate Committee, would be the surest way of preventing the commission from attaining any satisfactory results.—*Journal of Commerce (New York).*

Metropolitan District Railway Electrification.

This railroad has not yet, of course, derived financial benefit from its electrification. The days are too early. Electric traction was only partially commenced on this line on July 1, and was not completed until December. The necessity of continuing steam working, along with electric, involved special expenditure, delayed the completion of the automatic signal installation, interfered with train service, and prevented the running of a sufficient number of trains during the rush hours. Total receipts showed an increase of $29,600, but working expenses, due to the causes mentioned, were $145,134 greater. Net profit showed a corresponding decrease of $115,527. The total cost of the electrical equipment and installation, including 434 cars, has been $8,150,000. To this there must be added estimated further expenditure of $114,000 still to be made. This includes the cost of 70 more cars.

Wisconsin in 1874.

In a small, neat, uncarpeted room William R. Taylor, 86 years old, the Granger Governor of Wisconsin, who made the railroads tremble a generation ago, is dreaming away his declining days at the Gisholt Home for the Aged, at Madison, Wis. From his southwest window he beholds glistening in the sunlight the dome beneath which in palmier days he once ruled a sovereign commonwealth. The aged Governor takes little interest in public affairs now. His great weight of years, illness and privations of late have made it necessary for him to keep close to his room and forego all exertion as well as reading. Here is his own story of his campaign and the fate of his reforms:

"In that day the railroads were far more arrogant than they are to-day. The principle had not then been established that the people were above the corporations, and that the state had the full power and right to regulate them. . . . They committed shameful abuses upon the people. They put their lines through without paying for right of way, and claimed the right to charge what rates they pleased. In order to do up their rivals they also practiced the grossest discrimination. They made and unmade towns through rebates. A mighty protest went up from the people, and our party rode into power over the regular Republican ticket. We had a majority in the Legislature, and on March 1, 1874, we passed the Potter law relating to railroads, telegraph and express companies. We established a Board of three Railroad Commissioners with large powers. It classified freights, fixed the maximum fares for passengers and otherwise sought to curb the arrogance and power of the railroads.

"The railroads at once served notice on me that they did not propose to abide by the law, and I issued a proclamation that if necessary the whole power of the state would be invoked to compel them to obey it. They got the opinion of great railroad attorneys in the east, like W. M. Evarts, of New York, who held that the law was unconstitutional in that it invalidated the obligation of contracts and confiscated property. Of course, it was only a question of time when the courts would have to pass upon it. There was then a vacancy in the chief justiceship of the Supreme Court, which I had to fill.

"I had a poor field to pick from, as practically every lawyer of any ability was committed one way or the other on the questions. Most of them had been retained by the railroads. I finally decided upon E. G. Ryan. . . . The railroad party claimed Ryan at once, but he turned out all right. I also called in Judge David Davis, of the United States Supreme Court. Judge Davis was a very wealthy man, and it was thought for that reason he might decide for the railroads, but again our judgment proved good.

"It was a great legal struggle, and we had the biggest lawyers that railroad money could buy pitted against us, but we won. The Supreme Court decided that the Potter law was constitutional, and that the state had full power to regulate corporations of its own creation.

"The cause for the change of sentiment with the people? It was railroad money—pure and simple. They bought up the newspapers, the lawyers and the courts and deceived the people. They piled money in from the east. The people had also been corrupted by the pass evil. We passed an anti-pass law and its enforcement hurt me.

"In my second message I showed that the industrial depression was not peculiar to Wisconsin, but prevailed largely throughout the country. . . . Joining hands with the railroads were the lumber thieves of the north. They had stolen themselves rich, and I had threatened proceedings against them. They studied every candidate for the Legislature, approving only of such as they could buy or influence.

"Well, we couldn't stand the tide. We were before our time. When Governor Ludington was inaugurated he urged the repeal of both the Potter and the anti-pass law. A bill known as the Vance bill was passed, which took out the vitals of the law." . . . —*Exchange.*

Light Rails in 1905.

During 1905 the production in this country of all kinds of rails weighing under 45 lbs. to the yard shows a decrease of 65,303 tons as compared with 1904, but the production of rails weighing 45 lbs. and less than 85 lbs. shows an increase of 278,947 tons in 1905 over 1904. The great increase in the weight of rails in 1905 as compared with 1904 was, however, in sections weighing 85 lbs. and over, in which the increase amounted to 873,902 tons.—*Bulletin of the Iron and Steel Association.*

Dinner to Mr. Daniels.

At the Waldorf-Astoria Hotel, New York City, on the night of February 20, a dinner was given to Mr. George H. Daniels, Advertising Manager of the New York Central Lines, by a few of his friends; that is to say, about 500 of them. They came from Massachusetts, Florida, California, and most of the states between.

Manufacturing and Business.

Greene, Tweed & Co. have moved from 17 Murray street to more commodious quarters at 109 Duane street, New York City.

The Contractors' Supply & Equipment Co., Chicago, recently sold two Smith concrete mixers to the Missouri, Kansas & Texas Ry.

Armour Car Lines have placed an order for 20 steel underframes for tank cars with the Bettendorf Axle Co., Davenport, Iowa.

W. I. Hoklas, Saratoga, Wyo., in the engineering department of the D. Y. & P., is asking for catalogues and price-lists of railroad supplies and equipment.

August von Borries, the originator of the von Borries compound, which is used extensively on Prussian railroads, died at Meron, Germany, on February 14, at the age of 54.

The Northwestern Elevated has let a contract to K. E. Myers Co., of Chicago, for equipping 3½ miles of double-track (elevated) with third rail, and one mile of double-track (surface) with an overhead trolley line, on its Ravenswood extension.

The Ohio Brass Company has placed an order with the H. W. Johns-Manville Co., New York, for 850 squares of its "J-M" asbestos roofing for its factories at Mansfield, Ohio, which were partially destroyed by fire last year and which are now being rebuilt.

The Farlow Draft Gear Company, Baltimore, Md., has just received orders for upwards of 1,800 sets of the Farlow draft gear as follows: Kansas City Southern, 300 sets; Richmond, Fredericksburg & Potomac, 100 sets; Cudahy Packing Co., 225 sets; W. J. Rainey Co., 125 sets; Virginia & Carolina, 275 sets; Hocking Valley, 600 sets, and miscellaneous orders for 150 sets.

George W. Little, for the past four years Assistant Treasurer of the Pittsburg Spring & Steel Company, died on Friday, February 16, of pneumonia after an illness of one week. Mr. Little had a long experience in the spring business, having been originally connected, in the accounting department, with A. French & Company some 30 years ago and continued with that company and its successors until 1902.

The order for the cattle guards to be used on the new electrified line of the West Jersey & Seashore, between Camden, N. J., and Atlantic City, has been given to the Climax Stock Guard Company, of Chicago. The contract calls for about 30 carloads of the well-known "Clay" guards. The installation, with all material, labor and transportation, is to be furnished by the Climax Company. The line is to be finished, equipped by about June 1.

The State of Missouri has lost the suit in the Supreme Court of the United States which it brought against the state of Illinois to have the Chicago drainage canal declared a nuisance, and it is said that the immense power plant at Lockport, Ill., will now be begun. This project contemplates the development of 40,000 h.p. by a dam and electric generators, and the generators are now being built at the shops of the Crocker-Wheeler Co., Ampere, N. J. There will be four 1,000 K.V.A. three phase, 60-cycle, 6,600-volt alternating current generators.

Albert Ladd Colby has opened an office as consulting and inspecting engineer and iron and steel metallurgist at 477 Central Park West, New York. Mr. Colby was for 18 years with the Bethlehem Steel Co. and for the last three years was nickel steel expert for the International Nickel Co. He was a juror in metallurgy at the Paris Exposition in 1900 and has visited all the prominent steel works abroad. He has been Secretary of the Association of American Steel Manufacturers and is a member of the Am. Soc. C. E., Iron and Steel Inst., A. S. M. E., Am. Inst. M. E., American Chemical Society, and Society of Chemical Industry. He is also the author of a book on Steel Specifications and a frequent contributor to the technical press.

Iron and Steel.

The Kansas City Southern has bought from the Illinois Steel Co. 50,000 tons of 85-lb. rails to replace all rails lighter than 75 lbs. in its main line between Kansas City, Mo., and Shreveport, La., a distance of 560 miles.

The demand for small rails continues quite active. A number of orders running from 100 to 1,500 tons each have been placed aggregating 7,000 tons. In addition the Texas Central has given an order for 5,300 tons. A few small orders have been given for structural shapes and fabricated steel, and about 9,000 tons were recently let in New York.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of the General Section February 22, a paper on "Formulæ for Reinforced Concrete Beams," by Mr. Henry Goldmark, was read and illustrated by lantern slides.

Railway Signal Association.

The next meeting of this Association will be held at the Great Northern Hotel, Chicago, on Monday, March 19, beginning at 10 a.m. At this meeting a new constitution and by-laws will be presented for adoption. Mr. F. B. Corey, of the Railway Engineering Department of the General Electric Co., will read a paper on "Charging of Storage Batteries from Alternating Current Circuits." Mr. W. N. Spangler, Supervisor of Signals, West Jersey & Seashore, presents a paper on "Substituting track circuits for detector bars," and W. A. D. Short, Signal Engineer of the Illinois Central, will read a paper on "Power Operated Distant Signals."

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chicago & Alton.—B. F. Yoakum has been elected a director, succeeding W. B. Leeds, resigned.

Colorado & Southern.—J. M. Herbert, First Vice-President, has resigned.

San Antonio & Aransas Pass.—W. H. McIntyre has been elected President, succeeding C. R. Hudson, and W. M. Hobbs, formerly Assistant to the Second Vice-President of the Chicago, Rock Island & Pacific, has been elected First Vice-President and General Manager. M. D. Monserrate, Vice-President and General Manager, has been elected Second Vice-President.

Operating Officers.

Atlantic Coast Line.—W. B. Denham, First Assistant to the Third Vice-President, has resigned. See Georgia, Florida & Alabama.

Augusta & Florida.—Cecil Gabbett has been appointed General Manager.

Boyne City, Gaylord & Alpena.—J. K. V. Agnew, Assistant General Manager, Traffic Manager and Purchasing Agent, has resigned, to engage in other business.

Buffalo, Bradford & Kane.—A. B. Campbell, General Superintendent, has resigned to go to the Auditing Department of the Buffalo & Susquehanna. R. S. Bullis, Secretary, Treasurer, and General Freight and Passenger Agent, succeeds Mr. Campbell.

Gainesville & Gulf.—J. B. Cutler has been appointed General Superintendent and Traffic Manager, succeeding L. E. Barker.

Georgia, Florida & Alabama.—W. M. Legg, General Manager, has resigned. W. B. Denham, First Assistant to the Third Vice-President of the Atlantic Coast Line, succeeds Mr. Legg.

Lake Shore & Michigan Southern.—Edward A. Handy, who was recently appointed General Manager of this road, was born in 1855 and is a graduate of the Massachusetts Institute of Technology. His first railroad service was in 1878, as assistant engineer on construction of the Atchison, Topeka & Santa Fe. The next year he was made assistant engineer of bridges and buildings for the same road, and in 1880 went to the Mexican National as locating engineer. In 1881 he was appointed Principal Assistant Engineer of the Northern division of that road, being promoted in 1883 to Chief Engineer. After five years he went to the Lake Shore & Michigan Southern as Engineer of the Lake Shore division. In 1891 he was appointed Chief Engineer, his authority being extended in 1900 over the Lake Erie & Western. On July 5, 1905, he was appointed Assistant General Manager of the Lake Shore & Michigan Southern, the Lake Erie & Western, the Indiana, Illinois & Iowa, and the Lake Erie, Alliance & Wheeling, from which positions he is now promoted.



E. A. Handy.

Philadelphia, Baltimore & Washington.—The headquarters of the Delaware division have been removed from Clayton, Del., to Wilmington.

Southern.—J. J. Cotter, Superintendent at Birmingham, Ala., has resigned. W. M. Deuel, formerly Assistant Superintendent at Knoxville, Tenn., and later Assistant Superintendent at Birmingham, succeeds Mr. Cotter. C. L. Harris, formerly Superintendent of the Missouri, Kansas & Texas, at Parsons, Kan., succeeds Mr. Deuel at Birmingham.

Union Pacific.—W. A. Whitney, Superintendent at Cheyenne, Wyo., has resigned.

Traffic Officers.

Indiana Harbor.—F. G. Hopper, Assistant General Freight Agent of this road and of the Indiana, Illinois & Iowa, has resigned to engage in other business.

New York Central & Hudson River.—J. F. Fairlamb, Auditor of Passenger Accounts, has been appointed General Passenger Agent, succeeding G. H. Daniels.

St. Louis & San Francisco.—The authority of John Sebastian, Passenger Traffic Manager of the Chicago, Rock Island & Pacific, has been extended over the St. Louis & San Francisco.

Engineering and Rolling Stock Officers.

Lake Shore & Michigan Southern.—M. J. McCarthy, hitherto Master Mechanic of the Michigan Central at St. Thomas, Ont., has been appointed Master Mechanic of the Michigan Southern division of the L. S. & M. S., having authority also over the Indiana, Illinois & Iowa, with office at Elkhart, Ind., succeeding C. W. Cross, transferred.

Pennsylvania.—A. C. Shand, Assistant Chief Engineer, has been appointed Chief Engineer, succeeding W. H. Brown, retired.

H. J. Huber has been appointed Assistant Master Mechanic at Verona, Pa., succeeding Taber Hamilton, transferred.

Wheeling & Lake Erie.—M. E. Wells, Traveling Master Mechanic, has been appointed Assistant Master Mechanic of this road and of the Wabash-Pittsburg Terminal, with office at Columbia, Ohio.

Special Officers.

Southern Pacific.—H. C. Pearce, General Storekeeper of the Chicago, Rock Island & Pacific, has been appointed General Storekeeper of the Southern Pacific, succeeding W. R. Ormsby, resigned.

LOCOMOTIVE BUILDING.

The Sumpter Lumber Co., Sumpter, Ala., has ordered one 37-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Missouri, Kansas & Texas, as reported in our issue of February 2, has ordered 20 simple mogul (2-6-0) locomotives, 10 simple 10-wheel (4-6-0) locomotives, and five simple switching (0-6-0) locomotives from the Baldwin Locomotive Works, all for August delivery. The mogul locomotives will weigh 156,000 lbs., with 135,000 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 63 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,268 sq. ft.; 294 charcoal iron tubes, 2 in. in diameter and 12 ft. 8 in. long; Otis steel firebox, 102 in. x 56 in.; grate area, 39.6 sq. ft.; tank capacity, 7,500 gallons, and coal capacity, 14 tons. The 10-wheel locomotives will weigh 146,000 lbs., with 104,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 68 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,372 sq. ft.; 295 charcoal iron tubes, 2 in. in diameter and 14 ft. 3 in. long; Otis steel firebox, 100¼ in. x 41¾ in.; grate area, 29.1 sq. ft.; tank capacity, 6,500 gallons, and coal capacity, 10 tons. The switching locomotives will weigh 147,000 lbs.; cylinders, 20½ in. x 26 in.; diameter of drivers, 57 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,139.8 sq. ft.; 335 charcoal iron tubes, 2 in. in diameter and 11 ft. 3 in. long; Otis steel firebox, 108⅝ in. long and 41¼ in. wide; grate area, 31.15 sq. ft.; tank capacity, 5,600 gallons, and coal capacity, eight tons. The special equipment for all includes: Westinghouse-American air-brakes, Simplicity bell ringers, Magnesia boiler lagging, National-Hollow brake-beams, Sargent brake-shoes for 10-wheel and switching locomotives, Buckeye couplers for switching locomotives, Nathan Manufacturing Co.'s injectors and sight-feed lubricators, Railway Steel Spring Co.'s springs, Crosby steam gages for mogul locomotives, Safety steam heat equipment for 10-wheel locomotives, and Standard steel driving and truck wheel tires.

CAR BUILDING.

The Armour Car Lines are building 400 refrigerator cars of 60,000 lbs. capacity at their own shops.

The Augusta Railway & Electric Co., Augusta, Ga., has ordered six trolley cars from the J. G. Brill Co.

The Canadian Pacific has ordered 500 steel cars of 100,000 lbs. capacity from the Dominion Steel Car Co.

The Georgia Southern & Florida has ordered three freight cars from Barney & Smith, for May delivery.

The Chicago, Milwaukee & St. Paul, it is reported, will build 400 cars of 60,000 lbs. capacity at its own shops.

The Montreal Street Railway Co. (Electric), Montreal, Que., is building 100 passenger cars at its Montreal barns.

The Cleveland & South Western Traction Co., Cleveland, Ohio, has ordered 15 interurban cars from the Niles Car & Manufacturing Co.

The Central of Georgia, as reported in our issue of Feb. 9, has ordered 1,000 steel hopper coal cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The Union Railway Company has just placed a rush order for 50 trolley cars. Address Edward A. Maher, President and Manager, 204 East 128th street, New York City.

The Virginia & Southwestern, as reported in our issue of February 9, has ordered 250 gondola cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Cincinnati, New Orleans & Texas Pacific is not to build any new cars, as reported, at its Gadsden shops at present, but is merely getting ready to rebuild 19 of its old flat cars.

The Boston & Maine has ordered 1,000 box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co., in addition to its order which was recently reported in a previous issue.

The Kansas City Southern, as reported in our issue of February 2, has ordered 100 tank cars, of 10,000 gallons capacity, 200 gondola cars of 80,000 lbs. capacity, and 10 cabooses from the American Car & Foundry Co.

The Texas Company, Beaumont, Texas, has ordered 50 oil-tank cars from the American Car & Foundry Co. These cars are to be built at the Milton, Pa., plant, and are to be delivered within 90 days. The underframes will be of metal.

The Munising Railway has ordered two 60-ft. combination passenger and baggage cars from F. M. Hicks & Co., for May delivery. The special equipment includes: Westinghouse air-brakes, Buhoup couplers, National steel draft rigging and Baker heating system.

The Chicago, Burlington & Quincy has ordered six double plow cars from the Rodger Ballast Car Co. These cars are for April delivery and will be built by the American Car & Foundry Co. They will be 32 ft. long x 9 ft. 3 in. wide x 4 ft. 1 in. high over all.

The Marquette & Southeastern has ordered two 60-ft. coaches and two 60-ft. combination mail, passenger and baggage cars from F. M. Hicks & Co. The special equipment includes: Westinghouse air-brakes, Buhoup couplers, National steel draft rigging, and Baker heating system.

The Interstate has ordered 14 wooden hopper cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co. The special equipment includes: Bettendorf bolsters, Western Steel Car & Foundry Co.'s brake-beams, Westinghouse air-brakes, Major couplers, McCord journal boxes, Railway Steel Spring Co.'s springs, "Diamond" arch-bar trucks and Griffin wheels.

The Midland Valley, as reported in our issue of February 9, has ordered four standard cabooses from the Mt. Vernon Car Manufacturing Co. These cabooses will be 36 ft. long and 9 ft. wide, over all. The special equipment includes: Christie brake-shoes, Westinghouse air-brakes, Ajax Metal Co.'s brasses, Tower couplers, Miner draft rigging, Hewitt journal boxes, Patterson-Sargent paint, and Mt. Vernon Car Manufacturing Co.'s wheels.

The Central of Georgia has ordered 1,000 hopper bottom steel coal cars of 100,000 lbs. capacity from the Pressed Steel Car Co. These cars will be 31 ft. 10 in. long, 10 ft. ⅜ in. wide and 10 ft. 8 in. high, over all. The special equipment includes: Simplex truck bolsters and brake-beams, Lappin brake-shoes, Westinghouse air-brakes, Ajax brasses, Major couplers, Sessions draft rigging, McCord dust guards and journal boxes, and Railway Steel Spring Co.'s springs.

The Metropolitan Street Railway Company, Kansas City, Mo., has ordered 25 vestibule electric street cars from the St. Louis Car Co., and five cars of the same type from the American Car & Foundry Co., for June, 1906, delivery. These cars will have a seating capacity to seat 48 persons, and will measure 33 ft. 3½ in. inside. The bodies will be of wood and the underframes will be of wood and metal. The special equipment will include the Cambria Steel Company's axles, Curtain Supply Company curtain fixtures, Pantasote curtain material, Consolidated Car Heating Company heating system, Rodgers journal boxes, St. Louis Car Company's trucks and Griffin car wheels. Each of these cars will be equipped with four type G E 80 h.p. motors.

The Missouri, Kansas & Texas, as reported in our issue of January 26, has ordered 1,700 box, 300 ventilated box, 300 furniture cars, all of 60,000 lbs. capacity; 10 baggage and 10 chair cars, as reported in our issue of February 2, and eight postal cars from the American Car & Foundry Co., all for August delivery; and, as reported in our issue of January 26, 100 Rodger ballast cars of 80,000 lbs. capacity from the Rodger Ballast Car Co., to be built by the American Car & Foundry Co. The box cars will weigh 35,000 lbs. and 39,000 lbs., and measure 40 ft. 1 in. long, 9 ft. wide and 13 ft. 11½ in. high, over all. The furniture cars will weigh 37,000 lbs. and measure 13 ft. 10¼ in. long, 9 ft. 11⅜ in. wide and 15 ft. 1⅝ in. high, over all. The baggage and chair cars will be 69 ft. 3½ in. long and 9 ft. 3½ in. wide, inside measurements. The postal cars will be 60 ft. long and 9 ft. wide, inside measurements. The ballast cars will be 32 ft. long, 8 ft. 8 in. wide and 4 ft. high, inside measurements. The special equipment for all includes: American Steel Foundries bolsters for box and furniture cars and Common Sense bolsters for ballast cars; National Hollow brake-beams, Diamond "S" brake-shoes; Westinghouse air-brakes for postal cars, Major couplers for box, furniture and ballast cars and Janney couplers for baggage, chair and postal cars, Burrowes curtain fixtures and Pantasote curtain material for chair cars, Positive door fastenings and Security doors for box cars, Miner draft rigging, Safety heating system and Symington journal boxes for baggage, chair and postal cars; Pintsch light for chair and postal cars, Missouri Kansas & Texas standard paint for all cars except ballast cars, Lawler steel platforms for baggage, chair and postal cars, Chicago roofs for box and furniture cars, Scullin roofs for chair cars, American Steel Foundries trucks with Barber roller bearings for box and furniture cars, and Rodger trucks for ballast cars, Pullman vestibules for chair cars and American Car & Foundry Co.'s wheels for box and furniture cars, and Paige wheels for baggage, chair and postal cars.

BRIDGE BUILDING.

BARNSTABLE, MASS.—Bids will soon be asked by the County Commissioners for building the proposed bridge over the Bass river. The bridge is to be 700 ft. long and cost $20,000. Alfred Crocker is Clerk of the County Commissioners.

BOONVILLE, MO.—Bids are wanted March 7, by A. W. Nicol, Deputy County Clerk, for building a steel bridge 228 ft. long over the Blackwater river in Cooper County to cost $4,000.

CANYON CITY, COLO.—The newspapers say that a railroad bridge is to be built over the Royal Gorge. The bridge is to be 2,800 ft. above the hanging bridge of the Denver & Rio Grande, and is to be built as a part of an electric railway from Cañon City to Florence. It is said that the line to the top of the Royal Gorge will be in operation this summer. The cost of all the railroads proposed will be $500,000 and the suspension bridge spanning the chasm $100,000 additional. The air-line distance from Cañon City to the highest point the road will reach is six miles, but a tortuous road 10 miles in length will be built.

CHICAGO, ILL.—The Chicago, Rock Island & Pacific is planning to build several bridges on its main line between this place and Colorado Springs, and on the line between Burlington and St. Paul, also on its southwestern lines.

CLINTON, KY.—The Fiscal Court will probably ask for bids at its April meeting for a bridge 125 ft. long. J. A. Porter may be addressed.

EVANGELINE, LA.—Plans are being made by Acadia and Calcasieu parishes to jointly build a bridge about 600 ft. long over the Bayou Nepique. G. H. Brooks, of Crowley, La., may be addressed.

GALLATIN, MO.—Bids will soon be asked by W. Donell, of Coffeyburg, Mo., for building a steel bridge 180 ft. long, to cost $5,500, over the Grand river in Daviess County. W. R. Barnett may be addressed.

HENRIETTA, TEXAS.—Bids are wanted March 19, by C. L. Karsteter, County Clerk, for building a steel bridge 210 ft. long over the Big Wichita river in Clay County, to cost about $5,400.

LEAVENWORTH, KANSAS.—Bids are wanted March 5, by the Board of County Commissioners, for building five steel bridges in Leavenworth County. J. W. Niehaus is County Clerk.

MADISON, NEB.—Bids are wanted by George E. Richardson, County Clerk, March 20, for building a number of steel bridges in Madison County.

NIAGARA FALLS, ONT.—The Niagara Frontier Bridge Company has been formed for the object of building a new bridge across the Niagara river. Work is to be begun before Dec. 31, 1906.

OPELOUSAS, LA.—Bids are wanted by C. C. Genung for building a steel bridge 150 ft. long over Bayou Courtableau. W. B. Robert may be addressed.

PAINTSVILLE, KY.—Bids are being asked by W. E. Litual for building an iron bridge over Paint creek in Johnson County. W. P. Davis is Clerk of the County Court.

PERRYVILLE, ARKANSAS.—Bids are wanted by J. N. Stone, County Judge, for building a steel bridge over the Fourchelafuve in Perry county.

SALINA, KAN.—Bids are wanted by G. J. Duncan, County Clerk, March 20, for building three steel bridges in Saline County.

TROY, MO.—Bids are wanted April 6 by the County Court for building a steel bridge 304 ft. long over the Cuivre river. M. R. Long is County Clerk.

VANCOUVER, B. C.—The wooden bridge over the Pitt river on the main line of the Canadian Pacific is to be replaced with a steel structure.

WARRENSBURG, MO.—Bids will be asked about September 1 by the County Commissioners for building between 35 and 40 steel bridges in Johnson County. C. A. Boyles is County Clerk.

WILLIAMSON, W. VA.—A bill has been introduced in the lower House of Congress authorizing William Smith and associates to bridge the Tug Fork of the Big Sandy river near this place, where it forms the boundary between West Virginia and Kentucky.

YARMOUTH, ME.—The Portland & Brunswick, on its proposed extension to this place, is planning to build a steel bridge over the Royal river, 115 ft. long.

Other Structures.

ABBEVILLE, S. C.—The shops of the Seaboard Air Line at this place, which were recently damaged by fire, with a loss of about $25,000, it is said, are to be rebuilt.

BERKELEY, CAL.—The Southern Pacific will at once put up a new stone passenger station here to cost $30,000.

BRUNSWICK, GA.—The Atlantic & Birmingham is negotiating for water front land as a site for terminals, to cost about $500,000.

FORT COLLINS, COLO.—The Colorado Southern, it is said, has decided to make changes in its yards at this place, and to put up a new freighthouse and a new roundhouse.

ISHPEMING, MICH.—The Chicago & North-Western has decided to put up a new passenger station, to cost $20,000.

JACKSON, MISS.—Improvements to be made by the Illinois Central in connection with its new freight yard and terminal includes the building of a freight house and passenger station.

JACKSONVILLE, FLA.—The Seaboard Air Line, it is said, will put up two brick warehouses, one 315 ft. long and the other 515 ft. long.

KANSAS CITY, MO.—It has been anounced that contracts have been made for the purchase of 11 acres of land for a new union station to be built in this city, near Twenty-second street and Grand avenue (known as the South side site) subject to vacation of streets and alleys, and other necessary legislation by the City Council. The present depot has been in use since 1889 and has long been inadequate to meet the demands of travel. The providing of new passenger terminals has been under consideration for about three years. It was reported that a decision had practically been reached to rebuild near the present depot on the West bluffs, but during the flood of 1903 there was a depth of about six feet of water in the present depot and this caused the railroads to abandon this plan. Later a location in the north end of the city was considered, but the price placed by the Armour-Swift-Burlington Syndicate on land which it had acquired by purchase and reclamation from the Missouri river is said to have been so high as to make it inadvisable to adopt this site. The following roads are said to have agreed on the South side location: Atchison, Topeka & Santa Fe; Chicago, Milwaukee & St. Paul; Union Pacific; Chicago, Rock Island & Pacific; Frisco; Chicago & Alton; Missouri, Kansas & Texas. It is understood that the Missouri, Pacific, Burlington, Wabash, Kansas City, Southern, Chicago Great Western, St. Joseph & Grand Island and the Quincy, Omaha & Kansas City have not yet signified that they will come into the proposed new union station. The last four named lines do not enter the present union station, but use the Grand Central Station, which is situated in the north end of town.

MARSHALL, TEXAS.—The shops of the Texas Pacific at this place are to be enlarged and a number of stone and brick structures added, at a cost of $100,000.

MASON CITY, IOWA.—The Chicago Great Western, it is said, has bought ground on which it will put up a new passenger station this summer.

MT. CARMEL, IND.—A contract has been let to Henry Dollney, of Indianapolis, for building new shops, a roundhouse, and putting up other buildings for the C., C., C. & St. L. The buildings will cost about $60,000.

MUSKOGEE, IND. T.—The Midland Valley is arranging to build shops here, to cost about $50,000.

NASHVILLE, TENN.—The Illinois Central, it is said, is planning to build a grain elevator at this place, to cost between $300,000 and $500,000.

NEW ROCHELLE, N. Y.—According to local reports the New York, New Haven & Hartford is planning to put up a large passenger station here to cost about $100,000.

OGDEN, UTAH.—The Union Pacific and allied lines are to build a new power house and foundry, an oil house, storerooms and a new freight house.

SAN BERNARDINO, CAL.—The Atchison, Topeka & Santa Fe, it is said, is planning to enlarge its shops and yard at this place at a cost of $400,000.

STAMFORD, CONN.—The New York, New Haven & Hartford is making improvements in its yard at this place, and will put up a new repair shop 50 ft. x 100 ft., storehouse 30 ft. x 50 ft., and office building 25 ft. x 100 ft. An addition will also be added to the roundhouse. The power house for electric traction between Stamford & New York is to be at Cos Cob, 3 miles west of Stamford.

STRATFORD, ONT.—Bids are being asked for building additions to the Grand Trunk shops here, to include a boiler shop 120 ft. x 225 ft., and a plate shop 50 ft. x 125 ft., to cost about $100,000.

TORONTO, CAN.—The Railway Commission has granted permission for the building of the new passenger station here. Work is to be started by the Grand Trunk on the structure at once.

TORONTO JUNCTION, ONT.—The Canadian Pacific is reported hav-

ing bought land as a site for its shops, which are to be moved to this place.

WASHINGTON, D. C.—The Carnegie Institution of Washington has bought six acres of land north of the Pierce's Mill Road, and near Rock Creek Park and the Bureau of Standards, on which it is proposed to build at once a building to cost about $100,000.

WAYCROSS, GA.—The Atlantic Coast Line, it is said, has given a contract to the Pennsylvania Bridge Co., of Beaver Falls, Pa., for building its shops at this place. The cost of the work will be about $400,000. The contract calls for the completion by January of next year.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALLENTOWN, TAMAQUA & ASHLAND (ELECTRIC).—This company has been organized at Harrisburg, Pa., with a capital of $500,000, with William Lindsay, of Pittsburg, as President. Surveys are being made near Mahanoy City for the proposed road, to run from Slatington, Pa., west via Lehighton and Tamaqua to Mahanoy City, about 30 miles.

AUGUSTA & FLORIDA.—This company will begin work early in March on the balance of its road from Keysville to Augusta, Ga. (Oct. 13, p. 118.)

BEAUMONT, SOUR LAKE & WESTERN.—This company has filed an amendment to its charter to provide for an extension of its road from Sour Lake, northwest, to Humble, Tex., and thence south to Hofton; also to extend its road northeast from Beaumont to De Quincy, in Calcasieu County, La., a total of about 125 miles.

BLACK MOUNTAIN.—This company, it is said, is planning to build a 50-mile extension from the coal fields in Lee County, Va., to a connecting point with the Virginia & Southwestern at the Boden Coke plant.

BRITISH COLUMBIA ROADS.—Robertson & Robertson, of Victoria, B. C., have applied to the Provincial Legislature for a charter to build a line with branches from Penticton, B. C., to a point on the southern border of British Columbia.

BROOKVILLE & MAHONING.—An officer writes that work on the proposed extension from Brookville, Pa., to Brockwayville, 21 miles, has been completed from Brockwayville to Hydes. At the latter place connection will be made with the Pittsburg, Shawmut & Northern. The company is building with its own forces from Brookville to Knoxdale, at which point there are large coal fields. The maximum grade is one per cent., and maximum curvature 8 degrees. The work includes the building of three steel viaducts and a number of small steel girder bridges, for which contracts will soon be let. Edward E. Tait, Bradford, Pa., is President, and W. W. Henshey, Brookville, Chief Engineer. (December 22, p. 200.)

CANADIAN NORTHERN.—A contract has been given by this company to Mulkaney & O'Brien, for building an extension from Garneau Junction to Quebec, and from Mortfort Junction to Saint Jerome.

CANADIAN PACIFIC.—Bids are wanted March 10 by J. W. Leonard, Toronto, for ballasting, bridging and track laying work on the Sudbury branch between Romford and French river crossing, 40 miles.

CANADIAN ROADS.—Application is being made to build a line from Crows Nest, Alberta, east to Lethbridge, and thence to Medicine Hat; also for a line from the Montana boundary north to Lethbridge and Edmonton, with branches to Calgary and Medicine Hat.

COLORADO & SOUTHERN.—This company is planning to build a 300-mile extension northward from Orin Junction, Wyo., to a connection with the Yellowstone River, in Montana. The road will compete with the Burlington, which makes its connection with the Northern Pacific at Billings, on the Yellowstone. An engineering party is in the field. The proposed line extends through a fertile agricultural and grazing country. Work is proceeding rapidly on the Colorado & Southern's gulf extension. It is expected that the line will be completed this fall to Houston.

COLORADO, TEXAS & MEXICO.—President Morris B. Locke of this road is quoted as saying that contracts have been let for building 500 miles of its proposed road from Arkansas Pass, Tex., to Cheyenne, Wyo.

DELAWARE, LACKAWANNA & WESTERN.—According to newspaper reports this company has decided to extend its Erie & Central New York division, from its present terminus, at Cincinnatus, N. Y., to South Otselic, about 12 miles.

ELMIRA ELECTRIC.—Incorporation has been asked for in New York by a company under the above name, with a capital of $4,000,000. The company proposes to build a double track electric railroad from Rochester, N. Y., south to Elmira, 120 miles. Such a line would compete with the Erie and the Delaware, Lackawanna & Western for local passenger traffic. The Directors include: F. Eckstein, of 42 Broadway, New York; C. O. Geer, T. C. Buckingham, H. Gabel, S. Gifford and others.

ERIE.—See Honesdale & Hawley below.

FAYETTE VALLEY.—This company has been incorporated to build a railroad from a point on the Oregon Short Line at Fayette, Idaho, through the Fayette valley to a point near New Plymouth, 15 miles. The capital stock is $100,000. C. W. Nibley is President; H. E. Dunn, Vice-President; A. B. Moss, of Fayette, Treasurer, and F. S. Murphy, Secretary. The directors are: H. E. Dunn, C. W. Nibley and F. S. Murphy, of Salt Lake City, and A. B. Moss, of Fayette, and B. T. Dunn, of Weed, Cal.

GRAND TRUNK PACIFIC.—Contracts have been let by this company as follows: For building the section of the proposed road from the Touchwood Hills to Saskatoon, Sask., 140 miles, to the Canadian White Co., of Montreal, and from Saskatoon to Edmonton, Alb., 317 miles, to Foley Brothers, Larsen & Co., of St. Paul. A contract has also been let to Greer Brothers, of Port Arthur, Ont., for 700,000 ties. This company now has 920 miles of road under construction.

GREAT NORTHERN.—Surveys, it is said, are being made by this company to build a line from Havre, Mont., near the junction point of a branch running southwest to Great Falls, Helena and Butte, or from a point further west (Burnham) northwest to the boundary line, about 70 miles, and thence through Medicine Hat, Assiniboia, an additional 70 miles, and northwest of that place 280 miles to Edmonton.

GULF, BROWNWOOD & CISCO.—Under this name a company has been organized, with office at Brownwood, Tex., and with a capital of $61,000. The company proposes to build a railroad from Brownwood to Cisco, Tex., about 55 miles. Brooke Smith, J. T. Lee, J. C. Weakley, all of Brownwood; G. H. Connell, of Fort Worth; A. T. Maxwell, of Cisco, and others are interested.

HONESDALE & HAWLEY (ERIE) (ELECTRIC).—Under this name the Erie, it is reported, has organized a company to build a line to connect Honesdale and Hawley, Pa., eight miles. The Erie has owned the right of way for a long time. Permission has been granted by the Common Council of Honesdale to build through that borough, and the work is to be started at once.

ILLINOIS CENTRAL.—Announcement has been made by this company that contracts have been let for building its new line from Corinth, Miss., southeast to Haleysville, Ala., about 80 miles. C. D. Smith & Co., of Birmingham, have the contract for building from the north end, and George O. Clifton & Co., of Chicago, from the south end. Work is to be finished by January, 1907.

KENTUCKY MIDLAND.—Incorporation has been granted a company under this name in Kentucky to build a railroad from Madisonville, Ky., east to Central City, about 26 miles. The line will run through a rich coal section in Muhlenberg and Hopkins Counties. Connection is to be made with the Louisville & Nashville at Madisonville, and also with the Illinois Central and the Louisville & Nashville at Central City. The maximum grade will be 1 per cent., and maximum curvature 4 deg. There will be a tunnel through Muhlenberg ridge about 750 ft. long, and a pile bridge about one mile long over Pond river. The line is to be completed by August of this year. The names of the incorporators are not given.

KETTLE RIVER VALLEY.—Application has been made by this company to Parliament for permission to increase its capital to $5,000,000, and to build extensions as follows: From Midway, B. C., to Hedley, in the Similkameen Valley; from Hedley, north, for a distance of 20 miles to Twenty Mile Creek, and from this extension to Penticton, B. C.; also for permission to secure trackage rights over the Columbia & Western between Grand Forks and Midway and on its branch lines. An officer writes that contracts are to be let about April 1, for building 50 miles of road in a northerly direction from its present northern terminus.

MARSH FORK (TIDEWATER).—Incorporation has been granted this company in West Virginia to build an extension of the Tidewater to the Ohio River at the mouth of the Great Kanawha River, approximately 100 miles from Surveyor Station in Raleigh County, on the Deepwater, which is the West Virginia end of the Tidewater route. The officers of the company are: W. N. Page, President; G. W. Imboden, Vice-President; W. H. Evans, Secretary; G. H. Church, Treasurer; J. J. Corell, Assistant-Treasurer; Raymond DuPuy, General Manager, and H. Fernstrom, Chief Engineer.

MEXICAN ROADS.—A concession has been granted by the Mexican Government to Richard Honey to build a railroad from Tampico west to Mexico City.

MICHIGAN CENTRAL.—Bids are to be opened March 5 for building the proposed tunnel under the Detroit river. The contracts are to be decided on by a board consisting of W. J. Wilgus, New York, Vice-President of the New York Central, who is Chairman; H. A. Carson, of Boston, and W. S. Kinnear, Vice-President of the Michigan Central.

MISSOURI, ARKANSAS & SOUTHWESTERN.—A charter has been granted this company in Missouri, with a capital of $2,000,000, to build a railroad from a point in Dunklin County to Batesville, Mo. R. W. Ernhardt, A. T. Evans, T. M. Twaldrop and others are interested.

NORTHERN PACIFIC.—Contracts are reported let by this company to Porter Brothers & Walsh, railroad contractors, of Spokane, Wash., for extending its line from Culdesac, Idaho, southeast through a rich agricultural section bounded by the Snake, Clearwater and Salmon rivers, to Grangeville, about 55 miles. It is expected to have the line completed by the first of next year.

PIERRE, RAPID CITY & NORTH-WESTERN (CHICAGO & NORTH-WESTERN).—The Winston Brothers Company, of Minneapolis, which has the general contract for building this proposed extension of the North-Western from Pierre, S. Dak., west to Rapid City, about 155 miles, has sublet a six-mile section of the work to the Calhoun Construction Company, of Spearfish, S. Dak. The work will begin at a point about 25 miles west of Rapid City. (October 27, p. 125.)

ST. MARYS & WESTERN.—An officer writes that this company has completed the first 10 miles from St. Marys, Pa., to Trout Run on its proposed road from Johnsonburg, Pa., via St. Marys to Benezette, 25 miles. E. L. Willard, St. Marys, is Chief Engineer.

SOUTHERN PACIFIC.—According to newspaper reports this company has completed nearly 100 miles of its projected line, which it is building, under a concession from the Mexican Government, through the states of Sonora, Sinaloa and Jalisco, and the territory of Tepic to connect with the Cananea, Yaqui River & Pacific in the north, and with the Mexican Central in the south. The Southern Pacific is to receive a bonus of about $19,200 a mile. The road is to be built in four sections, the first is from some convenient point on the C. Y. R. & P. (which is controlled by the Southern Pacific) near the City of Alamosa, Sonora, southeast, to Culiacan and Sinaloa. The second section is from the latter place to Mazatlan, and the third from some convenient point on the line between Culiacan and Mazatlan near San Diego to Tepic in the territory of the same name. The remaining section is from Tepic to a point on the Mexican Central between San Marcos and Guadalajara, the capital of Jalisco, to which point the Mexican Central extension reaches.

STONE CANYON.—This company, recently incorporated in San Luis Obispo, Cal., with a capital stock of $300,000 by J. A. Chanslor, W. A. Sloane, I. W. Hellman, Jr., and E. W. Mason, will rush construction this spring on its proposed road from a point on the Southern Pacific near San Miguel, north through San Luis Obispo and Monterey counties to a point on Nelson creek, Monterey County, about 21 miles. The company has about 1,000 acres of soft coal in Stone Canyon, and has bought 100 acres of land at San Miguel as a site for its terminal and for shops, yards, etc.

TIDEWATER.—See Marsh Fork.

UNION PACIFIC.—According to a Chicago despatch, Union Pacific officials in that city have announced that all needed terminals in Seattle, Wash., for an extension of the Harriman Lines to that city have now been secured. Surveys on the line to be built from Portland to Seattle, probably under the charter of the Washington Northern, are being made as rapidly as possible.

VANCOUVER, WESTMINSTER & YUKON.—Application will be made to the Dominion Parliament for permission to build branch lines south from Anderson Lake and Green Lake along Lilloset Lake to the international boundry.

RAILROAD CORPORATION NEWS.

ATCHISON, TOPEKA & SANTA FE.—Gross earnings for the month of January were $6,536,985, an increase of $1,129,244; net earnings $2,286,437, an increase of $718,026.

BOSTON & MAINE.—Gross earnings for the six months ended December 31 were $20,379,882, an increase of $1,436,146; net earnings $5,926,732, an increase of $262,237. The surplus after charges was $2,113,635, an increase of $233,219.

CAROLINA NORTHERN.—See Charleston & Raleigh.

CHARLESTON & RALEIGH.—This is the new name of the Carolina Northern, which was recently sold to the bond holders. (October 27, p. 136.)

CHICAGO ELEVATED.—It is reported that the Northwestern Elevated and the Oak Park will be merged. This is said to be the first step in the final merging of all the elevated lines, which operate 105 miles of road and have, in all, $51,923,800 stock and $49,304,150 bonds outstanding.

CHICAGO GREAT WESTERN.—Gross earnings for the half year ended December 31 were $4,627,330, an increase of $626,391; net earnings $1,699,109, an increase of $398,397. The surplus after charges were $672,044, an increase of $401,607. The dividend on the preferred A stock was $284,310, leaving a surplus equivalent to a semi-annual payment of 2 per cent. on its B stock, and about four-tenths of 1 per cent. on its common stock.

CHICAGO TERMINAL TRANSFER.—Receivership proceedings have been begun by the United States Trust Co. acting for the holders of $16,500,000 first mortgage 4 per cent. bonds of 1947, on which, it is alleged, the company has defaulted payment of semi-annual interest three consecutive times.

CINCINNATI, HAMILTON & DAYTON.—According to the report of the receiver the total receipts from December 5 to December 31 were $1,720,763, which includes $511,830 raised by the sale of receiver's certificates. The total disbursements were $1,303,453, of which $436,725 was interest on funded debt.

DELAWARE & HUDSON.—Gross earnings for the six months ended December 31 were $6,359,612, an increase of $428,015; net earnings, $2,724,432, an increase of $88,739. The surplus after charges $1,234,592, an increase of $72,148.

DELAWARE, LACKAWANNA & WESTERN.—Gross earnings for the quarter ended December 1 were $3,034,955, a decrease of $128,675; net earnings $1,553,849, a decrease of $174,251. The surplus after charges was $953,522, a decrease of $150,386.

GEORGIA, FLORIDA & ALABAMA.—At a meeting of the directors, to be held on March 6, the Carrabelle, Tallahassee & Gulf will be merged with the Georgia, Florida & Alabama. The C., T. & G. runs from Carrabelle, Fla., to Tallahassee, 50 miles, and has been operated under lease by the G., F. & A.

GEORGIA SOUTHERN & FLORIDA.—Blair & Co., of New York, have bought $270,000 5 per cent. equipment notes of this company.

GRAND TRUNK.—Gross earnings for the year ended December 31 were $29,247,480, an increase of $1,484,672; net earnings $8,498,682, an increase of $747,290. The surplus after charges was $3,522,042, an increase of $781,922. To this surplus is to be added $33,534, as the surplus of the Detroit, Grand Haven & Milwaukee, and subtracted, $87,480, which is the deficit of the Canada Atlantic, making a surplus of $3,468,096 for the entire Grand Trunk System.

GRAND TRUNK PACIFIC.—This company is applying to the Dominion Parliament for permission to issue $25,000,000 of debenture stock instead of $20,000,000 of preferred stock, for which permission has already been obtained.

MINNEAPOLIS & ST. LOUIS.—Plympton, Gardiner & Co., and Kean, Van Cortland & Co., of New York, have bought $5,000,000 of this company's five-year 5 per cent. gold notes of 1911, subject to call at par and interest after February 1, 1908. The proceeds from this sale will be used to extend the Watertown division westward 250 miles, to the Missouri river, at LeBeau, S. Dak., and northwesterly to Leola, S. Dak. The notes are secured by the deposit of $6,250,000 first mortgage 4 per cent. bonds and by the entire capital stock of the Minnesota, Dakota & Pacific, a subsidiary company which is building the above extension.

NORTHERN CENTRAL.—Gross earnings for the year ended December 31 were $10,531,962, an increase of $243,758; net earnings $2,061,397, a decrease of $305,436. The surplus after charges was $2,238,787, an increase of $161,656.

OCEAN SHORE (ELECTRIC).—This company, which is building a double track trolley road from San Francisco to Santa Cruz, Cal., 81 miles, of which 10 miles are completed, has bought the United Traction Company, of Santa Cruz. The Traction Co. has 18 miles of 3 ft. 2⅝ in. gage road in Santa Cruz and to Capitola. It has $750,000 capital stock all outstanding, and $750,000 first mortgage 5 per cent. bonds of 1935, of which $300,000 is outstanding.

PHILADELPHIA COMPANY.—There have been deposited 320,000 shares of this company's stock. This is the amount necessary to make operative the plan for the acquisition of a majority of the Philadelphia Co. stock by the United Railways Investment Co. (Feb. 23, p. 62.)

YOSEMITE VALLEY.—This company, which has nearly completed 35 miles of its road from Merced, Cal., to the Yosemite Valley, a total of 70 miles, has sold $850,000 of its $1,000,000 first mortgage 5 per cent. sinking fund bonds and is now offering the balance for sale.

GENERAL NEWS SECTION

NOTES.

Hearings are being held in New Jersey on a bill authorizing trolley companies to carry freight.

The Japanese Government is reported to be considering the purchase of all the privately owned railroads in Japan.

During the month of February there were 150,000 more cars loaded on the New York Central Lines than during the same month of 1905.

It is proposed that Congress shall pass a law providing a $200,000 bonus for running a fast mail train from New York through Atlanta to New Orleans.

The first passenger wreck on the Bangor & Aroostook in its 12 years of operation recently took place, resulting in the severe injury of an express messenger.

A bill has been introduced into the New York State Legislature to broaden the liability of railroad companies for injuries to employees caused by the negligence of fellow-employees.

The steamer Homer Ramsdell, of the Central-Hudson Steamboat Company, made her first regular trip from New York City to Newburg on March 5. This is an unusually early opening of the Hudson river.

The joint grievance committee of Lackawanna conductors and trainmen at Scranton is reported to have been unable to reach an agreement with the officers of the company. A proposal to strike is to be voted on.

The Chicago Great Western and the Wabash are handling large quantities of corn from Nebraska points to Baltimore. The warm weather has checked the movement of corn to the Gulf, nearly all of it going to the Atlantic seaboard.

Grand Trunk locomotive engineers at Montreal have refused to accept a general wage increase of 4 per cent. in settlement of differences between them and the company. The points at issue have been submitted to a board of three arbitrators. The principal demand of the engineers is for a uniform rate, requiring the abolition of the sliding scale for different districts.

As part of the unification of the New York Central Lines, the Louisville, Ky., office of the White Line, a New York Central fast freight line, has been abolished and its business turned over to the Big Four traffic department. It is probable that similar action will be taken at other points where two or more agencies under the name of different roads in the system are each soliciting similar traffic.

The Wabash, by accepting a lower proportion of the Minneapolis rate on wheat and rye products to points east of the Illinois-Indiana state line, has reduced the rate on flour, Chicago to New York, from 17 to 16 cents. In addition, the milling in transit privilege has been granted. This tends to neutralize the advantage which flour millers in St. Paul and Minneapolis have had under the previously existing rates.

The Missouri Railroad Commission has reduced the rate on refined oil between Kansas City and St. Louis to 9 cents per 100 lbs., each way, the existing rate being 17 cents eastward and 20 cents westward. The independent refiners of Cleveland and Pittsburg have for some time protested against the existing rates on the ground that they favored the Standard Oil Company, which has refineries in Kansas City, and therefore does not need to ship refined oil west from St. Louis.

The grand jury of Putnam County, Ohio, sitting in Toledo, has indicted 12 county officials on the charge of stealing in connection with bridge contracts. This is only part of the bridge trust investigation there, for there have been 16 other indictments at this sitting. The grand jury has included in its inquiry every bridge company doing business in that county for the past five years. It is to be feared that if bridge contracts were as closely followed up all over the country the trail of graft would be found to extend very widely.—*Springfield Republican.*

Governor Pennypacker, of Pennsylvania, has vetoed a resolution calling for an investigation into the affairs of the Philadelphia & Reading Railroad Company and the Philadelphia & Reading Coal & Iron Company, and also a resolution directing the Attorney General to inquire by what right several of the railroads of the state are engaged in the business of mining anthracite coal. These resolutions, the Governor holds, were not germane to the call for the recent extra session. He also failed to approve a resolution requiring him to call an extra session of the legislature for the enactment of a two-cent-a-mile passenger rate law and a law giving electric railroads the right to carry freight.

The American Institute of Mining Engineers Entertained by Ingersoll-Rand Company.

The American Institute of Mining Engineers, who for the two days preceding had been in annual session at Bethlehem, Pa., were on Saturday, February 24, entertained by the Ingersoll-Rand Company at their works at Phillipsburg, N. J. A special train brought the visiting party, about 165 in number, from Bethlehem direct to the shop grounds. The guests were received by President W. L. Saunders of the company, assisted by members of the sales and engineering departments, both from Phillipsburg and New York. Each guest was given a leaflet showing a plan of the works, in black, with the route of the visitors through the shops, in red. In addition, the leaflet contained tabulated engineering data of the shop arrangement, equipment and capacity, together with a record of the company's machine production since its formation in 1871.

After inspecting the plant a luncheon was served in the dining room on the third floor of the office building, where during the luncheon each guest was furnished with a printed blank, to be filled out with name and address, and promising to each whose signature appeared a framed photograph of the day's meeting, with appropriate literature.

Murder in a Railroad Compartment.

The substitute for the American train robbery in Europe is assassination in a car compartment, where the victim is isolated, and has no protection by fellow-travelers or trainmen. An instance has lately occurred in France. An architect and contractor of Geneva, Switzerland, sold some property in Nice, on the Mediterranean, and had about $70,000 of the proceeds to take home. His wife, and, as it appears, other people, supposed that he would take it on his person. He took a night train from Nice to Geneva, and telegraphed for a servant to meet him at the Geneva station. He did not appear when the train arrived, but his hand baggage was found in a first-class compartment, where the cushions and floor were covered with blood, while bloodstains marked the outside of the car behind this compartment. Search was made along the track, and between two small stations about 50 miles from Geneva the body of the architect was found with his throat cut. It turned out, however, that he did not have the $70,000 with him, but, like a rational man, had remitted the amount to Geneva by check. The perpetrators of the murder not only missed their booty, but were, two in number, caught and have confessed, and will probably soon be executed. Here the parallelism with American train robbers fails.

New Eastbound Passenger Rate War.

The eastbound Chicago-New York passenger rate troubles of last August, resulted in giving the Michigan Central the privilege of charging a lower rate on some of its passenger business than the standard rate lines, the Lake Shore and the Pittsburg, Fort Wayne & Chicago. To this settlement the Grand Trunk at that time announced that it would not permanently agree. It has now filed notice with the Interstate Commerce Commission of its intention to reduce rates to New York and Boston on March 10 to the following basis:

To New York by way of Suspension Bridge or Buffalo and the New York Central, $20 first class and $17 second class; by way of the Grand Trunk and any other line, except the New York Central, $16 first class and $15 second class.

To Boston by way of the New York Central and Boston and Albany, $22 first class and $19 second class, by any other line, $16 first class and $15 second class.

These rates are $2 to New York and $3 to Boston below the regular differential rate and $4 to New York and $6 to Boston below the regular standard fare. Notice of the new tariff was filed by telegraph.

A Large Reinforced Concrete Chimney.

What is said to be the highest concrete chimney in the world has just been completed at the Butte Reduction Works, Butte, Mont. The inside diameter is 18 ft and its total height is 352 ft. 7 in. The foundation which weighs upwards of 13,000 tons, is formed of slag, which was poured into an iron casing 100 ft square. The base, which is of reinforced concrete, is 42 ft 6 in. square by 8 ft 3 in high. The wall, of the chimney proper, for the first 20 ft. is 18 in. thick. Above this height the chimney is

composed of a double shell, consisting of a 5-in. inner and of a 9-in. outer wall, separated by a 4-in. air space. The entire weight of the chimney, including the concrete base and slag foundation, is 15,275 tons.

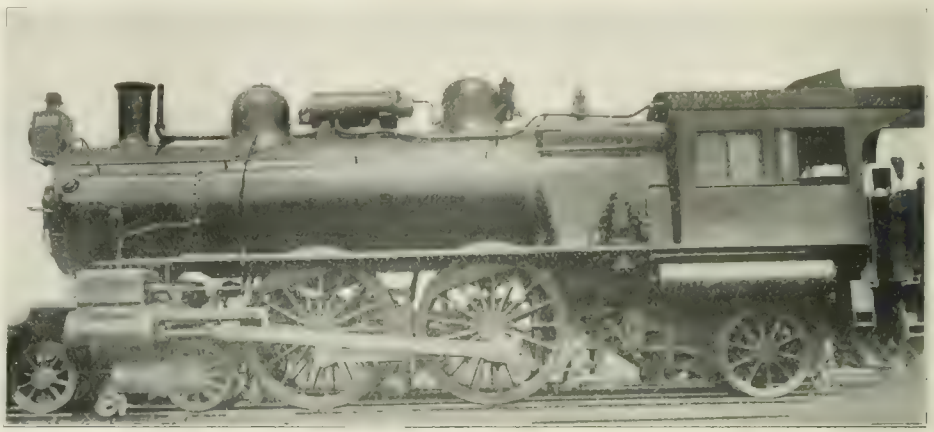
Steam Turbine Train Lighting Sets.

The General Electric Co., Schenectady, N. Y., has produced a new system of electric lighting for trains, which consists of a small Curtis steam turbine direct connected to an efficient generator. The combination of high speed with rotary motion produces a machine of compact and simple design. Because of the high speed the generator is small and light, and the absence of reciprocating parts eliminates wear, noise and vibration; all of which play a large part in the use of the ordinary engine. The generator for this outfit is a two-pole direct current machine, wound for 85 or 125 volts depending on the service required. The outfits are supplied in three sizes, one a 15-k.w. 80-volt generator coupled to a Curtis steam turbine running at 4,000 r.p.m.; the second a 20-k.w. 125-volt generator turbine driven at 4,500 r.p.m., and the third a 25-k.w. 125-volt generator driven at 3,600 r.p.m. These turbines can be furnished to operate at from 80 to 200 pounds steam pressure, and exhaust into the atmosphere.

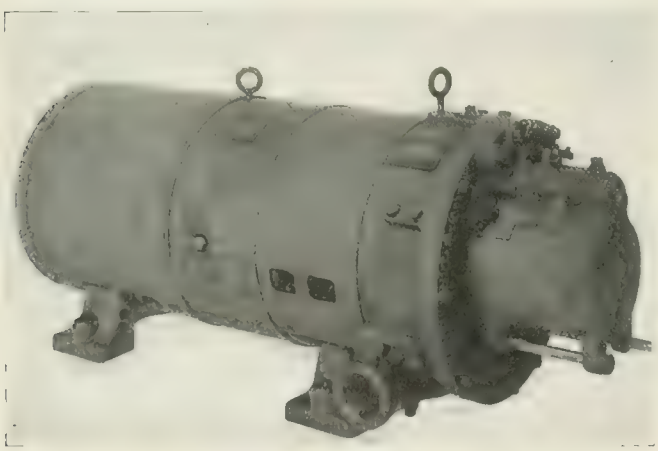
On account of the compactness and light weight (1,850 pounds net) of the smaller size Curtis steam turbine generating set it can be mounted upon the locomotive or in the baggage room. When placed upon the locomotive as shown in Fig. 1, the exhaust connection can be conveniently led into the stack. When located in the baggage car, this generating set occupies a minimum amount of space for the power generated, measuring approximately 66 in. x 22 in. In order to be as close as possible to the steam supply and avoid condensation losses, the generating set is generally placed at the front end of the car and connected to the locomotive by means of a flexible steam hose and coupling. As the turbine is exposed to the weather when placed on the locomotive, protective sheet iron casings are fitted. As can be seen in Fig. 2 these casings completely surround both the turbine and generating elements affording adequate protection against dirt and moisture. In Fig. 3 the set is shown adapted for service in the baggage car. In this case the moisture proof covers are unecessary.

Curtis steam turbine lighting sets of this design are in use upon many railroads in the United States. They are adapted not only for general train lighting but also for locomotive headlights and thus add not only to the luxuriousness of American train service but in addition increase its safety.

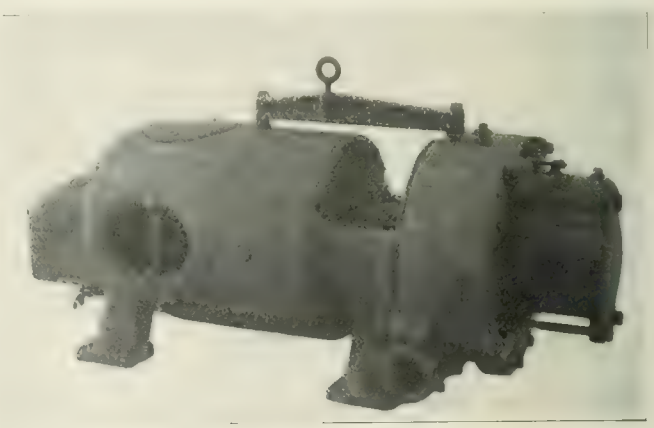
The General Electric Co. also makes a complete line of the necessary fittings, including cables, instruments, couplers, lamps, fans, etc., for the equipment of electrically lighted trains.



15 K.W. Curtis Steam Turbine Generator Mounted on P.R.R. Atlantic Type Locomotive.



15 K.W. Turbine Generator and Casing.



15 K.W. Turbine Generator Without Casing for Mounting in Baggage Car.

The Italian Railroad Strike.

Italian authorities have reported on the strike of railroad employees last April, when it was said that pretty nearly the whole force struck. But a detailed statement of the number of men who did not report for duty on each day of the strike shows that 72 per cent. of the whole number of employees continued at work on that day when the greatest number were out. The proportion of trainmen who struck was greater, and of course this interrupted traffic out of proportion to their numbers.

Sanitary Inspection of New York Subway.

George A. Soper, Sanitary Engineer of the New York Rapid Transit Board, has made a report of an investigation of the subway in which he criticises the management for lack of cleanliness at stations and in cars. Dr. Soper says that he found more carbon dioxide in the subway between 5.30 and 6 p.m. than at any other time, and more at the Fourteenth street station than at any other station. He found on an average twice as many bacteria on the streets as in the subway, excepting after rains, when there were fewer outside than inside. The oily roadbed apparently collects from the air large numbers of the bacteria and is helpful rather than injurious. The doctor does not view the heat of the subway in summer with alarm. In fact, the conditions in winter, when strong draughts of cold air enter the stations, are far more apt to affect health. The difference between the temperature in the subway and in the streets was much less in hot weather than was generally understood. The average temperature of the subway in July and August was 5.6 degrees higher than that of the streets. If it is found feasible to cool and otherwise improve the air by refrigeration, fans or other mechanical means, the advantage of doing so is apparent, but if this result cannot be accomplished the consequences will not be found disastrous.

Of far more importance than the question of heat is the need of maintaining proper conditions of cleanliness in the subway, says Dr. Soper. The stations and toilet rooms have not been kept in a clean and orderly condition. The filthy condition of the roadbed at the stations and the neglected condition of ventilation and cleanliness in some of the toilet rooms may properly be regarded as suitable subjects for the attention of the Board of Health.

Dr. Soper recommends that the ballast of the roadbed at the stations be renewed or replaced by concrete, that the ordinances of the Health Board in regard to spitting be enforced, that dry sweeping be abolished and that the cars and stations now inefficiently cleaned, be scrubbed at least once a week and at night.

Electric Headlights on Street Cars.

The Railroad Commissioners of Massachusetts have issued an order relative to the use of "searchlights" on electric cars. The order is issued on the petition of the Selectmen of the town of Wellesley, but has a bearing on any company in the State using lights of this kind. The Commission says:

"A railway in or along the side of a highway offers oppor-

tunities for obstruction that are not offered by railways which are constructed over private lands. To meet these conditions the cars upon some lines have of late been equipped with a powerful arc light as a safeguard against accident.

"It has been said that this street car light is no more objectionable than some of the lights used on automobiles. We cannot accept that statement; but if it were true the comparison is not profitable. The fact that other lights may be an annoyance or menace to people using old-time methods of going abroad at night does not justify us in approving a further invasion of their rights.

"It is true that there is a public demand for high speed on these railways, and this undoubtedly makes it necessary in the interest of safety to throw light a considerable distance ahead of the car. If to do this an arc light of high candle-power is to be used companies must take prompt action to provide a suitable device for so governing the direction of the light as to confine the effect of its high power to the track. Meanwhile they should turn off or obscure the light while cars are moving through streets otherwise well lighted or through thickly settled communities."

Liverpool Overhead Railway.

This electric railway has been severely hit by the competition set up by the electrification of the Liverpool-Southport line of the Lancashire & Yorkshire. There have also been severe losses of traffic suffered from municipal tramways' rivalry. Receipts per train mile are now much lower than on other English electric lines. The following comparative figures are given of the earnings per passenger and per train mile, on this and certain other lines:—

Company.	Receipts Per passenger	Per train mile
Liverpool Overhead	3.56 cts.	41.82 cts.
City & South London	3.66 "	61.58 "
Central London	3.66 "	133.60 "
Mersey Tunnel Railway	3.58 "	50.70 "

The closing of four of the smaller stations is now under consideration.

Russian Railroad Earnings.

The official report on the business of the Russian railroads for the first half of 1905 shows a slight increase in total gross earnings, but a very slight decrease in earnings per mile. Passenger traffic decreased about 5 per cent., but freight shipments increased 2.7 per cent. The number of passengers on the lines in Asia decreased 8½ per cent., and the tons of freight carried on these lines increased 37 per cent. This does not include military traffic.

Pennsylvania Railroad Pensions.

The Pennsylvania Railroad Pension Department, which seemingly was established but yesterday, has been running six years, and has paid to pensioners $2,004,088, and 890 pensioners have died. The payments have been (years ending December 31; all lines East of Pittsburg and Erie): 1900, $244,020; 1901, $292,290; 1902, $328,403; 1903, $359,374; 1904, $390,000; 1905, $390,000.

During the six years 2,700 employees have been retired as pensioners from the active service of the company. Of the total number retired, 688 were between the ages of 65 and 69 years, of whom 546 were retired on their own request with the approval of the employing officer.

Steam Motor Car of the Great India Peninsula Railway.

With a view to provide a frequent, speedy and economical train service on certain of its country branches and also to supplement the existing train services on some of its urban sections, the Great India Peninsula Railway has placed in operation a steam motor car made by Messrs. Kerr-Stuart & Co., London. The car is of a similar design to those made by the same company for the Great Western Railway, of England. The cylinders are 9 in. by 15 in., the driving wheels are 3 ft. 5 in. in diameter, the total heating surface is 353 sq. ft., to which the tubes contribute 306 sq. ft. and the fire-box the remaining 47 sq. ft. The grate area is 8.75 sq. ft. The inside fire-box is composed of copper, the sides, crown and back plates being half inch thick and the tube plates are three-quarters of an inch in thickness. The tubes are of solid drawn brass, 1½ in. in diameter. The working pressure of the boiler is 170 lbs. per sq. in. The valve gear is of the Walschaert type. The tank is placed at the end of the underframe and has a capacity of 550 gallons. The coal bin is located in front of the engine cab and has a capacity for 15 cwt. of coal. The locomotive portion and the underframe was shipped to India, where the car body was made and fitted to the underframe by the railroad company. The car body is 48 ft. long by 10 ft. wide. It has a capacity for seating 50 third-class passengers and 6 first-class passengers. The total length of the car is 60 ft. over buffers, and the total wheel base is 51 ft. 6 in.

Derailment on the Atchison.

Westbound passenger train No. 1 of the Atchison, Topeka & Santa Fe, was derailed on Monday morning, March 5, near Tolter, N. Mex., 80 miles west of Albuquerque, injuring twelve men, three of whom may die. The train was going at about 30 miles an hour when the engine jumped the track and took with it the six coaches, three of which turned completely over. The parlor car and a private car remained on the tracks. Most of the injured were in the forward coach.

Spring Styles for Rear Brakemen.

"Red neckties are always worn by foreign brakemen and conductors. Ever notice it?" said a railroader.

"No. Why is it?"

"As a safety device," was the reply. "These red neckties that flash upon your gaze on the railroads of Italy, France, Germany and England are not a sign that the people have a gay taste, but that they are cautious and prudent.

"They are supplied free by the railroad companies for use as danger signals in emergency. Thus, no matter when or where an accident may happen, there is no need to search or scramble for a red flag. The brakeman whips off his red necktie and waves it frantically aloft."—*Exchange.*

Gravity Yard for the Peoria & Pekin Union.

The Board of Directors of the Peoria & Pekin Union Railway have authorized the construction of a gravity yard in East Peoria, containing 23 miles of tracks, and involving about 140,000 cu. yds. of excavation and 2,000 cu. yds. of concrete. Bids for the work are asked until March 20, noon. Plans and specifications can be seen at the office of the Chief Engineer, Room 31 Union Station, Peoria, Ill.

Manufacturing and Business.

The Chicago, Milwaukee & St. Paul is to install a 225-k.w. Allis-Chalmers type "I" generator at its West Milwaukee shops.

The Farlow draft-gear attachments have been specified for 2,000 Atlantic Coast Line cars in combination with the Westinghouse friction draft gear.

The Cherry Valley Iron Works, West Middlesex, Pa., is installing a 15-ton, 46-ft. span Northern crane made by Northern Engineering Works, Detroit, Mich.

The Roanoke Bridge Co., with office at Roanoke, Va., has been incorporated with $50,000 capital to build bridges. E. C. McComb is President and Treasurer, and S. H. Holland, Secretary.

The Buda Foundry & Mfg. Co., Chicago, has recently erected a new warehouse and built an addition to its foundry in order to facilitate the handling of its business, which has greatly increased. A day and a night shift are now being worked.

Copeland & Grenier, Endicott Building, St. Paul, Minn., have formed a firm to handle tool steel, copper tubes and general railroad supplies. They also represent the Block-Pollak Iron Co. The members of the firm were formerly with the Rock Island.

Arthur Giesler, formerly Chief Engineer and designer for the Platt Iron Works Co., Dayton, Ohio, has opened offices at 170 Broadway, New York, as a Consulting Engineer, and will devote his time to the specialty of hydro-turbine power plants and hydro-turbine pumping machinery.

The Pittsburg Railway Company has ordered 20 emergency straight air-brake equipments from the General Electric Company, Schenectady, N. Y. The cars upon which these equipments will be mounted are to be run singly and in two car trains, consisting of one motor car and one trailer.

The College of Engineering of the University of Wisconsin has just received a 35-h.p. Curtiss steam turbine. The new machine, which is in part the gift of the General Electric Co., is being installed in the mechanical laboratory of the engineering building, where it will be used for the instruction of students and for experimental work.

At a meeting of the Board of Directors of the Railway Steel Spring Company, New York, held on March 1, 1906, Julius E. French, formerly President, was elected Chairman of the Board, William H. Silverthorn, formerly one of the Vice Presidents, was elected President; E. F. Fitzpatrick was re-elected Vice President, Frank Carnahan was elected Treasurer to succeed Mr. James C. Beach, who has retired. M. B. Parker was re-elected Secretary, as were also T. L. Chapman, Jr., and A. S. Henry, Assistant Secretaries. T. L. Chapman, Jr., was also elected Assistant Treasurer.

The Quincy, Manchester, Sargent Company has been incorporated and will take over the business heretofore operated by the Railway Appliances Company. This includes the business and plant of the Railway Appliances Company at Chicago Heights, Ill., formerly owned by the Q. & C. Company, also the business and plant of the Pedrick & Ayer Company, of Plainfield, N. J., manufacturers of locomotive repair tools, electric and pneumatic hoists and cranes and pneumatic riveters. The Quincy, Manchester, Sargent Company will also act as sole selling agent for the product of the Elastic Nut & Bolt Company, of Milwaukee, Wis.

Iron and Steel.

The Carnegie Steel Company is said to be building some 1,500 ton steel barges to carry rails and structural iron to the southwest.

The *Iron Age* says that this year is proving a very satisfactory one for girder rails, the demand for which has for some years been very light.

In addition to 11,000 tons of rails bought by the St. Louis & San Francisco, many orders are being placed by electric traction companies for standard and light sections.

The Wabash has bought about 10,000 tons of rails to be used on its lines east of Toledo, where a considerable amount of double tracking is to be done and light rails to be replaced with those of heavier section. This work is to be carried out during the present spring.

The rolling mills at Laramie, Wyo., recently started work under the direction of W. H. B. Jacobus, of Omaha, Superintendent, and A. H. Fetters, Mechanical Engineer. The mills have a number of large orders, including one from the Union Pacific for 100,000 tons of angle bars to be used on its Wyoming division. The mills are controlled by the Harriman interests.

The Erie is about to let orders for 3,000 tons of steel for new bridges, and the Lehigh Valley is also about to place a similar order. Orders for about 200,000 tons of structural material will be let in New York before May 1. This includes 40,000 tons that will be needed for the Manhattan bridge, and about 30,000 tons to be used in the Hudson river tunnels. The American Bridge Co. has orders for 1,200 tons for new buildings for the American Ship Building Co. and also has an order for 3,500 tons for delivery on the Pacific coast.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chicago Terminal Transfer.—F. B. Huntington has been appointed Comptroller, succeeding S. L. Prest, resigned.

Nashville, Chattanooga & St. Louis. John W. Thomas has been elected President and General Manager, succeeding J. W. Thomas, deceased. H. F. Smith has been elected Vice-President and General Traffic Manager. E. C. Lewis, Acting President, has been elected Chairman of the Board of Directors.

Norfolk & Southern.—W. L. Bird has been appointed Auditor, succeeding G. M. Glazier, resigned.

Pittsburg & Lake Erie.—B. C. Vaughn, Assistant to the Vice-President, has resigned, and the office has been abolished.

Operating Officers.

Chicago, Burlington & Quincy.—J. E. Votaw, who was recently appointed Superintendent at Brookfield, Mo., began railroad service as an operator on the C., B. & Q. in 1882. The next year he went to the Wabash as operator and despatcher, but returned to the Burlington in 1885 as despatcher. Three years later he was made chief despatcher and trainmaster, which position he has held until his recent appointment.

Chicago Terminal Transfer.—J. L. Nichols has been appointed Superintendent.

East Carolina.—Walter Rutland has been appointed Superintendent and Auditor, with office at Tarboro, N. C.

Louisville & Nashville.—A. B. Bayless, Trainmaster of the Birmingham and Alabama Mineral divisions, has been appointed Assistant Superintendent at Blue Ridge, Ga.

Southern.—C. C. Coffee, Engineer of Maintenance of Way at St. Louis, Mo., has been appointed Superintendent of the St. Louis division of the St. Louis-Louisville Lines, with office at Princeton, Ind., succeeding A. M. Smith, resigned. J. F. Sheridan has been appointed Assistant Superintendent at Princeton, Ind.

Traffic Officers.

Pennsylvania.—Robert C. Wright, who was recently appointed General Freight Agent in charge of local traffic, entered railroad service as a messenger on the Northern Central in 1888, having graduated the year before from the Baltimore City College. The next year he was appointed clerk in the office of the General Agent at Baltimore, where he remained until 1897, when he was made Soliciting Agent of the Star Union Line, at Baltimore. Two years later he was appointed special agent in the office of the General Superintendent of Transportation of the Pennsylvania, being made, after a few months, Division Freight Agent of that road at Altoona, Pa. In 1901 he was transferred to Harrisburg, Pa., with the same title, and in 1903 was appointed Assistant General Freight Agent, which position he held until his recent appointment.

New York Central & Hudson River.—J. F. Fairlamb, who was recently appointed General Passenger Agent of the New York Central & Hudson River Railroad and leased lines, was born in Pennsylvania in 1855. He was educated at Chester Academy and entered railroad service in 1874 as a clerk in the auditing department of the Pennsylvania. Ten years later he was appointed chief clerk to the Auditor of Passenger Receipts of the New York, West Shore & Buffalo. In 1886 he was made clerk in the office of the Auditor of Passenger Accounts of the New York Central, being promoted the next year to chief clerk. In 1888 he was appointed Assistant Auditor of Passenger Accounts and in 1890 Auditor of Passenger Accounts. He was on March 1st transferred to the traffic department as General Passenger Agent.



J. F. Fairlamb.

Engineering and Rolling Stock Officers.

Cincinnati, Hamilton & Dayton.—A. C. Hinckley, Master Mechanic, has been appointed to the new office of Superintendent of Motive Power.

New York Central & Hudson River.—Edward Elden has been appointed Master Mechanic at East Buffalo, N. Y., succeeding William Smith, resigned.

Pennsylvania.—E. B. Temple, Assistant to the Chief Engineer, has been appointed Assistant Chief Engineer. J. F. Murray succeeds Mr. Temple.

Pennsylvania Lines West.—A. W. Grosvenor, Assistant Engineer of Maintenance of the Western Division of the Northwest System, has been transferred to New York, in connection with terminal improvements. A. S. Bland succeeds Mr. Grosvenor.

St. Louis, Iron Mountain & Southern.—C. A. Brann has been appointed Master Mechanic of the Arkansas division, with office at Baring Cross, Ark. This appointment does not displace any of the three master mechanics already at Baring Cross.

Southern.—Edward Gray has been appointed Engineer of Maintenance of Way of the St. Louis-Louisville Lines, with office at St. Louis, Mo., succeeding C. C. Coffee, promoted.

Purchasing Agents.

Chicago Terminal Transfer.—A. C. Emery has been appointed Purchasing Agent.

LOCOMOTIVE BUILDING.

The Guayaquil & Quito has ordered 12 locomotives from the Baldwin Works.

The Italian Government has ordered 20 locomotives from the Baldwin works.

Zeigler Coal Company, Zeigler, Ill., has ordered three locomotives from the Baldwin Works.

The Atlanta & West Point, it is reported, has ordered five locomotives from the Rogers Locomotive Works.

The Duluth & Iron Range, it is reported, has ordered eight switching locomotives from the Baldwin Works.

The State Railway of Chile has ordered one 15-in. x 22-in. Mogul locomotive from the Lima Locomotive & Machine Co.

The Erie has ordered 25 Pacific type locomotives from the American Locomotive Co., delivery to begin in March, 1906.

Kilpatrick Brothers & Collins, Omaha, Neb., have ordered one 45-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Nitrate Railway Company, Iquique, Chile, has ordered one 80-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Syndicate de Orbas Publicas, Chile, has ordered two 12-in. x 18-in. Mogul locomotives from the Lima Locomotive & Machine Co.

The Buffalo, Rochester & Pittsburg has ordered four Atlantic

type locomotives and 10 consolidation locomotives from the American Locomotive Co.

The Ferro-Carril de Guantanamo (*Guantanamo R. R. Co.*), Guantanamo, Cuba, will shortly be in the market for two eight-wheel (4-4-0) type locomotives having a total weight of about 90,000 lbs., with cylinders 17 in. x 24 in.; two mogul locomotives (2-6-0) type, having a total weight of about 95,000 lbs., with cylinders 17 in. x 24 in., and two (0-6-0) type switching locomotives, with a total weight of about 65,000 lbs. Address Richard Brooks, Chief Engineer, Guantanamo, Cuba.

The Texas Central has ordered four simple consolidation (2-8-0) locomotives from the American Locomotive Co., for July delivery. These locomotives will weigh 135,000 lbs., with 120,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 51 in.; wagon top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,939 sq. ft.; charcoal iron tubes, 2 in. in diameter and 12 ft. 6 in. long; steel firebox, 104⅛ in. x 42⅞ in.; grate area, 31 sq. ft.; tank capacity, 4,500 gallons, and coal capacity, nine tons. The special equipment includes: Westinghouse-American air-brakes, Ohio injectors and American driving wheel tires.

CAR BUILDING.

The Alaska Central is asking prices on 15' flat cars.

The Chicago, Burlington & Quincy is about to order 1,000 box cars.

The Chicago Great Western is asking bids on 1,000 box and stock cars.

The National Car Line Co., Chicago, is figuring on building 50 cars at its own shops.

The Marion, Bluffton & Eastern Traction Co., Bluffton, Ind., has ordered eight cars.

The Pere Marquette has ordered 2,000 box cars of 80,000 lbs. capacity from the Pullman Co.

The Southern is in the market for upwards of 40 cars, including baggage, passenger and postal cars.

The Pennsylvania, it is reported, has ordered 11 additional electric cars for its West Jersey & Seashore line.

The Chicago, Lake Shore & Eastern is in the market for 500 steel underframe gondola cars of 100,000 lbs. capacity.

The Groton & Stonington Street R. R. (*Electric*), Mystic, Conn., has ordered two interurban cars from the Jewett Car Co.

The Norfolk & Western is in the market for 500 gondola cars in addition to the 3,500 reported in our issue of February 16.

The Baltimore & Ohio will shortly order a large amount of new freight equipment, but nothing definite has yet been decided.

The Nashville, Chattanooga & St. Louis will build 200 box cars in its own shops. Orders have already been placed for the material.

The O. F. Jordan Co., Chicago, has ordered, since January 1, 11 specially built flat cars from F. M. Hicks & Co. for their spreaders.

The Fairmont & Clarksburg Traction Company (*Electric*), Fairmont, W. Va., has ordered 10 interurban cars from the Jewett Car Co.

The Eureka & Palisade has about decided to build some hopper bottom cars at its Palisade shops, but will probably purchase trucks already built.

The Illinois Central will build 50 cars in its own shops. Thirty of these will be gondola cars and the remaining 20 will be box cars, all of 80,000 lbs. capacity.

The Pennsylvania Lines, it is reported, are about to place an order for 166 passenger, baggage, mail and express cars for the lines east of Pittsburg, and 68 cars of a similar type for the lines west of Pittsburg.

The Ferro-Carril de Guantanamo (*Guantanamo R. R. Co.*), Guantanamo, Cuba, will shortly be in the market for seven passenger coaches, 40 box cars of 60,000 lbs. capacity, and 60 flat cars of 60,000 lbs. capacity. Address Richard Brooks, Chief Engineer, Guantanamo, Cuba.

The Orange & Northwestern has ordered 50 logging cars from the Orange Iron Works, and 50 logging cars from the Beaumont Iron Works, all of 60,000 lbs. capacity. All cars will weigh 20,000 lbs., and measure 36 ft. long, 10 ft. wide and 32 in. high, over all. The special equipment includes Dickinson wheels.

The Boston Elevated has ordered 45 "Easy Access" steel cars from the Pressed Steel Car Co., for its elevated service, to be delivered in August and September, 1906. These cars will seat 48 passengers and will weigh about 36,000 lbs. The overall dimensions will be 46 ft. 7 in. long x 8 ft. 7 in. wide. The order for the trucks has as yet not been placed.

The National of Mexico will build at its own shops 150 gondola cars of 36-tons capacity, 100 flat cars of 36-tons capacity, and 15 cabooses, and is also in the market for 300 box cars of 80,000 lbs. capacity; five combination baggage and express cars; three third class, three second class and three first class coaches, all to be equipped with vestibules.

The Georgia Southern & Florida has ordered three 60-ft. express cars of 60,000 lbs. capacity from Barney & Smith, not freight cars, as reported in our issue of March 2. The special equipment for these cars will include: Diamond special brake-beams, Westinghouse air-brakes and draft rigging, Ajax brasses, Janney couplers, Gold heating system and Symington journal boxes.

The Chicago Great Western, as reported in our issue of February 23, has ordered 280 36-ft. box cars and 100 36-ft. furniture cars of 70,000 lbs. capacity from Pullman, and 320 36-ft. stock cars of 60,000 lbs. capacity from F. M. Hicks & Co. The special equipment for the box and furniture cars includes: Security doors, McCord journal boxes, Chicago roofs and Barber trucks. The special equipment for the stock cars includes McCord journal boxes.

The Mexican International, as reported in our issue of January 19, has ordered 300 gondola cars of 80,000 lbs. capacity from the South Atlantic Car & Manufacturing Co., for April 1 to May 15 delivery. The special equipment will include the Pennsylvania Brake-Beam Company's brake-beams, Westinghouse air-brakes, Tower couplers, Miner draft rigging, Symington journal boxes, Railway Steel-Spring Company's springs, and American Steel Foundries trucks.

The Boston & Maine has just let a contract to the Pressed Steel Car Co. for 1,000 box cars of 60,000 lbs. capacity, for October, 1906, delivery. These cars will weigh 31,700 lbs. and will measure 36 ft. long inside. The bodies and underframes will be of wood. The special equipment will include the Pressed Steel Company's bolsters and pedestal trucks, Simplex brake-beams, Westinghouse air-brakes, lead lined brasses, Gould couplers, Miner tandem draft rigging, and Railway Steel-Spring Company's springs.

The Erie, as reported in our issue of Feb. 23, has ordered 25 suburban passenger coaches from the St. Louis Car Co., for June 1, 1906, delivery. These cars will have a seating capacity for 70 passengers, and they will measure 66 ft. 7 in. long x 10 ft. wide x 14 ft. 6 in. high over all. The bodies and underframes will both be of wood. The special equipment will include Simplex bolsters, American Brake-Shoe & Foundry Company's brake-shoes, Westinghouse high-speed air-brakes, Climax brasses, Buhoup three-stem couplers, National curtain fixtures, Dayton door fastenings, Miner draft rigging, Gold heating system, M. C. B. malleable iron journal boxes, standard steel platforms, canvas roofs, four-wheel trucks, Pullman vestibules and Standard steel wheels.

BRIDGE BUILDING.

Albany, N. Y.—A bill has been introduced in the New York State Senate authorizing the Governor to negotiate with the New Jersey authorities to secure legislation and the appointment of a joint commission to buy the necessary land or water rights for building one or more bridges over the Hudson river from New York City to various points in New Jersey, at the joint expense of both states.

Atlanta, Ga.—It has not been definitely decided whether contract will be let to Grant Wilkins, of Atlanta, Ga., at his bid of $134,587 for the complete Washington street viaduct, or to the Oliver Co., at Knoxville, Tenn., at their bid of $184,587.

Bessemer, Mich.—Bids will be asked by the Township Board of Marenisco, Gogebic County, over the Presque Isle river. George Rupp, Bessemer, may be addressed.

Charlotte, N. C.—A contract has been given to the Virginia Bridge Co., of Roanoke, Va., for building a two-span steel bridge 25 ft. wide on concrete abutments over Sugar creek on East Fourth street.

Cincinnati, Ohio.—Plans are being made for rebuilding the Cincinnati Southern bridge over the Ohio river, at a cost of about $1,500,000.

Florence, Ala.—A contract is reported let for building a new steel bridge over the river at this place. The bridge is to carry three tracks. It will cost about $500,000.

Forest City, Ark.—A company has been organized with $40,000 capital, to be known as the Madison Bridge Co., to build a highway bridge over the St. Francis river near Madison. John Gatling is President and T. C. Morwin, Secretary.

GLOUCESTER, MASS.—Bids are wanted March 14 by the County Commissioners at Salem for building a rolling lift bridge over the canal at Gloucester, Mass. James P. Hale is Clerk of the County Commissioners.

GRAND RAPIDS, MICH.—A resolution has been submitted to the Board of Aldermen for permission to issue bonds for $66,000 to build a bridge from Ann to Victoria streets.

MEDICINE HAT, ASSIN.—The Alberta Government has decided to spend $50,000 for building the foundations and abutments for a highway bridge over the South Saskatchewan river at this place.

NEW HAVEN, CONN.—The New York, New Haven & Hartford, it is said, has let a contract at $600,000 for building a number of steel bridges, six of which will be over the New Haven cut.

SALEM, MASS.—The towns of Salem and Beverly will shortly ask bids for building a bridge 1,200 ft. long, with a draw, to cost $100,000, over the Danvers river. James P. Hale, Salem, Mass., may be addressed.

SAN DIEGO, CAL.—The Board of Public Works recommends three new steel bridges to replace the present wooden structures, at a cost of about $25,000.

SAN FRANCISCO, CAL.—The city officials have under consideration the question of building a reinforced viaduct 1,000 ft. long on Mission street between Bosworth and Marshall streets. The City Engineer's plans place the estimated cost of the structure at $250,000.

SIOUX CITY, IOWA.—The Great Northern, it is said, is planning to build a bridge here.

TOLEDO, OHIO.—A resolution has been introduced in the City Council to authorize a new concrete steel bridge to be the full width of the street at Cherry street, to replace the present structure.

TULSA, IND. T.—The Single Statehood Bridge Co. has been organized to build a bridge over the Verdigris river near Nowata, on which work is to be started at once. Incorporators include: M. B. Baird, T. G. Sanders and H. B. Talley.

Other Structures.

ALLEGHENY, PA.—The Baltimore & Ohio, according to the newspaper reports, has decided to build a new station on the site of the present Pittsburg & Western station at this place, to cost about $1,000,000.

BIRMINGHAM, ALA.—The Birmingham Terminal Co. has been granted franchises and will at once begin work on a new passenger station to cost about $1,500,000.

BRUNSWICK, GA.—The Atlantic & Birmingham will ask bids March 5 for building terminals here to cost $200,000. The contracts are to be let by the Fore River Ship Building Co., of Quincy, Mass.

CHATTANOOGA, TENN.—According to local reports, work is to be started early in April on a new passenger station for the Southern Railway, to cost about $300,000.

ELDORADO, KAN.—The Atchison, Topeka & Santa Fe is planning to put up a new passenger station here.

LAWRENCE, MASS.—The Boston & Maine, it is said, has bought a large plot of ground as a site for a new freight house and yard.

MEMPHIS, TENN.—The Southern Railway, it is said, has started work on two large storage warehouses, at a cost of $100,000, and is making repairs at the present freighthouse to cost about $25,000 and $30,000 additional.

NEW YORK, N. Y.—There are rumors that the Pennsylvania and the New York, New Haven & Hartford are planning to put up a union passenger station on the block between First and Second avenues, between 126th to 127th streets.

SALT LAKE CITY, UTAH.—The Denver & Rio Grande and the Western Pacific are planning to put up a stone passenger station to cost about $200,000.

SPRINGFIELD, MO.—The Missouri Pacific, it is said, will build a new passenger station here to cost about $18,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AMERICAN OF PORTO RICO.—An officer writes that this company is now building a new line to connect its two main lines, so as to furnish a through route from San Juan to Ponce, which are 170 miles apart. The new line, which is being built between Camuy and Aguadilla, over a rough country, will have grades of 2 per cent. The work is very heavy and considerable blasting has been necessary. The line crosses a number of small streams and deep canyons, over which many small and a few large bridges will be built, the largest of which will be about 500 ft. long. There will also be two tunnels. About 14 miles is completed and the remaining 13 will be finished this fall. The new line passes through the towns of Isabella and Quebradillas, through a fertile section. The work is being done by the company's men. George Servajeau, Isabella, is the Engineer in charge of construction.

ASHCROFT, BARKERVILLE & FORT GEORGE.—Application is being made by a company under this name for a charter to build a railroad in British Columbia, from Ashcroft to Fort George, approximately 300 miles. C. S. Riley, H. C. Crowe and others, of Winnepeg, Man., are interested.

AUGUSTA, WATERVILLE & OAKLAND (ELECTRIC).—Incorporation has been asked for by this company, in Maine, with a capital of $75,000, to build a street railroad through Oakland and Sydney to Augusta, about 18 miles. The directors include: E. G. Lawrence, A. B. Gerald, S. A. Nye, of Fairfield, Me., and C. W. Davis and R. M. Gilmore, of Waterville.

BALTIMORE & OHIO.—Announcement is made that this company will make improvements in the Pittsburg district including new terminals and freight station, at a cost of $2,000,000 instead of $500,000, as originally intended. Other improvements are to be made along the line of its road in the same district.

BEAUMONT TERMINAL.—Under this name a company has been organized in Texas, with a capital of $20,000, to build a belt line around the city of Beaumont, to provide additional facilities for the Beaumont, Sour Lake & Western, which is controlled by the Colorado & Southern. The Directors include: R. C. Duff, W. F. Keith, G. A. Clark and others of Beaumont.

BELLA COOLA & FRASER LAKE.—A. P. Lexton and Edgar Dewdney, of Victoria, B. C., are petitioning for a charter for a company under the above name to build a railroad from the mouth of the Bella Coola river, B. C., to Fort George on the Fraser river, approximately 400 miles.

BROOKLYN RAPID TRANSIT.—This company is planning to build four new electric surface roads in Brooklyn, N. Y., in and around the Twenty-sixth ward. Application has been made for franchises to cover the work. One of the proposed lines is to be an extension of the present Church Avenue Line, another a George Avenue Line, and to other lines on Liberty avenue.

CANADIAN ROADS.—A number of Chicago and English capitalists, represented by Edward Copps, of Detroit, are planning to build a railroad from the north shore of Lake Superior to Hudson Bay.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—See Indianapolis & Louisville.

COPPER RIVER & TELKWA.—Under this name a company has applied for a charter to build a railroad from the mouth of the Copper river, in British Columbia, to the mouth of the Telkwa river, about 210 miles. H. D. Lawson, E. V. Bodwell and James H. Lawson, all of Victoria, B. C., are interested.

DAWSON, GRAND FORKS & STEWART RIVER.—This company, incorporated in England with a capital of $2,500,000, to own and operate the Klondike Mines Railway Co., of Canada, has filed a mortgage on the completed road from Klondike City and Dawson to Sulphur Springs, about 30 miles. This section is to be completed in October of this year. The road is ultimately to be extended to the Stewart river, a total distance of 84 miles.

DENVER & RIO GRANDE.—This company is rebuilding and straightening the line and laying double-track between Pueblo and Florence, Colo. This part of the road is between high cliffs along the Arkansas river. The cost of the work will be about $1,000,000.

DETROIT ROADS.—Application is being made by a company in which Mayor Codd and Frank C. Andrews of Detroit, Mich., and Pendergast & Rawson, of New York, are said to be interested, for a charter to build a subway and a system of connecting surface lines in Detroit, Mich., to compete with the Detroit United Railway. The new company promises three-cent fares and universal transfer.

GILPIN & CLEAR CREEK DISTRICT.—Under this name a company is being organized in Colorado, with a capital of $600,000, to build a railroad from Central City, Colo., to Pactolus, about 90 miles. The proposed road will traverse a rich mining section. B. E. Seymour, E. R. Fouts, W. H. Stull and others, of Central City, are interested.

GUANTANAMO, CUBA.—An officer writes that this company, which operates a line in Cuba, has just completed 15 miles of road and that surveys are in progress for an extension of the main line to La Maya, an additional 25 miles. Construction work is to be commenced early in May, but contracts have not as yet been let. The work is not heavy, maximum grades being 1.5 per cent., and maximum curves 8 degrees. There will be two large steel bridges and about 12 small ones. Robert Mason, Santiago de Cuba, is President, and Richard Brooks, Guantanamo, is Chief Engineer.

HILLSBORO NORTHWESTERN.—This company has filed a notice in Wisconsin that it will build an extension from Hillsboro to Richland Center, 28 miles.

HUDSON RIVER & EASTERN TRACTION.—Incorporation has been granted this company in New York to build an electric railroad from the New York Central tracks in Ossining, N. Y., through Briarcliff Manor, Pleasantville and Sherman Park, about nine miles. The incorporators include: L. B. Grant, R. W. Yates, H. E. Keeler, A. T. Cole and others, of New York.

INDIANAPOLIS & LOUISVILLE (C., I. & L.).—This company, recently organized by the Chicago, Indianapolis & Louisville, has filed a mortgage with the Standard Trust Co., of New York, as trustee to secure an issue which will be guaranteed by the C., I. & L. to secure funds to build a line from a point at or near Indianapolis to Evansville, Ind.

KLONDIKE MINES.—See Dawson, Grand Forks & Stewart River.

LOUISIANA & ARKANSAS.—An officer writes that grading has been completed on the Alexandria extension from Packton to Alexandria, La., 36 miles, and track laid for a distance of 10 miles from Packton. M. T. Tousey, of Winfield, La., is the contractor.

LOUISVILLE & INDIANAPOLIS TRACTION.—Rights of way have been secured by this company for building its proposed railroad from Jeffersonville, Ind., north to Seymour, about 60 miles, where connection is to be made with a line already completed as far south as Columbus and now under construction to Seymour. I. N. Perry, John Long, C. B. Casurbur, of Memphis and Henryville, are interested.

MAINE ROADS.—Negotiations are under way for consolidating several electric roads in Maine. The companies to be included in the merger are the Portsmouth, Dover & York and the Atlantic Shore Line. The latter operates a line between Springvale, Kennebunk and Biddeford, Me. The two lines together operate about 100 miles of road. The recent sale of the Lewiston, Brunswick & Bath Street Railway is believed to be connected with this project. By completing a ten-mile section between York and Kennebunk, now being surveyed, connection will be completed for a chain of electric service from New York to Bath and Lewiston, Me.

MEXICAN ROADS.—A concession has been granted by the Mexican Government to John Lureno Gonzalez Trevenine, of Monterey, to build a railroad from Garza Galau, in the State of Coahuila, to Allende, 75 miles, where connection is to be made with the Mexican International.

MIDDLETOWN & CECILTON.—An officer writes that this company, which is building a line from Middletown, Del., via Warwick to Fredericktown and Georgetown, Md., 12 miles, has given a contract to W. R. Polk & Co., for building from Middletown to Cecilton, nine miles. Grading has been completed for 7½ miles, but no track has yet been laid. On the completion of the track over the section to Cecilton, the company will ask bids for the balance of the road. A branch is also projected to run from Cecilton to a point on Chesapeake Bay, an additional six miles. T. C. Cruikshank is President and W. R. Polk Secretary and General Manager, Wilmington, Del.

MONTGOMERY & HAYNEVILLE.—This road, which runs from Hayneville, Ala., to Morganville, on the Louisville & Nashville, has been completed and put in operation.

NEVADA ROADS.—The route of the road which is being built in opposition to the Las Vegas & Bullfrog branch of the San Pedro, Los Angeles & Salt Lake, is from Ludlow north to Rhyolite, Nev., 158 miles. The line will cross the S. P., L. A. & S. L. at a point about 19 miles south of Ludlow, at the south end of Soda lake, and is to run thence across Soda lake on the west side of Silver Dry lake past the east end of the Ayawartz mountains to Salt Spring, where the Amargosa river will be reached. Seven miles north of Salt Spring the road will enter the Amargosa River canyon, which is eight miles long, where the most difficult part of the work will be encountered. On leaving this canyon the route is to the old borax works near Resting Springs, and from there along the river through Resting Springs and Dry lake until it reaches Ash Meadow, from which point a branch will be run to Death Valley, the Lila C borax mine and the Furnace creek section.

NEW YORK SUBWAYS. The committee on plans and contracts has reported favorably to the Rapid Transit Commission on the resolution for a subway from Fourth avenue and Fortieth street in Brooklyn, through Fortieth street to New Utrecht avenue to Eighty-sixth street, and thence to Stillwell avenue, along which an elevated structure is to be built to Coney Island.

NORTHERN ALBERTA RAILWAY & COAL COMPANY.—Application is being made to the Legislature by A. J. Arnold, of Windsor, Ont., for permission to build this road, which it is proposed to build from Lethbridge via High river and Calgary to Edmonton, about 500 miles.

PENNSYLVANIA.—This company, according to the annual report, just issued, has work under way as follows:

Extension of the classification yard at Hollidaysburg, Pa., and on an extensive westbound yard at that place.

New yard facilities at the Morrisville, Pa., terminus of the Trenton cut-off.

At Philadelphia the widening and lengthening of the tracks on the south side of the new Broad street station.

At East Liberty, Pittsburg, a new passenger station and new freighthouses.

On the Cherrytree and Dicksonsville a branch line is being built from West Brownsville Junction, up the valley of the Monongahela for a distance of 4.5 miles, where connection is to be made with the Pennsylvania, Monongahela & Southern, which is now under construction for the purpose of further developing the Monongahela Valley.

Other work to be carried out during the present year includes the extension of the four-track system on the Middle and Pittsburg divisions, and revision of alinement and grades in connection with that work. The four-tracking between New York and Pittsburg will soon be complete with the exception of two three-track sections, one seven miles long between Spruce Creek and Tyrone Gorge, and the other one 3.5 miles immediately east of Conemaugh.

The low grade freight line from Yorkhaven on the Susquehanna, eastward to Glenloch, will soon be completed and will furnish an independent route with maximum grades of 0.3 per cent. eastbound and 0.6 westbound between Marysville, west of Harrisburg, and Morrisville, near Trenton, which are 137 miles apart.

Construction will be started at once on an additional freight line about 50 miles long from Morrisville, Pa., to Newark, N. J., and one from Glenloch, Pa., to Philadelphia, 20 miles.

A line is to be built to relieve the Pittsburg division, between Pitcairn and Blairsville, 43 miles, and one between Johnstown and Altoona, 39 miles. It has not decided whether the latter will be used for freight or passenger service. With these changes the company will have a double-track road independent of its four-track main line, from Pittsburg to Philadelphia and New York, with the exception of 96 miles on the Middle division, between Petersburg and Marysville, and a short section between Parkesburg and Thorndale on the Philadelphia division.

Work is under way on the tunnel line into and through the city of New York. All the necessary land for the terminal station in New York City has been bought and for most of that needed for the terminal yard in Long Island City. The contract has been let for building a drawbridge over the Hackensack river between Newark and the Hudson river.

Work is being pushed on the Bergen Hill tunnel which is being driven from both ends.

Work is under way on a power house at the new terminal station, New York City. The tunnels under the city are being driven westward from the main shaft at First avenue and in both directions from the intermediate shafts at Thirty-second and Thirty-third streets between Fourth and Madison avenues. On the East River section, the shields are in place on the Manhattan side and work is in progress towards the river. The shafts on the Long Island side are not yet completed, but considerable work has been done on them and at the eastern portal of the tunnel in Long Island City.

This company has started work on the elevation of the Columbia & Port Deposit Railroad along the Susquehanna river to avoid the damages caused by floods and ice. The road now runs along the river shore, but will be placed upon the side of the hills. At Safe Harbor a stone bridge nearly 100 ft. high will be built over the Conestoga river.

PHILIPPINE RAILROADS. The Philippine Railway Construction Co. has been incorporated in New Jersey with capital of $1,000,000, to build and operate railroads in the Philippine Islands and elsewhere. The incorporators include: A. C. Wall, 1 Exchange Place, Jersey City; J. P. Carter and E. B. Bruce, 52 William street, New York City.

QUEBEC, MONTREAL & SOUTHERN.—Application will be made to the Dominion Parliament by this company to take over the Quebec Southern, which includes the South Shore, the United Counties, and the East Richelieu Valley Railroads, to complete the line which the South Shore was authorized to build from Noyan Junction to the international boundary, to secure terminal lands and wharfs, and to operate steamers on the St. Lawrence and Richelieu rivers.

SOUTHERN. This company, it is said, will spend between $200,000 and $300,000 at Hamilton Springs, Tenn., where five miles of track is to be laid and a new turn table built.

TAYGARTS & CHEAT RIVER.—A charter has been granted to a company under this name in West Virginia, with a capital of $20,000 to build a railroad from Cecil on the Baltimore & Ohio in Taylor County, east to Rowlesburg, in Preston County, about 20 miles. The incorporators include J. Baumgartner, S. McNiel, C. H. Moran and A. R. Stuart, of Baltimore, and G. H. Clapp, of Aberdeen, Md.

Toledo, Fort Wayne & Indianapolis.—This company has been organized with a capital of $3,000,000, and, it is said, will begin work in April on its proposed road between Toledo and Indianapolis. Rights of way have been secured. W. B. Strang, of New York, is President.

Vanderbilt Roads.—According to newspaper reports, Vanderbilt interests are promoting a project to link electric lines in northern Indiana and southern Michigan, and extend the three-rail system to various points reached by interurban lines. The plans include the operation of electric cars from South Bend to Niles, Mich., over the Michigan Central and the C., C., C. & St. L. to Benton Harbor over the I., I. & I. to St. Joseph, Mich., over the Lake Shore & Michigan Southern temporarily to Elkhart, Ind., and the Lake Erie & Western to Michigan City, Ind.

Wabash.—This company, it is said, will build the Uniontown & Wheeling Short Line, which is to be 68 miles long, from Uniontown, in Fayette County, to Wheeling, W. Va. (See Uniontown & Wheeling Short Line. Nov. 3, p. 144.)

Wisconsin Central.—This company, it is said, is the owner of the Milwaukee Terminal Railroad, which is seeking entrance into Milwaukee, Wis., and is planning to build terminals at that place to cost between $5,000,000 and $7,000,000. The Milwaukee Southern, it is said, is opposing the plans of this company for its terminal site.

Yosemite Valley.—This company is offering for sale bonds to secure funds for continuing work on the line which it is building from a connection with the main lines of the Southern Pacific and Atchison, Topeka & Santa Fe at Merced, Cal., to the Yosemite National Park. F. G. Drum is President.

RAILROAD CORPORATION NEWS.

Allegheny Valley. See Pennsylvania.

Ann Arbor.—See Detroit, Toledo & Ironton.

Birmingham Railway, Light & Power.—N. W. Harris & Co., New York, are offering for sale $5,000,000 general mortgage refunding 4½ per cent. bonds of 1954. These bonds, after the retirement of underlying bonds on July 1, 1906, will become a first lien on the entire gas, electric light and power business of the company, and on 72 miles of electrical road in Birmingham, Ala.

Brooklyn Rapid Transit.—Gross earnings for the year ended December 31 were $17,493,011, an increase of $2,033,351; net earnings, $7,414,088, an increase of $1,216,344; surplus after charges controls, $2,251,451, an increase of $778,180.

Canadian Pacific.—Gross earnings for the month of January were $4,422,691, an increase of $1,170,189; net earnings, $1,267,234, an increase of $844,565.

Cincinnati, Hamilton & Dayton.—Gross earnings for the year ended June 30, 1905, were $8,008,917, a decrease of $13,314; net earnings, $2,003,951, a decrease of $232,689.

Colorado Southern.—A semi-annual dividend of 2 per cent. has been declared on the $8,500,000 first preferred 4 per cent. non-cumulative stock of this company. The dividend on this stock was passed in the fall of 1904, on account of losses due to the Colorado coal strike, and none has been paid since.

Colorado Southern, New Orleans & Texas Pacific.—This company has made a mortgage to the Central Trust Company to secure $12,000,000 first mortgage 4½ per cent. bonds. The road is under construction between Houston, Tex., and Baton Rouge, La.

Dayton, Springfield & Urbana (Electric).—A. E. Locke, of Boston, who bought this road recently at receiver's sale for $600,000, is reported to have also bought the other "Appleyard" lines.

Detroit, Toledo & Ironton.—This company is to exchange $500,000 consolidated mortgage 4½ per cent. gold bonds for the 5,000 shares of Ann Arbor preferred stock which were not taken up by the D., T. & I. last June, when it acquired a majority of the preferred and common stock of the Ann Arbor.

Great Northern. This company has taken over the property of the Union Terminal Co., of Sioux City, Iowa, having had an option on it for about a year. The terminal company has $1,800,000 capital stock and $1,250,000 bonded debt, and consists of about 30 miles of road, a union passenger station and other terminals. The purchase price is said to have been $1,250,000.

Havana Electric.—Gross earnings for the year ended December 31, 1905, were $1,504,837, an increase of $257,351; net earnings, $728,785, an increase of $206,045; surplus after charges, $370,921, an increase of $233,313.

Interborough-Metropolitan.—This company, which was recently incorporated as the holding company of the Interborough Rapid Transit, Metropolitan Street Railway and Metropolitan Securities Company, has filed a certificate of increase of capital stock from $15,000 to $155,000,000, of which $100,000,000 is common stock. The plan for the merger has been declared operative, but deposits of stock of the three old companies will be received up to March 16. (Feb. 2, p. 38; Jan. 26, p. 30.)

Kansas City, Mexico & Orient.—This company has applied for authority to issue $10,984,400 bonds to pay for the construction of the Texas section of the road.

Lake Erie & Western.—Gross earnings for the year ended December 31 were $5,025,777, an increase of $27,769; net earnings $1,354,486, an increase of $49,451, surplus after charges $117,660, a decrease of $12,027.

Long Island.—Gross earnings for the year ended December 31 were $7,824,985, an increase of $741,179; net earnings $1,560,349, a decrease of $280,154, surplus after charges $122,528, a decrease of $204,481.

New Jersey & Pennsylvania.—F. V. Pitney, of Morristown, N. J., has been appointed receiver for this road, which runs from Whitehouse, N. J., to Morristown, 26 miles, and has $145,000 stock outstanding and $1,000,000 first mortgage 5 per cent. bonds of 1930.

Pan-American.—George D. Cook & Company are offering for sale $1,000,000 first mortgage 5 per cent. bonds of 1934. About 200 miles of road are now completed and in operation, and it is expected that 300 miles will be in operation within 18 months.

Pennsylvania.—A special meeting of the stockholders of the Allegheny Valley will be held on March 14 to act on the proposal to sell the Allegheny Valley to the Pennsylvania. (Nov. 17, p. 160.)

Pere Marquette.—Gross earnings for the year ended June 30, 1905, were $12,639,420, an increase of $1,236,728; net earnings decreased $971,349. The operating ratio was 78.3, an increase of 10.8 per cent.

Pittsburg, Shawmut & Northern.—The receiver has been authorized to issue $3,800,000 receiver's certificates to provide for extensive improvements and additions.

Quebec, Montreal & Southern.—Permission will be asked from the Dominion Parliament to incorporate a company under this name to acquire and operate the Quebec Southern, the South Shore, the United Counties, and the East Richelieu railroads. This will be a Canadian holding company for the Delaware & Hudson, which recently bought the Quebec Southern.

St. Louis & North Arkansas.—This company having defaulted payment of interest on its $3,065,500 first mortgage bonds, a reorganization committee, consisting of John Scullin, D. R. Francis and others, requests the deposit of bonds with the St. Louis Union Trust Co., preparatory to foreclosure and reorganization.

St. Louis & San Francisco.—Gross earnings for the six months ended December 31 were $21,611,407, an increase of $986,456; net earnings, $7,952,547, an increase of $280,080. Surplus after charges were $1,001,903.

Santa Fe Central.—It is reported that this road has been sold to C. W. Tallmadge, of Chicago, at a price said to be about $2,500,000. The road runs from Santa Fe, N. Mex., to Torrance, 117 miles.

Union Terminal (Sioux City, Iowa). See Great Northern.

West Jersey & Seashore.—At a meeting of the stockholders held on March 6, an increase of capital stock from $8,076,000 to $10,000,000 was approved. The new stock is to pay for the installing of an electric line between Camden, N. J., and Atlantic City.

Wheeling & Lake Erie.—Gross earnings for the year ended January 30, 1906, were $4,595,607, an increase of $270,325; net earnings, $956,472, a decrease of $93,511. The deficit after charges was $193,360 as compared with a surplus, for the previous year, of $63,654. In commenting on the report, the President says:

"Your directors have the utmost confidence in the ultimate success of the property. The difficulty heretofore has been that the road was too poor to adequately supply itself with equipment or to make necessary improvements to take care of the business at hand. * * * It has not yet begun to receive any considerable benefit from the Wabash-Pittsburg Terminal, and probably not until the latter part of the present fiscal year will the benefits of the Pittsburg extension accrue to any large extent; but it is confidently expected that by the summer of 1906 there will be a very material increase in business derived from this source."

GENERAL NEWS SECTION

NOTES.

A bill has passed one house of the New Jersey legislature permitting electric street railroads to carry freight.

Clergymen in Pittsburg, Pa., are receiving notice from the Central Passenger Association to return their half fare permits.

A bill has been introduced in the legislature of Maryland to create a transportation commission and to empower it to regulate freight rates.

The general office building of the Seaboard Air Line, at Portsmouth, Va., was burnt down March 4; loss about $25,000. Many valuable papers were destroyed.

The Grand Trunk last week made a reduction of $2 in the fare from Chicago to New York and $3 to Boston. The Wabash road took similar action, but it does not yet appear that any other road has joined in the movement.

Of the numerous successive record-breaking movements of freight over the Middle division of the Pennsylvania, the last reported, is that of Sunday, March 4th, 8,158 cars. These care were made up into 153 trains.

Representative Esch, of Wisconsin, has introduced a bill in Congress empowering the Interstate Commerce Commission, when complaint is made, to fix the maximum number of hours employees of railroads may be required to work continuously.

Through trains are to be run between Knoxville, Tenn., and St. Louis, Mo., over the Louisville & Nashville, and the Louisville, Henderson & St. Louis. Two trains will be run each way each day, beginning April 1. The distance is 600 miles and it will be covered in about 15 hours.

Mr. Henry B. Seaman, Civil Engineer, of New York City, formerly connected with the Erie and the New York, New Haven & Hartford roads, later on the New York city subway, and again, recently, on the New Haven road, has been appointed Consulting Engineer to the Department of Bridges, New York city.

A press despatch from Clarksburg, W. Va., says that the suit of the Red Rock Fuel Company against the Baltimore & Ohio has been withdrawn, the road having agreed to make the track connection which the fuel company desires, at Buckhannon, W. Va., and to make rates, on the usual basis, for shipments of coal from the Fairmont coal district.

The Metropolitan Street Railway Company's large car barn on the North river, New York City, between Forty-second and Forty-third streets, was destroyed by fire March 4; loss about $150,000. The fire originated in a car and is supposed to have been caused by defective wiring. The company lost 42 cars and seven sweepers which were in the building at the time of the fire.

The Subway in Manhattan, New York City, operated by the Interborough Rapid Transit Co., was opened on Monday last from the temporary northern terminus at 157th St., north to 221st St. The stations at 168th St. and at 181st St., which are over 100 ft. below the surface, are not yet ready for use and trains do not stop there. In the valley beyond Fort George the road is on an elevated structure.

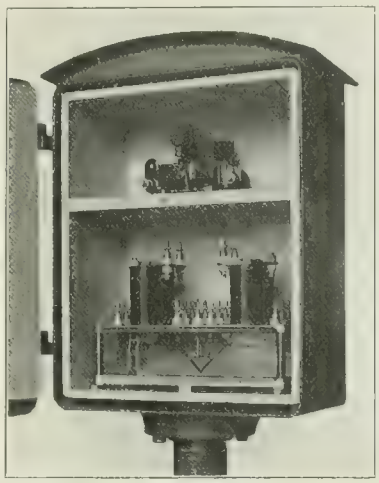
The state of Wisconsin just now enjoys the distinction of having two railroad commissions. One is the body of three members established last year, and the other is the single railroad commissioner who performed the duties of the office before the establishment of the new commission. He holds over because, having been elected by the people, there is no power to remove him. His term does not expire until the first of next January. It appears, however, that he now has nothing to do.

The Interstate Commerce Commission has reopened the case of W. R. Hearst against the anthracite coal roads, charging exorbitant rates, and will give a hearing at Washington, March 29. In connection with the inquiry which Congress has directed the Commission to make concerning the relation of railroads to coal and oil interests, the Commission will also investigate the same subject under the Interstate Commerce Act. A notice has been issued announcing that the Commission will, on its own motion, thus enlarge the scope of its inquiry.

According to press despatches from Cincinnati, T. E. Conner, Agent of the Cleveland, Cincinnati, Chicago & St. Louis, in that city, testified before the Interstate Commerce Commission, at a hearing there, that a large number of shippers in Cincinnati were permitted to send freight over his road at their own statement of weight. The Cincinnati Freight Committee determines what shippers shall have this privilege. George H. Ingalls, General Freight Agent, said that on coal this shrinkage of weights amounted to a discount of $3 to $9 a car. Mr. Ingalls also said that on a certain steel shipment from Pittsburg to Kansas City a rebate was paid in money.

A New Combination Relay and Crossing Bell Outfit.

The accompanying illustration shows a new combination relay and crossing bell outfit designed and made by the General Railway Signal Co., Buffalo, N. Y. The illustration shows the box with the door open showing the relay and bell movements. The gong is mounted on the back side of the wooden box and is sounded by a vertical moving clapper which strikes against the upper inside edge of the gong. The make and break contacts appear on the very top of the bell movement and directly in front, where they are easily accessible. The relay is of the well-known interlocking type, except that all of the contacting parts are enclosed in a dust-proof glass case. In addition to the contacts for ringing the bell, the relay is provided with three front contacts on each side. The first relay of this type was designed about the middle of February, 1905, and was built soon after.

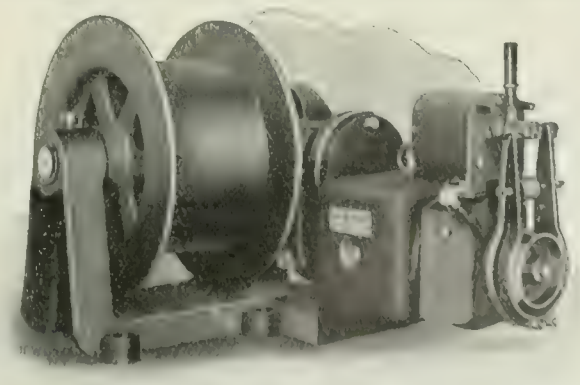


A New Combination Relay and Crossing Bell.

The box back of the relay is provided with a false back, thus permitting the wires to be brought in and criss-crossed as required, after which they are let out through holes provided in the false back opposite the proper binding posts to which the wires should be connected. The entire wood box is removable, so that access may be had to the gong if desired. The gong is covered by an apron which extends down to the bottom of the box where a grating is provided, which prevents the entrance of snow or the tampering with the bell by mischievous persons. The Bryant Zinc Company, Chicago, Ill., is the agent for this device.

Winding Drum Hoists.

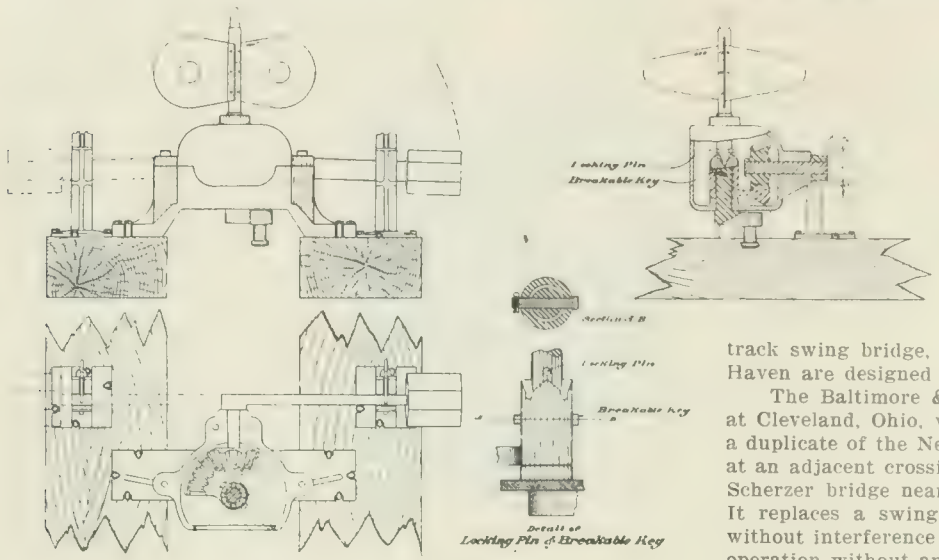
One of the most recent types of electric winding drum hoists made by the Sprague Electric Company, New York, is shown in the accompanying illustration. Hoists of this style require to be fastened securely to a foundation when in use, but they can be mounted upon a movable platform, truck or car, and thus be made portable between hoisting operations. They are used on boom derricks for raising both the load and the boom, as whip hoists, to raise loads rapidly through a hatchway, or in the open, and on docks, on board ships or in buildings. They can be used out of doors without protection from the weather as they are entirely enclosed and are dust and moisture proof. The controller, shown on the hoist motor, can be located in any desired position regardless of the location of the hoist, thus affording the utmost convenience in operation. Standard winding drum hoists are rated for single rope with maximum pull of ½ ton, 1½ tons and 2½ tons. By multiplying the number of ropes correspondingly increased loads can be worked at reduced speeds.



A New Type of Electric Winding Drum Hoist.

The Brown Switch Stand.

The peculiar feature of the Brown switch stand illustrated herewith is the sleeve surrounding the target staff and fastened thereto by a breakable key as shown, the sleeve being the hub of the main gear of the stand. The upper end of the sleeve is provided with four notches on the quarter points and above the sleeve a locking pin passes through the staff. In case the switch is run through, the shock against the points shears off the breakable key and the ensuing action of the stand is the same as if the lever were thrown. When the points have reached the reverse position the stand is locked automatically by the locking pin dropping into the notches below it, with the target also in reverse position. Then by removing the top housing and lifting the staff a new key can be



The Brown Switch Stand.

inserted, restoring the switch to service. By the action described the target always indicates the actual position of the switch points.

It is stated by the inventor of this stand that while the accidental running through a switch with the usual stand when the latter is locked may cost in repairs to stand, switch points and parts from $2 to $50, without considering the liability of a wreck and the resultant loss, in the event of a forced switch with this stand five minutes' time with unskilled labor with a wrench and 15 cents expenditure for material restores the stand to its original condition without further inconvenience. Meantime the tracks are protected by the proper signal. It is practically a one-piece stand without springs, bolts, nuts, etc. It is sold by the Brown Sphinx Company, Chicago, and is in use on a large number of important roads, including the Burlington, Rock Island, Frisco System, Missouri Pacific, Louisville & Nashville and Monon.

Hayes Lifting Derail.

The accompanying illustration shows a Hayes lifting derail installed at Woodhaven Junction on the Long Island Railroad. The derail is part of an interlocking plant at the entrance to a yard, and is betweeen a switch point and a road crossing. The short track room required for this form of derail makes it particularly well adapted for use in such a place. The Hayes Track Appliance Co., Geneva, N. Y., has recently received a large number of orders for



Hayes Lifting Derail at Woodhaven Junction, L. I. R. R.

these derails, both of the lifting and pivot types, and it is now building a new plant which will have several times the capacity of the present one. Among the large orders for derails received since Jan. 1, 1906, are the following: Pennsylvania Lines East and West, 548; New York Central Lines, 250; B. & O., 170; M., K. & T., 202; Erie 193; Southern Railway 148 and International & Great Northern 99.

Scherzer Bascule Bridges.

An inherent limitation of center pier, swing drawbridges is the inability to enlarge or widen them for the accommodation of additional tracks. For bascule bridges, on the other hand, one of the advantageous features is the opportunity for adding any number of parallel tracks from time to time as traffic requirements make necessary, by building new bridges alongside of existing bridges, without disturbance to traffic. An example of such an arrangement is found in the Westport, Conn., bridge of the New York, New Haven & Hartford, recently placed in service. The crossing consists of two double-track Scherzer rolling lift bridges placed side by side, forming a four-track bridge. A similar arrangement is nearing completion at Cos Cob, Conn., and another, across the Housatonic river, will be ready in a few months. The substructure for an extra long span double-track Scherzer bridge across the Connecticut river is nearing completion, and the superstructure is well advanced in the shops. The plan contemplates building another double-track bridge alongside this one in the future and operating them jointly or separately, as desired, with one operator. Work has begun on a four-track Scherzer bridge across the Neponset river, replacing a double-track swing bridge, and the plans for two six-track bridges, one across East Chester bay and the other across the Bronx river, have been completed. They replace a double-track and four-track swing bridge, respectively. All of these bridges for the New Haven are designed for the heaviest loadings.

The Baltimore & Ohio will replace a single-track swing bridge at Cleveland, Ohio, with a double-track Scherzer bridge, practically a duplicate of the Newburgh & South Shore, 160-ft. bridge in service at an adjacent crossing. The B. & O. is also building a 230-ft. span Scherzer bridge near the mouth of the Cuyahoga river, Cleveland. It replaces a swing bridge and is being erected in open position without interference to traffic. Upon completion it will be placed in operation without any delay to the heavy traffic at this point.

The Scherzer bridge across the Suir river, Ireland, on the Fishguard & Rosslare Railways has been completed. It is intended to facilitate the movement of trains on this modern high-speed line, built to shorten the time and distance between Queenstown, Cork and the south of Ireland and London. The Dutch Railroad Company is building a three-track Scherzer bridge across the Harlem river, being induced to do so from observation of the results from the bridge of the Southeastern & Chatham Railway across the Swale river, on the fast mail route to the Continent.

The Buenos Ayres Great Southern (Argentine Republic) is double-tracking its line and is replacing a single-track bridge across the Riachuelo river, Buenos Ayres, with a Scherzer double-track bridge.

In addition to the foregoing, and the large number of other railroad bridges built, the Scherzer Rolling Lift Bridge Company, Chicago, has built or has under way more than 40 electric railway and highway bridges.

London Tube Railways.

Experimental trains have been running for some weeks past in the Baker Street and Waterloo tubes, and on March 10 the lines were opened to the public. A short section at the southern end will be completed in a few months, and part of the extension at the Baker street end is being pushed forward. The next tube line to be completed, after the Baker Street & Waterloo, is the Great Northern, Piccadilly & Brompton, and this is expected to be opened by the end of this year. One other line that is building, but is not in so advanced a state, is the Charing Cross, Euston & Hampstead. The Waterloo & City tube is being amalgamated with the London & South Western Railway.

Chicago Traction Decision.

The United States Supreme Court has decided that the 99-year act passed by the state of Illinois in regard to the franchises of Chicago traction companies is invalid. This makes it possible for the city to at once buy several of the lines whose charters have, with the extension granted in the 99-year act, expired. The companies most affected are the Union Traction, North Chicago and West Chicago companies.

Lodgepole Pine Ties from the Yellowstone.

A striking interest attaches to the recent sale by the Government of about 50,000,000 feet of timber on the Montana division of the Yellowstone forest reserve to a contracting company, which will convert most of the timber into railroad ties.

This is one of the largest sales ever made of Government timber; the price is advantageous; and a large percentage of the cut will be of a species which a few years ago was without market value, namely, lodgepole pine. Further, it may be said with assurance that had not the preservative treatment of ties been shown to be both practical and economical, such a sale could not now have been made, for 60 per cent. of the cut, or approximately

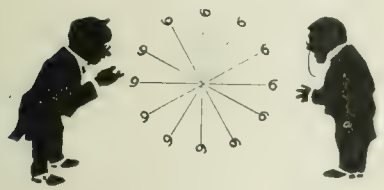
1,000,000 ties, is to be treated with preservatives by a process which experiment and trial have placed on a sound business basis.

The purchasers of the timber have contracted to supply the Chicago, Burlington & Quincy and the Northern Pacific railroads with ties for three years. The timber for which they applied to the Government consists of lodgepole pine, red fir, and spruce. A large proportion of the stand is lodgepole pine, which grows very densely. Consequently, after all the specified timber has been removed, a plentiful stand of young trees will be left, which in a few years will again form a forest of merchantable dimensions.—*Washington Post.*

Perpetual Motion at Last.

I submit herewith the drawing of a working model of a perpetual motion machine. I know how other inventors who have worked along this line have been made fun of, and the fear of ridicule has for years kept me from making my invention public. In fact, I invented it while still a small boy, and I think a single glance at the drawing will show how simple both the machine and its inventor are.

The machine consists of a number of radial arms, to the end of each of which is attached a weight, the whole revolving on an axis. The machine revolves from right to left. As it turns, the weights attached to the ends of the arms gradually change from 6 to 9 lbs. each, the transformation being reversed as the weights begin to rise. This may seem complicated—even absurd—to some; but every great invention has been laughed to scorn by the ignorant and fatuous populace. Besides, a single glance at my drawing will show that in spite of what physicists may say, the weights on my machine do act in just that way.



I am not looking for any financial reward. I shall be satisfied if no one throws a brick.—*I. N. Ventor in The Technical World.*

Manufacturing and Business.

The St. Louis Car Co. is erecting a new building exclusively for the manufacture of steel cars.

The Indianapolis Switch & Frog Co., Springfield, Ohio, has lately added increased facilities and equipment, enlarging the plant to almost twice the former capacity. It has been only about three years since the previous enlargement, which also doubled the capacity.

The new office building of the Union Pacific at Omaha, Nebraska, is to be equipped by the B. F. Sturtevant Co., Boston, Mass., with a complete heating, ventilating and air cleansing installation, which will comprise a fan to be driven by a motor, a heater, a tempering coil and a special Sturtevant air washer.

The Union Switch & Signal Company has made an addition to its foundry and is enlarging its power house so as to put in an additional gas engine of 300 h.p.; and during the past two months has taken orders aggregating almost $2,000,000. The number of orders now on hand for electric semaphore signals for automatic blocking aggregates over 4,000 blades. This department of the company's shops now turns out 30 of these signals a day, and this output will soon be increased. About 40,000 sq. ft. of floor space has been added to the shops during the past year, all of it for this department and still another building is soon to be built for it. At the annual meeting of the company March 13, George Westinghouse was re-elected President, and Robert Pitcairn, William McConway, George C. Smith, Thomas Rodd, Henry G. Prout and John B. Jackson were chosen directors. The earnings for the year ending December 31 were $2,980,889; disbursements, $2,571,222. The assets are $3,905,631, and the liabilities $2,879,599.

Mr. Edward J. Beard, since 1902 Principal Assistant Engineer of the Chicago, Rock Island & Pacific Railroad, has been appointed chief engineer in charge of the construction of a large part of the new Philippine railroad projects, by J. G. White & Co., to whom the contract has been awarded by the Insular Government. This company will build and equip over 300 miles of steam railroads, roughly divided in thirds, among the principal islands of the Viscayan group, Negros, Cebu and Panay. This contract includes operating rights for 30 years, to become optional thereafter and is valued at $11,000,000. Mr. Beard is a railroad engineer of 25 years experience. He was at one time a contracting engineer and built the street and suburban railways of Meridian, Miss., in 1890. Later he became superintendent and engineer of the New Orleans & North western. In 1894 he went to the Kansas City, Pittsburg & Gulf, on which he served successively as Locating Engineer, Division Engineer and Assistant Chief Engineer. In 1895 and 1896 he was Superintendent and Chief Engineer of the Gila Valley, Globe & Northern, and in 1897 he became associated with the Boston & Montana Copper Company as Chief Locating Engineer for the railroads of that company in New Mexico and Arizona. He will sail in a few weeks for the Philippines, and it is expected that this big enterprise will be put fully under way during the coming summer.

ELECTIONS AND APPOINTMENTS.

Operating Officers.

Canadian Northern.—James Abbott, who was recently appointed Superintendent of the Fourth district, with office at North Battleford, Sask., was born in 1872 and entered railroad service in 1886 as a Telegraph Messenger on the Canadian Pacific. After being made operator and despatcher, he resigned, in 1896, to go to the Northern Pacific as operator and train despatcher on the Manitoba division. When the Canadian Northern in 1901 acquired the lines of this division he became Chief Despatcher of the new operating company. In May, 1905, he was appointed Acting Superintendent of the Fourth district, being given his present title when the line was completed to Edmonton, Alberta.

Central Indiana.—See Cleveland, Cincinnati, Chicago & St. Louis.

Chesapeake & Ohio.—See Cleveland, Cincinnati, Chicago & St. Louis.

Chicago, Burlington & Quincy.—W. B. Throop, who was recently appointed Superintendent at Burlington, Iowa, is a graduate of Cornell University. He entered railroad service in 1878 in the Engineering Department of the Burlington. After serving in several positions he was, in 1885, made roadmaster at Aurora, Ill. Five years later he was appointed Superintendent at Beardstown, Ill., and in 1893 was transferred to Galesburg. In 1902 he was made Superintendent of the Aurora division, which position he held until his recent appointment.

Cleveland, Cincinnati, Chicago & St. Louis.—W. C. Moore, Superintendent of the Central Indiana, has been appointed Superintendent of terminals of the C., C., C. & St. L., and the Chesapeake & Ohio at Louisville, Ky., succeeding M. L. Akers, transferred.

Evansville & Terre Haute.—See St. Louis & San Francisco under Purchasing Agents.

Toledo, St. Louis & Western.—L. W. Berry, formerly Superintendent of the Chicago, Burlington & Quincy at Beardstown, Ill., has been appointed inspector of transportation of the T., St. L. & W., with office at Frankfort, Ind.

Engineering and Rolling Stock Officers.

Canadian Pacific.—F. P. Gutelius, Engineer of Maintenance, has been appointed Assistant Chief Engineer in charge of engineering and maintenance on the eastern lines, with office at Montreal.

Chicago, Rock Island & Pacific.—E. J. Beard, Principal Assistant Engineer, has been appointed Chief Engineer in charge of the construction of the railroads in the Philippine Islands, which are to be built by J. G. White & Co., New York.

Louisville, Henderson & St. Louis.—Leonard Cox has been appointed Chief Engineer, succeeding R. N. Hudson.

Mexican Central.—A. S. Williamson has been appointed Mechanical Inspector.

Purchasing Agents.

St. Louis & San Francisco.—F. P. Jeffries, formerly General Manager of the Evansville & Terre Haute, has been appointed General Purchasing Agent of the St. Louis & San Francisco, with office at St. Louis, Mo.

LOCOMOTIVE BUILDING.

The Orange & Northwestern is in the market for locomotives.

The Northern Pacific has ordered 55 locomotives from the American Locomotive Co.

The Central Ontario has ordered one 8-wheel locomotive from the Canadian Locomotive Co.

The Chicago & Illinois Western has ordered 22 locomotives from the American Locomotive Co.

The Minneapolis & Rainy River has ordered three locomotives from the American Locomotive Co.

The Hocking Valley, it is reported, has ordered 10 locomotives from the American Locomotive Co.

The Washington, Idaho & Montana has ordered two 10-wheel locomotives from the American Locomotive Co.

The Temiskaming & Northern Ontario has ordered two 10-wheel locomotives from the American Locomotive Co.

A. F. Kaiser & Co., Philadelphia, Pa., are in the market for several switching locomotives with cylinders 18 in., 19 in. or 20 in. x 24 in.

The National Railroad of Mexico expects soon to purchase 12 consolidation freight locomotives and five 10-wheel passenger locomotives.

The Alaska Central is in the market for two standard gage

simple Mogul locomotives for delivery as early as possible. The specifications call for a total weight of 140,000 lbs., with 120,000 lbs. on drivers; cylinders, 19 in. x 24 in.; driving wheels, 57 in. in diameter, and extended wagon top boiler with a working steam pressure of 190 lbs.; tank capacity, 5,000 gallons, and coal capacity, 10 tons.

The Chicago, Lake Shore & Eastern has ordered six simple switching (0-6-0) locomotives from the American Locomotive Co. These locomotives will weigh 130,000 lbs.; cylinders, 19 in. x 26 in.; diameter of drivers, 51 in.; and working steam pressure, 180 lbs. The special equipment includes Westinghouse air-brakes, Nathan and Ohio injectors, Jerome piston and valve rod packings and Simplex springs.

The Intercolonial, as reported in a previous issue, will build four simple 10-wheel passenger locomotives at its own shops. These locomotives will weigh 145,440 lbs., with 114,204 lbs. on drivers. Cylinders, 20 in. x 26 in.; diameter of drivers, 72 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; total heating surface, 1,992.3 sq. ft.; 270 charcoal iron tubes 2 in. in diameter x 13 ft. long; firebox, 96 in. x 40⅞ in.; grate area, 30.6 sq. ft.; tank capacity, 5,000 imperial gallons; coal capacity, 10 tons. The special equipment includes Westinghouse air-brakes, Intercolonial standard automatic bell ringers, asbestos boiler lagging, Simplex brake beams, Christie brake shoes, Hancock injectors, brass babbitt-lined journal boxes, U. S. Metallic valve rod and piston rod packing, Detroit sight-feed lubricators, Crosby steam gages and cast steel wheel centers.

The Buffalo, Rochester & Pittsburg has ordered four simple Atlantic type locomotives and six simple consolidation type locomotives from the American Locomotive Co. The Atlantic type locomotives will weigh 173,000 lbs., with 99,000 lbs. on drivers; cylinders, 20¼ in. x 26 in.; diameter of drivers, 72 in.; radial stayed straight-top boiler with a working steam pressure of 210 lbs.; total heating surface, 2,992 sq. ft.; 336 charcoal iron tubes 2 in. in diameter by 16 ft. ¼ in. long; firebox, 108 in. x 74 in.; grate area 54.4 sq. ft.; tank capacity, 6,000 gallons; coal capacity, 10 tons. The consolidation locomotives will weigh 186,000 lbs., with 166,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of driving wheels, 57 in.; radial stayed extended wagon top boiler, with a working steam pressure of 210 lbs.; total heating surface, 2,862 sq. ft.; 354 charcoal iron tubes 2 in. in diameter by 14 ft. 6⅜ in. long; firebox, 108 in. x 74 in.; grate area, 54.4 sq. ft.; tank capacity, 6,000 gallons; coal capacity, 12 tons. The special equipment for all locomotives will include Westinghouse air-brakes, openhearth steel axles, Hammett bell ringers, sectional magnesia boiler lagging, Pennsylvania brake beams, Climax steel couplers, Dressel 16-in. headlights for consolidation type and Pile electric headlights for Atlantic type, Handcock injectors, U. S. multi-angular piston rod and valve stem packing; three 3-in. Consolidated safety valves, and one muffled safety valve for each locomotive, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashcroft steam gages, Midvale driving wheel tires and cast steel wheel centers.

The Minneapolis, St. Paul & Sault Ste. Marie, as reported in our issue of February 9, has ordered 15 compound Mogul (2-6-0) locomotives, eight compound consolidation (2-8-0) locomotives and two simple six-wheel switching (0-6-0) locomotives from the Schenectady works of the American Locomotive Co. for August delivery. The Mogul locomotives will weigh 148,000 lbs., with 129,000 lbs. on the drivers; cylinders, 21 in. and 32½ in. x 26 in.; diameter of drivers, 55 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 1,842.6 sq. ft.; 266 tubes, 2 in. in diameter and 12 ft. 4 in. long; Otis steel firebox, 90⅛ in. x 62¼ in.; grate area, 38.9 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The consolidation locomotives will weigh 201,500 lbs., with 174,000 lbs. on the drivers; cylinders, 23 in. and 35 in. x 34 in.; diameter of drivers, 63 in.; extended wagon top boiler, with a working steam pressure of 210 lbs.; heating surface, 2,897.1 sq. ft.; 332 tubes, 2 in. in diameter and 15 ft. 9 in. long; Otis steel fire-box, 96⅛ in. x 70¼ in.; grate area, 46.8 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The switching locomotives will weigh 119,600 lbs.; cylinders, 19 in. x 24 in.; diameter of drivers, 51 in.; straight top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,459.6 sq. ft.; 229 tubes, 2 in. in diameter and 11 ft. long; Otis steel firebox, 90 in. x 41 in.; grate area, 26 sq. ft.; tank capacity, 4,000 gallons, and coal capacity six tons. The special equipment for all includes Westinghouse air-brakes, Gollmar bell ringer, Simplex brake beams, Walsh brake shoes, Washburn couplers, Ohio injector, Paxton Mitchell piston and valve rod packings, Crosby safety valve and steam gages, Leach sanding devices and Chicago sight-feed lubricators.

CAR BUILDING.

The Chicago City Railway Co., Chicago, is about to order 50 cars.

The Central of Georgia has ordered 1,000 freight cars from the South Atlantic Car & Mfg. Co.

The Bangor & Aroostook has ordered 635 flat cars and 510 box cars from the American Car & Foundry Co.

The Metropolitan West Side Elevated Railway Co., Chicago, has ordered 50 motor cars from the Pullman Co.

The Lorain Street Railway Co., Cleveland, Ohio, has ordered five 48-ft. semi-convertible cars from the G. C. Kuhlman Car Co. The special equipment includes Westinghouse air-brakes and Brill trucks.

The Virginia & Southwestern has ordered 500 wooden gondola cars from the Western Steel Car & Foundry Co., and 250 box cars from the American Car & Foundry Co., in addition to the 250 gondola cars reported as ordered in our issue of March 2.

The Delaware & Hudson has ordered an additional 1,000 composite gondola cars of 85,000 lbs. capacity from the American Car & Foundry Co., which are identical in construction with those cars now being built for them by the American Car & Foundry Co.

The Orange & Northwestern has ordered 50 logging cars from the Orange Iron Works, and 50 logging cars from the Beaumont Iron Works, all of 60,000 lbs. capacity. All cars will weigh 20,000 lbs., and measure 36 ft. long, 10 ft. wide and 32 in. high, over all. The special equipment includes Dickinson wheels.

The Joliet, Plainfield & Aurora, Joliet, Ill., has ordered two motor cars and four trailers from the St. Louis Car Co. for May delivery. These cars will weigh 60,000 lbs. and measure 50 ft. long and 9 ft. 2 in. wide, over all. The special equipment includes Consolidated electric heating system, Brill trucks and Griffin wheels.

The Central of Georgia has ordered 1,000 plain box cars of 60,000 lbs. capacity from the South Atlantic Car & Manufacturing Co., delivery to begin July 1. These cars will weigh about 32,500 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment includes Simplex bolsters and brake beams, Lappin brake shoes, Westinghouse air-brakes, Ajax brasses, Tower couplers, Dayton door fastenings, Jones doors, Butler tandem draft rigging, Symington dust guards and journal boxes, Sherwin-Williams or Lowe Bros. paint, Murphy's outside metal roofs, Railway Steel Spring Co.'s springs, standard arch-bar trucks and Decatur wheels.

The Boston Elevated, in addition to the cars for elevated service, reported as ordered in our issue of March 9, has ordered 50 semi-convertible cars for surface use from the J. G. Brill Co., for delivery in July and August. These cars will seat 52 passengers and will measure 45 ft. 10 in. long x 8 ft. 6 in. wide x 12 ft. high. Thirty-seven of the cars will be fitted with steel underframes, and the remaining 13 will be fitted with wood underframes. The trucks will be furnished by the J. G. Brill Co., and will be of its 27-E type. The cars will be equipped with air-brakes and air operated doors, and heating and lighting will be by electricity. All of the cars will be of the "Easy-Access" type, without platforms, and with doors opening directly into the car. Steam railroad type of roofs will be used.

RAILROAD CORPORATION NEWS.

Hudson & Manhattan.—This is the name of a railroad company which, according to Wall street reports, is to be formed for the purpose of taking, owning and operating the two tunnels under the Hudson river at New York, now in the hands of "The Hudson Companies." The bankers interested, Harvey Fisk & Sons, say that the Hudson Companies is essentially a construction company, and will be liquidated when the new company takes control. The Hudson & Manhattan expects to have an authorized capital of $50,000,000 and an authorized bond issue of $100,000,000. The old Hudson river tunnel, begun over 20 years ago, is now nearly finished. The company is to build a large terminal building at Church, Cortlandt and Fulton streets, Manhattan. It is said that this will be 22 stories high. The company proposes also to put up a large terminal building at Broadway and Thirty-second street, to which point the one tunnel, which is now nearly finished, is to be extended northward from its present eastern terminus. The company also proposes to build elaborate electric lines on the New Jersey side, to connect with Newark and other cities. Connections will be made with the Erie and the Lackawanna roads. The financing of the projects calls for an expenditure during the next few years of about $60,000,000, and $50,000,000 of bonds will be reserved to complete further work. It is said that a subscription to the 4½ per cent. bonds carries with it a bonus of 25 per cent. in common stock. Mr. Fisk says: "To build our terminals in New York, to construct the line between Jersey City and Hoboken and to equip the line on the Pennsylvania Railroad between Jersey City and Newark additional cash has to be provided. The Hudson Companies had a capital of $21,000,000, but it is now proposed to issue $50,000,000 4½ per cent. bonds, convertible into common stock after five years at 110. We propose to have $10,000,000 of preferred stock, of which, however, only $5,250,000 will be issued. In addition, there will be an issue of $40,000,000 of common stock."

GENERAL NEWS SECTION

NOTES.

The Maine Central is to oil a considerable additional mileage of its roadbed the coming summer.

Re-examinations of sight are being made among the employees throughout the lines of the Pennsylvania Railroad.

A bill has been introduced in the legislature of Maryland to limit the working time of block signal operators to eight hours a day.

A press despatch says that the Chicago, St. Paul, Minneapolis & Omaha is to run its trains into the union station of the Union Pacific and turn its present passenger station into a freight house.

The People's Line steamers between New York and Albany began running on March 17. This is the earliest opening of navigation on the Hudson river for many years.

The government of Mexico is reported to have made arrangements for a subsidized line of steamers from Vera Cruz, Tampico, Progresso and other Mexican ports to various Canadian ports, including Montreal.

It is estimated that there will be 20,000,000 bushels of grain in store at the head of the Great Lakes at the opening of navigation, and more if the opening is late. There are now more than 18,000,000 bushels in store at Duluth.

According to a statement recently issued by the Mexican Government, 255 miles of railroad was built in that country in 1905, making a total mileage of 10,488 miles. The plans for new roads projected aggregate more than 1,000 miles.

A press despatch from Boston says that the New Haven road has sold the Park Square station. This station, the former passenger terminal of the Providence division, has been idle since the establishment of the South Station in 1899.

The Coal & Coke Railway, of West Virginia, has made an exclusive contract with the Hocking Valley by which its freight for the Northwest will be sent over the H. V. One account says that this traffic will amount to 10 train loads a day.

Western papers report that the railroads leading from the Missouri river to Colorado have reduced the through rate on cotton piece goods in accordance with the recent recommendation of the Interstate Commerce Commission. The reduction is from $1.25 to 80 cents.

The Alabama Railroad Commission has refused an application to reduce rates on cotton from the fields to Alabama mills, holding that the rates are already low; but the President of the commission, Mr. Comer, dissented, taking the ground that all freight rates are too high.

The Chicago, Milwaukee & St. Paul and the Chicago, Rock Island & Pacific are making arrangements to operate jointly their parallel lines between Neola, Iowa, and Council Bluffs, 20 miles, as a double-track road. Four stations are to be abandoned and joint stations operated at Neola, Underwood, Weston and Council Bluffs.

An officer of the New York Central is reported as saying that where two years ago 50 to 100 engines were required to keep the tracks of the company clear of snow, now no engines whatever are thus engaged. The present winter has been comparatively mild throughout the territory traversed by New York Central lines.

The Brotherhood of Railway Telegraphers having threatened recently to order a strike against the Southern Railway, that company, it is said, ordered a carload of telephones and had them distributed along the road, where they could quickly be put into service. Now the anticipated trouble has blown over and the telephones are to be returned.

The great exhibit of locomotives and models which was shown by the Baltimore & Ohio Railroad at the World's fairs in Chicago and St. Louis is now stored at Martinsburg, W. Va. The Field Columbian Museum, of Chicago, has an option on the collection, but its option expires with the present year, and Major Pangborn is looking about to see if some Eastern city does not want the collection. He says that a wealthy man is ready to give $100,000 as the beginning of a fund to bring the engines and models to Baltimore.

The annual report of the Omaha Grain Exchange shows an increase of nearly 100 per cent. in business. Total receipts of grain for 1905 were 34,523,500, against 16,433,285 in 1904. The 1905 receipts in details were: Wheat, 6,518,200 bushels; corn, 19,771,300; oats, rye and barley, 8,234,000. Two years ago there were three grain elevators in Omaha, with a combined capacity of 2,140,000 bushels, since then nine elevators with a combined capacity of 1,950,000 bushels have been constructed and three elevators, capacity 1,550,000, are under construction.

The Louisiana State Railroad Commission has imposed a fine of $500 on the Louisiana Western Railroad (a part of the Southern Pacific system) for failure to furnish cars when demanded by a shipper, in November last. The demurrage due to the shipper, according to the Commission's rules, was $68, and this the road refused to pay until the complaint was entered before the Commission. It is held, however, that in view of the persistent violation of the rule the payment of the $68 is not sufficient punishment, and therefore the fine of $500 is imposed.

A serviceable chemical fire extinguisher for use in passenger cars has not yet been found; at least such is the statement made by the lawyer of the Boston & Maine at a hearing before the legislative committee at Boston this week. The representative who introduced a bill to require the use of extinguishers says that he shall persist in his purpose, notwithstanding the recommendation of the state railroad commissioners that further investigation should be made before passing compulsory legislation. The Boston & Maine estimates that to supply all of its passenger cars with extinguishers would cost $25,000.

The Railroad Commission of Georgia has filed its annual report. Among the numerous recommendations offered to the legislature are the following: An act to compel railroads to put on extra passenger trains when the advertised schedule departure is delayed an unreasonable time; an act to compel railroads to place end platforms on freight cabs; an act empowering the commission to compel railroads to put in sufficient side tracks; an amendment to the present law requiring suit to recover penalties to be brought in the county in which the principal offices of the offending company are located, to the county in which the offense is committed; a mandatory law to compel offending roads to pay penalties without recourse to the courts to recover.

The volume of freight traffic on the railroads of South Carolina is this winter heavier than ever before, and the state railroad commissioners have in consequence received many complaints of delay—so many that they have issued a long explanatory statement. They say that the railroads did not expect such a great increase, and consequently are caught with many lines unfit for fast time in the winter season, and that, by reason of heavy rains, the roadbeds have in many cases been so damaged that even freight trains have to be run more slowly than usual. The commissioners say that all of the railroads made the serious mistake of not laying heavier rails and putting in more and better ballast last summer and fall. Shipments of fertilizer have increased one-third over former years.

A California paper reports that the directors of the California Fruit Growers' Exchange have passed resolutions asking Congress to expressly authorize the Interstate Commerce Commission to establish through rates and through routes. In other words, these fruit men do not admit the justice of the recent decision of the Supreme Court sustaining the railroads in their rule forbidding shippers to route their oranges. The resolution says that the railroads have not succeeded in making so good time as was made when the shippers routed the cars themselves; the time has been from two to six days longer, and there have been many losses by decay due to the delay. If these resolutions reflect the true condition it would seem that the evidence recorded by the courts was incorrect or incomplete; there appears to be something wrong.

The proposition before the legislature of Massachusetts to pass a law requiring the use of the block system in the state has taken a new shape; a bill drawn by the railroad commissioners having been substituted for that which was proposed by Representative Sullivan. The commissioners' bill will probably be reported to both the Senate and the House. It reads:

"Section 1. The Board of Railroad Commissioners may from time to time require railroad companies to install and maintain at such places upon the railroad premises as it shall designate such block or other signals or devices as it shall approve, for the purpose of safeguarding public travel.

"Sec. 2. The supreme judicial court shall have jurisdiction in equity to enforce compliance with any order issued by the board under the preceding section."

At the Interstate Commerce Commission hearing in Kansas City on rates charged by the railroads for carrying oil, testimony was offered to show that in Kansas the railroads carry oil for the Standard Oil Company at less than half the rates charged other shippers. E. L. Wilthoyt, formerly an agent at Topeka for the Standard Oil Company, but now an independent dealer, said: "The Standard Oil Company was charged $5 a car by the Terminal Company in St Louis for transporting a car from East St Louis Ill., to St Louis.

Mo. To save this $5 the Standard laid a pipe line under the river, and every car of oil bound westward would be pumped out in East St. Louis and pumped into another car in St. Louis." Mr. Wilthoyt said that while agent for the Standard at Topeka he got information from railroads as to competitors' shipments. "I was allowed $8 a month to spend with railroad employees in buying drinks and making myself a good fellow," he said, "and I was permitted to give away oil and gasolene to railroad employees and report such gifts as 'donations.' By keeping track of the shipments made by its competitors the Standard was enabled to know the name of every dealer who was buying oil from independents."

Derailment in Catesby Tunnel.

The latest accident report received from the British Board of Trade has to do with the derailment of a passenger train consisting of an engine and five eight-wheel cars, which was running through a tunnel at about 60 miles an hour and no person suffered any bodily injury. Stranger still, only two passengers even made a claim of injury. The place of the accident was Catesby tunnel, on the Great Central, between Charwelton and Willoughby. The cause of the derailment is decided to have been a broken rail, which originally weighed 86 lbs. per yard, but which had been worn on its upper surface about ¼ in., reducing its weight to 76 lbs. per yard. There was a concealed flaw. The Inspector, Colonel von Donop, thinks that "the company should give careful consideration to the question" as to whether rails on the main line should not be renewed earlier. The Inspector condemns the use of gas for lighting cars. Three of those in this train were lighted by gas, and the lights in all of these were at once extinguished by the derailment, and there was a great escape of gas. It was only by taking the utmost precautionary measures that naked lights were kept away from the vicinity. The Inspector continued: "It is terrible to contemplate what might have been the results of this accident if an explosion had occurred or a carriage had caught fire in the tunnel." Further: "The leading and rear vehicles of the train were both lighted electrically; the lights in the latter were extinguished, but in the former vehicle they remained alight throughout, and were of the greatest assistance in rescuing and controlling the passengers," who numbered between 50 to 60.

Referred to Congressman Esch.

Perhaps the railroads are a unit in wishing that they could introduce the block system into the Federal and State legislatures. *Baltimore American.*

A Municipal Ownership Incident.

The Staten Island ferry, running across New York Harbor from Manhattan to Staten Island, which is now owned by the city of New York, is to raise all fares to the uniform rate of five cents, except that to workingmen and school children season tickets will be sold, as now. The advance affects chiefly those passengers who travel on the railroad of the Staten Island Rapid Transit Company and who have ridden through from their residences to Manhattan on a single season ticket. The Commissioner of the Department of Docks and Ferries says that the advance is made because the boats do not pay expenses. The cost of running the line is much higher than formerly because the city gives shorter hours and higher wages, and also because it has put on new and larger boats, and larger forces of men. The Commissioner says that the deficit was expected; that the fault-finders should remember that the municipality does not run things as corporations do; that probably the city will finally carry the passengers free and charge the whole cost of the ferry to the tax payers.

New Signals on the Lackawanna.

The plans of the Delaware, Lackawanna & Western for the current year contemplate the installation of automatic block signals on the main line to complete the equipment of the line throughout its length from Hoboken to Buffalo, 410 miles. On the east side of Pocono mountain, where the down grade track is already signaled, Union electric motor signals, a home and a distant on each post, will be put in for 17 miles on the up grade track. On the other side of the mountain, 14 miles will be similarly equipped. This is from Nay Aug to Lehigh. The seven miles from Scranton to Clark's Summit will be signaled. From Mount Morris to Buffalo, 62 miles, a storage battery line will be installed similar to the lines farther east, such as were described in the *Railroad Gazette* of January 6, 1905. Between Mount Morris and Buffalo there will be 117 signals, all Union electric motor, the same as those in the other places mentioned, except that storage instead of primary batteries will be used. The electric generators will be 500 volt, 3¾ k.w., and the gasolene engines to run them will be of 6 h.p.; the generators and the engines both being considerably larger than those used on the lines built last year. The chloride accumulators will be of 24 ampere-hour capacity. There will be three power stations in the 62 miles.

The Lackawanna will also put in a number of new interlocking plants this year. Most of these will be mechanical, but with electric distant signals. At the Hoboken terminal, however, where the yard is to be greatly enlarged, there will be a new electro-pneumatic interlocking machine of 131 levers. The smaller electro-pneumatic machine now in use at the terminal will be re-erected at Grove street, a short distance west.

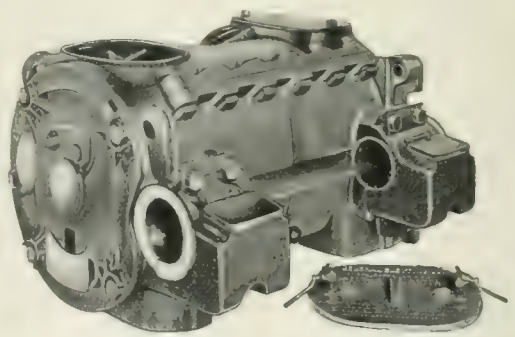
General Electric Single Phase Alternating Current Railway Motor.

Following is a brief description of the G. E. single-phase motor which has met with much success in traction service. For this class of work the General Electric Company furnishes a complete line of alternating current single-phase railway motors, including sizes of 75 h.p., 125 h.p. and 200 h.p. respectively. These various motors embody the same constructive principles as the GEA 605 (75 h.p.) type shown in the accompanying illustration. In general this motor is built with the same regard for constructive detail which characterize the GE direct current railway motor. The magnet frame is split and bolted together so that the armature may be readily accessible, and to further the ease of handling bails are cast into the frame. Provisions for ventilation and inspection of the interior of this motor are amply provided for and the opening over the commutator is closed with an iron cover with a felt gasket, and the cover is held in place by an adjustable cam locking device.

The frame heads are made of malleable iron cast in one piece. In order to secure large and long bearings without sacrificing other desirable features of construction, the heads are made conical in shape and extend under the commutator shell and pinion-end armature core head. The frame head castings have large oil wells into which oily wool waste is packed and comes in contact with a large surface of the armature shaft through an opening in the low-pressure side of the bearing linings.

The linings are unsplit bronze sleeves, finished all over with a thin layer of babbitt metal soldered to the interior bearing surface. Oil is prevented from entering the interior of the motor by oil deflectors which throw it into large grooves cast in the heads, from which it is carried away.

The armature coils are insulated with mica, enabling the armature to stand a high temperature without injury, and the armature



General Electric Company's Single-Phase Alternating-Current Railway Motor.

bars are soldered directly into the commutator car. The commutator is made up of segments of hard drawn copper, insulated throughout with mica. The cone micas are built up and pressed hard and compact in steam molds. The segment mica is made of a somewhat softer quality with the view of making it wear down evenly with the copper.

The brush-holders, four in number, are made of cast bronze and have two carbon brushes per holder. The brushes slide in finished ways and are pressed against the commutator by independent fingers which give a practically uniform pressure throughout the working range of the brushes.

There is a "pig tail" or shunt between the fingers and the brush-holder body to prevent current passing through the springs or pivoting pins.

The motor field consists of annular laminated punchings assembled into a cylinder and contains the exciting and compensating windings. The compensating winding consists of mica insulated bars inserted in partly closed slots in the face of the polar projections; all the bars being connected in series and the whole connected permanently in series with the armature at the motor and the two elements are treated as a single unit. The exciting winding consists of coils similar to the field coils of a direct current motor and may be removed as a unit, as is customary in direct current motors; that is, the spool surrounds a projecting pole piece.

The 75 h.p. motor is wound for four poles and has four brush studs, while the 125 h.p. motor is wound for six poles and has six brush studs. The compensating winding is connected permanently in series with the armature, and the exciting windings are connected in series with these at the controller or commutating switch, where the change is made for reversing the direction of the motors and for changing the connections when desired to change from a.c. to d.c.

The armature speeds are relatively low, insuring good commu-

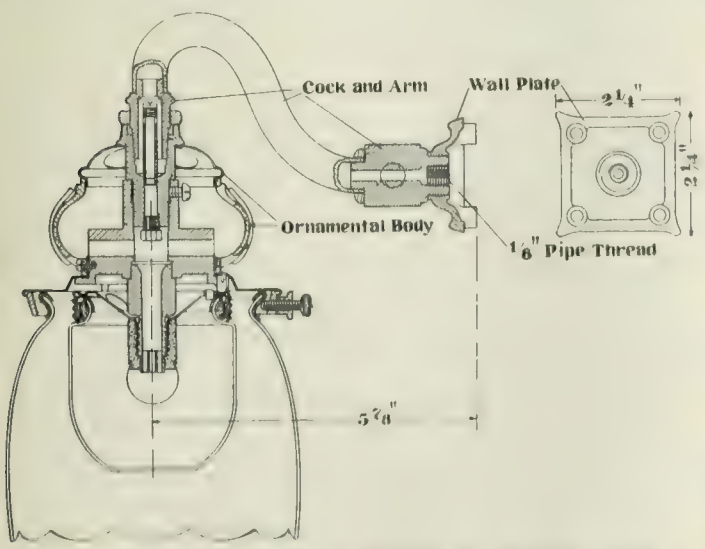
tation and absence of bearing troubles. For the control of these motors the General Electric Company has developed suitable hand controllers for single car operation and Sprague General Electric type M control for operation of cars in trains. The controlling apparatus is extremely simple, whether equipments are to be operated on alternating current alone or on both alternating and direct current circuits. As in most instances it will be necessary to operate alternating current equipments over existing direct current trolley lines, particular attention has been paid to simplifying the equipment for both a.c. and d.c. operation with the result that equipments of this type are practically automatic in changing over from one system to the other and can be handled by inexperienced motormen with success.

Inverted Mantle Pintsch Gas Lamps.

The new Pintsch inverted mantle lamp is now being generally applied to passenger cars of all classes throughout the United States. The high candle-power obtained and the advantages gained in the construction of the lamp permit of presenting this system of illumination under the most advantageous conditions. The use of opal, opalescent or art glassware makes it possible to bring together the rays from the separate burners so that the lamp presents a unit of light. The accompanying illustration of bracket-lamp No. 2515 shows the general arrangement of parts and the construction of the incandescent burners. The possibilities for artistic design when using the inverted mantle are shown in the interior view of a dining car equipped with Nos. 2512 and 2513 lamps. In using this new lamp there is obtained an illumination three times as great as that given by the present satisfactory flat flame Pintsch lamp, the merits of which have caused it to be applied to over 29,000 cars in the United States, Canada and Mexico, and on over 140,000 cars in the world. This additional light is secured without increasing the consumption of gas, and it is possible to remodel all the lighting equipment now in service with only a small expenditure for the new lamps. The inverted mantle with its holder are fitted into the globe, and this combination is handled as a unit, so that when the mantle has given its average service of three months the complete globe with its mantle, or, in other words, the bulb can be removed and a new bulb applied in just the same manner as an electric lamp is placed into its socket. The demand for improvement in artistic effects in lighting fixtures has been fully met by these new mantle lamps, which are made by the Safety Car Heating & Lighting Co., New York. A number of designs suitable for application to various classes of cars are illustrated in the company's new mantle lamp catalogue No. 141-A.



Interior of Dining Car Lighted With Inverted Mantle Pintsch Gas Lamps.



Section of Inverted Mantle Pintsch Gas Bracket Lamp.

Columbia Creosoting Plants for the Northern Pacific.

The Northern Pacific Railroad has contracted with the Columbia Creosoting Company for two timber preserving plants to be located at Brainerd, Minn., and Coeur d'Alene, Idaho, respectively. Each will be practically a duplicate of the Shirley, Ind., plant of the Columbia Creosoting Company, described in these columns last week. This company will prepare the plans and erect and install the plants, turning them over upon completion to the railroad company to operate, using the Lowry patents and processes. The plants will be so designed that either the creosoting or zinc chloride process can be administered. Work is to begin immediately, and it is expected to have both plants ready by October 1. The arrangement with the Northern Pacific contemplates an ultimate increase to five plants.

An Air Line (?) Across Pennsylvania.

The officer of the Pennsylvania Railroad who is disloyal to his company has never been heard of, or even imagined; yet we read in the *Harrisburg Patriot* that Third Vice-President Rea has come out in a letter advocating a rival line from Philadelphia to Pittsburg, and one 70 miles shorter than the Pennsylvania! The rivalry, however, is not likely to be at all acute, and Mr. Rea's proposition is not at all reprehensible. It is to rehabilitate and macadamize the old stage roads and make them fit for the use of automobiles, and he estimates that with efficient devil wagons the trip of 284 miles could be made between an early breakfast in Philadelphia and a dinner in Pittsburg, which means, we suppose, about 14 hours, or, say, 20 miles an hour. It appears that under a law passed in May, 1905, establishing a highway department, the state of Pennsylvania now stands ready to pay three-fourths of the expense of improving highways where citizens desire such improvement, and Mr. Rea thinks that the roads under consideration could be put in good shape for $2,500,000—one-fourth of which sum would be but a moderate burden on the counties. Many of the roads which make up this long route were originally built by corporations which charged tolls, and a few toll roads still remain. These would have to be bought up. From Philadelphia to Paoli, 20 miles, the toll road of the Lancaster Avenue Improvement Company, formerly the old Philadelphia and Lancaster turnpike, is excellent, but from Paoli to Lancaster much of the route is not well maintained. From Lancaster the line runs via Columbia to York, and thence to historic Gettysburg, where junction is made with the old turnpike from Baltimore (only 52 miles distant from Gettysburg), thence across South Mountain, well remembered as the line of retreat of Lee's army after the Battle of Gettysburg, thence into the beautiful Cumberland Valley at Chambersburg.

From Chambersburg westward Sideling Hill, Tuscarora Mountain and other mountains are crossed. From Bedford the route crosses the main Alleghany range, the Somerset plateau, Laurel Hill Mountain, and into Ligonier Valley, thence through the gap in Chestnut Ridge, and by the Loyalhanna River it rises through Greensburg, Irwin, Turtle Creek and into Pittsburg, 70 miles from Bedford.

Mr. Rea thinks that the old tavern stands and stage houses would soon be repaired and reopened, as has been the case in England, and he would look for a great influx of visitors. As Mr. Rea

has been in the engineering and real estate departments of the Pennsylvania Railroad for many years, his judgment in a matter of this kind is entitled to respect.

A Possible Competitor of the Philadelphia Rapid Transit.

The Philadelphia & Western, a company chartered in Pennsylvania to build a railroad from Parkesburg, Chester County, east to the western limit of Philadelphia (63d and Market streets), has applied for a franchise to build an elevated and underground road east across the city to the Delaware river, about five miles. Such a line would parallel the elevated and underground road now being built by the Philadelphia Rapid Transit Company. In its application for a franchise, the Philadelphia & Western makes a proposal to pay the city 2 per cent. of the gross earnings from passenger traffic within the city during the first two years of operation, 3 per cent. during the third year, 4 per cent. during the fourth year, and 5 per cent. during the fifth year and for 30 years thereafter. At the end of this time the property is to be turned over to the city, the company, however, having the option of leasing the road for a further period of 40 years at an annual rental of $400,000, plus the 5 per cent. of earnings as before. Work is under way on the Philadelphia & Western, but the company has been troubled with litigation. It was chartered, as was supposed, to build a road to be run by steam, but it is building with a view to using electricity.

It was announced in Philadelphia on Monday that Mayor Weaver had made an agreement with the Philadelphia Rapid Transit Company by which the company would release important franchises now held by it. To complete its subway and elevated lines it must have an extension of time, and, as a price of agreeing to this extension, the Mayor demanded and secured the surrender of the franchise for a subway under Chestnut street (which would leave an opening for the Philadelphia & Western) for surface lines on Broad street, and for elevated lines in a number of other streets and avenues. The company agrees to complete the Market street subway in three years, to build a subway north in Broad street, to build an elevated road throughout the thickly settled portion of the city, north and south, and to build a number of other lines. On Tuesday the directors of the Trades' League came out with a demand for much larger concessions, asserting that the Mayor had been far too easy. The directors of the Trades' League demand that the time extension desired by the Rapid Transit Company be refused unless it agrees to pay the city 5 per cent. on the gross earnings of the completed Market street elevated and subway line; to give up its right to build a subway in Broad street; to give up its right to build an elevated line to Frankford; to give up all other franchises upon which no work has been done; to give up about 21 miles of streets where tracks are laid but on which cars are not regularly operated.

Manufacturing and Business.

The H. W. Johns-Manville Company, through their Chicago branch, has just completed a large contract, for the installation of fire felt pipe and boiler covering in the new plant of Seers, Roebuck & Co., of Chicago, involving an expenditure of several thousand dollars. "Fire Felt" pipe covering, it is claimed, is absolutely fireproof, elastic, light in weight, and is unaffected by the expansion or contraction of the pipes.

The Rail Joint Company, New York, has closed contracts for the enlargement and new equipment of its works at Troy, N. Y. These improvements will enable the company to double its output of previous years. The works are now running day and night to keep pace with the growing demands from steam and electric railroads for the three types of base supported rail joints known to the trade as the Continuous, Weber and Wolhaupter types for tee and girder rail sections, also insulating and compromise or step joints to unite different sections of rails maintaining a perfect surface, and doing away entirely with low joints.

The Chicago Pneumatic Tool Company has closed its Norfolk office, which was located in the Chamberlain Building, and will, in the near future, open an office at Richmond, Va. Its office at 602 Empire Building, Pittsburg, Pa., will be closed April 1st, and moved to 10 and 12 Wood street, where a store building has been secured for the purpose of making a general display of air-compressors, tools, etc., a large stock of which will be carried as soon as the factories are in a position to furnish the same. An up-to-date repair department will also be maintained at that point for the benefit of customers in the Pittsburg district. The office at Seattle, Wash., has been closed and a new office opened at 84 Sixth street, N., Portland, Oregon. The company reports business entirely satisfactory both home and abroad, and all of its factories working double time.

OBITUARY NOTICES.

J. J. R. Croes, formerly President of the American Society of Civil Engineers, died on March 17 in Yonkers, N. Y., at the age of 71. Mr. Croes was engaged in the building of the Brooklyn water works from 1857 to 1860, and in the extension of the Croton water works after that. In 1863 he was First Assistant Engineer of the Washington aqueduct, and was later in charge for two years of the building of the storage reservoirs in the Croton water shed, north of New York City. He has been Engineer for several rapid transit commissions. In 1893 he was made Consulting Engineer to the New York State Health Department. He resigned from this position a year ago. He was Treasurer of the American Society of Civil Engineers from 1877 to 1887, and was its President in 1901.

Samuel O. Howe, Treasurer and Assistant Secretary of the Chicago & North-Western, died of heart failure in New York City on March 17. Mr. Howe had been on the C. & N.-W. for 35 years and had been Treasurer since 1898.

MEETINGS AND ANNOUNCEMENTS.

(*For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.*)

New York Railroad Club.

At the April meeting of this club there will be a paper on "Superheaters," by H. H. Vaughn, of the Canadian Pacific.

American Society of Civil Engineers.

At the meeting of this society March 21, a paper on "New Facts About Eye-Bars," by Theodore Cooper, was presented for discussion. This paper was printed in "Proceedings" for January, 1906.

M. C. B. & M. M. Associations.

The Committee of Arrangements has decided to hold all business sessions of the Atlantic City conventions of the two associations in the sun parlor on the outer end of the steel pier, instead of in the hall over the entrance to the pier at the shore end. This will compel visitors to pass through the exhibits in going to and from the meetings. Under the original agreement with the Hotel Men's Association, the use of the east half of the pier was assigned for exhibition purposes on condition that the public be excluded. As this space was inadequate the entire pier has been secured, with the understanding that the public may be admitted. It is thought that this will not inconvenience the exhibitors and will secure a large amount of additional exhibit space.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Lehigh Valley.—J. A. Middleton, First Vice-President, has been put in charge of the operating department. The General Manager, Purchasing Agent and the Chief Engineer will report directly to him. T. N. Jarvis, Freight Traffic Manager, has been elected Second Vice-President in charge of traffic, Mr. Middleton having been, hitherto, at the head of this department. The offices of both will be in New York City.

Missouri Pacific.—J. D. Rockefeller, Jr., and E. P. Prentice have resigned from the Board of Directors. They are succeeded by J. H. Smith and S. D. Warfield.

Western Pacific.—George J. Gould, W. W. Miller, C. W. Slack, H. M. McCartney, J. F. Evans and Warren Olney, Jr., have been newly elected Directors. Those re-elected are: E. T. Jeffery, V. G. Bogue, W. J. Bartnett, Edwin Hawley, Warren Olney, W. J. Shotwell and J. D. Brown.

Operating Officers.

Atlantic Coast Line.—H. A. Ford, Superintendent at Gainesville, Fla., has been appointed General Superintendent of the Third division, with office at Jacksonville, Fla. The new office and its authority will cover all the lines in Florida.

Central of Georgia.—J. T. Johnson, General Superintendent of Transportation, has been appointed General Superintendent, and the office of General Superintendent of Transportation has been abolished. G. L. Candler, Superintendent at Savannah, Ga., has been appointed Superintendent of Transportation. J. C. O'Dell, Trainmaster at Savannah, succeeds Mr. Candler.

Chicago, Rock Island & Pacific.—C. J. Wilson, Superintendent at Fairbury, Neb., has been transferred to Estherville, Iowa, succeeding C. L. Brown, who takes Mr. Wilson's position at Fairbury.

Mexican Pacific.—A. P. Herbert has been appointed Superintendent of the completed line from Colima, Mex., to Manzanillo, 60 miles, this being part of the property of the Mexican National Construction Co., recently acquired by the Mexican Pacific.

Engineering and Rolling Stock Officers.

Louisville & Nashville.—E. L. Cruger, Assistant Engineer at Knoxville, Tenn., has resigned to become Chief Clerk to the Chief Engineer of the Chicago & Alton.

Mexican Central.—C. H. Burk, Master Mechanic at Chihuahua, has been appointed Assistant Superintendent of Machinery, with office at Aguascalientes. R. H. Rutherford, Assistant Master Mechanic of the Mexico division, succeeds Mr. Burk, and his previous position is abolished. J. J. Cavanugh is appointed Master Mechanic at San Luis Potosi, succeeding T. Smith, resigned.

LOCOMOTIVE BUILDING.

The Central of Georgia, it is reported, is in the market for upwards of 30 locomotives.

The Tidewater, it is reported, has ordered six locomotives from the Baldwin Locomotive Works.

The Pittsburg & Lake Erie will build ten 6-wheel switching locomotives in its shops at McKee's Rocks.

The Louisville & Nashville has ordered 30 consolidation freight locomotives, with cylinders 21 in. x 28 in., from the Baldwin Locomotive Works.

The Tramway Rural, Buenos Ayres, has ordered two standard gage passenger locomotives, with cylinders 12 in. x 15 in., from the H. K. Porter Co.

The Ruddock-Orleans Cypress Co., New Orleans, La., has ordered one Mogul locomotive, with cylinders 14 in. x 20 in., from the H. K. Porter Co.

The Minnesota Land & Construction Co., Duluth, Minn., has ordered one Mogul locomotive, with cylinders 16 in. x 24 in., from the H. K. Porter Co.

Messrs. Vaccaro Bros. & Co., Salado, Spanish Honduras, have ordered a 36-in. gage passenger locomotive, with cylinders 10 in. x 16 in., from the H. K. Porter Co.

The Lake Erie & Western, it is reported, will soon be in the market for additional locomotive equipment, including passenger, freight and switching locomotives.

The Boyne City Chemical Co., Boyne City, Mich., has ordered a six-wheel (0-6-0) switching locomotive, with cylinders 12 in. x 16 in., from the H. K. Porter Co.

The Boston Consolidated Mining Co., Salt Lake City, Utah, has ordered five 36-in. gage contractors' locomotives, with cylinders 10 in. x 16 in., from the H. K. Porter Co.

The Central San Cristobal, Porto Rico, has ordered one eight-wheel saddle tank locomotive of one meter gage, with cylinders 10 in. x 14 in., from the H. K. Porter Co.

The Lima Locomotive & Machine Co. reports the following orders during the past week for its Shay locomotives: Owl Bayou Cypress Co., Louisiana, one 15-ton locomotive; Kirby Lumber Co., Texas, two 37-ton locomotives; Beaumont & Northern R. R., Texas, one 28-ton locomotive; Lackawanna Lumber Co., Pennsylvania, one 65-ton locomotive; Standard Lumber Co., Louisiana, one 20-ton locomotive; Port Susan Logging Co., Oregon, one 37-ton locomotive; Oregon Timber Co., Oregon, one 37-ton locomotive, and the Kilpatrick Bros. & Collins, Nebraska, one 45-ton locomotive.

The Minneapolis & Rainy River, as reported in our issue of March 16, has ordered three simple (2-6-0) locomotives from the American Locomotive Co., for April delivery. These locomotives will weigh 124,000 lbs., with 108,000 lbs. on the drivers; cylinders, 19 in. x 24 in.; diameter of drivers, 54 in.; extended wagon top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,560.61 sq. ft.; 236 tubes, 2 in. in diameter and 11 ft. 8 in. long; firebox, 96 in. x 41¼ in.; grate area, 28.12 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, seven tons. The special equipment includes: Westinghouse air-brakes, National-Hollow brake-beams, Tower couplers, Nathan triple injector and Midvale driving wheel tires.

The Atlantic Coast Line has ordered 27 10-wheel simple freight locomotives and 20 six-wheel simple switching locomotives from the Baldwin Locomotive Works. The freight locomotives will weigh 155,000 lbs., with 115,000 lbs. on drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 63 in.; straight top boiler with a working steam pressure of 200 lbs.; total heating surface, 2,675 sq. ft.; 336 Shelby tubes, 2 in. in diameter by 14 ft. 5 in. long; firebox, 96¼ in. x 66 in.; grate area, 44.1 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 11 tons. The special equipment will include: Westinghouse air-brakes, Hammond steel axles, Keasbey & Mattison sectional boiler lagging, Diamond special brake-beams, Perfecto brake-shoes, Dressel headlights, Hancock injectors, Damascus bronze journal bearings, U. S. piston rod and valve stem packings, Star safety valves, Leach's sanding devices, new Nathan bull's-eye sight-feed lubricators, Atlantic Coast Line standard springs, Crosby steam gages, Standard steel driving wheels; cast steel wheel centers, Lindstrom eccentric blocks and Richardson balanced slide valves. The switching locomotives will weigh 110,000 lbs.; cylinders, 19 in. x 24 in.; diameter of drivers, 50 in.; straight top boiler, with a working steam pressure of 180 lbs.; total heating surface, 1,669 sq. ft.; 213 tubes, 2 in. in diameter by 14 ft. long; firebox, 71 11/16 in. x 34⅜ in.; grate area, 17 8/10 sq. ft.; tank capacity, 2,500 gallons, and coal capacity, seven tons. The special equipment will include: Westinghouse friction draft gear on pilot and tender, Westinghouse air-brakes, Tower couplers and Monitor injectors. The other equipment will be similar to that given for the 10-wheel locomotives.

The Atlanta & West Point, as reported in our issue of March 9, has ordered two simple 10-wheel (4-6-0) passenger locomotives, two simple 10-wheel (4-6-0) freight locomotives and one switching locomotive from the Rogers Locomotive Works, for April delivery. The passenger locomotives will weigh 191,000 lbs., with 153,000 lbs. on the drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 78 in. (outside); wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 3,100 sq. ft.; 335 Detroit seamless tubes, 2 in. in diameter and 15 ft. long; carbon firebox, 133 in. x 41 in.; grate area, 38 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 12 tons. The freight locomotives will weigh 180,000 lbs., with 142,000 lbs. on the drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 60 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,393.76 sq. ft.; 335 Detroit seamless tubes, 2 in. in diameter and 13 ft. 8 in. long; carbon firebox, 123 in. x 40 in.; grate area, 34.6 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 12 tons. The switching locomotive will weigh 117,000 lbs.; cylinders, 19 in. x 24 in.; diameter of drivers, 50 in.; straight boiler, with a working steam pressure of 180 lbs.; heating surface, 138.3 sq. ft.; 225 Detroit seamless steel tubes, 2 in. in diameter and 11 ft. 2 in. long; flange firebox, 96 in. x 33 in.; grate area, 22.26 sq. ft.; tank capacity, 3,500 gallons, and coal capacity, five tons. The special equipment for all includes: Westinghouse air brakes, Cook's bell ringer, Philiy Carey Manufacturing Co.'s boiler lagging, National-Hollow brake-beams, Lappin brake-shoes, Tower steel couplers, Pyle-National electric headlights for passenger and freight locomotives, Monitor injector, Ajax journal bearings, Jerome piston and valve rod packings, Ashton safety valves, Watters sanding devices, Nathan bull's-eye sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashton steam gages. Gold steam heat equipment for passenger and freight locomotives, Midvale driving, truck and tender wheel tires for passenger and freight locomotives, and Midvale driving wheel tires for switching locomotive. Other specialties for passenger and freight locomotives are Elvin automatic driving box lubricators.

CAR BUILDING.

The Chicago & Illinois Western is in the market for freight equipment.

The Lake Erie & Western is in the market for 17 coaches and four smoking cars.

The Chicago Union Traction, it is reported, will shortly be in the market for new cars.

The Contract Process Co., Buffalo, N. Y., has purchased three tank cars from Robt. M. Burns & Co., Chicago.

The Poudre Valley Gas Co., Fort Collins, Col., has purchased two tank cars from Robt. M. Burns & Co., Chicago.

The Pittsburg & Butler Street Railway has ordered 10 interurban cars from the Niles Car & Manufacturing Co.

The Louisiana Railway & Navigation Co. has ordered 250 coal and 250 box cars from the American Car & Foundry Co.

The Lake Shore & Michigan Southern expects to have its gasoline motor car completed by the latter part of March. The car is being built in the company's own shop.

The Erie has ordered 25 passenger cars from the American Car & Foundry Co., and is reported as in the market for 500 steel underframe twin-hopper gondola cars of 100,000 lbs. capacity.

The White Oak Railway is in the market for 1,000 all steel and 1,000 combination wood body and steel hopper bottom cars of 100,000 lbs capacity. Mr. R. W Kirtley, Macdonald, W Va., is Purchasing Agent, and Mr. S. Dixon, Macdonald, W. Va., is General Manager.

The Alabama Great Southern is in the market for 1,000 box cars of 60,000 lbs. capacity, 250 self clearing steel hopper cars of 100,000 lbs capacity, 250 coke cars of 60,000 lbs capacity, 250 40 ft flat cars of 80,000 lbs capacity and 250 40 ft self clearing gondola cars of 80,000 lbs capacity.

The Cincinnati, New Orleans & Texas Pacific is in the market for 1,250 wooden drop bottom coal cars of 60,000 lbs capacity, 1,000 box cars of 60,000 lbs capacity, 250 40 ft flat cars of 80,000 lbs capacity, 250 40 ft drop bottom gondola cars of 80,000 lbs capacity, and 250 coke cars of 60,000 lbs capacity.

The Illinois Central has ordered 400 Hart convertible cars of

80,000 lbs. capacity from the Roeger Ballast Car Co. The cars are to be built by the American Car & Foundry Co., and are for June or July delivery. They will measure 36 ft. 10 in. long by 10 ft. 2⅝ in. wide by 8 ft. 6 in. high, each over all.

The Madison & Interurban Traction Co., Madison, Wis., has ordered 11 Brill semi-convertible cars from the American Car Co., for May delivery. These cars will measure 31 ft. long by 8 ft. 4 in. wide over all. The special equipment will include Peacock air brakes, Brill couplers and trucks, Acme curtain fixtures and Griffin steel tire wheels.

The Rutland Valley, as reported in our issue of February 16, has ordered 300 gondola cars of 80,000 lbs. capacity from F. M. Hicks & Co. These cars will weigh 33,000 lbs., and measure 35 ft. 7½ in. long, 9 ft. 4 in. wide and 4 ft. 1 in. high, all inside measurements. The special equipment includes: Simplex bolsters and brake-beams, Christie brake-shoes, Westinghouse air-brakes, More-Jones brasses, Tower and Climax couplers, Miner draft rigging, McCord journal boxes, Sherwin-Williams paint and Mt. Vernon wheels.

The Erie has ordered a 100-h.p. Ganz steam automobile car for July or August delivery as an initial step toward the adoption of such cars for its branch line passenger traffic. The car will be of all steel construction. It will measure 57 ft. long over all, and will weigh 40 tons in working order, and is designed to maintain a speed of 48 miles per hour on a level track. This car will have a seating capacity for 60 passengers and will be fitted with a Ganz water tube steam generator having a working pressure of 300 lbs. It will carry about 700 gallons of water and from 800 to 1,000 lbs. of coke.

The Atlanta & West Point has ordered 180 cars from the Louisville & Nashville to be built at its Decatur shops. The order calls for 55 box cars of 65,000 lbs. capacity, fifty 40-ton drop bottom coal cars of 80,000 lbs. capacity; 50 flat cars of 80,000 lbs. capacity and 25 furniture cars of 65,000 lbs. capacity. The box cars will measure 36 ft. long by 9 ft. wide by 9 ft. 2 in. high, all inside measurements. The bodies and underframes will be of wood. The flat cars will measure 40 ft. long by 9 ft. wide, inside measurements, and will also be of wood. The furniture cars will measure 45 ft. long by 9 ft. wide by 10 ft. 2 in. high. The special equipment for all will include the American Steel Foundries cast steel body and truck bolsters, Simplex brake-beams, Westinghouse air-brakes, Ajax plastic bronze brasses, Tower couplers, Security door fasteners for box cars and furniture cars, Miner tandem draft rigging, McCord dust guards and journal boxes, St. Louis Roof Company's roofs, Railway Steel Spring Co.'s springs and arch bar trucks.

The Atlantic Coast Line has ordered 2,000 steel underframe box cars of 60,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co., for May delivery; 500 flat cars of 60,000 lbs. capacity from the South Atlantic Car & Manufacturing Co., and 40 passenger coaches from Harlan & Hollingsworth, for July delivery. The box cars will weigh 36,500 lbs. and measure 36 ft. long, 8 ft. 6 in. wide and 7 ft. 5⅛ in. high, inside measurements. The flat cars will be 40 ft. long, over end sills; 9 ft. wide, over side sills, and 4 ft. 4¼ in. high, over floor. The special equipment for box and flat cars will include: Pennsylvania brake-beams, Christie brake-shoes, Westinghouse air-brakes, Tower couplers, National Malleable Castings Co.'s door fastenings and Farlow-Westinghouse friction draft rigging for box cars; Thornburg tandem draft rigging for flat cars, Harrison dust guards, Symington journal boxes for box cars and National Malleable Castings Co.'s journal boxes for flat cars, Atlantic Coast Line standard paint, Atlantic Coast Line double board roofs for box cars, Atlantic Coast Line standard springs and Atlantic Coast Line standard arch-bar trucks. The passenger coaches will weigh 81,000 lbs. and measure 61 ft. 3 in. long, over end sills, and 9 ft. 8 in. wide, over side sills. The special equipment will include: Diamond special brake-beams, Christie steel back brake shoes, Westinghouse automatic air-brakes, Janney-Buhoup couplers, Forsyth or National curtain fixtures, Pantasote curtain material, Adams & Westlake door fastenings, Westinghouse friction draft rigging, Harrison dust guards, Gold heating system, National Malleable Castings Co.'s journal boxes, Pintsch light, Pullman standard outside paint, Atlantic Coast Line standard springs, Pullman wide vestibules and Atlantic Coast Line special 36-in. chilled cast wheels. Other specialties are: Adams & Westlake polished bronze trimmings and Linstrom hand brakes.

BRIDGE BUILDING.

Alabama.—On March 13 the United States Senate passed a bill authorizing the Mobile Railway & Dock Co. to build bridges across Dog river and Fowl river, in Mobile County, Alabama.

Calhoun, Ga.—Bids are wanted April 4 by the County Commissioner for building a steel bridge 220 ft. long over the Oostanaula river in Gordon County.

Crampton, Md.—The Commissioners of Queen Anne County will shortly ask for bids for putting up a steel bridge 75 ft. long. A. B. W. Mitchell is Clerk, of Centerville.

Forest City, Ia.—Bids are wanted April 3 by Leo Aspalin, County Auditor, at Garner, Ia., for building a steel bridge over Lime creek, 100 ft. long, in Hancock County.

Lloydminster, Alb.—The government has decided to build a bridge over the Battle river at this place. R. W. McIntyre, of Edmonton, Alb., may be addressed.

Louisville, Ky.—The Louisville, Henderson & St. Louis is having plans made to substitute steel structures for many of the wooden bridges on its line.

Madison, Ark.—The Madison Bridge Co., of Forest City, is asking for incorporation, with a capital of $40,000, to build a bridge over the St. Francis river at this place. The directors include S. H. Mann, T. C. Marwin and E. A. Rolfe. The Lower House of Congress has passed a bill authorizing this work.

Minnesota.—The Duluth, Rainy Lake & Winnipeg and the state of Minnesota, it is reported, are planning to jointly build a bridge over the river at Fort Francis. The railroad has bought the land necessary for the Canadian approach.

Oroville, Cal.—Bids were recently asked by the County Supervisors for a highway bridge to be built over Butte creek, four miles west of Nelson in Butte County, to consist of one 60 ft. steel span, with 540 ft. of pile trestle work.

The Board of Supervisors of Butte County has agreed to pay half of the cost of a steel drawbridge over the Sacramento river, between Butte and Glenn Counties, if the latter county will pay the other half.

Philadelphia, Pa.—The Board of Supervisors have approved the plans for the Walnut Lane bridge to be built over the Wissahickon to connect Germantown and Chestnut Hill with Manayunk and Roxborough. The proposed structure will be built entirely of concrete, and with a total length of 565 ft. and 60 ft. wide. The central span over the creek will be 233 ft. long. The cost of the structure will be $250,000.

St. Anne's, Que.—The Canadian Pacific, it is said, has decided to rebuild the bridge over the Ottawa river at this place.

St. Paul, Minn.—Both Houses of Congress have approved the building of a bridge over the Mississippi river between the Fort Snelling Military Reservation and St. Paul.

San Francisco, Cal.—The California Northwestern will build a double-deck bridge 160 ft. long over Hulbert's creek near the entrance to Guernwood Park. The upper deck will be used for highway traffic.

Sunnyside, N. Mex.—The Atchison, Topeka & Santa Fe will build a bridge over the Rio Pecos on the line of its cut off from Belen to Texico. The work on the bridge will be difficult because of quicksand and will take about eight months to complete the structure.

Tennessee.—Both Houses of Congress have passed bills authorizing the Cairo & Tennessee River Railroad to build bridges over the Tennessee and Cumberland rivers in Tennessee.

Toledo, Ohio.—Resolutions have been introduced in the City Council providing for a viaduct 93 ft. long, also for the removal of the present Cherry street bridge to Ash and Consaul streets. A number of resolutions have been previously filed seeking the removal of this structure.

Van Buren, Maine.—A bill was introduced in the House of Representatives on March 12 making an appropriation to aid in building a bridge across the St. John river between this place and St. Leonard's, New Brunswick.

Waters Ferry, Ala.—On March 13 the United States Senate passed the bill authorizing the Commissioners' Court of Baldwin County, Ala., to build a bridge over the Perdido river at this place.

Williamson, W. Va.—On March 12 the United States Senate passed the bill authorizing William Smith and associates to bridge the Tug Fork of the Big Sandy river near this place. (March 2, p. 70.)

Other Structures.

Allentown, Pa.—The Central Railroad of New Jersey has bought land as a site on which it will put up a large roundhouse and a shop. Work is to be started at once.

Decatur, Ill.—Revised plans have been completed for the Wabash shops. They call for 15 buildings, the two largest of which will be the car shop and the machine shop. Work is to be started early next month, and completed during the present year.

Fargo, N. Dak.—The Great Northern is having plans made for putting up a new passenger station here, for which bids are to

be asked shortly. Plans are also being made for a new freight house, to be 40 ft. by 600 ft.

INDIANAPOLIS, IND.—The Big Four, it is said, has bought 2,640 acres of land on the south adjoining Indianapolis, as a site for shops. An appropriation of $3,500,000 has been made by the company to build a town at this place to be called Beech Grove.

LONSDALE, TENN.—The Southern, it is said, will enlarge its shops at this place to double their present capacity, at an expense of about $1,000,000.

LOUISVILLE, KY.—The Louisville & Southern Indiana Traction Co. has secured land on Third street as the site for a large terminal building to cost about $300,000.

MONCTON, N. B.—The shops of the Intercolonial, recently destroyed by fire, it is announced, will be replaced as soon as possible with new structures.

OAKLAND, CAL.—The Southern Pacific has applied for permission to build its new machine shop, boiler shop, copper shop and roundhouse at Oakland, near the Perlata street front slip. Piling foundations for the machine shop, 195 ft. by 500 ft., have been completed and work on the superstructure will soon be commenced.

PHILADELPHIA, PA.—The Baltimore & Ohio is planning to spend $750,000 for terminal facilities at Philadelphia. The work includes the building of a roundhouse, a car and locomotive repair shop and other structures, also a freight yard. Land has been bought between Twenty-fifth and Dickinson streets and Thirty-sixth street and the Schuylkill river. The company intends to begin work as soon as its plans are approved by the city officials. The object of this work is to improve its freight handling facilities, and as soon as the new buildings are completed the present shops will be abandoned.

PROCTOR, B. C.—The Canadian Pacific, it is reported, will put up a new station here.

SEATTLE, WASH.—The Union Pacific is planning to build solid concrete quays at a cost of about $1,000,000 on Salmon Bay. The bay will be connected with Puget Sound by a channel now being widened and dredged by the government. The Great Northern and the Northern Pacific also own large tracts of land suitable for terminal purposes within a few miles of the entrance of Salmon Bay.

SPOKANE, WASH.—The Oregon Railroad & Navigation Co. has bought land on North Monroe street as a site on which it will put up large warehouses.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

CANADIAN PACIFIC.—This company has announced that it will extend its Yorkton branch to Wetaskiwin 50 miles south of Edmonton. About 300 miles of this branch has already been built, and when completed it will form a trunk line 800 miles long from Winnipeg to Edmonton, 200 miles shorter than the present railroad distance between these two towns. The work includes the building of a high level bridge over the Saskatchewan between Strathcona and Edmonton.

CHESTER, PERRYVILLE & STE. GENEVIEVE.—This company has extended its road from Perryville, Mo., southeast to Cape Girardeau, 47 miles.

CHICAGO & NORTH-WESTERN.—The Ashland division of this road, which formerly ended at Laona, Wis., has been extended to Long Lake, 20.5 miles.

CHICAGO, BURLINGTON & QUINCY.—This company, according to the newspapers, has had incorporated in Colorado the Denver, Utah & Pacific, to build a line from Denver to the Pacific Coast, and from Denver to a connection with the Burlington lines in Wyoming. There was a company of this name several years ago, but its charter has lapsed.

CHICAGO GREAT WESTERN.—Work has been started by A. D. Eizle, who has the contract, for double tracking this road at Helena Junction. The road is to be made double track between Dubuque and Chicago.

CHICAGO, MILWAUKEE & ST. PAUL.—An officer is quoted as saying that the work to be carried out by this company during the present year includes the rebuilding of 400 miles of its road from St. Paul to the Missouri river, which will form part of its Pacific Coast line, and the double tracking the Chicago-St. Paul line. This line is 420 miles long; 228 of this is double track, and 77 miles additional will be completed this year. It is intended to have the remaining 115 miles completed by the time the transcontinental line is finished. Between Chicago and Omaha, 500 miles, about 208 miles is double track and $500,000 will be spent reducing the grades.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—A charter has been granted in Kentucky to this company to build a branch 25 miles long, from Sloan's Valley, in Pulaski County, to the confluence of the Laurel and Cumberland rivers.

See Kentucky & Southeastern.

DULUTH, RAINY LAKE & WINNIPEG.—A contract has been given by this company to P. McDonnell, of Duluth, for building 65 miles of its proposed extension from Ashawa, Minn., north to Pether's point on Rainy river, about two miles from International Falls. The contract includes grading, ballasting, track laying and bridge construction, and calls for the completion of the work by June 1, 1907. The line will be continued to International Falls, where a bridge will be built over the river by the Rainy River Bridge Co., recently incorporated for this purpose, and will ultimately be extended further north. The road will connect with the Canadian Northern, giving a through connection with Winnipeg and the Canadian Northwest.

GRAND TRUNK PACIFIC.—Bids were recently received for building 245 miles of this road east from Winnipeg, also 155 miles west from Quebec, and a steel viaduct 3,000 ft. long at Cape Rouge Valley. The bidders for building the road were the Pacific Construction Co.; M. J. O'Brien; J. P. Mullarky; Hogan & MacDonald; McCarthy Construction Company, Ltd., of Canada; H. M. Davis and J. T. Davis; Connolly, Wilson & Jardine, and J. D. MacArthur; and for the bridge the Dominion Bridge Co.; Locomotive & Machine Co., of Montreal; Phœnix Bridge Co., of Pittsburg, and the Canadian Bridge Co., of Walkerton, Ont. Contracts for the work will soon be let. The Canadian Government's estimates for the next fiscal year provide for an expenditure of $10,000,000 on this eastern section of the Grand Trunk Pacific, which is being built by the government.

GREAT NORTHERN.—According to newspaper reports large tracts of land are being bought for J. J. Hill in Saskatchewan, with a view of building various branch lines from the boundary. It is said that the company will build into Regina during the present year, and that plans are being made for making a through line from Lethbridge to Winnipeg, passing a few miles south of Wayburn, with branches into wheat-growing territory.

GREAT WESTERN.—This company has now in operation a branch from Johnstown, Colo., to Liberty, 11.9 miles.

HANOVER RAILWAY.—Incorporation has been granted this company in Illinois, with a capital of $650,000, to build a line from the Chicago, Burlington & Quincy, at Hanover station in Joe Daviess County, to the Chicago Great Western at North Hanover in the same county. The office of the company will be at Hanover. Incorporators include: William Speer, John Eadie and Albert B. White, all of Hanover.

INLAND EMPIRE.—J. P. Graves and associates have organized a company in the state of Washington, under the above name, with a capital of $20,000,000, to consolidate a number of existing electric roads and to build extensions. The companies to be included are: Cœur D'Alene & Spokane, operating 34 miles between Spokane and Cœur D'Alene, Idaho; the Spokane Traction Co., operating a system in the city of Spokane; the Spokane & Inland, which is building south from Spokane to Palouse and Colfax (partially completed), and the Spokane Terminal Company, which is putting up a terminal station in Spokane for these three other companies. Money has been secured by the new corporation to carry out the work, to include the extension of the Spokane & Inland to Snake river. There it will connect (at Lewiston) with the Lewiston & Southeastern system, which has already let contracts for building its line from that place to Grangeville, Idaho. Other work includes the extension of the line west from Spokane into the Big Bend country.

KENTUCKY & SOUTHEASTERN (C., N. O. & T. P.).—A charter has been granted this company to build a line southeast through Breathitt, Perry, Knott and Letcher Counties, Ky., a distance of about 70 miles.

LORAIN SOUTHERN.—Announcement has been made by Joseph Ramsey, former President of the Wabash, that he has organized a company under this name, and also bought the Industrial Railroad of Lorain from the Sheffield Land Company. He proposes to build a line from Lorain, Ohio, on Lake Erie to the Hocking Valley and other coal fields along the Ohio river. A line is also projected into the coal fields of Pennsylvania near Pittsburg.

LOS ANGELES & SAN DIEGO BEACH (ELECTRIC).—Incorporation has been asked for by E. S. Babcock and associates for a company under this name at San Diego, Cal., with a capital of $6,000,000. The company proposes to build an electric road from Los Angeles southeast to San Diego, about 150 miles, and to take over the franchises held by the Lajola and National City of the latter place.

LOUISVILLE & NASHVILLE.—The first freight train over the new line of this company between Knoxville and Atlanta was started on March 20. The road will not be opened for passenger traffic for several months.

Louisville, Henderson & St. Louis.—This company recently completed an extension to which it reaches Louisville over its own rails. Previously it used the tracks of the Illinois Central. The company is planning to build freight terminals in Louisville to cost $500,000.

Minneapolis, St. Paul & Sault Ste. Marie.—Barnard & Goeder have the contract for 15 miles of an extension of this road, and will sublet parts of the work. Work is to be begun at Garrison, N. Dak. N. W. Barnard, Crookston, Minn., may be addressed.

Missouri, Iowa & Nebraska.—Incorporation has been granted the company in Missouri to build a railroad from Millard, Mo., northwest through Adia and Putnam Counties in Missouri, and through Appanoose, Wayne, Clark, Madison, Adai, Guthrie, Audubon, Shelby, Crawford, Monona and Woodbury to Sioux City, Ia., approximately 290 miles.

Pennsylvania Roads.—A charter has been granted to a company in Pennsylvania to build a railroad five miles long, from Shady Grove to a point near the intersection of the Hagerstown & Northern. The company has a capital of $50,000, and Christian W. Lynch, of Harrisburg, is President. The Directors are: Abner C. McKee, John S. Lynch, Alfred G. Miles, Donald C. Haldeman, Richard C. Haldeman and Theodore Zeiders, all of Harrisburg, Pa.

Quebec Southern.—This company will extend its line from Francois to Chaudiere Junction, and hopes to have the work completed as far as Becarcour this year. The Dominion Government has granted a subsidy of $3,500 per mile.

Somerset.—This company, which is building an extension from Bingham, Me., to Birch Harbor on Moosehead Lake, about 50 miles, has completed work as far as Moxie Pond, 18 miles from Bingham, and expects to have the entire 50 miles completed this year. The contract for the remaining portion of the work has just been let. The road will connect with the Canadian Pacific at a point about three miles west of Asquith, Me.

Weatherford, Mineral Wells & Northwestern.—Announcement has been made that this Texas road, which was bought about two years ago by the Goulds, and now forms a part of the Texas & Pacific system, will be extended northwest from Mineral Wells to a connection with the Pecos Valley road, about 300 miles. Contracts are shortly to be let for building the first 100 miles, from Mineral Wells to Throckmorton. The road will parallel the Fort Worth & Denver City for about 100 miles. It is proposed ultimately to extend it to a connection with the Denver & Rio Grande in Colorado, connecting these two sections of the Gould System.

RAILROAD CORPORATION NEWS.

Boston & Albany.—Gross earnings for the six months ended December 31 were $5,784,962, an increase of $378,029; net earnings, $2,008,841, an increase of $116,875, surplus after charges $232,963, an increase of $4,850.

Canadian Pacific.—The shareholders have ratified the proposal to increase the common stock from $110,000,000 to $150,000,000. The President announced that $20,280,000 additional stock would be issued at once, making the total outstanding $121,680,000. The new stock will be entitled to the dividend of December 31, 1906, if fully paid up. (Feb. 16, p. 56.)

Chicago & Alton.—The stockholders have agreed to the consolidation of the Chicago & Alton Railroad and the Chicago & Alton Railway under the name of the Chicago & Alton Railroad. The stock of the merged company will be $40,000,000, as follows: $899,300 cumulative 4 per cent. preferred, $19,557,900 non-cumulative 4 per cent. preferred, and $19,542,800 common. Three shares of the cumulative preferred stock will be exchanged for each of the 73 shares outstanding of the preferred stock of the C. & A. R. R., and two shares of the new cumulative preferred for each of the 4.287 shares common stock of the railroad company outstanding. The non-cumulative preferred and common stock will be exchanged share for share for the similar amounts of preferred and common stock respectively outstanding of the C. & A. Railway Co. (Jan. 26, p. 30.)

Chicago, Cincinnati & Louisville.—In answer to injunction proceedings instituted by the Pere Marquette to restrain W. A. Bradford, Jr., President of the C., C. & L., and Rudolph Kleybolte & Co. from forcing the Pere Marquette to pay interest on the $3,500,000 P. M. and C., H. & D. joint collateral 4 per cent. bonds of 1914, the defendants have filed statements to the following effect:

Mr. Bradford accuses J. P. Morgan & Co. of entering into a conspiracy to break up the Great Central Route and divide its component parts among various other roads in which Mr. Morgan holds a large interest. The Chicago, Cincinnati & Louisville was wrecked, he says, for the benefit of the Monon line, a Morgan property; the Pere Marquette is being put in a position to be turned over to the Erie; the Cincinnati, Hamilton & Dayton is to be removed as a competitive factor by being absorbed by the Chesapeake & Ohio; the Toledo Terminal Railroad Company is to be taken over by various Morgan properties entering Toledo, and the Chicago, Cincinnati & Louisville, Mr. Bradford's road, after being wrecked, is to be bought in at a low price by the Southern or the Queen & Crescent, both Morgan properties.

As part of the answer, Rudolph Kleybolte filed the report of J. T. Odell, now President of the Suffolk & Carolina, to the Pere Marquette on the condition of the Chicago, Cincinnati & Louisville just prior to the acquisition of the C., C. & L. by the Pere Marquette and the Cincinnati, Hamilton & Dayton. The report says in part: "For a new road, its condition is excellent. It is laid with 70-lb. steel for most of the way, and the balance with 80-lb. steel. The road crosses 20 other roads in the entire distance, 11 of them over and above grade and the balance are grade. All but two of the grade crossings are equipped with the interlocking device and at all the large cities all the grade crossings at open streets have been eliminated, crossing the streets overhead and on steel girders, with concrete abutments. The length of the line from Griffiths to Cincinnati is 253 miles and from Griffiths to Chicago 30 miles, a total of 288 miles, as compared with 305 miles by other roads. I do not see why a combination of the Cincinnati, Hamilton & Dayton and this road, with the prestige of the Cincinnati, Hamilton & Dayton, would not make the strongest line in existence between Cincinnati and Chicago. It is 20 miles the shortest at all events, if that counts for anything. I do see, however, when this line is fully completed and equipped, they can fix a rate far below anything now in existence, and make more than the other lines at the higher rate. I think the fact that this line exists and will do business stands as a menace to every other Chicago and Cincinnati line. It's the strongest proposition that I know of of its kind."

Cincinnati, Hamilton & Dayton.—Gross earnings during the month of January were $1,248,978; disbursements, $1,084,683.

See Chicago, Cincinnati & Louisville.

Interborough-Metropolitan.—The time for the deposit of securities of the Interborough Rapid Transit, Metropolitan Securities and Metropolitan Street Railway expired March 16. At that date 95½ per cent. of the I. R. T. stock had been deposited, 93½ per cent. of Metropolitan Securities, and 81½ per cent. Metropolitan Street Railway.

Kansas City Southern.—At a meeting of the stockholders on March 19, it was voted to issue $5,100,000 six-year 5 per cent. collateral notes, this sum to be spent within the next two or three years for betterments. The notes are to be secured by an issue of $10,000,000 4½ per cent. 20-year improvement bonds, redeemable at any interest date on 60 days' notice.

Michigan Central.—Gross earnings for the year ended December 31, 1905, were $23,283,868, an increase of $1,790,924; net earnings, $4,417,952, a decrease of $33,978. The surplus after dividends was $223,934, an increase of $100,679.

Minneapolis & St. Louis.—A special meeting of the stockholders has been called for April 11, to act on a proposition to aid the Minnesota, Dakota & Pacific in the construction of its proposed road from Watertown, S. Dak., to a point at or near Lebeau, with a branch from Conde to Leola, 240 miles in all. The plan is to issue $5,000,000 five-year 5 per cent. notes, secured by a trust indenture executed to the Central Trust Company, trustee.

New York Central & Hudson River.—A meeting of the stockholders has been called for April 18 to authorize an increase of capital stock from $150,000,000 to $250,000,000. There is now $149,442,500 stock outstanding.

Gross earnings for the month of February were $6,582,125, an increase of $1,186,790.

Pere Marquette.—See Chicago, Cincinnati & Louisville.

Pittsburg & Lake Erie.—In the annual report, the President makes the following statement: "On November 2, 1905, the Pittsburg & Lake Erie Railroad Company made a first and partial payment to the Little Kanawha syndicate toward the acquiring of railroad properties and franchises in West Virginia, Ohio and Pennsylvania controlled by it, the purchase to include the Little Kanawha Railroad, Burnsville and Eastern Railroad, Buckhannon and Northern Railroad, Belington & Northern Railroad, Parkersburg Bridge & Terminal Railway, Marietta, Columbus & Cleveland Railroad, Zanesville, Marietta & Parkersburg Railroad and other properties. On the same date the company acquired by purchase the entire holdings of the Greene county syndicate, owning railroad properties and franchises in Greene and Washington Counties, Pa." In another part of the report, $1,504,721 is given as the amount of this payment.

GENERAL NEWS SECTION

NOTES.

The bill which was before the legislature of Iowa to reduce all passenger fares in the state to two cents a mile has been defeated.

The Pere Marquette Railroad has issued an order to its agents to confiscate for its own use all of the coal mined in the Saginaw Valley between March 21 and April 1.

The legislature of New Jersey has passed the Perkins bill for the equalization of taxes, which, it is said, will increase the amounts to be paid by the railroads of the state by about $3,000,000 a year.

It is announced in Canada that the Canadian Pacific is making out a new price list for its western lands, and hereafter will sell none at less than $10 an acre. The company still holds 10,900,000 acres in Manitoba.

Reports from Pittsburg, Chicago, Indianapolis and other cities report that all railroads are stocking their coal piles as rapidly as possible, with a view to being prepared for a strike of miners, and many of the roads evidently are confiscating coal which is in transit.

A press despatch from Casper, Wyo., reports a wreck of a work train on the Chicago & North-Western near Natrona, Wyo., March 25, in which 10 employees, mostly laborers, were killed and 15 were injured. The train broke through a bridge which it was crossing at low speed while the track was submerged by a flood.

A press despatch from Albuquerque, N. Mex., says that the Caledonian Coal Co.'s suit against the Atchison, Topeka & Santa Fe, and others, for $600,000 damages, has been compromised and will be dismissed. It appears that the developed mines of the Caledonian company are to be bought by the railroad and its allied coal companies.

According to a press despatch from Durango, Col., of March 22, a passenger train carrying 50 passengers was stuck in the snow at Cumbress Pass in the mountains for 12 days. Provisions had to be carried to the train by men wearing snowshoes, and some of the passengers were made sick by their long stay in the rarefied atmosphere of that high altitude.

The "ladies' smoking car," referred to in a press despatch from London last week as being in service on one of the roads between London and Liverpool, proves to be a "fake." The story appears to have had for its basis the engagement of a car, for a single trip, by a party in which were three women who had a carriage or compartment reserved for themselves for smoking.

As a result of the investigation following the collision at Baker Bridge, Mass., last November, the Boston & Maine has put in use a fusee which is a combination of a stop and a caution signal. The fusee burns red for three minutes and then yellow for five minutes. For use on long descending grades a 10 minute fusee has been made. This burns red five minutes and yellow five minutes.

Passenger trainmen on the Monongahela division of the Pennsylvania have had their wages raised about 10 per cent., the new scale being as follows: On all trains making more than 113 miles a day—Conductor, $4.29; baggage master, $2.53; brakeman, $2.03; engineman, $4.73, and fireman, $2.69. On all trains making 113 miles a day or less—Conductor, $4.01; brakeman, $1.92; engineman, $4.40, and fireman, $2.25.

In New York City last week a street car conductor was sentenced to prison for 10 years for causing the death of the driver of a mail wagon. The accident occurred at 3 o'clock in the morning, when the conductor had temporarily taken the place of the motorman who had gone inside of the car to talk with a woman passenger. The conductor lost control of the car and ran it into the mail wagon. The railway company paid $20,000 to the family of the man who was killed.

According to a Pittsburg paper, 50 female car-cleaners in that city who, the other day, failed to secure an interview with the superintendent of their division, went to his house in a body, about 9 o'clock in the evening, and stormed his library, so to speak; that is to say, they brushed aside the butler, who was not going to admit them, and went in and hunted up their man. The spokeswoman had uttered only three words before the other 49 strikers joined in the address, or appeal. Then, says the reporter, the superintendent threw up his hands. After telephoning to his assistant to hear the women's complaint the next day, he succeeded in calming the strikers, so that they left.

In New York City last week the Interstate Commerce Commission took evidence concerning wrong and presumably fraudulent classifications of freight by shippers. Inspectors for the Trunk Line Association testified that 34,000 false classifications had been found at New York in a single month. There are 49 inspectors. One of the inspectors said that the number of frauds which escaped them was probably larger than the number detected. In the month of January corrections were made on 14,060 local shipments and on 10,486 through shipments. The increased revenue secured by these corrections was $16,000 on reclassification and $1,000 on increased weight. Drugs had been described as salt and fertilizer, and an expensive chemical as ginger ale. Artificial flowers were billed as millinery, and human hair as horse hair. Some shippers tried to fool the inspectors by putting higher priced goods in the bottoms of the boxes. The witnesses gave the names of a number of shippers who, they said, were persistent in their offenses. Two of these are, we regret to say, within a stone's throw of the office of the *Railroad Gazette*. On the second day of the hearing, testimony was taken from shippers and shippers' agents alleging that the wrong classifications were due to the mistakes of packers and to difficulty in classifying a mixed lot of goods. One shipper who always billed looking glasses as plate glass said that several years ago the railroads supplied him with rubber stamps reading "plate glass" and he had continued to use them. One witness, telling how manufacturers had to practice deception to meet competition, said that goods made in Massachusetts had to be labeled "Made in Germany."

D. & H. Gasoline-Electric Motor Car.

The General Electric Company's new gasoline-electric motor car for the Delaware & Hudson was tried on Tuesday of this week in three round trips between Schenectady and Saratoga. It was shown and described in this paper February 9, and the trials have fully met the expectations of the designers, but in one respect, the use of cheap kerosene instead of the more costly gasoline, has not been found to be feasible. The car will be run experimentally in the Schenectady-Saratoga service, and it seems likely to solve the problem of working stub-end branches of steam roads until sufficient traffic warrants an electrical equipment. It is operated from either end, obviating the necessity for turntables or switching arrangements to accomplish the same purpose, and the efficiency and flexibility of the electrical features, combined with the fact that this part of the equipment is tried and proven, seems to indicate its superiority over any gasoline outfit with mechanical drive. It has also a better tractive effort secured by the electric motors on both trucks, a feature not possible through the mechanical drive.

With improved engine design and a complete equipment brought down considerably in weight, there seems to be no good reason why such a car should not be useful.

Armour Refrigerator Cars.

Mr. J. Ogden Armour, who has not yet finished his defense of the packers, returns, in the last issue of the *Saturday Evening Post*, so his argument presented in his opening article, that conservative fruit dealers are satisfied with the Armour management of refrigerator cars. The actual growers and shippers of fruit, he says, have never voiced a serious complpaint against the car lines and do not now favor the agitation against the private car companies. He quotes from speeches made and resolutions passed by fruit jobbers, who have complained among themselves how they have advanced the price of fruit (for example, strawberries in Arkansas) by sending too many buyers down there to compete. Last season there were at Van Buren the first week "ten buyers for each car" of berries, and the local shippers took advantage of the situation to "boost the prices out of sight," making from $300 to $500 a car extra profit. This, says Mr. Armour, goes to prove his statement that the Armour lines have been a great benefit to the fruit grower by sending competing buyers to his door. A Chicago fruit merchant, F. Newhall, says that while the private cars make high charges for refrigeration, their service is cheaper in the end because of the uniformly good condition of the fruit at destination.

Troubles of the Relief Department.

According to despatches sent out from several cities, the pensioning of employees of the Pennsylvania Lines west of Pittsburg may be discontinued. Threats to this effect have been made repeatedly of late, it is said, by agents of the Pennsylvania Company. The threat is being made, it is explained, in an effort to get signatures to a gigantic petition against a bill in the Ohio Legislature aimed against rules of the volunteer department of the Pennsylvania Lines. The alternative given the employees is to sign or to see both pension and relief systems abolished.

The bill which is causing the trouble has already passed the Ohio State Senate, and will come up before the House within a few days. It provides that railroad employees shall not be allowed to

surrender their right to damages for injury received on the road which employs them.

When an employee becomes a member of the relief association he is required to sign an agreement by which he waives all rights to damages for himself or family in case of accident or death on the road. This is regarded by employees as an obnoxious feature. It is not compulsory that they join the organization, but new employees receive a gentle intimation that it is expedient to join. Some sign the release-from-damages agreement under protest. Others do not realize the real force of the agreement and attach their signature without a murmur.

Abolition of the relief department, into which many of the old employees have been paying dues for fifteen years or more, and which entitles them to small weekly payments during disablement, and a life insurance policy, payable to their families, would go hard with the older employees. Abolition of the pension system would be an even greater blow to the older employees.

It is thought by many that the threat of the company's agents, who have already obtained the names of 5,000 employees to the petition against the Ohio bill, is merely a "bluff." These say that the railroad would not dare abolish its pension and relief systems, because of the ill feeling that would be engendered among its thousands of employees.—*Indianapolis News.*

The Railroad Problem, Condensed.

Chairman Knapp, of the Interstate Commerce Commission, in an address before a club at Washington recently, expressed the opinion that the national conscience is awakening. He says the pass evil is becoming recognized as a great evil, and from being a badge of distinction, is now recognized, if not as a mark of infamy, at least as a distinction of a sinister sort. Chairman Knapp went over the whole railroad situation. The governments of foreign countries control the railroads directly. This country had never come to look with favor on government ownership, but it is now vitally interested in government supervision of rates. The railroad is of essential use to the community and should be open on equal terms to every one. The total valuation of railroad property in the United States has reached the enormous figure of $11,250,000,000.

These roads may be divided into eight great groups—the Hill, Harriman, Vanderbilt, Atchison, Pennsylvania, Atlantic Coast, Southern and Rock Island. These included fully 70 per cent. of the roads and three-quarters of the traffic and the receipts. The men who are at the head of the railroads are also at the head of the oil, steel and other great industries. All these interests have a common center in New York, and the problem that is before the people is in reality far deeper than the mere regulation of rates. It is the control of wealth itself, and the problem of whether the country should be governed from Washington or Wall street. . . . Publicity will do much to correct any evils complained of. There should be a sworn statement each year of traffic, earnings and expenses. Giving of rebates should be made a criminal misdemeanor. The rates should be made by such body as shall be designated by Congress. But the question of whether such regulation should be of a legislative or judicial character was a matter yet to be determined.

Destruction of the Steamer Plymouth.

The side-wheel steamer Plymouth of the Fall River Line was burned to the water at the wharf of the company's repair shops at Newport, R. I., on the morning of March 27, and the freight steamer City of Lowell was badly damaged. Damage to the sheds and to other steamers brought the total loss up to $1,000,000. One fireman was burned to death on the Plymouth. The cause of the fire is unknown.

Japan to Buy Railroads.

A press dispatch from Tokio, March 27, says that the bill for the nationalization of railroads as amended by the House of Peers, was again presented in the House of Representatives and, after strong opposition, was adopted. The amendments, however, do not change the compulsory nature of the bill. The period for the whole transaction is changed from five years to ten years. The companies to be bought are reduced from thirty-two to seventeen, cutting down the total amount to be expended from $235,000,000 to $220,500,000. The time for delivery of the bonds representing the price of each railroad is extended from two years to five years, and means are provided for protest being made against the official price.

The Cincinnati Rebate.

Following the charges against the trunk lines of unlawful discriminations in favor of the sugar trust, come these frank admissions by traffic officials of the "Big Four" system, of paying money rebates to favored steel and coal corporations, and of maintaining a special list of shippers who were permitted to ship goods at their own statement of weight. And this right in the face of repeated announcements that the roads are now observing the anti-rebate law. As a matter of fact, are they making any effort to observe the law, and do they care a rush about the law, anyway? If these particular traffic officials were led into the practice by the lawlessness of other roads, why did they not expose and seek the punishment of the other roads? But it does not appear that they were influenced by any other power than a force of habit, obtaining among American roads, of specially favoring a selected class and making the unfavored many bear the burden. And then they come forward and confess their lawlessness only when promised immunity from prosecution. Such disclosures as these will not help the roads in their present campaign for a let-alone policy on the part of the government.—*Springfield Republican.*

Two Famous Engines.

After several endeavors to put them to more practical use, the North Star and the Lord of the Isles, perhaps the two most renowned locomotives in England, have been consigned to the scrap heap of the Great Western Railway at Swindon. Both engines are survivals of the old broad-gage system, and the Lord of the Isles, as such, has been exhibited in all parts of the world. It was one of 30 engines designed in 1842 by the late Sir Daniel Gooch, and drew the last train of broad-gage vehicles which left Paddington station prior to the abolition of the system in 1892.

A Tragedy—Taken from Life.

The accompanying cut does not represent a show collision; it is a halftone from a snapshot which Mr. B. W. Stevens, of Pinole, Cal., happened to be able to catch the other day of an actual accident, a butting collision of a double-header going in one direction



Courtesy of New York Tribune.

Snapshot of a Collision.

with a train drawn by one engine in the other direction. (At least, there is only one opposing engine visible.) The engineman and fireman are just in the act of dropping off. One of these men was killed. The spray at the right of the picture is water from a rupture in the tilted tender.

Land Grants to Projected Railroads in the Province of Quebec.

The Quebec legislature at its present session has made land grants of 4,000 acres a mile to the following railroad corporations: Atlantic, Quebec & Western, for building 150 miles of road; Matane & Gaspe, for 30 miles; Quebec & Lake St. John, for 12 miles; Quebec Central, for 9 miles (in lieu of cash subsidy); Joliette & Lake Manuan Colonization Railroad, for 60 miles; Interprovincial & James Bay, for 50 miles; Pontiac & Inter-Provincial, for 30 miles; also for lines from Herbertville to St. Joseph d'Alma, on the Saguenay, 10 miles; Roberval toward James Bay, 30 miles, and Jonquieres toward Ha Ha Bay, 30 miles. A grant of 3,000 acres a mile was also voted to the Northern Colonization Railroad for 32 miles of projected road and grants of 2,000 acres a mile to the St. Maurice Valley, for 30 miles; Great Northern of Canada, for 85 miles; Lotbiniere & Megantic, for 30 miles, and Orford Mountain, for five miles. All mines and minerals on these lands are reserved for the Crown. The choice of lands is to lie with the Lieutenant-Governor of the Province.

Manufacturing and Business.

The Tacoma Eastern Railroad has ordered 50 sets of Bettendorf trucks and bolsters for 35-ton cars.

F. W. Bird & Son, East Walpole, Mass., have opened a new department known as the Hydrex Felt & Engineering Co., in charge of Edward W. DeKnight, with headquarters at 120 Liberty street, New York.

The name of the St. Louis Expanded Metal Fireproofing Co.,

St. Louis, Mo., has been changed to Expanded Metal & Corrugated Bar Co., and the offices have been moved from the Century Building to the Frisco Building.

The Vacuum Cleaner Co., 427 Fifth avenue, New York City, has made a contract with the Louisville & Nashville to build a plant, adjoining the station of that road in Louisville, Ky., for cleaning the interior of the office building as well as the passenger cars at the terminal.

The general offices of the Republic Iron & Steel Co. have been removed to the Frick Building Annex, Pittsburg, Pa., to which all general office correspondence should be addressed. The present district sales offices will be maintained, including a Chicago sales office, located in the First National Bank Building.

The Watters A. B. C. pneumatic sander, made by J. H. Watters, Augusta, Ga.—E. G. Fisher, Chicago, general western agent—has been specified for 100 new locomotives recently ordered by the Southern Railway from the Baldwin Locomotive Works; also for a number of new locomotives for the Chicago Junction Railway.

The Solid Steel Tool & Forge Co., Brackenridge, Allegheny County, Pa., makers of drop forgings, car forgings, track tools, etc., announces that the company will be taken out of the hands of the receiver, James D. Wilson, as soon as the necessary formalities can be gone through. James H. Baker, who has been managing the Sales Department of the company for the receiver, will become a member of the new board of directors and take an active part in the management of the company's affairs.

Compressed Air announces that with its issue of May it will appear in enlarged form and under new management. Hereafter it will be published by The Kobbe Co., 90-92 West Broadway, New York. A special feature of the paper will be a department devoted to correspondence, a discussion of which will be encouraged among its readers. But probably the most valuable information will be contained under the heading, "Practical Items for Practical Men," where data of direct and practical value to compressed air users will be discussed. Mr. W. L. Saunders will remain as editor-in-chief, W. R. Hulbert will be managing editor, and P. F. Kobbe, Jr., will be business manager.

Iron and Steel.

Orders for rails continue active. The Chicago, Milwaukee & St. Paul has given an order to the Illinois Steel Co. for 125,000 tons of rails, most of which is to be used on its Pacific coast line. The Brookville & Mahoning Valley has given its first order for rails—5,000 tons—to the Carnegie Steel Co., and will probably buy more during the present year. Seventeen thousand tons have been ordered from the same company for delivery this summer by the Lake Erie & Michigan Southern, and the Great Northern has given an order for 20,000 tons. The Northern Pacific has given an order for 30,000 tons to the Lackawanna Steel Co., and the Delaware & Hudson 15,000 tons to the Pennsylvania Steel Co. Inquiries are being made for about 150,000 tons additional for foreign orders.

OBITUARY NOTICES.

Robert Miller, at one time General Superintendent and later Superintendent of Motive Power and Equipment of the Michigan Central, died in Detroit, Mich., March 13. At the time of his death he had been retired from railroad service for several years. Mr. Miller was a typical example of the western railroad man who by his own unaided efforts and native ability works himself up from a humble position in the ranks to a high official position on an important road. Born in Ithaca, N. Y., in 1840, he entered railroad service at the age of 19 as a machinist in the shops of the Chicago, Burlington & Quincy. He served in the army throughout the Civil War. At the close of the war he returned to the Burlington as foreman of the erecting shop. In 1876 he went to the Michigan Central as Master Car Builder, being also in charge of buildings and waterworks. In 1884 he was made Assistant General Superintendent and six years later became General Superintendent. In 1896 he became head of the motive power department with the title of Superintendent of Motive Power and Equipment. He continued in this position until 1900, retiring at the age of 60 years.



Robert Miller.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

National Association of Railway Commissioners.

The annual meeting of this association is to be held in Washington, D. C., beginning April 2. The call for the meeting contains the usual list of subjects.

Canadian Society of Civil Engineers.

At a meeting of the Mechanical Section held March 29 the following papers were read: "Notes on the Shops and Power House of the Canada Car Co.," by E. G. M. Cape; "Durability of Wire Rope Under Severe Conditions," by T. H. Schwitzer. The papers were illustrated by lantern slides.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atlantic & Birmingham.—The offices of the Vice-President and General Manager, the Auditor and the General Freight and Passenger Agent have been removed from Waycross, Ga., to Atlanta, Ga.

Chicago & North-Western.—R. H. Williams, Assistant Treasurer and Second Assistant Secretary, has been appointed Treasurer and Assistant Secretary, succeeding S. O. Howe, deceased. M. B. Van Zandt succeeds Mr. Williams.

New York Central & Hudson River.—J. L. Ferris, Chief Clerk to the Auditor of Passenger Accounts, has been appointed Auditor of Passenger Accounts, succeeding J. F. Fairlamb, promoted.

Philadelphia & Reading.—C. E. Henderson, Second Vice-President, has resigned as First Vice-President of the Philadelphia & Reading Coal & Iron Co., but he remains in charge of the Traffic Department of the railroad.

St. Louis, Iron Mountain & Southern.—T. T. Eckert has been elected a member of the Executive Committee, succeeding Russell Sage, resigned. Mr. Sage remains on the Board of Directors.

Operating Officers.

Chicago, Burlington & Quincy.—O. E. Stewart, Superintendent at Ottumwa, Iowa, has been appointed Superintendent at Burlington, Iowa, succeeding W. G. Sharretts, resigned. L. B. Allen, formerly Superintendent of the Chicago, Rock Island & Pacific at Rock Island, Ill., succeeds Mr. Stewart.

A. T. Perkins, Superintendent at St. Joseph, Mo., has resigned to become adviser to the St. Louis Municipal Bridge & Terminal Commission.

Coal & Coke.—F. M. Fisher, Trainmaster, has been appointed Superintendent.

Denver & Rio Grande.—The authority of A. E. Welby, General Superintendent of the Rio Grande Western, has been extended over the D. & R. G., succeeding H. T. Herr, resigned.

Louisiana & Arkansas.—W. T. Tyler, formerly General Superintendent of the St. Louis, Iron Mountain & Southern, has been appointed General Manager of the L. & A., with office at Texarkana, Ark.

New York Central & Hudson River.—F. E. Williamson has been appointed Car Accountant, effective April 2, 1906. Mr. Williamson graduated from the Academic Department of Yale University in 1898, and entered railroad service the next fall as a clerk in the office of the Superintendent of the Mohawk division of the New York Central. The next year he was appointed division claim agent, and after a year and a half was made agent at Rome, N. Y. He was later transferred to Utica and then to Troy, N. Y. In 1903 he was appointed Chief Clerk in the office of the Car Accountant, at New York, where he has remained until his present promotion.

Rio Grande Western.—See Denver & Rio Grande.

Trinity & Brazos Valley.—P. A. Gorman, General Superintendent, has resigned.

Traffic Officers.

Cumberland Valley.—J. L. Eysmans has been appointed General Freight Agent, with office at Harrisburg, Pa., succeeding H. C. Clevenger, resigned.

Galveston, Harrisburg & San Antonio.—See Texas & New Orleans.

St. Louis & San Francisco.—John Sebastian, Passenger Traffic Manager of the Chicago, Rock Island & Pacific, whose authority was recently extended over the St. Louis & San Francisco and the Chicago & Eastern Illinois, entered railroad service as a clerk on the Atchison, Topeka & Santa Fe in 1869, becoming later Chief Clerk and then Traveling Passenger Agent. In 1880 he went to the Chicago, Rock Island & Pacific as general southwestern passenger agent. Seven years later he was made General Passenger and Ticket Agent of the Chicago, Kansas & Nebraska, remaining there two years, until the company was made a part of the C., R. I. & P. He then was made General Passenger Agent of the Rock Island, and was appointed Passenger Traffic Manager in 1902. In 1903 his authority was extended over the Choctaw, Oklahoma & Gulf, the St. Louis, Kansas City & Colorado, and the Chicago, Rock Island & El Paso.



John Sebastian.

Texas & New Orleans.—Joseph Hellen, Assistant General Passenger Agent of this road and of the Galveston, Harrisburg & San Antonio, has been appointed General Passenger and Ticket Agent of the T. & N. O., with office at Houston, Tex., succeeding T. J. Anderson, resigned.

Engineering and Rolling Stock Officers.

Canadian Pacific.—A. L. Hertzberg, Engineer of the Ontario division, has been appointed Engineer of Maintenance of Way, succeeding F. P. Gutelius, promoted. J. M. R. Fairbairn, Engineer of the Eastern division, succeeds Mr. Hertzberg, with office at Toronto, Ont. J. H. Barber, Engineer of the Atlantic division, succeeds Mr. Fairbairn.

Denver, Enid & Gulf.—J. F. Carey has been appointed Chief Engineer, with office at Enid, Okla. T., succeeding J. B. Dalton, resigned.

Erie.—D. H. Wilson, Jr., has been appointed Electrical Engineer.

Louisville & Nashville.—J. O. Ely has been appointed Assistant Engineer at Knoxville, Tenn., succeeding E. L. Cruger, resigned.

Pennsylvania.—E. B. Temple, who was recently appointed Assistant Chief Engineer, was born in 1871 and graduated from the Engineering Department of Swarthmore College in 1891. He immediately began railroad work in the Construction Department of the Pennsylvania, being engaged in the surveying corps, and later on inspection of construction work. In 1897 he was transferred to the Drafting Department and was later appointed Assistant Engineer in that department. He took entire charge of the department in 1901, and on Jan. 1, 1905, was made Assistant to the Chief Engineer, where he remained until his recent promotion.

C. H. Andrus, General Foreman at West Philadelphia, Pa., has been appointed General Locomotive Inspector, with office at Altoona.

Pittsburg & Lake Erie.—G. M. Campbell, Electrical Engineer, has resigned to become Assistant Superintendent of the Western Electric Co., at Chicago.

Wabash.—E. F. Needham, Master Mechanic at Fort Wayne, Ind., has been appointed Master Mechanic at Springfield, Ill., succeeding C. H. Doebler, resigned. G. W. Smith, General Foreman at Fort Wayne, succeeds Mr. Needham.

LOCOMOTIVE BUILDING.

George Cousin, Louisiana, has ordered one 20-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Kaul & Hall Lumber Co., Pennsylvania, has ordered one 65-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Lake Champlain & Moriah has ordered one simple consolidation locomotive from the Baldwin Locomotive Works for April 1 delivery. The total weight of this locomotive will be 207,000 lbs., with 175,000 lbs. on drivers; cylinders, 22 in. by 28 in.; diameter of drivers, 50 in.; straight top boiler, with a working steam pressure of 200 lbs.; total heating surface, 3,298 sq. ft.; 406 tubes, 2 in. in diameter by 14 ft. 9 in. long; firebox, 114 in. by 72 in.; grate area, 57 sq. ft.; tank capacity, 5,500 gallons, and coal capacity, six tons. The special equipment will include Westinghouse air-brakes, Pneumatic bell ringer, Magnesia boiler lagging, Tower couplers, Schroeder headlights, Sellers injectors, United States piston rod and valve rod packing, Leach sanding devices, Detroit sight-feed lubricators, Railway Steel Spring Company's springs, and Walschaert valve gear.

The Central of Georgia, as reported in our issue of March 23, has ordered 25 simple consolidation freight (2-8-0) locomotives, 10 simple Pacific passenger (4-6-2) locomotives, and five six-wheel simple switching (0-6-0) locomotives from the Baldwin Locomotive Works, all for October and November delivery. Fifteen of the consolidation locomotives will weigh 156,940 lbs., with 140,740 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 56 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,209.3 sq. ft.; 271 Detroit steel tubes, 2 in. in diameter and 14 ft. 8 in. long; carbon wide firebox, 96⅛ in. x 66⅛ in.; grate area, 44.1 sq. ft., and tank capacity, 6,000 gallons. The other 10 consolidation locomotives will weigh 197,750 lbs., with 176,650 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 57 in.; straight top boiler, with a working steam pressure of 200 lbs.; heating surface, 3,517 sq. ft.; 403 Detroit steel tubes, 2 in. in diameter and 14½ ft. long; wide carbon firebox, 108 in. x 71¾ in.; grate area, 53 sq. ft.; tank capacity, 7,500 gallons, and coal capacity, 12½ tons. The Pacific locomotives will weigh 184,200 lbs., with 117,700 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 68 in.; straight top boiler, with a working steam pressure of 200 lbs.; heating surface, 3,357.5 sq. ft.; 280 Detroit steel tubes, 2¼ in. in diameter and 19 ft. 5 in. long; wide carbon firebox, 102⅜ in. x 66 in.; grate area, 46.8 sq. ft.; tank capacity, 7,500 gallons, and coal capacity, 12½ tons. The switching locomotives will weigh 145,800 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; wagon top boiler, with a working steam pressure of 185 lbs.; heating surface, 2,473 sq. ft.; 300 Detroit steel tubes, 2 in. in diameter and 15 ft. 1½ in. long; carbon wide firebox, 65⅛ in. x 65¼ in.; grate area, 29.68 sq. ft., and tank capacity, 4,000 gallons. The special equipment for all includes: Westinghouse air-brakes, Gollmar bell ringer, magnesia boiler lagging, Simplex brake-beams for 15 consolidation and switching locomotives, and Diamond Special brake-beams for the other locomotives, Perfecto and Lappin brake-shoes, Tower couplers, Pyle-National headlights for consolidation and Pacific locomotives and Dressel headlights for switching locomotives, Nathan Simplex injector, Ajax journal bearings, U. S. piston and valve rod packings, Ashton safety valves and steam gages, Leach sanding devices for consolidation and Pacific locomotives, and Economy sanding devices for switching locomotives, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs and Gold steam heat equipment for Pacific locomotives. Other specialties are: Miner gravity side bearings for consolidation and Pacific locomotives, Linstrom tank valve fixtures, Philip's double boiler checks, Elvin driving box lubricators for consolidation and Pacific locomotives, Bordo blow-off cocks for consolidation and switching locomotives, Homestead blow-off cocks for Pacific locomotives, and Westinghouse friction draft gear for consolidation and Pacific locomotives.

CAR BUILDING.

The Tacoma & Eastern Lumber Co. is building 50 logging cars at its own shops.

The Chicago Great Western, it is reported, is in the market for additional freight equipment.

The Canadian Northern has ordered six standard second-class tourist cars from Rhodes, Curry & Co.

The Hastings Express Co., Chicago, has purchased two furniture cars from Robert M. Burns & Co., Chicago.

The Mexican International has ordered 100 box cars of 80,000 lbs. capacity from the American Car Co. for 1906 delivery.

The Minnesota Land & Construction Co., Duluth, Minn., has ordered 75 logging cars from the Russell Wheel & Foundry Co.

The National of Mexico, as reported in our issue of March 9, has ordered 300 box cars of 80,000 lbs. capacity from the American Car Co., for 1906 delivery.

The Mobile & Ohio, it is reported, has ordered 600 freight cars of 60,000 lbs. capacity and 10 furniture cars of 60,000 lbs. capacity from the American Car & Foundry Co.

The Los Angeles & Redondo is building 10 interurban cars and 10 flat cars of 80,000 lbs. capacity at its Redondo shops. The interurban cars will be 44 ft. 6 in. long by 8 ft. 3 in. wide over all.

The Great Lakes Coal Co. has ordered 15 flat cars of 60,000 lbs. capacity from the Erie Car Works. These cars will weigh about 23,000 lbs., and measure 35 ft. long and 8 ft. 8 in. wide, over all.

The Atchison, Topeka & Santa Fe has ordered 1,000 box cars and 60 baggage cars from the American Car Co., 100 ballast cars from the Rodger Ballast Car Co., and 200 flat cars from the Pressed Steel Car Co.

The Lake Champlain & Moriah has ordered 25 steel "Jimmy" cars from the Pressed Steel Car Co. These cars will weigh 4,500 lbs. each and will have a capacity for 19 tons. The dimensions are 10 ft. long by 6 ft. wide by 6 ft. 9 in. wide inside. The bodies and underframes are of metal. The special equipment includes Monarch couplers.

The Chicago, Burlington & Quincy is considering the purchase of 17 additional chair cars. These cars are estimated to weigh about 110,500 lbs. each, and to measure 69 ft. 6 in. long by 9 ft. wide by 9 ft. 6 in. high, inside measurements. The special equipment will include the Chicago, Burlington & Quincy bolsters, brake-beams, brasses and trucks.

The Nashville, Chattanooga & St. Louis is receiving bids for 500 standard 36-ft. 60,000 lbs. capacity box cars, and will in the near future commence on an order of 500 standard 36-ft. 80,000 lbs. capacity flat bottom drop door coal cars, to be built at its own shops. These cars will be duplicates of previous cars of this type built at these shops during the past three years, specifications of which have from time to time been printed in the *Railroad Gazette*.

The Stockton Electric Railroad, Stockton, Cal., has ordered 40 cars from the St. Louis Car Co., for April delivery. These cars will be 33 ft. 6 in. long, 11 ft. 10½ in. wide, and 11 ft. 7 in. inside measurements. The special equipment will include the Brill axles, bolsters, brake-beams, brake-shoes, brakes, brasses, journal boxes, springs and trucks; St. Louis car couplers and curtain fixtures, Pantasote curtain material, Valentine paint, Monitor roofs, and Griffin car wheels.

The United Railways & Electric Co., Baltimore, has ordered 100 double-truck semi-convertible cars from the J. G. Brill Co. These cars will have a seating capacity for 44 passengers. They will weigh 45,000 lbs. and will measure 29 ft. 9½ in. long by 8 ft. 2 in. wide inside. The bodies and underframes will be of wood. The special equipment will include American Brake-Shoe & Foundry Company's brake-shoes, Van Dorn couplers, Keeler curtain fixtures, Pantasote curtain material, Brill journal boxes and Brill's 27 G. E. I. forged side frame trucks.

The Georgia Southern & Florida is building 500 flat cars of 60,000 lbs. capacity at its Macon, Ga., shops, for November delivery. These cars will weigh 26,500 lbs. and measure 40 ft. long and 9 ft. wide, over all. The special equipment includes: J. R. Johnston Co.'s steel axles, American cast-steel body bolsters and Simplex truck bolsters, Simplex brake-beams, Westinghouse air-brakes, Ajax brasses, Climax couplers, Miner tandem draft rigging, Symington journal boxes, Sherwin-Williams paint, Railway Steel Spring Co.'s springs, arch-bar metal trucks and Decatur wheels.

The British Columbia Electric Railway Co., New Westminster, B. C., will build 20 cars at its New Westminster shops. Eighteen will be for passenger service and two for freight service. The passenger cars will be of the Narragansett type and will have a seating capacity for 48 persons. They will weigh 19 tons each, and will measure 30 ft. 2 in. long by 7 ft. 2⅞ in. wide by 8 ft. 4¾ in. high, all inside dimensions. The bodies and underframes will be of wood and metal. The special equipment will include Brill trucks, National Wheel Company's wheels, and Pantasote curtain material.

The Alabama Great Southern, as reported in our issue of March 23, is in the market for 1,000 box cars of 60,000 lbs. capacity, 250 self-clearing steel hopper coal cars of 100,000 lbs. capacity, 250 40-ft. flat cars of 80,000 lbs. capacity, 250 drop bottom coal cars of 80,000 lbs. capacity, and 250 drop bottom coke cars of 60,000 lbs. capacity. The box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The steel hopper coal cars will be 30 ft. long and 9 ft. 6 in. wide, inside measurements. The drop bottom coal cars will be 37 ft. 8 in. long, 8 ft. 5 in. wide and 45 in. high, inside measurements. The coke cars will be 39 ft. 4 in. long, 8 ft. 3 in. wide and 6 ft. 10¼ in. high, inside measurements. The special equipment for all of these cars are the same as for the Cincinnati, New Orleans & Texas Pacific reported in our issue of this week.

The Cincinnati, New Orleans & Texas Pacific, as reported in our issue of March 23, is in the market for 1,250 hopper cars of 60,000 lbs. capacity, 1,000 box cars of 60,000 lbs. capacity, 250 40-ft. flat cars of 80,000 lbs. capacity, 250 drop bottom coal cars of 80,000 lbs. capacity, and 250 drop bottom coke cars of 60,000 lbs. capacity. The hopper cars will be 25 ft. 7¼ in. long and 7 ft. 7 in. wide, inside, and 9 ft. 2⅝ in. high, over all. The box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The coal cars will be 37 ft. 8 in. long, 8 ft. 5 in. wide and 45 in. high, inside measurements. The coke cars will be 39 ft. 4 in. long, 8 ft. 3 in. wide and 6 ft. 10¼ in. high, inside measurements. The special equipment for all will include: Buffalo brake-beams, Westinghouse air-brakes, R. E. Janney couplers, Jones doors for box cars, Miner tandem draft rigging, Harrison dust guards, Symington journal boxes, Chicago roofs for box cars, Pittsburg springs and arch-bar trucks.

BRIDGE BUILDING.

BIRMINGHAM, ALA.—The bids recently submitted for building nine steel bridges in Jefferson County have all been rejected by the Board of Revenue and new ones will shortly be asked. H. W. Cook is a member of the board.

BRANDON, MAN.—The Railway Commission has granted permission to the Brandon, Saskatchewan & Hudson Bay to build a bridge over the Souris river near this place.

DOAKTOWN, N. B.—Amasa Killam, bridge inspector of the Intercolonial Railway, has decided on a new steel structure, 160 ft. long, to replace the present bridge here.

HAZELHURST, MISS.—Bids are wanted April 2 by J. H. Long, County Clerk, for building a steel bridge 120 ft. long over Saddlers creek in Copish County.

JOLIET, ILL.—Representatives of six railroads entering Joliet have signed an agreement that work will be started within 30 days, as provided in an ordinance passed in January, for elevating the tracks through the city, at a cost of about $3,000,000.

LONDESBORO, ONT.—A steel bridge is to be built over the Mailland river here. James Campbell may be addressed.

LONDON, ONT.—A new steel bridge will be erected between the townships of Caradoc and Lobo, in Middlesex County.

MEDICINE HAT, ALB.—The Alberta Government will provide $50,000 this year to build the abutments and foundations for a highway bridge over the Saskatchewan river at this place. Mayor Forster may be addressed.

MILWAUKEE, WIS.—Work on the new Grand avenue viaduct is to begin early in May. Funds amounting to $450,000 will shortly be available for this purpose.

MONTANA.—A bill has been introduced in the House of Representatives and was passed by the United States Senate on March 23, authorizing a bridge across the Yellowstone river, in Custer County, Montana.

MONTCLAIR, N. J.—The Delaware, Lackawanna & Western has agreed to begin work shortly on a viaduct to carry its tracks over Bloomfield avenue. The cost of the work will be about $60,000, one-half of which is to be paid by the railroad and the balance by the street railroad and the county.

MONTREAL, QUE.—The Harbor Board has consented to the building of a new highway bridge from Commissioner's street to Victoria pier, to cost $11,000.

PEORIA, ILL.—Work is soon to be started on a proposed bridge over the Illinois river at the foot of Walnut street.

PINE BLUFF, ARK.—A site is being selected for building the proposed highway bridge over the Arkansas river at this place.

PINKERTON, ONT.—Sealed bids will be received by J. J. Donnelly, clerk township Greenock, for the erection of a 90-ft. span, 14-ft. roadway, Warren truss steel bridge over the Teeswater river, side line 5, township of Greenock; also for the erection of a 110-ft. steel bridge over the Teeswater river, concession 8, Greenock. Plans to be submitted by parties tendering.

PORTAGE LA PRAIRIE, MAN.—The Midland Railway has submitted plans for a steel bridge, 400 ft. long, to be built over the Assiniboine river at this place.

PROVIDENCE, R. I. Application has been made to the War Department by the New York, New Haven & Hartford for permission to build a drawbridge over the Seekonk river between the Twin Line and Red bridge.

SOUTH DAKOTA.—A bill was passed by the United States Senate on March 23, and is before the House of Representatives, authorizing a bridge across the Missouri river between the counties of Walworth and Dewey, S. Dak.

TACOMA, WASH.—Bids are wanted April 6 by the Board of County Commissioners of Pierce County for building the Crocker

bridge near Crocker, in Pierce County. I. M. Howell is County Auditor.

Tuscaloosa, Ala.—Negotiations are under way for building a bridge 400 ft. long over the tracks of the Alabama Great Southern on Second avenue.

Washington.—The United States Senate on March 23 passed bills authorizing bridges across the Columbia river between the counties of Franklin and Benton, and between Douglas and Kittitas; and across the Snake river between the counties of Whitman and Columbia, in the state of Washington. Bills authorizing the two bridges across the Columbia have also been introduced in the House of Representatives.

Winnipeg, Man.—The City Engineer has been asked to report on the cost of a steel overhead bridge over the Canadian Pacific tracks.

Other Structures.

Chicago, Ill.—Announcement has been made that the Chicago, Milwaukee & St. Paul will shortly begin work on large additions to its Chicago shops.

Huntington, L. I.—The Long Island has bought ground as a site for a new passenger station.

Omaha, Neb.—Work is to be started at once by the Union Pacific improving its passenger terminals at a cost of $150,000.

Rochester, Pa.—Plans have been completed for additional improvements to be made by the Pennsylvania to its yards at Conway. The work includes the building of an additional roundhouse with a radius of 187 ft., with stalls for 41 engines. An outside turntable will also be put in, and a coaling station and ashpits for handling 150 engines a day; and a large storehouse and office building, two stories high.

St. Louis, Mo.—The Wabash, it is said, has bought eight city blocks as a site for new freight yards.

Tampa, Fla.—The Tampa Terminal Co. has been organized to build terminals for the Seaboard Air Line on Grassy Island at the mouth of Hillsboro river, at a cost of about $300,000. Work is to be started shortly.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alaska Central.—This company, which is building a line from Seward, on Resurrection Bay, north to Fairbanks, 490 miles, has completed 49 miles of road, and 25 miles of the line is now in operation. The company will put a large force of men at work this year on the road. The extension will be through a rich mineral, coal and timber section.

Alberta & Flathead.—Application has been made to the Dominion Parliament by A. C. Kommis, of Pincher Creek, Alb., for permission to incorporate a company under the above name to build a railroad from a point on the Crow's Nest branch of the Canadian Pacific, near Pincher station, to the Waterton Lakes; thence to the eastern boundary of British Columbia at Flathead river, and up that river to its source. Also for permission to build branches not to exceed 40 miles in length.

Atchison, Topeka & Santa Fe.—This company has had the charter of the Jasper & Eastern amended, permitting it to extend and build a branch line from a point between De Ridder and Alexandria, on the main line of its projected road in the Parish of Vernon, La., southeasterly through Vernon, Rapides and Calcasieu parishes, to a point on the St. Louis, Watkins & Gulf, between Woodworth and Oberlin, approximately 30 miles.

Bowling Green & Western.—Incorporation has been granted a company under this name in Kentucky to build a railroad from Bowling Green to Horsebranch, where a connection will be made with the Illinois Central. Surveys have been completed and construction work is to be started about the first of June. The road will traverse a rich coal and mineral section. The directors include: J. T. Sweeney, A. H. Taylor, of Bowling Green; W. A. Helm and J. M. Carson, of Morgantown.

Brooklyn Rapid Transit.—The New York City Rapid Transit Commission has formally approved the plans to build a subway to Coney Island, as an extension of the Fort Hamilton route. The line will run from Atlantic and Flatbush avenues, in Brooklyn, through Fourth avenue to 40th street, New Utrecht avenue to 86th street; at a point between 23d and 24th avenues it will reach the surface and run on an elevated structure through Stillwell avenue to Coney Island.

Canadian Northern.—This company intends to build this year the first link in the Hudson Bay line, an extension 92 miles long from Etoimian, on the Prince Albert branch, northeast to The Pass. The extension will run through the Carrot river country, one of the best wheat regions in Canada. It will probably be completed, next year, to Fort Churchill, on the west coast of Hudson Bay.

Two branches each 25 miles long from the main line, which now reaches Edmonton, will be built this year.

Canadian Pacific.—Sub-contracts for grading 80 miles of this company's line between Strassburg and Saskatoon will shortly be let. The British Columbia Contract Co., of Vancouver and Calgary, of which George H. Webster is manager, can furnish information.

Contract has been given by this company to J. D. MacArthur, of Winnipeg, for building 40 miles of its Wolseley-Reston branch, also for building the Winnipeg Beach line extension.

This company is asking bids for building the Stonewall-Manitoba branch and for straightening the main line on the Medicine Hat division.

This company, it is said, proposes to build a line to Portland, Me., and surveys from the existing lines have been under way for some time. Negotiations are under way for securing a water front at South Portland.

Chicago, Milwaukee & St. Paul.—The city of Milwaukee, Wis., is reported to have passed an ordinance requiring this company to elevate its tracks in that city.

The City Council of Seattle, Wash., after deliberating more than two months, has granted the application of this company, permitting it to enter that city. According to the statement of an official, construction of the Washington division of the Pacific coast line will be started in Washington within the next two weeks.

Denver, Laramie & Northwestern.—This company was recently granted a charter in Colorado, with a capital of $5,000,000, and the first board meeting has been held, at Laramie, Wyo. The charter grants power to build a railroad from Denver, through Denver, Jefferson, Adams, Boulder, Walden and Laramie Counties, Colo., and through Albany, Carbon, Natrona, Fremont and Big Horn Counties in Wyoming, to the northern boundary of Wyoming—a total of about 450 miles. The directors say that they have no connection with other roads, and that the necessary funds to carry out the work have been secured. The officers are: S. Johnson, President; W. R. West, Vice-President; R. H. Dwyer, Second Vice-President and General Manager; S. Kent, Third Vice-President; J. O. Curry, Treasurer, and J. T. West, Secretary.

Edgewater Connecting.—See Missouri Pacific.

Erie, London & Tilsonburg (Electric).—Application has been made by this company for a charter to build an electric road from Port Burwell along the north shore of Lake Erie to London, Ont., 34 miles.

Galveston, Beaumont & Northeastern.—A charter has been granted a company under this name in Texas, with a capital of $100,000, and with office at Beaumont. The company proposes to build a railroad from Beaumont, through the counties of Jefferson, Orange, Jasper and Newton, to a point on the Sabine river in the northeast corner of Newton County. The incorporators are T. E. Meece, C. S. Marshall, B. I. Sparks, C. H. Moore, M. Stuart, K. Moore, of Galveston, and E. H. Greer, Jr., of Beaumont.

Gulf & Ship Island.—See Mississippi Garden.

Gulf, Colorado & Santa Fe.—Notice has been filed by this company that it will build about 500 miles of railroad in Texas. Under the charter of the Pecos & Northern Texas, plans have been made for a branch line from a point on the main line in Parmer County, near the western boundary of the State of Texas, southeast to Brownwood, in Brown County, about 350 miles. Also for a branch from a point near Canyon, in Randall County, to the southern boundary of Lubbock County, an addition of 125 miles.

Hampton & Yorktown (Electric).—An officer writes that this company, incorporated in Virginia to build an electric road from Hampton to Yorktown, 19 miles, is now making surveys and will begin construction work as soon as financial arrangements which are now under way have been completed.

Hillsboro Northeastern.—Application has been made by this company, which operates five miles of road in Wisconsin, for permission to extend its line from Hillsboro, in Vernon County, west and southwest to Richland Center in Richland County, 28 miles.

Interurban.—This company has been incorporated in Ohio to build an electric line from South Lebanon east to Morrow, about five miles. The proposed line is to form a division of the Interurban Railway & Terminal Co.

Jasper & Eastern.—See Atchison, Topeka & Santa Fe.

Kamloops, Boundary & Cariboo.—Application has been made to

the Dominion Parliament by Pringle & Guthrie, Solicitors, of Ottawa, for permission to incorporate a company under the above name to build a railroad from the city of Grand Forks, in British Columbia, north, following the valley of the North Fork of the Kettle river to Franklin Camp and Fire Valley, and thence northwest to Grand Prairie.

Kansas City, Tulsa, Texas & Gulf.—Bids are soon to be asked by this company, which was recently organized, for building a road from Kansas City to Matagorda, Tex. Negotiations are under way for land at the latter place for terminal and port facilities. D. B. Merry, of Tulsa, is Chief Engineer.

Kentucky Valley.—An officer writes that this road has been completed from Providence, Ky., via Montezuma to Wheatcroft, 10 miles, and that it was put in operation this month.

Louisiana Roads.—The city of Monroe is building an electric line 6½ miles long. The Western Electrical Construction Co., of St. Louis, Mo., is doing the work. George Selman is City Engineer.

Mexican Central.—This company is planning to build a large terminal and secure port facilities at Manzanillo, on the completion of its line to that port. About 1,000 acres of land has been bought, a yard will be laid out and new shop buildings will be put up. The company has already built a sea wall along the harbor front for about one mile, and a breakwater for about half this distance. On the completion of its line it will have a direct connection to the port of Tampico. Part of the line from Calamena to Manzanillo will consist of an existing road recently bought from the National Construction Co., which is to be rebuilt.

Mexico City Roads.—The government railroads—the National, the Interoceanic, the International and the Vera Cruz & Pacific—have joined in an application to the federal authorities for a concession to build a belt railroad around Mexico City. The San Rafael & Atlixco Railroad Company is also interested in the project.

Mississippi Central.—This company has organized the Natchez & Eastern, in Mississippi, to build an extension from Brookhaven west to Natchez, about 70 miles.

Mississippi Garden.—Incorporation has been granted a company under this name in Mississippi to build a railroad from Hattiesburg north through Perry, Jones, Covington, Smith, Scott and Leake counties to Carthage. The incorporators are: G. A. Flater, of Toledo, Ohio; S. P. Floeter, of New Albany, Miss., and W. F. Floeter, of Taylorsville, Miss. This line is projected over the route that was selected by the Gulf & Ship Island for its road before it was decided to build to Jackson, and it is thought that the G. & S. I. is behind the project.

Missouri, Kansas & Texas.—See New Orleans, Crowley & Western.

Missouri Pacific.—Under the name of the Edgewater Connecting, a charter has been granted a company in Kansas City, with a capital of $500,000, to build a line, two miles long, to connect the Missouri Pacific with the Chicago Great Western in Kansas City. B. T. Waggner and J. W. Orr, of Atchison, are directors.

The St. Louis, Iron Mountain & Southern has begun train service from Latour, Ark., south to McGehee, Ark., 81.76 miles. This part of the line will be known as the Latour District of the Memphis Division.

Natchez & Eastern.—See Mississippi Central.

New Orleans, Crowley & Western.—This company has been recently incorporated to build a line from New Orleans to a point in Texas to connect with the Missouri, Kansas & Texas, which is supposed to be back of the project. The Franklin & Abbeyville road, 32 miles long, is to be taken over by the new company. W. F. Owen, formerly Superintendent of Morgan's Louisiana & Texas Railroad, is President of the company.

North Coast.—It is said that this road, projected to run from Walla Walla, Wash., northwest through North Yakima to Seattle, has, through its promoter, Robert E. Strahorn, bought the Spokane-Columbia River & Navigation Co., which was started by farmers to build a line from Ringold Bar, Wash., on the Columbia river, northeast through Connell 153 miles to Spokane. Rights of way for the latter road have been secured, and grading has been completed for 26 miles. With this acquisition the construction of the North Coast into Spokane is believed to be insured. Connection with the new line will be made at Pasco, completing an additional line across the State of Washington.

Norfolk & Western.—The route of the proposed belt line to reduce the grades around Lynchburg, Va., which this company will build, is from Forest depot, on the main line, to Concord, about 23 miles. The new line will shorten the distance over the existing road about two or three miles, and will avoid the heavy grades at the Concord Hill.

Oregon Railroad & Navigation.—This company is reported having authorized the rebuilding of its line from Troutdale, Ore., to Bonneville, 17 miles, to eliminate severe curves. Surveys are being made and contracts are to be let as soon as the surveys are completed.

Oregon Short Line.—This company, it is said, will build a 20-mile extension of its Minidoka branch from its present terminus at Twin Falls, Idaho, to a new town called Buhl. Also a branch from a point half way between St. Anthony and Marysville on the Idaho Falls branch southeast, and three additional lines in Idaho, the routes of which have not yet been announced.

Pacific & Eastern.—Application has been made to the Dominion Parliament by Belcourt & Richie, of Ottawa, for incorporation of this company, to build a railroad from Victoria, B. C., to the northern end of the island of Vancouver, thence to Bute Inlet and east through the district of Cariboo via Yellow Head Pass to Edmonton, Alberta; thence continuing east to Prince Albert, Sask., and thence to Fort Churchill on Hudson Bay, with a branch from Edmonton northwest to Dungevan on the Peace river.

Pecos & Northern Texas.—See Gulf, Colorado & Santa Fe.

Pennsylvania.—Announcement has been made that the West Penn division of this road is to be improved at a cost of $3,500,000. The plans call for a large yard at Sharpsburg, to cost $2,500,000; the rebuilding of the line from Tunnelton to Blairsville, and the double-tracking of the remaining portion of the division. The ruling grade will be reduced from one per cent. to three-tenths of one per cent. Work on the Sharpsburg yard will be commenced as soon as litigation, now pending to secure some of the property, is concluded. The new line will form part of a two-track low-grade line from Bolivar to Allegheny, 75 miles. Additional bridges will be built over the Conemaugh. Contracts for this work are to be let early next month.

This company, it is said, has let contracts for improvements to be made in the Pitcairn yards, to cost $2,000,000. The work includes about 60 miles of new track and two large storage sheds, each 1,000 ft. long. It calls for the excavation of about 800,000 yards of earth, the laying of 10,000 yards of masonry, and 20,000 yards of foundation excavation.

Philadelphia & Western.—See Philadelphia Rapid Transit.

Philadelphia Rapid Transit.—The arrangement between this company and the city of Philadelphia for the relinquishment by the company of its rights in certain streets and the immediate construction of elevated or subway lines in other streets, which was noticed in the *Railroad Gazette* last week, page 88, General News Section, is said to have been practically agreed upon, and it was expected that the necessary ordinance would be signed this week. The engineering force of the Rapid Transit Company is working night and day on the plans for the subway in Broad street and for the elevated line to Frankford. Under the terms of the agreement these plans must be ready by June 1, and work must be begun within a month after they are approved by the city authorities. The Philadelphia & Western, whose application for a franchise was also noted last week, has made no further announcement concerning its plans.

Rockford Railroad.—Incorporation has been granted this company in Illinois, with a capital of $10,000, to build a belt line in the city of Rockford. The office of the company is at Chicago, and the incorporators are B. F. Lee, A. F. Humburg, S. F. Andrews, C. E. Foreich and W. E. Claflin, of Chicago.

Southern.—This company is reported making surveys near its Nashville division between Monterey and Harriman, Tenn., for the construction of short lines into the coal fields of that district. Preliminary surveys have been completed from Crossville to a point on the Big Laurel river, 20 miles.

Texas, New Mexico & Pacific.—The Rock Island Construction Co., which has the general contract to build this road, has sublet some of the work to Callahan & Frye, who are to begin work within a month. The graders will begin at McKinney, and work west, and it is expected to have the line completed to Bridgeport or to some point on the western boundary of Wise County within one year. (See Construction Record).

Texas Railway.—This company has been organized in Texas with office at San Antonio and a capital of $1,000,000, to build a railroad from San Antonio southeast to Port O'Connor, on Matagorda Bay, 210 miles, with a branch from Yoakum to La Grange, 32 miles. The incorporators include Samuel Granat, of New York City; Joseph Faust, Harry Landa, William Clemens, of New Braunfels, Texas; John Sullivan, of Oklahoma City, Okla.; J. P. Barclay, M. Goggan, William Aubrey, W. W. Lipscomb, M. Hicks, T. L. Conroy, W. C. Rigsby, C. H. Florian and M. S. Blackburn, all of San Antonio; B. N. Peck, of Gonzales, W. L. Johnson and Ed B. Caruth, of Yoakum.

Texas Roads.—Plans are being made by Charles M. Schwab

and other eastern capitalists to build a railroad from Vernon, Tex., to Roswell, N. Mex., about 365 miles. J. E. Lutz, of Vernon, Tex., is the local representative. Temporary surveys have been made.

Tidewater.—Announcement has been made by Raymond DuPuy, General Manager of this road, that the company has bought four acres of land on Main and Bermuda streets, in Norfolk, Va., adjoining the freight terminals of the Norfolk & Western. This will be used as a site for a passenger station and freight yards.

Vicksburg, Natchez & Gulfport. Application has been made by this company for a charter in Mississippi to build a railroad from Vicksburg southeast to Gulfport, about 225 miles, with a branch from Natchez east through the counties of Adams, Franklin, Amite and Pike to a junction with the main line, an additional 100 miles.

Western Pacific.—The Los Angeles (Cal.) City Council has granted a franchise allowing a steam railroad permission to lay tracks from the eastern limits of the city along the Los Angeles river to Aliso street. It is surmised that the Western Pacific is behind the application.

Yosemite Valley.—This company has completed grading on a large part of its road from Merced, Cal., northeast about 60 miles, to the Yosemite Valley, and will have all but 12 miles of track laid early this summer.

RAILROAD CORPORATION NEWS.

Allegheny Valley.—The stockholders at their recent meeting refused to approve the proposed merging of the company with the Pennsylvania. (March 9, p. 80).

Atchison, Topeka & Santa Fe.—Gross earnings for the month of February were $6,487,557, which compares with $4,669,306 during the same month of 1905, and $5,346,860 in 1904.

Aurora, Elgin & Chicago (Electric).—Under the above name the Elgin, Aurora & Southern, the Aurora, Elgin & Chicago, and the Cook County & Southern have been merged. The total length of the lines is 150 miles, and the new company will be capitalized at $6,200,000. The $1,500,000 6 per cent. cumulative preferred stock of the old Aurora, Elgin & Chicago will be exchanged for $1,800,000 new cumulative preferred stock, and the $3,000,000 common stock will be exchanged for the same amount of new common stock. Every 100 shares of the $2,000,000 stock of the E., A. & S. will be exchanged for 65 shares of new preferred stock, and the $100,000 Cook County & Southern stock will be exchanged share for share for the new common. The new company will take up the $5,500,000 bonds of the old companies, issuing in exchange for them part of the new $25,000,000 5 per cent. bonds. The issue of these is to be voted on at a special meeting of the stockholders in the latter part of May.

Baltimore & Ohio.—Gross earnings for the month of February were $5,802,508, an increase of $1,057,848.
See Washington Branch.

Chicago Great Western.—This company is to issue $1,000,000 additional 5-year notes for equipment purposes.

Darien & Western.—See Georgia Coast & Piedmont.

Georgia Coast & Piedmont.—Under this name the Darien & Western and the Reidsville & Southeastern are to be consolidated. (Oct. 6, p. 112).

Holly River & Addison.—See West Virginia Midland.

Hudson Valley (Electric).—The New York State Railroad Commission has authorized this company to increase its capital stock from $3,000,000 to $5,500,000. The increase is to provide for the conversion of the $2,500,000 2 per cent. non-cumulative debenture B bonds. When the company was reorganized recently, the holders of these debenture bonds were to have the right to convert them into 5 per cent. non-cumulative preferred stock two years from the date of issue.

Illinois Central.—This company has filed a notice of agreement with various roads showing the trackage rights by which it gets an entrance into Birmingham, Ala. The I. C. is to use the Mobile & Ohio tracks from Jackson, Miss., to Corinth. It will build 80 miles from there to Haleyville, Ala., from which point it will use the Northern Alabama tracks to Jasper, Ala., and from there the St. Louis & San Francisco tracks to Birmingham. The Mobile & Ohio will have trackage rights over the new Illinois Central line from Corinth to Haleyville, and the St. Louis & San Francisco will run trains over the Illinois Central from Baton Rouge, La., to New Orleans.

Indiana, Illinois & Iowa.—Gross earnings for the year ended December 31, 1905, were $1,812,462, an increase of $110,491; net earnings, $442,569, a decrease of $3,301. The surplus after dividends was $2,123, a decrease of $17,885, 4 per cent. having been paid on the $5,000,000 capital stock as compared with 3 per cent. in 1904. There were 219 miles of road operated, a decrease of 31 miles.

Lake Shore & Southern.—The annual report of this company shows that in the year ended December 31, 1905, it acquired $14,821,900 additional stocks and bonds of other railroads. The principal new acquisitions of stock are as follows: Cleveland, Cincinnati, Chicago & St. Louis, 75,287 shares, its holdings in this property now having a par value of $18,752,700; Indiana, Illinois & Iowa, 1,274 shares, the Lake Shore now owning the entire $5,000,000 outstanding stock of this company; Detroit & Chicago, $1,000,000; Mahoning Coal R. R. common, $865,900; Mahoning Coal R. R. preferred, $399,500; North Central Michigan, 598,500; Jamestown & Franklin, $583,350; Franklin & Clearfield, $555,000; Indiana Harbor Railroad of Illinois, $500,000; Indiana Harbor Railroad of Indiana, $425,000; Detroit, Monroe & Toledo, $414,100; Sturgis, Goshen & St. Louis, $300,000; Kalamazoo & White Pigeon, $230,900; Elkhart & Western, $229,900; and East Chicago Belt Railroad, $100,000. The total par value of stocks owned or acquired under lease by the Lake Shore is $104,671,200, as compared with $90,847,300 in 1904, an increase of $13,823,900. The Lake Shore also acquired last year $200,000 Elkhart & Western first mortgage bonds, $298,000 Jamestown & Franklin first mortgage bonds, and $500,000 Jamestown & Franklin second mortgage bonds. The total par value of the bonds held by the Lake shore is $1,527,000, as compared with $529,000 in the previous year. The grand total of the par value of the stocks and bonds owned by the company is $106,198,200, carried on the books of the company at a total value of $77,892,988, as compared with a total par value in 1904 of $91,376,300, carried on the company's books at $63,019,898. The company's income from dividends and interest increased $815,906.

New York, Chicago & St. Louis.—J. P. Morgan & Co., New York, have bought an issue of $10,000,000 4 per cent. debenture bonds of 1931. The proceeds of the sale of these will be used to buy equipment and for improvements and other purposes. This issue makes the total funded debt $29,425,000, excluding $426,000 equipment notes.

New York, New Haven & Hartford.—This company has been given authority to increase its capital stock from $100,000,000 to $140,000,000. The new stock, when issued, will be used for the conversion of $30,000,000 3½ per cent. debenture bonds of 1911, at the rate of $150 of debenture bonds for $100 of stock at par. The rest is to be exchanged for the capital stock of acquired companies. There is now $80,221,800 stock outstanding, and application has been made to the New York Stock Exchange to list an additional amount, making the total $89,286,300.

Norfolk & Southern.—See Virginia & Carolina Coast.

Pennsylvania.—See Allegheny Valley.

Texas & Pacific.—Gross earnings for the year ended December 31, 1905, were $12,130,391, a decrease of $302,756; net earnings, $3,504,225, a decrease of $817,230. The surplus after charges was $1,203,042, an increase of $44,303.

Virginia & Carolina Coast.—This company is to have $25,000,000 capital stock and $25,000,000 bonds. It has just acquired the Norfolk & Southern, and its holdings are now as follows: Norfolk & Southern, running from Norfolk, Va., to Edenton, N. C., having, including branches, 223 miles of road; it has $2,000,000 capital stock, $1,655,000 first mortgage 5 per cent. bonds of 1941, and $2,790,000 first general mortgage 5 per cent. bonds of 1954 outstanding; the Suffolk & Carolina, running from Suffolk, Va., to Edenton, N. C., 75 miles; and the Pamlico, Oriental & Western under construction from New Bern, N. C., to Goose Creek, 38 miles. New construction is planned which is to make the total mileage of the Virginia & Carolina Coast about 600.

Washington Branch.—The state of Maryland has, through the Board of Public Works, accepted the offer of $2,500,000 made by the Baltimore & Ohio for the 5,500 shares of Washington Branch stock which the state holds. It is probable that the intended investigation by a state legislative committee of the disposition by the Baltimore & Ohio of Washington Branch earnings will now be dropped.

West Virginia Midland.—This company, which was incorporated last year, with a capital of $500,000, to build from Sutton, W. Va,. to Marlinton, about 50 miles, has bought the entire property of the Holly River & Addison, and will operate it, beginning April 1, without immediate change in its officers. The H. R. & A. runs from Holly Juncton, W. Va., to Webster Springs, 30 miles, and has a four-mile branch. There is $200,000 stock outstanding and $200,000 first mortgage 5 per cent. bonds of 1922.

GENERAL NEWS SECTION

NOTES.

On March 29 the number of immigrants arriving in New York from Europe was 11,383.

The Atlantic Coast Line has increased by eight per cent. the wages of about 900 station agents and telegraph operators.

It is announced in Montreal that the Grand Trunk Railway is to put up a telephone line from Portland, Me., to Chicago.

Lumber dealers in Minneapolis say that shippers in Oregon and Washington need 5,000 cars more than they can get to ship lumber to Minnesota.

The exports of grain from Philadelphia for the three months ending March 31 amounted to 11,500,000 bushels, the largest three months' business on record.

A roundhouse of the New York Central at Mott Haven, New York City, was damaged by fire on March 31; loss, including damage to several locomotives, $50,000.

The Chicago, St. Paul, Minneapolis & Omaha has adopted a pension plan and it went into effect on April 1. The plan is similar to that of the Chicago & North-Western.

The readjustment of wages which has just taken effect on the New York, New Haven & Hartford, increases by eight per cent. (average) the pay of about 2,000 yardmen.

R. D. Wood & Co., tried at Philadelphia last week for accepting unlawful rebates on shipments of iron pipe to Winnipeg, were acquitted by the jury, which was out only 20 minutes.

Pennsylvania papers report that officers of the Pennsylvania Railroad who receive house rent, fuel and light from the company are hereafter to be charged for these services, and to have their salaries adjusted accordingly.

Both houses of the Ohio legislature have passed a bill creating a state railroad commission of three members, to be a "strong" commission. At present Ohio has a single commissioner, who does not exercise important functions.

The Norfolk & Western is to establish a large experimental farm near Ivor on its line in Southampton County, Va. Liberal terms will be offered to settlers and contracts have been awarded for the construction of 50 houses.

A conductor and a signalman of the Atchison, Topeka & Santa Fe have been indicted by the Grand Jury at Peoria on a charge of manslaughter for causing a collision between a passenger train and a freight at Chillicothe Ill., in the month of January.

The Commercial Club of Louisville, Ky., has sent to about 100 general passenger agents copies of a list of 35,000 persons, former residents of Kentucky, who have been invited to attend an "old home week" at Louisville next summer. It is expected to gather many more names to send out later.

Those enterprising railroad officers of the West who have sent out missionary trains to enlighten the farmers have stirred even the effete East. The Boston & Maine has equipped a "farming special" train of four or five cars, which is to be sent on a tour through Massachusetts, Vermont, New Hampshire and Maine.

The United States Circuit Court of Appeals, sitting at New Orleans, has granted a permanent injunction against ticket brokers, forbidding them to deal in non-transferable tickets. The suit was begun in May, 1903, and the case has been persistently contested by the brokers, who endeavored to have the injunction confined to the particular issues of tickets which occasioned the suit.

The Federal Grand Jury in New York city has found indictments against the New York Central & Hudson River Railroad and the American Sugar Refining Company for giving and receiving illegal rebates on shipments of sugar to western cities. The rebates are said to have amounted to from two cents to five cents per 100 lbs., and to have been paid in the shape of transfer and trucking charges.

The Erie road has laid off considerable numbers of car shop men (apparently for a very short time), and the newspapers report that other roads in the anthracite coal region are taking or will take similar action. One account says that repair work is light because the winter has not been severe and another says that the road is reducing expenses in preparation for loss of traffic by reason of the expected strike of coal miners. On April 2 the Chicago & Eastern Illinois laid off 500 shopmen and considerable numbers of trainmen on account of the expected strike in the coal mines. The Philadelphia & Reading and the Vandalia are said to have confiscated large quantities of coal in transit. The Receiver of the Pere Marquette, anticipating a scarcity of coal, announced last week the suspension of 22 regular passenger trains.

The Lower House of Congress on Monday of this week passed a "personal liability bill" suspending the common law rule which bars a recovery of damages for the personal injury or death of an employe caused by the negligence of a fellow-servant. It makes both parties responsible for their own negligence, and renders void any contract intended to restrict the liability of the employer for the negligence of the employee.

According to Los Angeles papers the damage done by floods last month on the San Pedro, Las Angeles & Salt Lake Railroad will aggregate many hundreds of thousands of dollars, and it was estimated that two weeks' time would be required to put the road in running order. One acount said that the roadbed had been destroyed for 100 miles. Within two or three days after the damage was done, 900 men were put at work to restore the track.

Cornelius J. Jackson, the signalman who was on duty at Fifty-third street, New York city, on the Elevated Railroad, last September, when a train was derailed by running too rapidly over a curve, resulting in eight or more fatal injuries to passengers, has been indicted by the Grand Jury and charged with manslaughter in the second degree. Kelly, the motorman, who was the one directly chargeable with causing the derailment, ran away and has never been arrested.

The Supreme Court of the United States has this week held that the Texas law providing a penalty of $25 a day for failure to furnish cars requested by shippers is unconstitutional, being so arbitrary as to amount to a burden on interstate commerce. The court held that the law made no provision for exemptions through accidents, washouts, fires or congestion of traffic—conditions which would work injustice to the railroads—and as far as it applied to interstate commerce it was unconstitutional.

Baker Street & Waterloo

The Baker Street & Waterloo was opened for traffic on March 10, from Baker Street to Kennington Road, about three miles. Its two tracks are laid in two iron tubes and the road will eventually be about four and one-half miles long, running from Paddington, on the Great Western, southeast to the Elephant and Castle. The bill permitting the construction of this line was presented to Parliament over 15 years ago, and the scheme has since been in the hands of different companies. The franchise was finally secured by the Underground Electric of London, which has completed the present portion. The existing subways run generally east and west, and the Baker Street & Waterloo aside from providing for a certain amount of north and south traffic is a step towards making the underground system of the city more unified. When completed, the line will connect with the City & South London, the London County Council tramways, the London & South-Western, the Metropolitan District, the Central London and the Great Western.

The greater part of the work was through clay, through which the tunnels were driven by a 12-ft. Greathead shield. A heading about 6 ft. in diameter was first cut by hand and then the shield was driven forward under hydraulic pressure of from 1,200 to 1,600 lbs. per sq. in. The tube was built in behind the shield in 20 in. segments, the space left between the tube and the face of the clay being filled with grouting of lime and water. Progress was at the rate of about 73 ft. a week. The road passes under the Thames between Trafalgar Square and Waterloo Station, and, the bed of the river being composed of gravel, the above method of construction had to be modified. Holes were bored in the heading in front of the cutting edge and filled with clay, so that when the shield was driven forward it left a tunnel lined with packed clay and gravel, in which the segmental tube was built as before.

The electric power is generated at the Lots Road power station of the Underground Electric Company, and there are three substations at Charing Cross, St. George's Circus and Baker street. The current is carried on two high-tension cables and four low-tension cables hung on iron brackets on the tunnel walls. There are 37 electric elevators in all at the different stations. The cars are all steel excepting that fireproof wood is used for some of the internal fittings. The standard train in rush hours consists of six cars, a motor car at each end, with four trailers between; three-car trains are used at other times. The average speed is to be 11 miles an hour, the maximum between stations being 35 miles an hour, and the trains will run on a three minute headway, excepting early in the morning and late at night, when they will be five minutes

apart. They are to be operated only between 5 a.m. and 1 a.m. The Sprague-Thomson-Houston system of multiple control is used, and the signals are automatic and semi-automatic. The motorman is in constant communication with the stations by telephone, and automatic train stops are installed at each signal. The tunnel is lighted at intervals of 40 ft.

Government Advisory Board on Fuels and Structural Materials.

The Government through the Geological Survey and the Forest Service is engaged in investigating the properties and best methods of using the fuels and structural materials of the United States. In order that these investigations may be brought into closer touch with both the producers and users of fuels and structural materials, the President has invited selected membrs of the national engineering societies and allied organizations to form, with representatives of such Government Bureaus as are carrying on actual construction work, a National Advisory Board on Fuels and Structural Materials.

The Forest Service is now engaged in testing the strength of structural timbers, and expects in the near future to begin tests on the preservative treatment of timbers. In both of these lines it is desired to have all methods and plans of work passed upon by the advisory board.

The organizations which will be represented on the advisory board through the members thus invited by the President are given in the accompanying list.

From the American Institute of Mining Engineers: John Hays Hammond, Robert W. Hunt and B. F. Bush.
From the American Institute of Electrical Engineers: Francis B. Crocker, Henry G. Stott.
From the American Society of Civil Engineers: C. C. Schneider, Geo. S. Webster.
From the American Society of Mechanical Engineers: W. F. M. Goss, Geo. H. Barrus, P. W. Gates.
From the American Society for Testing Materials: Charles B. Dudley, Robert W. Lesley.
From the American Institute of Architects: George B. Post, William S. Eames.
From the American Railway Engineering and Maintenance of Way Association: H. G. Kelley, Julius Kruttschnitt, Hunter McDonald.
From the American Railway Master Mechanics Association: J. F. Deems, A. W. Gibbs.
From the American Foundrymen's Association: Richard Holdenke.
From the Association of American Portland Cement Manufacturers: John B. Lober.
From the Geological Society of America: Samuel Calvin, I. C. White.
From the Iron and Steel Institute: Julian Kennedy, C. S. Robinson.
From the National Association of Cement Users: Rich'd L. Humphrey.
From the National Board of Fire Underwriters: Chas. A. Hexamer.
From the National Brick Manufacturers' Association: John W. Sibley, Wm. D. Gates.
From the National Fire Protective Association: O. U. Crosby.
From the National Lumber Manufacturers' Association: Nelson W. McLeod, John L. Kaul.
From the Corps of Engineers, U. S. Army: Lieut.-Col. Wm. L. Marshall.
From the Isthmian Canal Commission: Lieut.-Col. O. H. Ernst.
From the Bureau of Yards and Docks, U. S. Navy: Civil Engineer Frank T. Chambers.
From the Supervising Architect's Office, U. S. Treasury Department: James K. Taylor.
From the Reclamation Service, U. S. Interior Department: F. H. Newell.

The Coal and Oil Traffic Investigation.

In the coal and oil investigation ordered by Congress, the Interstate Commerce Commission has directed the Pennsylvania, the Baltimore & Ohio, the Chesapeake & Ohio, the Norfolk & Western, the West Virginia Central & Pittsburg, the Buffalo, Rochester & Pittsburg and the New York Central & Hudson River to furnish the following information:

A list of the names and location of all coal mines upon lines or on other roads in which the said companies are interested, giving the rating for each such coal mine for car distribution when car distribution is made upon a basis involving the rating of mines.

A list of the names of stockholders at the last date when stock books were closed, specifying such date, and including the post-office address of each stockholder if that will not occasion delay in complying with this request; and in cases where the last dividend was paid to persons not stockholders of record, the names and post-office addresses of such persons.

A list of the names of stockholders present in person at the last annual meeting, and a list of the names of stockholders voting by proxy, together with the names of persons acting as proxy at such meeting and a blank form of the proxy used.

A map or maps of the lines of railroad owned or operated; also a map or maps of any lines of railroad in which said companies are interested.

A map or maps of the coal territories served by the said companies, or by companies in which said companies are interested, showing the location upon said lines and upon the lines of such other companies of each coal mine from which coal is offered for shipment.

Junk: High Class and Low Class.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has rendered its decision in the case of the National Machinery & Wrecking Company against the Pittsburg, Cincinnati, Chicago & St. Louis and others. A box from Georgia for Cleveland was described as one box of scrap iron, weight 3,500 lbs. The Pennsylvania raised the weight from 3,500 to 6,300 lbs., and insisted that the shipment was not scrap iron but an electric dynamo. The rate upon electric dynamos was $1.33, while that upon scrap iron was 65 cents. The consignee paid the freight, $83.79, under protest and filed complaint. The Commission holds that the defendants were justified in applying the dynamo rate, and the complaint will be dismissed; but "the rules of the carriers should be so modified that the shipper could, had he elected, have shipped this dynamo for what it was in fact, viz., junk. We do not attempt to make any order, for we have no authority to do so, but we call this to the attention of the defendants in the hope that they may give it consideration." Whether the rate on a second-hand dynamo shipped from the electric light station to the repair shop should be lower than is charged upon either a new or a second-hand dynamo sent to the station for use is a question of policy for the railroads, and the Commission cannot say that it is unjust or unreasonable to exact the same charge for the new as for the second-hand dynamo. Old dynamos which have become merely combinations of copper, brass and iron scrap and valuable only as junk should, under suitable regulations fixed by the carrier, be given the rating for junk, basing the same on the highest class metal used in the construction.

Not the Usual Program.

An attempt by seven men, wearing masks, to hold up a train on the Southern Railway was foiled on the night of April 2, at Caswell, Tenn., by the vigilance of Engineer Johnson and the bravery of Express Messenger Smith. When Johnson was coming to a halt at Caswell he noticed seven men with faces concealed run from behind the water tank, some toward the engine and others toward the express car. The engineer immediately opened the throttle, and the engine shot ahead before the robbers could reach it. Shots were fired at the engineer, but without effect. Three of the robbers, however, reached the express car, the door of which had been opened by Smith in order to put off some matter for Caswell. When the train shot ahead the messenger was quick to see that something was wrong, and as the robbers sprang to enter the car he knocked them back to the ground. Before they could get to their feet the train was running at a good speed. The robbers in their anger fired into the coaches as they passed, but did no injury.—*New York Times.*

Chicago May Own Its Street Railways.

At the city election in Chicago April 3, municipal ownership of the street railways was the main issue, and the result of the vote is that the city can proceed to acquire and control the railways but cannot operate them. But the voters, while declaring that the city should not operate the railways, declared that, as a question of public policy, it would be desirable for it to do so.

Three propositions were submitted to the voters, the first of which was: "Shall the city of Chicago proceed to operate street railways?" This proposition required 60 per cent. of the total vote cast in order to become effective. The total vote was 231,171; and there were only 120,911 affirmative votes. As a three-fifths vote was necessary, the proposition failed of indorsement by 17,792 votes.

The second proposition involved the approval of an ordinance previously passed by the City Council providing for the issue of street railway certificates, not to exceed $75,000,000, for the purchase, ownership and maintenance of the street railways. This was carried by about 3,800 votes.

The third proposition was: "Shall the City Council proceed without delay to secure the municipal ownership and operation of the street railways under the Mueller law, instead of granting franchises to private companies?" This proposition was carried by about 3,600 votes. The total vote was much larger than had been expected, and party lines were largely ignored.

The New Sudan Railroad.

The railroad which was opened between Abu Hamed and Karima, 138 miles, early in March, was made entirely with native labor in eight months. This is fast construction, for the district is hilly and difficult for engineering. Interesting pyramid fields are rendered accessible to travelers by this road and the rich province of Dongola is opened to connection with the markets of the east. The line was built under the direction of Macauley Bey and his assistant director, Midwinter Bey.

British Strategy in Afghanistan.

In the course of an interesting lecture on "The Defence of India," Lieut-Gen. Sir Edwin Collen remarked that the British could not build railroads in Afghanistan in peace time owing to a rooted idea that Great Britain wished to annex the country. Every endeavor ought to be made to broaden the views of the Afghans regarding defensive requirements. The British must continue their policy settled many years ago of linking the vantage points on the frontier with the Indian railroad system.—*London Times.*

An English Consolidation Defeated.

The proposal to transfer the Lancashire, Derbyshire & East Coast Railroad to the Great Central Company has been defeated by the powerful opposition of the Midland, North Eastern, and Lon-

don & North Western. The North Eastern contended that the proposal would give the Great Central control of the output of the Derbyshire coal fields, which would be prejudicial to the interests of the North Eastern. A clause inserted by the Committee in Parliament protecting the North Eastern led the Great Central to withdraw the bill authorizing the consolidation.

The Tattlers' Club.

The so-called "Tattlers' Club" of the Western lines is about to disband because of a lack of business, according to a statement by J. C. Stubbs, traffic director of the Southern Pacific, and chairman of the organization. The "Tattlers' Club" is a committee of executive officials, formed last winter to go to Washington and offer to aid the Interstate Commerce Commission in enforcing the laws against secret rate cutting. "There is no business for the club to perform," declared Mr. Stubbs, who has just returned from a trip through the West. "The railroad men are living up to the law, and I guess we might as well disband."—*Chicago Press Despatch.*

Still Pounding.

Senator Penrose, of Pennsylvania, has introduced in Congress once more that venerable bill "to determine the quantity of the so-called hammer blow of the counterbalance in locomotive driving wheels," etc. The bill provides for an appropriation of $50,000 to be equally apportioned between the Franklin Institute, Purdue and other institutions.

Enforcing Rates in China.

The Chinese have found a new way of raising railroad rates. We know how to make rates, but it is the Chinese who are showing how to make people pay them. In Canton the Viceroy proclaimed advanced rates on the Hankow Railroad. The merchants' guilds objected and voted not to ship any freight at those rates. Then the Viceroy threatened the merchants with death, and summoned three gunboats from Shanghai. This was reported Jan. 23, and as we hear of no bombardment at Canton, we perhaps may conclude that the merchants have come down with the freight and the money.

The "Commercial Engineer."

The Railway Club of Pittsburg now confers degrees—or at least we have received from the Secretary a paper which is very like a diploma. It is printed on recherché linen paper, and the letter press is surrounded by an ornate gilt border. It comes about in this way: Mr. George A. Post, in a paper read before the club, last October, declared that "The man who sells things is entitled to a degree"; for he has to hustle, and he has to learn more, know more and suffer more than the workman, the designer, the boss or the proprietor; and therefore Mr. Post suggests that the drummer should have the scholastic title of "Commercial Engineer." With a view to giving wider circulation to Mr. Post's breezy utterances, the club distributes to its members these special illuminated copies of his address.

English Railroads and Motor Omnibuses.

A case of considerable importance to English railroad companies has just been decided by Justice Warrington in the London High Courts. The point raised was whether railroads are entitled to run motor-omnibus services in connection with their lines for conveyance of "pick-up" passengers. The parties to the action were the municipal corporation of Birkenhead and the Mersey Railway Company. The municipality is operating an electric trolley tramroad system within its borough, and the Mersey company owns the electrified tunnel railroad connecting Liverpool with Birkenhead. The tunnel passes under the river Mersey and then the line divides into two branches, one northwest and the other to the southeast and then to the south and on to a southern suburb of Birkenhead. A large part of the railroad's business is in carrying passengers between Liverpool and Birkenhead. It was therefore a public convenience for a line of omnibuses to run between the Central Station and the residential district. The Mersey company established the motor-omnibus service for the convenience of its through passengers, but did not limit the service to this, for it conveyed at low fares many passengers from intermediate points to intermediate points. Here came in the question raised by the Birkenhead municipal corporation: Was the railroad company doing what might fairly be regarded as being incidental to its powers—namely, to build and operate a railroad. Justice Warrington has decided that it was not, and that an injunction should be granted restraining it from running omnibuses "for carrying passengers within the borough of Birkenhead."

Before the case had been heard the Mersey Company had already made application to Parliament for motor omnibus powers and its bill is shortly to come up for consideration. Municipal corporations are generally ready enough to set up competition with railroads by running electric trolley services, but in this case one of them invokes the aid of the law to prevent a railroad company from running motor-omnibus service which was competing with its tramway.

Manufacturing and Business.

S. H. Pitkin has been elected First Vice-President and General Manager of the Wellman-Seaver-Morgan Company, Cleveland, Ohio.

F. H. Rapley, formerly Assistant to the President of the Pressed Steel Car Company, has resigned and has returned to England to accept a position in a manufacturing concern.

The United States District Court of Western Pennsylvania recently dismissed two suits for patent infringement brought by the Stirling Company against the Rust Boiler Company, the court holding that there had been no infringement.

Since the election of Waldo H. Marshall to the Presidency of the American Locomotive Company several changes in the organization of that company have been made. R. J. Gross, formerly Second Vice-President, is now Vice-President, in charge of the commercial department, including domestic and foreign sales; J. E. Sague, Vice-President, is in charge of manufacturing, and Leigh Best, Vice-President and Secretary, is responsible for the corporate business of the company. A new department has been created to take care of the details of the foreign business, and will be in charge of Charles M. Muchnic, with the title of Manager Foreign Department. Mr. Muchnic, whose portrait we print, is well fitted for the work, having had both practical and commercial experience. He is a graduate of the Drexel Institute of Philadelphia (1896). In July, 1896, he was employed in the mechanical department of the Baldwin Locomotive Works, leaving there the following year to go to the Brooks Locomotive Works at Dunkirk, N. Y. During the greater part of 1899 he was engaged in locomotive designing work for the Cie. de Fives-Lille, Lille, France. For four months in 1899 and 1900 he worked in the office of A. G. de Glehn, designer of the de Glehn compound, at Mulhausen, Germany, leaving there to go with Sanders & Co., of London, export agents for a number of American industries. In 1901 he returned to this country and served successively as Chief Draftsman and Mechanical Engineer of the Wisconsin Central and Mechanical Engineer of the Denver & Rio Grande, resigning the last-named place in January, 1903, to become assistant to Mr. Gross. He accompanied Mr. Gross in that capacity on the latter's trip around the world in 1903. Mr. Muchnic has made several trips to Europe in the interests of American locomotive builders, and has naturally acquired an acquaintance among railroad officials in all parts of the world. He has a good command of several foreign languages.



C. M. Muchnic.

Iron and Steel.

The Western Maryland has given contracts for 6,000 tons of girders.

According to newspaper reports the Tennessee Coal & Iron Co., of Birmingham, Ala., is planning to build additions to its works at Birmingham and to put up a steel mill at Thomas. The syndicate of which John W. Gates is President, which recently bought a controlling interest in this company, is planning to make improvements.

Orders have recently been given for rails as follows: The Northern Pacific 30,000 tons, and the Great Northern 20,000 tons from the Lackawanna Steel Co.; the Atchison, Topeka & Santa Fe 10,000 tons from the Pennsylvania Steel Co., and 10,000 tons from the Cambria Steel Co. The latter has also received an order from the Central of Georgia for 10,000 tons, and for a similar amount from the Chesapeake & Ohio. The Buffalo, Rochester & Pittsburg has given an order for 2,000 tons, the Erie for 4,000 tons, and the Fredericksburg & Potomac, 4,500 tons. The Grand Trunk Pacific has given a contract to the United States Steel Corporation for 50,000 tons of rails. Additional contracts have recently been given to the American Bridge Co. by western parties for 8,000 tons of steel. The output of rails for 1906, estimated by present orders, will exceed that of last year by 50 per cent. The Carnegie Steel Co., which has a capacity of about 4,000 tons a day at its Edgar Thomson works, at Bessemer, Pa., and its Ohio works at Youngstown, Ohio, has orders for 1,200,000 tons of rails. The Illinois Steel Co., with works at Chicago, has orders for 900,000 tons. The large rail mill at Birmingham, Ala., of the Tennessee Coal & Iron Co., which makes only

open hearth rails, has contracted for its entire output up to March of next year. There is every indication that the orders this year will reach a total of 2,200,000.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At the business meeting of this society April 4, a paper on the Panama Canal by A. G. Menocal, was presented for discussion. This paper was printed in the *Proceedings* for February, 1906.

Railway Telegraph Superintendents.

The Association of Railway Telegraph Superintendents will hold its annual meeting at Denver, Colo., beginning June 20. Headquarters will be at the Adams Hotel. The President of the Association is Mr. E. E. Torrey, of the Mobile & Ohio.

American Society of Mechanical Engineers.

At the fifty-third meeting of this society, to be held at the Read House in Chattanooga, Tenn., May 1-4, the following papers will be presented: "Low Resistance Thermo-Electric Pyrometer and Compensator," by William H. Bristol; "Manganese Steel," by Henry D. Hibbard; "History of the Introduction of a System of Shop Management," by James M. Dodge; "Collapsing Pressures of Bessemer Steel Lap-Welded Tubes," by R. T. Stewart; and "New Liquid Measuring Apparatus," by George B. Willcox.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Seaboard Air Line.—Alfred Walter, Chairman of the Board of the South & Western, has been elected President of the S. A. L., succeeding J. M. Barr, resigned as President.

Southern Pacific.—James Speyer and Charles H. Tweed, of Speyer & Co., have resigned from the Board of Directors.

Operating Officers.

Central of New England.—O. M. Laing, Assistant Superintendent, has been appointed Superintendent, with office at Hartford, Conn., succeeding J. F. Hedden, resigned. J. H. Turbush succeeds Mr. Laing.

Chicago, Burlington & Quincy.—A. N. Willsie, Master Mechanic at Brookfield, Mo., has been appointed Superintendent at St. Joseph, Mo., succeeding A. T. Perkins, resigned.

Evansville & Terre Haute.—J. O. Crocket, Superintendent, has been appointed General Manager, succeeding F. P. Jeffries, resigned.

Great Northern.—R. W. Bryan, Superintendent at Melrose, Minn., has been appointed to the new office of Master of Transportation. Frank Bell, Superintendent of Car Service, succeeds Mr. Bryan.

Missouri, Kansas & Texas of Texas.—Charles Hammond, Trainmaster at Trinity, Tex., has been appointed Superintendent at that place.

Traffic Officers.

Charleston & Western Carolina.—R. A. Brand, Freight Traffic Manager, has been appointed Traffic Manager, succeeding H. M. Emerson, deceased.

Lehigh Valley.—C. A. Blood, General Freight Agent, has been appointed Freight Traffic Manager, succeeding T. N. Jarvis, promoted. H. C. Burnett, Assistant General Freight Agent, succeeds Mr. Blood.

Missouri, Kansas & Texas.—W. M. Fenwick has been appointed Assistant General Passenger Agent at St. Louis, Mo.

Engineering and Rolling Stock Officers.

Atlantic Coast Line.—C. L. Meister has been appointed to the new office of Mechanical Engineer, reporting to the General Superintendent of Motor Power.

Chicago, Milwaukee & St. Paul.—Edward Laas, Superintendent at Ottumwa, Iowa, has been appointed to the new office of Engineer of Maintenance.

Grand Trunk.—G. J. Bishop, Master of Bridges and Buildings, at Durand, Mich., has resigned. The authority of T. T. Irving, Resident Engineer at Detroit, has been extended over the Bridges and Buildings Department heretofore in charge of Mr. Bishop.

New York Central & Hudson River.—G. W. Kittredge, Chief Engineer of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed Chief Engineer of the N. Y. C. & H. R., effective April 9.

Northern Central.—See Pennsylvania.

Pennsylvania.—H. M. Carson, Superintendent of Motive Power at Buffalo, has been appointed Assistant to the General Manager. R. J. Reading, Superintendent of Motive Power at Williamsport, Pa., succeeds Mr. Carson. D. M. Perine, Master Mechanic at West Philadelphia, succeeds Mr. Reading. J. T. Wallis, Master Mechanic of the Northern Central at Baltimore, Md., succeeds Mr. Perine. J. C. Mengel, Master Mechanic at Sunbury, Pa., succeeds Mr. Wallis. J. M. Henry, Master Mechanic of the Northern Central at Elmira, Pa., succeeds Mr. Mengel. C. K. Shelby, Assistant Engineer of Motive Power at Williamsport, succeeds Mr. Henry. J. L. Cunningham, General Foreman at Columbia, Pa., succeeds Mr. Shelby.

Union Pacific.—J. C. Young, heretofore General Signal Inspector on the Southern Pacific, has been appointed Signal Engineer of the U. P., with office at Omaha, Neb.

LOCOMOTIVE BUILDING.

The Pennsylvania has ordered 100 locomotives from the Baldwin Works.

The Mexican International, it is reported, is in the market for locomotives.

The Southern, it is reported, will shortly order additional locomotive equipment.

The Maryland & Pennsylvania, it is reported, has ordered one 10-wheel locomotive.

The Queen & Crescent has ordered three locomotives from the Baldwin Locomotive Works.

The Chesapeake & Ohio has ordered three 150-ton Shay locomotives from the Lima Locomotive & Machine Co.

The Minnesota Land & Construction Co., Duluth, Minn., has ordered six consolidation locomotives from the American Locomotive Co.

The Lima Locomotive & Machine Co. report the following orders for the week ending March 31: Davidson Lumber Co., Bridgewater, N. S., one 17-in. x 24-in. six-wheel switching locomotive; Marysville & Northern, Bryant, Wash., one 37-ton Shay locomotive; Clear Creek Lumber Co., Birmingham, Ala., one 37-ton Shay locomotive; Flat Creek Mill Co., Mobile, Ala., one 37-ton Shay locomotive, and the Culbreath Logging Co., Huttig, Ark., one 37-ton Shay locomotive.

The Chicago & Western Indiana has ordered five simple mogul (2-6-0) and five six-wheel switching (0-6-0) locomotives from the American Locomotive Co., for August delivery. The mogul locomotives will weigh 160,000 lbs., with 140,000 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 57 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; 330 tubes, 2 in. in diameter and 13 ft. long; Otis steel firebox, 102 in. x 66 in.; grate area, 47.4 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, eight tons. The switching locomotives will weigh 142,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; straight boiler, with a working steam pressure of 200 lbs.; 331 National tubes, 2 in. in diameter and 11 ft. long; Otis steel firebox, 108 in. x 42 in.; grate area, 31.4 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, eight tons. The special equipment for both includes: Westinghouse air-brakes, Otis axles, Cooke & Strong bell ringer, National-Hollow brake-beams, Perfecto brake-shoes, Gould couplers, Schroeder headlights, Nathan injector and sight-feed lubricators, Cicero bronze journal bearings, Jerome piston rod packings, American Balance Valve Co.'s valve rod packings, Ashton safety valve and steam gages, Leach sanding devices, French springs, Gold steam heat equipment and Midvale driving, truck and tender wheel tires.

CAR BUILDING.

The Western Maryland is in the market for one private car.

The Florida & East Coast is in the market for 100 box cars.

The Pennsylvania, it is reported, is contemplating the purchase of a number of additional freight cars.

The Merchants Despatch Transportation Co. will build a number of refrigerator cars at its Despatch shops.

The New Orleans & Northeastern contemplates getting additional equipment, but nothing has yet been arranged.

The Rogers & Southwestern wish to buy a combination passenger, baggage and mail coach and a second-hand passenger coach.

The Minnesota Land & Construction Co., Duluth, Minn., has ordered 100 flat cars of 80,000 lbs. capacity from Fitz-Hugh, Luther Co.

The Atchison, Topeka & Santa Fe has ordered 12 cabooses from

the American Car & Foundry Co., and is asking bids on 100 tank cars.

The Huntingdon & Broadtop has ordered 300 all steel hopper coal cars of 100,000 lbs. capacity from the American Car & Foundry Co.

The Maryland & Pennsylvania, it is reported, has ordered 25 standard box cars of 60,000 lbs. capacity, eight standard gondola cars of 60,000 lbs. capacity, two stock cars and three passenger cars.

BRIDGE BUILDING.

BROWNSVILLE, PA.—The Lower House of Congress has passed a bill authorizing the Fayette Bridge Co. to build a highway bridge across the Monongahela river near this place.

CLARKSVILLE, TENN.—The Lower House of Congress has passed the bill authorizing a bridge across the Cumberland river at or near this place. (Feb. 23, p. 60.)

CLEVELAND, OHIO.—Announcement has been made by City Engineer Carter that between $300,000 and $350,000 of the $500,000 issue of grade crossing bonds, which will soon be issued, will be used to build a bridge through the upper flats connecting Clark with East Clark avenue, the south side and Newburg.

FORT FRANCIS, ONT.—W. H. Cook, Duluth, Minn., will receive bids for building a bridge over the Rainy river, between this place and Koochiching, Minn., for the Duluth, Rainy Lake & Winnipeg.

GAINESVILLE, GA.—Several steel bridges will soon be built in Hall County.

INDIANOLA, IOWA.—The Board of County Supervisors at their meeting April 9 will receive bids for two steel bridges to be built in Warren County.

MINNESOTA.—The bill authorizing a bridge across Rainy river in this state was passed by both Houses of Congress.

MISSISSIPPI.—The Lower House of Congress on March 26 passed the bill authorizing the counties of Holmes and Washington to build a bridge across the Coldwater river. (Jan. 26, p. 28.)

MONTANA.—Both Houses of Congress have passed the bill authorizing the Chicago, Milwaukee & St. Paul Railway Co. to build a bridge across the Yellowstone river in this state. (March 20, p. 97.)

NASHVILLE, TENN.—The Lower House of Congress on March 26 passed a bill authorizing two bridges across the Cumberland river at or near this place. (Feb. 23, p. 60.)

NIAGARA FALLS, N. Y.—The International Railway Co. and the Toronto Railway Co. are planning to jointly build a new bridge to carry electric cars over the Niagara river 300 ft. below the present steel bridge at Niagara Falls. A bill will be introduced in the New York State Legislature to incorporate the Trans-Niagara Bridge Co., with a capital of $1,000,000, to carry out this work. F. Nicholls, D. E. Thompson, of Toronto; G. B. Schley, of New York; H. J. Pierce, of Buffalo; F. A. Dudley, of Niagara Falls, and others are named as commissioners in the bill. The commissioners will appoint a committee to locate the site for the bridge, and will have an office at Niagara Falls.

PINKERTON, ONT.—Bids are wanted April 9 by J. J. Donnelly, Clerk of Greenock township, for building a 90-ft. span Warren trust steel bridge, with 14-ft. roadway, over the Teeswater river. Also for a 110 ft. steel span over the same river.

SOUTH DAKOTA.—Both Houses of Congress have passed the bill authorizing a bridge across the Missouri river between the counties of Walworth and Dewey in this state. (March 30, p. 97.)

TORONTO, ONT.—City Engineer Rust is making plans for building a bridge at Bathurst street to carry street cars.

WARSAW, IND.—Bids are wanted April 16 by Eff Sharp, County Auditor, for building five steel bridges in Kosciusko County.

WASHINGTON.—Both Houses of Congress have passed the bill authorizing a bridge across the Snake river between the counties of Whitman and Columbia in the state of Washington. (March 30, p. 98.)

Other Structures.

BIRMINGHAM, ALA.—Stollitt & Co., of Chicago, will have the contract for building a union passenger station here, to cost $1,500,000. It is expected to have the structure completed by January, 1907.

CHICAGO, ILL.—Negotiations for the purchase of land between Madison and Randolph streets and Clinton and Canal streets, it is said, have been made for the Chicago North-Western, which is said to be planning to build a large passenger station on this site.

The Pennsylvania, it is reported, has secured land on which it will put up a large passenger station.

DECATUR, ILL.—The Wabash has given a contract to James Stewart & Co., of St. Louis, for the following work: Car shop, 88 ft. x 484 ft.; blacksmith and machine shop, 80 ft. x 294 ft.; wood working mill, 80 ft. x 238ft.; storeroom, 40 ft. x 464 ft., with a two-story office building at one end; cabinet, tin, upholstery, glazing and electrical work shop, 40 ft. x 550 ft.; coal, iron and coke shed, 20 ft. x 294 ft.; power house, 60 ft. x 108 ft.; dry kiln, 20 ft. x 80 ft., with reinforced concrete roofs. Also an oil and paint shop with reinforced concrete roof and floors and some small sheds. Bids are being asked by C. A. Howe, Acting Purchasing Agent, for the machinery for these shops.

HOMESTEAD, PA.—The Pennsylvania, it is said, has plans ready for putting up a brick passenger station here, to cost $20,000.

KNOXVILLE, TENN.—The Southern, it is said, has selected a site for a new shop building.

MILWAUKEE, WIS.—The Chicago, Milwaukee & St. Paul will increase its shops at this place and make this the shop headquarters for its entire system. The improvements include an addition to the car erecting shop, which will be 80 ft. x 668 ft., with a second addition to the same building 44 ft. x 103 ft., giving a total area of 58,000 sq. ft. in addition to the present area of 60,000 sq. ft. A concrete blacksmith shop will be built 80 ft. x 600 ft., which will be equipped with machinery to build cars and locomotives. The cost of these improvements will be about $500,000.

OMAHA, NEB.—The Chicago & North-Western has bought four parcels of land from Thirteenth to Fourteenth streets and from Webster to Davenport streets as a site for a new passenger station.

PHILADELPHIA, PA.—The Philadelphia & Reading is asking bids for building an additional story on its Callowhill street freight office.

PORTSMOUTH, OHIO.—The Norfolk & Western, according to a statement, is planning to build, during the present year, a 20-story brick roundhouse, with an 85-ft. span; a car shop, 65 ft. by 300 ft., and smith shop, 72 ft. by 144 ft.

ROANOKE, VA.—The Norfolk & Western plans the building of a foundry 144 ft. x 740 ft.; paint storehouse, 63 ft. x 82 ft., and a boiler shop, 39 ft. x 51 ft. The present paint shop, 74 ft. x 152 ft., is to be extended to 74 ft. x 300 ft. All the buildings will be of brick and steel.

ROCHESTER, N. Y.—An appropriation of $250,000, it is reported, has been made by the New York Central to rebuild and enlarge its passenger station in this city.

SCRANTON, PA.—The Delaware, Lackawanna & Western will commence work at once on new yards and put up a number of buildings at a total cost of about $2,000,000.

VERA CRUZ, MEX.—The Mexican Federal Government has approved the plans of the Vera Cruz Terminal Association, formed by the railroads entering that port, for a new union passenger station and terminals, to cost about $6,000,000. Contracts for the work will soon be let.

YORK, PA.—The Maryland & Pennsylvania is to build a new freight house and make other improvements

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALASKA CENTRAL.—The annual report for 1905 says that the road, which was originally a light line with heavy grades, is to be made a first-class road. It has been decided to reduce the maximum grade to one per cent., excepting only two per cent. across the mountain ranges. This will necessitate the building of seven tunnels on the first 55 miles of road. Along the north shore of Turnagain Arm, where the road will be built on the side of the mountain for a distance of 30 miles, the work is very heavy and expensive. The cost of the rock excavation will be between $40,000 and $80,000 a mile. The work of locating the line has been slow and costly, the sum of $140,000 having been spent last year on this work. A force of engineers, in charge of G. A. Kile, Chief Engineer of Surveys, completed last year the permanent location of 87 miles, preliminary location of 260 miles, and reconnoissance surveys for 780 miles. At Seward, the southern terminus of the road, the company has rebuilt its wharves, and the terminals were enlarged and improved. An office building costing approximately $50,000 has been put up. A temporary roundhouse and a machine shop have been built and plans made for a permanent roundhouse and shops, on which construction work will soon be started. The first 11 miles of road have been reconstructed to reduce the grade and straighten the line. The cuts and fills were widened and the road is now completed and in operation to mile 45. Considerable work has been done between

that point and mile 105; contracts for six of the tunnels at mile 52 let to Rich & Harris last summer, call for the completion of this work early this month. The grade from mile 75 to mile 105 along the north shore of Takamaka Arm, which includes the heaviest rock work on the entire line, with the exception of the tunnels, has been let to P. Welch & Co., of Spokane, whose contract calls for the completion of this work by August. Both of these contractors are actively pushing the work, although experiencing great difficulty in securing and retaining labor to carry out the work. The company has lost about 1,000 men during the year, most of whom have left railroad work to become prospectors. During the winter there has been employed an average of 1,200 men, and this force is to be increased during the summer. The track is laid with 65-pound rails and ties 2-ft. apart on centers. The bridges and trestles will be built of heavy timber capable of carrying loaded 80,000-lb. capacity cars. Nearly $2,000,000 has already been spent on construction. One of the tunnels at mile 49 will be 800 ft. long, and it is expected to have this and the other tunnels completed early in July. The company is planning to let contracts for building the road from mile 105 to mile 150, and it hopes to have this part of its road completed during the present year. It also is to build the Matanuska branch from a junction with the main line, at mile 150, 30 miles east to the Chickaloon coal fields. Contract has been given to the Illinois Steel Co. for delivery during the present summer of 5,000 tons of rails and fittings. (March 30, p. 98.)

Baton Rouge, Hammond & Eastern.—This company has been organized in Louisiana to build a railroad from Baton Rouge, east via Hammond and Covington to Nicholson, thence northeast to Merrill, Miss., where connection is to be made with the Mobile, Jackson & Kansas City. The road will traverse a fine timber and agriculture district. S. O. L. Wexler is President of the company. It is expected to have the road completed as far as Hammond this year. The office of the company will be in Baton Rouge.

Brooklyn Rapid Transit. On the Sea Beach line of this company additional switching and terminal tracks are being put in. At Sheepshead Bay the tracks of the Long Island Railroad will be used to run to the race course. The Canarsie line, formerly operated by steam power by the Brooklyn & Rockaway Beach Company, is to be practically rebuilt and equipped with electric power, and extended. The tracks will be relaid with 70-lb. rails and new terminals built. The company expects to run trains from the Manhattan end of the Williamsburg bridge to Canarsie in 30 minutes. The power station at Williamsburg is nearing completion. This will furnish an additonal 12,000 h.p., and more trains can be run. Work will also be started on the improvement of the tracks on other lines of the company.

Cairo, Mayfield & Nashville.—See Nashville, Chattanooga & St. Louis.

Canadian Pacific.—The President of this road, Sir Thomas Shaughnessy, announces that the company, during the present year, will complete 867 miles of new line. The most important of these are the following: Sudbury-Toronto line, through a rocky section with a maximum grade of three-tenths of 1 per cent.; Gulf & Goderich with a number of branch lines which will furnish a new service between Toronto and Goderich. New lines in the west include the Wolseley branch to Reston, 122 miles, which it is expected will furnish an outlet for wheat shipments next fall to Regina; the Pheasant Hills extension and the Edmonton & Wataskawin. These will furnish the company another through trunk line from Winnipeg to Edmonton. The Manitoba & Northwestern branch will pass through Grand Trunk territory and give access to the Quill and the Touchwood mountain section. The Gimlic extension in Manitoba will furnish an outlet for the fishing industries on Lake Winnipeg, and the Teulon extension a through line to the fertile section west of Lake Winnipeg. The extension from Lander to Broomhill will furnish an additional through line to Southwestern Manitoba, and in British Columbia the Nicola-Kamloops line will run through the fruit valleys of the Nicola Lake region.

Cincinnati Roads.—A company has been formed and a bill introduced in the State Senate authorizing the building of an overhead road from one of the suburbs of this city to the down town district.

College City & Southern.—Incorporation has been granted a company under this name in Oklahoma, with a capital of $500,000, to build a railroad from Kiowa, Kan., to Alva, 35 miles. The office of the company will be at Alva. E. T. McNight is President and General Manager; T. G. Woodward is First Vice-President; J. B. Kent, Second Vice-President; W. B. Taylor, Secretary, and J. B. Dullin, Treasurer.

Cobalt Range.—Application will be made to the Dominion Parliament for the incorporation of this company to build a railroad from Haileybury, Ont., east through the Cobalt district via Fort Temiskaming and Villa Marie, thence southeast to a connection with other roads. Lake Temiskaming is to be crossed by a car ferry.

Co-Operative Construction. This company has been incorporated with a capital stock of $10,000 to build an electric line from Grand Rapids, Mich., northwest via Fremont, Hesperia, Hart and Pentwater to Ludington, about 95 miles. The officers are: George E. Hilton, President; John Pikart, Vice-President; John G. Anderson, Secretary, and Thos. David, Treasurer, all of Fremont.

Detroit & Adrian Traction Co. Incorporation has been asked for by a company under this name, in Michigan, to build an electric road from Detroit to Adrian, about 60 miles. Such a line would parallel the Wabash from Detroit to Milan.

East Central.—Incorporation has been granted this company in Florida, with a capital of $1,000,000, to build a railroad from Ormond south to Daytona, thence west to De Land, and thence south to Sanford and Orlando, about 70 miles. E. L. Potter, Seabreeze, is President; J. Clyde Power, Indianapolis, is Vice-President; S. H. Grove, Daytona, General Manager; J. Hall Brumsey, De Land, Secretary, and J. B. Crocker, Seabreeze, Treasurer. The first regular meeting of the company is to be held on April 5 at De Land.

Elgin & Du Page (Electric). A charter has been granted a company under this name, in Illinois, with a capital of $10,000, to build an electric line from River Forest, in Cook County, west through Cook and Du Page counties to Elgin, in Kane County, about 40 miles.

Elk Short Line.—This company has been incorporated in Michigan with a capital stock of $8,000 to build a short railroad in and near the village of Elk Rapids. The directors are Homer Sly, Milton B. Lang, Harry Hirshberg, Helmuth Krarup and Fitch R. Williams, all of Elk Rapids.

Erie.—The directors of this company have authorized surveys to be made for the electrification of the Rochester division from Rochester to Corning, N. Y.; also of the Bath & Hammondsport and the Mt. Morris branch from Avon to Mt. Morris. The total mileage to be electrified is approximately 150 miles.

Grand Trunk Pacific.—Contract has been given to Cash Bros. for building the first section of this road in Alberta. Work will be started at a point 110 miles east of Lacombe, near the Battle river.

Great Northern.—Surveys, it is said, are being made by this company to build an extension from its existing line near Wenatachee on the Columbia river in Washington, north on the west bank of that river through Cheland County, giving an outlet to the Colville Wheat Belt and Okanogan Mines.

Vice-President Louis W. Hill has confirmed the report that this company will build a line through Canada to the Pacific coast. According to Mr. Hill: "The only interest we have in the Canadian Northern is that we lease its lines from the boundary up to Winnipeg. But we have already secured our own terminals in Winnipeg and we shall soon build a Winnipeg line of our own. Then we shall be entirely independent of the Canadian Northern. Our line includes only 800 or 900 miles that are still to be constructed west of Winnipeg. The Grand Trunk Pacific has done nothing yet in that section. It has been stated that the Grand Trunk must take four or five years to finish their line but we could complete ours within two or at any rate within three years."

Gulf, Plainville & Northern.—A charter has been granted to a company under this name in Kansas with a capital of $1,000,000. The incorporators are all residents of Plainville, Kan. The company proposes to build 60 miles of railroad from Plainville north to the Nebraska line. It is reported in Topeka that the project is being backed by Union Pacific interests.

Indiana Roads.—Announcement has been made that William Kenefick, of Kansas City, and associates will organize a company with a capital of $25,000,000, to build a railroad with a northern terminus at Tolleston, in Lake County, Ind., to run south via Indianapolis to Evansville, with a number of branches. It is proposed to enter Chicago over the Chicago Belt Road.

Lake Erie & Southern.—Incorporation has been granted this company in Ohio, with a capital of $125,000, to build a railroad from Cleveland south via Akron to Massillon, about 60 miles, and to ultimately extend the road further south. The incorporators are R. T. Wood, H. B. Camp, J. R. Zmunt, F. W. Green and H. McIntyre, all of Cleveland.

Lake Shore & Michigan Southern.—This company will do considerable four-tracking work between Toledo and Cleveland during the present year. The section from Toledo to Holland on the west, and from Toledo to Milbury on the east, 15 miles, has been completed. A considerable amount of four-tracking will also be carried out during the present year between Toledo and Chicago. Work is being pushed on the road east of Cleveland.

Lorain & West Virginia.—See Wabash.

Louisville & Nashville.—Contract has been given by this com-

pany to Kreis Bros., of Knoxville, Tenn., for building a four-mile branch from a point on its line two miles south of Mentor to Maryville, in Blount County. The contract calls for completion of the grading by the end of July next.

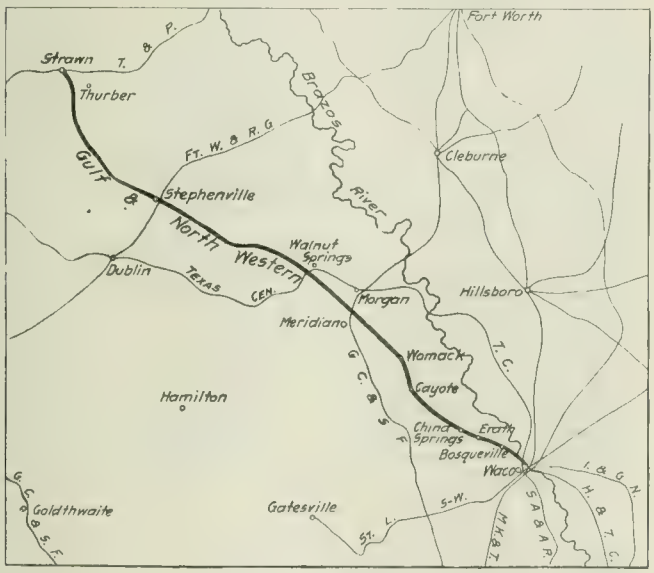
Martinez & Contra Costa.—Incorporation has been granted this company in California, with a capital of $100,000, to build a steam or electric railroad, five miles long, in the city of Martinez, Cal., under the franchise granted to M. R. Jones.

Midland Railway.—Contract has been given by this company to the Guthrie Co., of St. Paul, Minn., for grading its road from Portage la Prairie, Kan., to the international boundary, between 80 and 90 miles.

Missouri, Kansas & Texas.—According to newspaper reports this company is planning to build a line from Palestine, Tex., via Athens, to Dallas, and is now making surveys.

This company expects to run trains into Austin this month over the tracks of the International & Great Northern.

Gulf & Northwestern.—An officer writes that bids are wanted for building this road, to include the bridges, water stations, etc. Surveys have just been completed from Waco, Tex., at the head of navigation on the Brazos river, northwest via Bosqueville, Erath, China Springs, Cayote, Womack and Adle's ranch, crossing the Gulf, Colorado & Santa Fe between Meridian and Morgan. The Texas Central will be crossed near Walnut Springs, and thence the line runs up the East Bosque valley via McCurdy and Daniel's ranch, Mathern Gap, Johnsville and Bunker Hill to Stephenville, where the Fort Worth & Rio Grande is crossed; thence up the South



Gulf & Northwestern.

Bosque valley, through Cage's ranch, Berlin and Twin Mountains; through the Thurber coal fields to Strawn on the Texas & Pacific, a total distance of 122.1 miles. The first 75 miles will have a maximum grade of 0.8 per cent. and the balance 1.0 per cent. McCarthy, Starnes & Co., Consulting Engineers, of Lufkin, Tex., are the engineers in charge. (See Construction Record.)

Nashville & Valdosta.—A charter has been granted this company in Georgia, with a capital of $300,000, to build a railroad from Valdosta north to Nashville, in Berrien County, about 35 miles. The incorporators are residents of Nashville and Valdosta.

Nashville, Chattanooga & St. Louis.—Under the name of the Cairo, Mayfield & Nashville this company is planning to build a line to Cairo, Ill., from Murray, Ky. Such a line will be a competitor of the Illinois Central. The leasing of the Tennessee Central by the Illinois Central is said to be the incentive to the building of this line.

New York, New Haven & Hartford.—Work will soon be started on the rebuilding of the Highland division of this road from Waterbury, Conn., northeast to Bristol, 14 miles. This involves some very heavy work, including the relocation of much of the line and a tunnel 35,000 ft. long. The present ruling grade of 75 ft. to the mile is to be reduced to 57 ft.

Northwestern Development Company.—Under this name the Northwestern Commercial Company, which controls several enterprises in Alaska, it is said, in connection with J. P. Morgan & Co., A. A. Housman & Co., and the Guggenheim interests, is organizing the above company, with a capital of $6,250,000, to build a railroad from Nome, Alaska, northeast for a distance of 120 miles. H. C. Davis is President; K. K. McLaren, Vice-President, and John Rosene, Chairman of the Board.

Pennsylvania.—This company has given a contract to H. S. Kerbaugh for the grading, masonry and track laying of its proposed eastbound receiving and classification yards at Pitcairn. The work calls for the laying of about 30 miles of track. The company has practically decided to change the grade and alinement of its tracks through New Florence, Pa. The work includes the building of a subway at Ligonier, the elevation of the tracks 8 ft., and the lowering of the street grade 8 ft.

A contract has been given by this company at about $1,000,000 to Reilly & Weber for laying tracks in its eastbound classification yard at Hollidaysburg.

This company is asking bids April 16 for piercing a tunnel at Blairsville, Pa.

Pennsylvania System.—The record of mileage for the year ended December 31, 1905, shows that the total length of main line on the lines East of Pittsburg and Erie is 5,186 miles, with 1,647 miles of second track, 550 miles of third track, 438 miles of fourth track, and 3,888 miles of company's sidings, a total of 11,708 miles. There was a decrease during 1905 of four miles of first track, and an increase of 66 miles of second, third and fourth tracks, and 248 miles of sidings, a total increase of 310 miles. On the Pennsylvania lines West of Pittsburg and Erie the mileage is 2,867 miles of first track, 1,089 miles of second track, 130 miles of third track, 77 miles of fourth track, and 2,118 miles of company's sidings, a total mileage of 6,281. During the year there was an increase of six miles of first track, 78 miles of second, third and fourth tracks and 144 miles of sidings, a total increase of 228 miles. The mileage of the Vandalia Railroad is: First track, 928 miles; second track, 65 miles; sidings, 595 miles; a total of 1,587 miles. During the year there has been an increase in first track of 131 miles, second track 46 miles, and sidings 193 miles, total, 370 miles. The grand total of all lines, including those operated by and associated in interest with the Pennsylvania Railroad, is 10,907 miles of first track, 2,977 miles of second track, 696 miles of third track, 522 miles of fourth track, and 7,263 miles of sidings, a total of 22,365 miles. Of this, 6,030 miles of first track are East and 4,877 miles of first track are West of Pittsburg and Erie.

Philadelphia Rapid Transit.—Mayor Weaver on March 28 signed the ordinance granting this company an extension of three years for the completion of its Market street subway. In consideration of this extension, the company has filed, with the Secretary of the Commonwealth at Harrisburg, and with the City Solicitor of Philadelphia, a full surrender of all other franchises acquired by the company several years ago with two exceptions. The company also agrees to pay $400,000 towards the cost of abolishing certain grade crossings. (March 30, p. 99.)

Philippine Railway.—This company, which was lately incorporated in Connecticut, with a capital of $5,000,000, is to build 300 miles of railroad. William Salomon & Co., of New York, are the bankers for the syndicate that is to finance the construction. The Philippine Railway Construction Company, incorporated in New Jersey, with a capital of $1,000,000, has given the contract to J. G. White & Co., of New York, to build the road. (See Construction Record.)

Pittsburg, Cincinnati, Chicago & St. Louis.—The work under way by this company, according to its yearly report, includes the following: Change of alinement and construction of eastbound freight track from Bulger to R. S. tower. This includes a cut at tunnel number three. Change of grade and construction of second track from Woodstock to Hagenbaugh 10.3 miles, including new east and westbound passing sidings at Brush Lake and at Hagenbaugh; construction of second track from Hagenbaugh to Urbana, 6.5 miles, and reduction of grade in Urbana. Second track from Summit to Bradford, 7.56 miles, change of grades and alinement through Covington and the abandonment of grade crossings of the Cincinnati, Hamilton & Dayton, and street crossings in Covington, also the construction of a new double-track bridge over Stillwater river. Second track from Bradford to Horatio, 5.68 miles, together with a change of grade, has been completed. The freight track from Aylesworth to P. V. tower, 11.39 miles has been converted into a second main track. Work is under way on the classification yard at Columbus, Ohio, to increase its capacity 150 cars. A produce yard, with a capacity of 51 cars, was built in yard C at Columbus, Ohio, and extensive changes made in the yard at Bradford, Ohio, in connection with the building of a second track, which included part of the yard track and the laying of 3.7 miles of new track. Two miles of additional storage tracks were laid between 63d and 72d streets, Chicago, and five additional tracks were laid at Campbell avenue. New freight stations were put up at Ingram and Burgettstown, and combined passenger and freight stations at Mill Grove and McGrawsville. A commissary house was built at Dennison avenue, Columbus, for the use of the dining car depart-

ment, together with the necessary tracks, and new house for trainmen is under construction at 59th street, Chicago. At Dennison, Ohio, a 32 stall roundhouse with a 75 ft. turntable, oil house, coal hoist and a complete water system, is being put in. A water softening plant and coaling station has been completed at Bradford, and a new coaling station put up at Logansport, also a water softening plant put in at Richmond. The work of elevating the tracks in Chicago from Fulton street to Ashland avenue, with a run-off to a point 300 ft. east of Ada street is practically completed. The involves the elevation of the run-off of the Rock street elevation between Fulton street and Weston avenue 1,500 ft., thence west over 10 streets for about one mile, thence to a grade crossing at Ada street 1,900 ft. The track was raised for a distance of 1.61 miles. All the work in connection with the elevating of the tracks from the Illinois and Michigan canal to Weston Avenue Boulevard has been completed with the exception of the crossing at the Chicago & Alton road at Weston avenue, where the tracks are not elevated to the new grade, pending action of the Chicago & Alton, as to the abandonment of the grade crossing.

Sandusky, Fremont & Southern.—Incorporation has been granted this company in Ohio, with a capital of $10,000, to build a railroad from Sandusky, on Lake Erie, southwest to Fremont, in Sandusky County, about 30 miles. The incorporators include G. H. Kelly, M. G. McAlleman, T. H. Hogsett, H. H. Johnson and George C. Ford.

Southern.—Contracts are reported let by this company at about $5,000,000 for laying second track between Knoxville and Morristown, and Chattanooga and Ooltewah, Tenn.

Southern Pacific.—Contract has been given by this company to the North American Dredging Co. to fill in a large crescent shape area on the water front of Visitacion Bay, which is six miles south of San Francisco. The filling in will range from a depth of 3 ft. to 15 ft., and a large amount of yard room will be made available. The water front will be dredged, giving sufficient depth of water for large vessels to land at the wharves that are to be built in connection with the new yards.

Statesboro & Midville.—Incorporation has been granted a company under this name in Georgia, with a capital of $50,000, to build a railroad from Statesboro, in Bulloch County, northwest to a point near Garfield on the Millen & Southwestern, thence to Midville in Burke County, on the Central of Georgia; thence continuing in a northwesterly direction to Louisville, Jefferson County, about 60 miles. The road will pass through a rich agricultural and timber section. Surveys will be started at once. The office of the company will be at Savannah. The incorporators are C. G. Ogburn, J. A. Doyle, R. Meldrin, G. N. Jones and others, of Savannah.

Wabash.—Under the name of the Lorain & West Virginia this company is building an extension from Wellington, Ohio, on the Wheeling & Lake Erie north to Lorain. Contracts have been let to G. M. Kepner, of Connorsville, and to F. J. Petterson, of Cedar Rapids, Iowa. The road will be 20 miles long and the grading will cost about $1,500,000.

RAILROAD CORPORATION NEWS.

Alton, Granite & St. Louis.—See East St. Louis & Suburban.

Bessemer & Lake Erie.—Gross earnings for the year ended December 31, 1905, were $5,407,692, an increase of $1,130,546; net earnings, $2,758,595, an increase of $626,062.

Canadian Pacific.—Gross earnings for the month of February were $4,224,452, an increase of $1,168,358.

Chicago, Rock Island & Pacific.—This company has sold to Speyer & Co. $6,000,000 two-year 4½ per cent. collateral notes secured by $7,500,000 Rock Island, Arkansas & Louisiana bonds. The proceeds of the sale of these notes will be used to meet expenditures made and to be made for the construction of the R. I., A. & L.

Colorado Southern, New Orleans & Pacific.—This company has sold to Blair & Co. and the Old Colony Trust Co. $7,500,000 5 per cent. five year notes secured by $8,000,000 4½ per cent. bonds, and by the entire capital stock of the C. S., N. O. & P. The proceeds are to pay for the construction of the road.

Cripple Creek Central.—The directors have declared the regular quarterly dividend of 1½ per cent. on the $2,500,000 common stock, and an extra dividend of one-half of 1 per cent.

East St. Louis & Suburban (Electric).—The stockholders of this company and of the Alton, Granite & St. Louis have agreed to consolidate the two companies. The new company will have $7,000,000 5 per cent. preferred stock cumulative from May 1, 1906, and $7,000,000 common stock. For each 50,000 shares of stock of the East St. Louis & Suburban, one share of preferred and one and one-twentieth shares of common stock of the new company will be issued. For each of the 500 shares of preferred stock of the Alton, Granite & St. Louis, one share of preferred and one-fifth of a share of common stock of the new company will be exchanged and half a share of preferred and six-tenths of common of the new company will be exchanged for each of the 21,500 shares of common of the Alton, Granite & St. Louis.

Erie.—Gross earnings for the month of February were $3,635,419, an increase of $922,338.

Illinois Central Traction.—Julius Christensen & Co., Philadelphia, are offering for sale the unsold portion of a block of $1,300,000 I. C. T. first mortgage 5 per cent. bonds of 1933, principal and interest guaranteed by the Illinois Traction Co. The bonds are secured on 40 miles of interurban road between Decatur, Ill., and Springfield.

Indiana Harbor.—See Indiana, Illinois & Iowa.

Indiana, Illinois & Iowa.—Plans are under way for the consolidation of this company with the Indiana Harbor, the new company to be known as the Chicago, Indiana & Southern, with $20,000,000 capital. The Lake Shore & Michigan Southern now owns the entire capital stock of the I., I. & I.

National of Mexico.—Gross earnings for the year ended Dec. 31, 1905, were $6,377,862, an increase of $593,238; net earnings, $2,235,534, an increase of $303,247. The surplus after charges increased $340,639. The average mileage operated was 1,713, an increase of 126 miles.

This company has acquired the Hidalgo & Northeastern, a narrow gage railroad, 138 miles long, at a cost of about $3,100,000.

New Orleans Great Northern.—This company has arranged for trackage rights for five years over the New Orleans & Northeastern tracks from Slidell, Ala., to the outskirts of New Orleans.

New York, New Haven & Hartford.—This company offers to exchange one share of its capital stock for each $200 of the 4 per cent. debentures of the Consolidated Railway, of which there are $7,491,000 outstanding.

This company has sold $1,500,000 Harlem River & Port Chester 4 per cent. gold bonds of 1954, being part of an authorized issue of $15,000,000, of which $7,865,000, are outstanding. The proceeds will be used for six-tracking and other improvements of the Harlem River branch.

The Massachusetts Legislature has passed bills authorizing the Rhode Island & Massachusetts Railroad Company to sell its franchises and property to the N. Y., N. H. & H., and one to authorize the New Haven & Northampton to increase its stock, to issue bonds and to sell its franchise and property to the N. Y., N. H. & H. Both roads have long been controlled by the New Haven.

Northern Pacific.—This company and the Great Northern have made an agreement whereby they will use jointly their two parallel single track roads on the east side of the Mississippi running from St. Paul, Minn., northwest to St. Cloud, about 75 miles. This gives each company the advantages of a double-track line.

Pennsylvania.—Gross earnings of the lines east of Pittsburg and Erie for the month of February were $10,905,124, an increase of $2,216,300.

The New York Stock Exchange has listed $2,980,000 additional capital stock, making the total amount listed $305,933,300.

Philadelphia & Reading.—Gross earnings for the month of February were $3,253,275, an increase of $651,072.

Southern.—Gross earnings for the month of February were $4,433,002, an increase of $1,021,151.

Tri-City Railway & Light.—This company, which is a consolidation of all the street railway, gas and electric lighting companies of Rock Island, Moline, and East Moline, Ill., and Davenport, Iowa, will have an authorized capital stock of $12,000,000, of which $2,600,000 6 per cent. cumulative preferred stock and $9,000,000 common stock will be issued soon. The funded debt will consist of $9,000,000 5 per cent. bonds of 1923, redeemable on any interest date at 105 and accrued interest. Of this amount $464,000 is reserved for the retirement of underlying bonds maturing annually up to 1911, while $6,000,000 are being offered for sale by Mackay & Co., and N. W. Halsey & Co., of New York. The remainder of the bonds is reserved for additions and improvements.

United Railway Investment Company of San Francisco.—The directors have declared a dividend of 4¾ per cent. on the $15,000,000 preferred stock, payable May 1. This dividend includes all the arrears of this stock.

GENERAL NEWS SECTION

NOTES.

April 16 is the day set for the opening of navigation on Lake Michigan.

It is announced that the Central of Georgia will increase by 15 per cent. the pay of telegraph operators.

The Grand Trunk Railway of Canada is said to have acquired large tracts of coal lands in Nova Scotia.

The Minneapolis, St. Paul & Sault Ste. Marie now issues a mileage ticket for 5,000 miles at two cents a mile, "flat."

The legislature of Maryland, which has adjourned, passed a bill limiting all passenger rates to two cents a mile, but the Governor has vetoed it.

The Governor of New Jersey has signed the Perkins bill, under which "first-class" railroad property is to be taxed at local rates, largely increasing the tax burden on all of the railroads.

By a law which has been recently passed electric railroad companies in New Jersey may now carry freight through those cities and towns which, by ordinance, grant permission to do so.

A press despatch from St. Paul tells of 9,000 home-seekers going west and north from that city in a single week. The number of cars of emigrants' movables sent forward from St. Paul is about 1,000 a week.

Chicago papers report that all of the railroads carrying grain either to or from that city have agreed to abolish the switching charge on grain delivered to elevators away from their own tracks, and have also agreed to grant milling-in-transit privileges.

On the Wyoming division of the Union Pacific an order has been issued requiring copies of train orders to be delivered to the head brakeman of each train. On passenger trains the head brakeman must show his copy to the flagman. On freight trains the conductor must show his copy to the rear brakeman.

On the night of April 8 the Twentieth Century Limited express of the Lake Shore & Michigan Southern was run from Cleveland to Toledo, 108 miles, in 99 minutes, or at the rate of 65½ miles an hour, and it is said that a speed indicator in one of the cars indicated, near Vermillion, a rate of 96 miles an hour. The number of cars is not given, but the train usually has six, we believe.

The suit which was brought in behalf of the Dearborn station, at Chicago, to compel the Chicago & Eastern Illinois to continue using that station has failed; the Supreme Court of the United States refusing to take up the question. The C. & E. I., since it came under the control of the Rock Island, runs its passenger trains to and from the Rock Island (La Salle street) station.

The Massachusetts Legislature has passed a law giving the State Railroad Commission authority over the doings of express companies as follows: "The Board of Railroad Commissioners may, upon the complaint of any party interested, exercise over express companies, partnerships and individuals doing an express business upon the railroads or railways in this Commonwealth supervisory power with regard to the character of accommodations, service and the reasonableness of rates."

The legislature of Massachusetts has passed a bill modifying the law relative to safeguards against fire by striking out the limitation of such safeguards to cars "in which heating apparatus may be placed," and by changing the word "approve" to "order," so that the law now reads as follows: "Every passenger, baggage, mail and express car, which is owned or regularly used on any railroad in this Commonwealth, shall be provided with such safeguards against fire as the board [of railroad commissioners] in writing shall order. A corporation which violates the provisions of this section shall forfeit three hundred dollars for each offence."

Annual Meeting of the Technical Publicity Association.

At the second annual meeting and banquet of the Technical Publicity Association held April 5, at the Aldine Association, New York, these officers were elected: President, F. H. Gale, General Electric Co.; First Vice-President, H. M. Cleaver, Niles-Bement-Pond Co.; Second Vice-President, C. B. Morse, Ingersoll-Rand Co.; Secretary, Rodman Gilder, Crocker-Wheeler Company; Treasurer, H. M. Davis, Sprague Electric Co.; members of Executive Committee, Robt. L. Winkley, Pope Mfg. Co., and G. M. Basford, American Locomotive Company; members of Election Committee, C. W. Beaver, Yale & Towne Mfg. Co.; Chas. N. Manfred, Johns-Manville Co., and H. H. Kress, A. S. Cameron Steam Pump Works. P. F. Kobbé, Jr., former President of the Association, now an advertising specialist, was the guest of the evening. He gave an address on the general subject of advertising. An informal discussion followed. The other companies represented at the banquet were: American Wood Working Machinery Co., *Railroad Gazette*, John A. Roebling's Sons, De La Vergne Machine Co. and A. A. Griffing Iron Co. Richard S. Chisolm, of the *Railroad Gazette*, in a speech declared that investigation of circulation would be of the greatest value, not only to members of the Association but to reputable magazines also. Membership of the Association shows a steady increase, and its finances are in good condition. The following resolution was unanimously passed: "Resolved, That the Association take active steps to secure definite information regarding the circulation of mediums in which members of the Association are interested."

The Block System in Massachusetts.

The bill empowering the State Railroad Commission to order the installation of block signals has passed both houses of the Massachusetts legislature, so that, unless there is a veto from the Governor, Massachusetts will be the first state in America to make this requirement by law.

Washington Union Station.

The new union station at Washington, D. C., may now be said to be half done, and one track is completed on the connection northeastward to the Philadelphia, Baltimore & Washington road at Magruder. Next Tuesday an officers' inspection train will be run over this connecting line. The excavations on the Patterson hill at Eckington are finished. The bridges over the streets south of Florida avenue are approaching completion. Work on the station building has been carried on rapidly through the winter, and the east end and the south front are well advanced. The arched frame of the roof in the rear of the main structure is in place over about half of the 850 ft. of the station's width.

The stone courses of the outer walls of the entire structure are about finished to the first story, and derricks are being raised to begin work upon the imposing south front of the building. The building should be sufficiently advanced for the use of a part of it for the accommodation of passengers by next spring. It is said to be the intention to make use of the east end for this purpose, while the west end is being completed, thus permitting the removal of the present temporary tracks by which the Baltimore & Ohio trains enter the old station.

One drift of the tunnel under Capitol Hill is now at a stage which allows material to be carried in from the north end. In and about the station 500 men are now employed, and to these forces 100 or 200 will soon be added.

The Pennsylvania freight station in South Wasington and the elevated tracks in that part of the city will be finished long before the tunnel. Ground has been broken for the extensive yards and shops of the Pennsylvania, the Southern and the Chesapeake & Ohio south of the Potomac.

New York City Rapid Transit.

The legislature of New York has passed the Elsberg bill, amending the law governing rapid transit in New York City. The principal purpose of this bill is to give the Rapid Transit Commissioners more latitude in letting contracts. It permits the separation of the contracts for construction, equipment and operation, unless the Board of Estimate and Apportionment declares that it is practicable, expedient and required by the public interest that the contracts should be let jointly, in which event the rapid transit commission is authorized to exercise its discretion to so let them.

From the possible separation of the contracts it is expected that competition will come, or, at any rate that the possibility of competition will exist.

Power is reserved to the city to construct for itself and to equip for itself, and, as a last resort, to operate if that should be absolutely necessary. If a contract for operation is awarded to a private bidder, the operating term if the contractor equips at his own expense is cut down from 25 years to 10 years. Under the existing law the term is 50 years, with a 25-year renewal. Under the Elsberg bill the term is 20 years, with 20-year renewal. If the operating contractor does not equip at his own expense then the maximum term under the new bill is 20 years, that is, 10 years with a 10-year renewal. The power of the rapid transit commission given to it

under the existing law to grant perpetual franchises is absolutely taken away.

Provision is made that in the future pipe galleries shall be built in connection with new subway roads, and that such pipe galleries shall be open to the use of any one on fair terms.

The self-perpetuating feature of the rapid transit commission is abolished, and hereafter when vacancies occur in that commission they will be filled by the Mayor.

The Coal Strike.

In the bituminous regions, following the concessions of the operators, work has been very generally resumed in the mines, and suspensions of employees and other retrenchments ordered by the railroads have been largely revoked. On the Pennsylvania Railroad the track repair men were reduced to 25 hours a week throughout the main line, but on April 10 an order was issued restoring full time.

In the anthracite regions the mines with few exceptions continue idle, and the negotiations between the operators and the committee of miners are still going on. The result up to the time of this writing is embodied in a proposal which was made on Tuesday of this week by the representatives of the operators to Mr. Mitchell and his committee, as follows:

The members of the Anthracite Strike Commission, or such of them as may be able and willing to act (not less than a majority of the whole number) shall be requested to decide whether any changes in the conditions of the anthracite industry have occurred since the award of the Anthracite Coal Strike Commission, which requires that the award should be modified, as to the following subjects, and, if so, what that modification shall be.

First. As to wages or rates of payment of the employees, either by way of increase or reduction.

Second. As to adjustment of complaints through the conciliation board or otherwise.

Any party so desiring shall present his claim in writing to the commission, stating the same in detail.

Work shall be resumed at once. The award shall be effective from April 1, 1906, and the present award of the commission with any modification thus made shall continue in effect until March 31, 1909. Three years are suggested, because that time has been found satisfactory in the present case, and also because this would avoid introducing into purely business questions the political considerations of a Presidential campaign.

The members of the commission shall be paid such compensation for services and expenses as may be fixed by themselves. The operators shall furnish one-half of the same and your committee shall furnish the other half.

The proposition was signed by George F. Baer, W. H. Truesdale, J. B. Kerr, David Willcox, Morris Williams, E. B. Thomas and J. L. Cake, the latter representing the independent operators.

The following are the members of the Anthractie Strike Commission:

Judge George Gray, United States Circuit Court, Wilmington, Del.

Carroll D. Wright, president of Clark College, Worcester, Mass., formerly Commissioner of Labor.

Brigadier General John M. Wilson, United States Army, Washington, D. C.

Bishop John L. Spalding, Peoria, Ill.

Edgar E. Clark, grand chief conductor, Order of Railway Conductors of America, Cedar Rapids, Iowa.

Thomas H. Watkins, formerly an independent coal operator, now a soft coal operator, Scranton, Penn.

Edward W. Parker, expert statistician, Washington, D. C.

Of these all are in good health except Bishop Spalding. When the commission was originally appointed an appropriation of $50,000 was made by Congress for its maintenance.

Philadelphia papers report that the Reading road has taken out of service 135 freight locomotives.

New B. & O. Pier at Locust Point.

Work on the substructure of the new freight pier of the Baltimore & Ohio under construction at Locust Point, is well under way, and the McLean Construction Company, which has the contract, expects to finish this part of the work in August. Plans for the superstructure have been completed, and bids are being asked for. This new pier will be one of the largest and best on the Atlantic coast, and will be known as new pier No. 8, taking the place of old piers Nos. 6, 7, 8 and 9, which will be removed. The new pier will be two stories high, and will have a total floor space of 300,000 sq. ft. It will rest on about 10,000 piles, averaging 60 ft. long. On the floored pile foundation concrete piers will be built under the building columns. The frame will be of steel, about 2,000 tons being required, and it will be covered with galvanized corrugated iron. The second floor will be carried on heavy timber joists resting on steel girders. The flooring will consist of an underfloor of pine, with a finished surface of maple which has been found to be the most economical for trucking floors. The roof will be of composition, and the skylights and windows of wired glass. The building will have eight large elevators, four barrel hoists and four traveling cranes. The cranes will travel on a single rail set in the first floor and have an overhead guide. The elevators and cranes will be operated by electricity. Special attention has been paid to meeting the views of the fire underwriters. The building is to be completely equipped with high-pressure water pipes and hose, and also have a fire wall across the center of the building. The pier will have berth space for three of the largest vessels. The export and import business at Locust Point is now very heavy. With elevator capacity for about 2,250,000 bushels, it has frequently occurred recently that over 2,000,000 bushels was on storage. Of corn, there is now about 1,200,000 bushels. The pier now under construction is the second to be finished under the general improvement policy which the company is pursuing at Locust Point. The first was pier No. 9, built about a year ago, and which is designed for handling immigrant business.

Projected Government Railroad in Canada.

As a result of the success of the Temiskaming & Northern Ontario, the Ontario Government has decided on further government railroad building. If a more complete survey justifies the expectations as indicated by the preliminary reports a line will be built from Cobalt to Sudbury, where connection will be made with the Canadian Pacific. The proposed line will traverse a rich mineral and forest section.

Equipment for Egyptian Railroads.

The Egyptian Government is planning to spend a large amount of money to improve its railroads, and many locomotives and passenger and freight cars will be added. The locomotives will come from England, but there is a possibility that the passenger and freight cars may be ordered in the United States. The manager of the road is J. H. L'E. Johnstone, to whom all inquiries should be addressed at Cairo, Egypt.—*Consular Report.*

Increase in Fares on Intercolonial.

There has been an increase in passenger rates on the Intercolonial Railway, owned by the Canadian Government, of about 5 per cent. The new schedule provides for a charge of 3 cents a mile for any distance from 1 mile to 200 miles. Previously the 3-cent rate was only up to 100 miles, and from 101 miles upward on a graduated scale. There is a charge, from 201 to 300 miles, of 2.7 cents per mile, and a gradual reduction on each 100 miles up to 1,000, when the rate is 2 cents. For commercial travelers the rate will be 2¼ cents, instead of 2 cents as now, and the 1,000-mile ticket is also advanced from 2 cents to 2¼ cents per mile. These rates, it is stated, are still lower in most cases than those on the Grand Trunk and Canadian Pacific. The Intercolonial Railway has never been a paying institution.—*Consular Report.*

Inspection of Engine Brakes.

At the February meeting of the Canadian Railway Club, Mr. A. B. Brown, of the Westinghouse Air Brake Co., read a paper on Inspection and Repairs of Engine Brakes in Engine Houses. He urged that the condition of the brakes as well as the character of the work done should be reported to the general air brake inspector on a suitable blank, form for which was recommended. Mr. Brown proposes that all defects shown on this form shall be repaired in the engine houses, except those having a small star opposite. Loose nuts upon the air end of main piston rod belong to this category, and, therefore, except in an emergency, must not be tightened up in engine house, but, instead, the pump should be replaced and sent to the shop where facilities are available for making proper repairs.

Railroad Building in Mexico.

President Diaz, in his message to Congress, sums up the railroad situation in that country as follows: For the past six months the new railroad built aggregated 190 miles. The names of the companies building were: Kansas City, Mexico & Orient; Pan-American, and Cananea, Rio Yaqui & Pacific. The government railroad system aggregates 10,735 miles. On the Mexican Central extension between Tuxpan and Colima a tunnel about 500 ft. long and a bridge with a span of about 300 ft. has been completed.

Manufacturing and Business.

James Rawle, of Bryn Mawr, Pa., has been elected President of the J. G. Brill Co., to succeed the late G. Martin Brill.

The Capitol Lock-Nut & Washer Co., Columbus, Ohio, has opened an office in Chicago at 960 Monadnock Building, with C. L. Wolfersberger in charge.

Fairbanks, Morse & Company have appointed S. F. Forbes, formerly Purchasing Agent of the Rock Island, to a similar position with their company, with headquarters at Chicago.

J. C. Mitchell, formerly with the Atlas Engine Works, Indianapolis, Ind., has accepted a position in the sales department of the Dayton Pneumatic Tool Co., with headquarters at Dayton, Ohio.

The new 30-stall roundhouse of the Southern Railway at Atlanta, Ga., is being equipped with a complete heating and ventilat-

ing system, consisting of fan and steel pipeheater, furnished by the B. F. Sturtevant Co., of Boston, Mass.

The street car lines in Bahia, Brazil, are being converted into electric lines. This involves about 65 miles. Negotiations in regard to contracts are being carried on by M. T. Guinle, who may be addressed, care of the General Electric Co., 44 Broad street, New York. Five thousand tons of rails for the new line have been ordered from the Lorain plant of the United States Steel Corporation.

General Eugene Griffin, First Vice-President of the General Electric Company, sailed from New York on April 10 on the steamer "Graf Waldersee," to make an extended trip in England and on the continent, largely for rest and recreation. As he is a director in the Cie Francaise Thomson-Houston and Vice-Chairman of the British Thomson-Houston Company, these interests will naturally claim a portion of his time.

G. Martin Brill, President of the J. G. Brill Company, died suddenly on March 31st at his home in Merion, Pa. Up to the time of his death Mr. Brill had been enjoying the best of health and every day found him the same energetic man of business. He was born in Hesse Cassel, Germany, in 1846, and was the eldest son of John George Brill, who came to America in 1847, settling in Philadelphia, where he soon became employed by the firm of Murphy & Allison, street car builders. It was not long before the son adopted his father's trade, for soon after his school days he began work in the same company, and for a number of years was foreman of its woodworking department. After the plant was destroyed by fire in 1868, Mr. Brill and his father took hold of the business that their employers had discontinued, and established the firm of J. G. Brill & Son. In 1888 Mr. Brill's father died. The present plant was fashioned after Mr. Brill's own ideas, and his genius and enterprise are evidenced in its every department. Very thorough in everything he undertook, so he trained his men to be likewise. He was of a very kindly disposition, large in mind and heart, and his many friends will feel his loss keenly. In the business world he was regarded as a very capable organizer and director of affairs, and all his dealings were governed by the highest principles. Nearly 100 patents have been issued to him on cars and trucks. He was a member of the Manufacturers' Club of Philadelphia, the New York Club, the Union Club of Cleveland, the St. Louis Club, and a Director of the Merchants National Bank, of Philadelphia, and of the Interstate Railway Company.



G. Martin Brill.

In connection with the electrification of the Nankai Railroad, a 56-mile private line in Japan, rails, cars and motor equipment are to be ordered through the three principal Japanese contracting houses: Mitsui & Co., Silk Exchange Building; Takata & Co., 10 Wall street, and Okura & Co., Bowling Green Building, New York City. The contract for the electrical equipment of the power house will include Westinghouse generators and McIntosh-Seymour engines.

T. George Stiles, of Arlington, N. J., writes: "In your issue of March 30th, describing the interlocking at Roseville, N. J., you have printed a cut of our Universal single and double deck pipe carriers which are designed, patented and manufactured by the writer, without giving any intimation that they are a patented article. This is liable to lead us and others into trouble and litigation. We are not looking for free advertising, but your readers should be informed that these pipe carriers are protected by United States patent. This would not have been necessary had the word 'Patent' been used on the cut."

At a meeting of the Board of Directors of the Westinghouse Electric & Manufacturing Company held Tuesday, April 10, L. A. Osborne, formerly Third Vice-President of the company, was elected Second Vice-President to succeed Frank H. Taylor, resigned. Mr. Taylor, who is also a Director of the company, will retain his seat on the Board. Mr. Osborne's duties as Third Vice-President comprise the direction of the engineering and manufacturing activities of the company. As Second Vice-President he will assume the direction of the commercial branch while retaining those of the Engineering Department. The new Second Vice-President is a graduate of Cornell University, and entered the employ of the Westinghouse Electric & Manufacturing Company in 1891, and has successively held the positions of Assistant Superintendent, Assistant to the Vice-President, Manager of Works, Fourth Vice-President and Third Vice-President.

Iron and Steel.

The output for March of the United States Steel Corporation was the largest in the history of the company.

The Tonopah & Goldfield has given a contract for 8,000 tons of rails, bringing its orders since April 1 up to 14,000 tons.

The American Bridge Co. is making at its Elmira, N. Y., and Ambridge, Pa., works 50,000 tons of bridge material for some 200 bridges on the projected Seoul-Wiji railroad in Korea.

Orders for rails for the past week have been somewhat small, aggregating only 36,000 tons. The Baltimore & Ohio has ordered 2,000 tons additional, and the Philadelphia Rapid Transit 500 tons.

The combined sale of rails for 1906 delivery already aggregate 3,100,000 tons, which is more than the combined output of all the producers during last year. Negotiations are pending for an additional 200,000 to 250,000 tons.

The American Bridge Co. received contracts for 60,000 tons of fabricated steel during March. This was the largest in the history of the company, and exceeds the next highest record, which was March, 1901, when the orders aggregated 54,000 tons.

The United States Steel Products Export Company, New York, the export company of the United States Steel Corporation, has a number of contracts in hand for rails to be used in building electric roads in Europe and South America. The British affiliation of the New York engineering and contracting firm of J. G. White & Co., which was recently awarded the contract by the London County Council for building 22½ miles of railroad in the northern portion of the British metropolis, is to use Lorain rails. The Glasgow corporation has also requisitioned for Lorain special work to be carried out in the extension of the tramways in that city.

OBITUARY NOTICES.

Wilhelm Bork, one of the most accomplished railroad engineers in Germany, a member of the Berlin directory of the Prussian State Railroads, in which he had charge of the locomotive service and of the experiments in electrical traction, died March 9, in his 63d year. Bork was the son of a locksmith, learned his father's trade and two others also, by his own exertions obtained an engineering education, and at a very early age distinguished himself in bridge construction. Even after that time he served as locomotive engineer and in train service, and so qualified himself as an operating officer. Of late years he was especially active in electrical railroad operation, on the street railroads and elsewhere.

Henry W. Parkhurst, until recently Engineer of Bridges and Buildings of the Illinois Central, died in Chicago, Sunday, April 8. His death was the result of a severe accident sustained on February 20 at the Illinois Central suburban station of Windsor Park, Chicago. Mr. Parkhurst was born in Boston, Mass., in 1847. His early life was spent in Providence, R. I., and he graduated from Brown University in that city in 1869. His professional work was begun in the office of a civil engineer in Providence, but the following year he took up railroad work, being engaged on the double-track work of the Providence & Worcester Railroad. In 1871 he went West to be one Assistant Engineer under Mr. E. L. Corthell on the Hannibal bridge over the Mississippi river. He was associated with Mr. Corthell for a number of years, being Resident Engineer of the Sny Island Levee, 50 miles long, in Illinois, opposite the towns of Hannibal, Louisiana and Clarksville, Mo., and Resident Engineer on the Louisiana, Mo., bridge over the Mississippi, after which he was engaged with Mr. Corthell on work connected with the South Pass jetties of the Mississippi river. For several years following this he was engaged on railroad construction work, being Division Engineer on the construction of 15 miles of the extension of the Chicago & Alton to Kansas City and Chief Engineer of Construction of the St. Louis, Keokuk & Northwestern from Hannibal to Clarksville, Mo. He next became associated with the late Mr. Geo. S. Morrison, first as Resi-



H. W. Parkhurst.

dent Engineer of the Gallatin, Mo., bridge of the Chicago & Alton, then as First Assistant Engineer of the Plattsmouth, Mo., bridge from November, 1879, to December, 1880, on the Bismarck, N. Dak., bridge from January, 1881, to June, 1882, and finally on the Blair Crossing bridge from June, 1882, to November, 1883.

In 1883-4 Mr. Parkhurst was engaged in surveys for a railroad in Venezuela, South America. The railroad was never built, however, as a similar concession had also been granted to a French company. Returning to the United States, Mr. Parkhurst was Assistant Engineer in charge of foundations of the Omaha bridge over the Missouri river for a few months in the latter part of 1885. In December of that year he met with an accident which resulted in the amputation of his left leg below the knee, obliging him to change his professional work more to office duties. However, he was able later to take charge of the construction, under Mr. Morison, of the Merchants' bridge at St. Louis, living there from 1889 to 1891. The following year he entered the service of the Illinois Central as Engineer of Bridges and Buildings, his title for part of the time, however, being Engineer of Construction. During the 14 years that he was with that road he designed and built the Burnside, Water Valley, Waterloo and Memphis shops; the Stuyvesant docks, elevators, wharves, etc., at New Orleans; rebuilt the La Salle, Dubuque and Tennessee river bridges, and helped carry out track elevation and depression work, and bulkhead work on the lake front, Chicago. He also designed and built some notable reinforced concrete bridges, the most remarkable being the Big Muddy bridge near Carbondale, Ill., which is a three-span, 140-ft. elliptical arch, double-track structure. For the past few months Mr. Parkhurst has been engaged in consulting engineering work in Chicago. He was a member of the American Society of Civil Engineers and of the Western Society of Engineers, being a past-president of the latter association. He was also a charter member of the American Railway Engineering and Maintenance of Way Association.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Rock Island Company.—H. C. Frick has resigned from the Board of Directors.

Union Pacific.—A. J. Earling, President of the Chicago, Milwaukee & St. Paul; David Wilcox, President of the Delaware & Hudson, and Robert Goelet, have been elected directors, succeeding Jacob H. Schiff, James H. Hyde and Otto H. Kahn.

Operating Officers.

Chicago, Milwaukee & St. Paul.—J. A. Macdonald, Superintendent at Mendota, Ill., has been transferred to Ottumwa, Iowa, succeeding E. Laas, promoted. W. H. Molchior, Trainmaster at Savannah, Ill., succeeds Mr. Macdonald.

Evansville & Terre Haute.—J. O. Crockett, who was recently appointed General Manager, was born in Indiana in 1868. His first railroad service was in 1885 as a messenger on the Pennsylvania Lines. From 1889 to 1894 he was Train Despatcher on the Richmond division, after which he was transferred to Terre Haute, where, after six years, he was appointed Chief Despatcher. In 1902 he was Superintendent of the Peoria division, and in 1903 Superintendent of the Terre Haute & Logansport and of the Logansport & Toledo divisions of the Pennsylvania Lines. In 1904 he went to the Chicago, Rock Island & Pacific, and was made Superintendent of Telegraph and Mails. He was made General Superintendent of the Southwestern district of that company later in the year. In August, 1905, he was appointed Superintendent of the Evansville & Terre Haute and of the Evansville & Indianapolis, where he has remained until his recent promotion.

Pennsylvania.—H. M. Carson, who was recently appointed Assistant to the General Manager, was born in Baltimore, Md., in 1867, and graduated from Lehigh University in the class of 1889, having taken the mechanical engineering course. He immediately began railroad service as an apprentice in the Altoona shops of the Pennsylvania, and has remained with that company ever since. In 1893 he was appointed assistant road foreman of engines of the Philadelphia division, and two years later was made Assistant Engineer of Motive Power at Altoona. In 1900 he was promoted to be Master Mechanic of the Pittsburg division, and the next year was made Superintendent of Motive Power of the Buffalo & Allegheny Valley division, in which position he served until April 1 of the current year.

Traffic Officers.

Lehigh Valley.—J. S. Wood, Division Freight Agent at Buffalo, has been appointed Assistant General Freight Agent, with office at New York, effective May 1, succeeding H. C. Burnett, promoted.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—W. F. Buck, Master Mechanic at Needles, Cal., has been appointed Mechanical Superintendent of the Eastern Grand Division, with office at Topeka, Kan., succeeding F. N. Risteen, deceased.

Beaumont, Sour Lake & Western.—See St. Louis & San Francisco.

Chicago, Peoria & St. Louis of Illinois.—A. L. Rosseter, Master Mechanic, has been appointed Superintendent of Motive Power and Equipment.

Cleveland, Cincinnati, Chicago & St. Louis.—W. M. Duane, Superintendent of Construction, has been appointed Chief Engineer, succeeding G. W. Kittredge, now Chief Engineer of the N. Y. C. & H. R.

National of Mexico.—J. M. Reid, Chief Engineer of Construction, has been appointed Chief Engineer, succeeding R. T. Macdonald, resigned.

New York Central & Hudson River.—George W. Kittredge, who on April 9 became Chief Engineer of this road, graduated from the Massachusetts Institute of Technology in 1877. His first railroad service was in 1880 in the Maintenance of Way Department of the Pittsburg, Cincinnati, Chicago & St. Louis. He remained on the Pennsylvania Lines for 10 years in this department, and then was appointed Engineer of Maintenance of Way and Assistant Chief Engineer of the Cleveland, Cincinnati, Chicago & St. Louis. In 1891 he was made Chief Engineer of that company, which position he has held until his recent appointment. He was also Chief Engineer of the Peoria & Eastern and of the Louisville & Jeffersonville Bridge Co. Mr. Kittredge is a member of the American Society of Civil Engineers, and was at one time President of the Engineers' Club of Cincinnati. He was a charter member of the American Railway Engineering & Maintenance of Way Association, and was its second President.



G. W. Kittredge.

G. A. Harwood, Designing Engineer for the Electric Zone, has been appointed Terminal Engineer at New York, succeeding A. B. Corthell, resigned on account of illness. V. Spangberg succeeds Mr. Harwood.

St. Louis & San Francisco.—M. A. Hanson, Chief Engineer of the Beaumont, Sour Lake & Western, has been appointed Assistant Chief Engineer of the St. Louis & San Francisco, with office at St. Louis.

Union Pacific.—R. T. Guppy has been appointed Principal Assistant Engineer, succeeding R. L. Huntley, promoted.

Purchasing Agents.

Missouri Pacific.—S. P. Pryor, Purchasing Agent, has been appointed to the same position on three other Gould roads, the Texas & Pacific, the St. Louis Southwestern, and the International & Great Northern.

Wheeling & Lake Erie.—J. P. Stark, Purchasing Agent of this company, of the Wabash-Pittsburg Terminal, and of the West Side Belt, has resigned, to engage in other business at Toledo, Ohio.

LOCOMOTIVE BUILDING.

The New York, Chicago & St. Louis is in the market for 15 locomotives.

The Hokkaido-Tanko Railway, Japan, has ordered five locomotives from the American Locomotive Co.

The Kanawha & West Virginia has ordered one passenger and one freight locomotive from the American Locomotive Co.

The Seward Peninsula, Alaska, has ordered three locomotives from the Climax Manufacturing Co. Address J. W. Dixon, President, 40 Pine street, New York.

The Wabash will soon have 20 switching locomotives built at the Baldwin Works and 60 locomotives by the American Locomotive Co. The type of the latter has as yet not been decided upon.

The Mexican International, as reported in our issue of April 6, is in the market for 15 simple consolidation locomotives for delivery as early as possible. The specifications call for a total weight of

202,000 lbs., with 182,000 lbs. on drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 57 in.; straight top boiler, with a working steam pressure of 200 lbs.; total heating surface, 2,648 sq. in.; 316 Shelby steel tubes, 2 in. in diameter x 15 ft. 3 in. long; firebox, 114 in. x 66 in.; tank capacity, 8,000 gallons, and coal capacity, 125 tons. The special equipment called for is as follows: Westinghouse air-brakes, Magnesia Sectional boiler lagging, Tower couplers, Dressel-Elliott acetylene headlights, Nathan non-lifting injectors, U. S. metallic piston rod and valve rod packing, Crosby safety valve, Leach's sanding devices, Nathan sight-feed lubricators, Crosby steam gages and steel wheel centers.

The Kansas City, Mexico & Orient has ordered eight Allfree-Hubbell type simple (2-6-0) and two Allfree-Hubbell type simple (4-4-0) locomotives from the American Locomotive Co., for December delivery. The 2-6-0 locomotives will weigh 168,000 lbs., with 145,000 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 63 in. over tires; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,177 sq. ft.; 300 Seamless Tube Co. of America steel tubes, 2 in. in diameter and 12 ft. 9 in. long; carbon firebox, 108 in. x 40 in.; grate area, 30 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 12 tons. The 4-4-0 locomotives will weigh 140,000 lbs., with 99,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 69 in. over tires; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 1,590 sq. ft.; 230 Seamless Tube Co. of America steel tubes, 2 in. in diameter and 12 ft. 2 in. long; carbon firebox, 96 in. x 40¼ in.; grate area, 26.6 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 12 tons. The special equipment for both includes: Westinghouse air-brakes, Franklin K. & M. boiler lagging, National-Hollow brake-beams, Perfecto brake-shoes, Tower couplers, Handlan-Buck headlights, Ohio injector, Magnus journal bearings, Sullivan piston rod packings, Locomotive Appliance Co.'s valve rod packings, Hayden safety valve, Baltimore sanding devices, Chicago sight-feed lubricators, Railway Steel-Spring Co.'s springs, Crosby steam gages, Economy and Gold steam heat equipment and Schoen tender wheel tires for 4-4-0 locomotives, and Davis cast-steel wheel tenders.

The Southern, as reported in our issue of April 6, has ordered 100 locomotives from the Baldwin Works as follows: Thirty-five six-wheel switching locomotives, 10 Pacific type locomotives, and 55 consolidation locomotives. Ten of the switching locomotives will weigh 145,000 lbs. each, with cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; wagon top boiler with a working steam pressure of 185 lbs.; heating surface total, 2,186.5 sq. ft.; 300 Detroit seamless steel tubes, 2 in. in diameter x 15 ft. 1½ in.; firebox, 65⅛ in. x 65¼ in.; grate area, 29 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, seven tons. The remaining 25 six-wheel switching locomotives will each weigh 120,000 lbs., with cylinders 19 in. x 24 in.; diameter of drivers, 51 in.; wagon top boiler, with a working steam pressure of 185 lbs.; total heating surface, 1,550 sq. ft.; 246 tubes, 2 in. in diameter x 11 ft. long; firebox, 96⅛ in. x 41 in.; grate area, 27.37 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, seven tons. The special equipment for all switching locomotives will include the Westinghouse air-brakes, Golmar bell ringers, Philip-Carey Co.'s magnesia boiler lagging, Waycott brake-beams, Perfecto brake-shoes, Major couplers, Schroeder headlights, Hancock injectors, Ajax journal bearings, Jerome piston rod and valve rod packing, Coale safety valves, Water's sanding devices, Nathan bull's-eye sight-feed lubricators, Railway Steel-Spring Company's springs and Ashcroft steam gages. The simple Pacific type locomotives will weigh 143,690 lbs. on drivers; total weight, 216,850 lbs.; cylinders, 22 in. x 28 in.; diameter of drivers, 63 in.; straight radial stayed wide firebox boiler, with a working steam pressure of 200 lbs.; total heating surface, 3,885 sq. ft.; 314 Detroit seamless tubes, 2¼ in. in diameter x 20 ft. long; firebox, 109¼ in. x 73 in.; grate area, 54 sq. ft.; tank capacity, 7,500 gallons, and coal capacity, 12½ tons. The consolidation locomotives will weigh 197,750 lbs., with 176,650 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 57 in.; straight boiler, with wide firebox, with a working steam pressure of 200 lbs.; total heating surface, 3,517 sq. ft.; 403 tubes, 2 in. in diameter x 14 ft. 6½ in. long; firebox, 107⅛ in. x 71⅜ in.; grate area, 53 sq. ft.; tank capacity, 7,500 gallons, and coal capacity, 12½ tons. In addition to the special equipment as given for the six-wheel switching locomotives, the Pacific type and consolidation type locomotives will have the following specialties: McCord journal boxes, Barber roller trucks, Anaconda hose, Klinger "Reflex" water gages, Elvin driving box lubricators, Tate flexible staybolts, Sessions type "C" draft rigging, Bordo blow-off cocks, McLaughlin flexible joints, United States staybolt iron, and Hancock 6 in. chime whistles.

CAR BUILDING.

The Deepwater is in the market for one business car and nine coaches.

The Three States Lumber Co. has ordered one tank car from Robt. M. Burns & Co.

The Central Pennsylvania Lumber Co. has ordered one tank car from Robt. M. Burns & Co.

The Kanawha & West Virginia has ordered 20 flat cars of 60,000 lbs. capacity from F. M. Hicks & Co.

The Marion, Bluffton & Eastern has ordered eight additional cars from the Niles Car Manufacturing Co.

The Atchison, Topeka & Santa Fe, it is reported, has ordered 50 smoking cars fitted with steel underframes.

The Midland Linseed Despatch, Minneapolis, Minn., has ordered five steel tank cars from Robt. M. Burns & Co.

The Delaware & Hudson has ordered 1,000 hopper bottom gondola cars from the American Car & Foundry Co.

The Chicago & Alton has ordered 250 stock cars, 500 box cars and 250 flat cars from the American Car & Foundry Co.

The Seward Peninsula, Alaska, has ordered 30 flat cars from the Climax Manufacturing Co. Address J. W. Dixon, President, 40 Pine street, New York.

The Cincinnati, New Orleans & Texas Pacific has ordered two café cars from Barney & Smith. These cars will be 72 ft. 6 in. long, over sills, and 9 ft. 8 in. wide. The special equipment includes: Commonwealth bolsters, National-Hollow brake-beams, Perfecto brake-shoes, Westinghouse brakes, Janney-Buhoup couplers, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Miner tandem draft rigging, Harrison dust guards, Gold heating system, Symington journal boxes, Newbold electric and Pintsch gas light, Empire roofs, Railway Steel Spring Co.'s springs and Pullman vestibules.

The Tehuantepec National has ordered 100 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for July delivery. These cars will be 34 ft. 4⅜ in. long, 8 ft. 5⅜ in. wide and 6 ft. 10¼ in. high, all inside measurements. The special equipment includes: Midvale steel axles, American Steel Foundries' bolsters, National-Hollow brake-beams, Christie brake-shoes, Westinghouse brakes, American Car & Foundry Co.'s standard brasses, draft rigging, journal boxes, paint and wheels, Tower couplers, Wagner doors, Simplex Railway Appliance Co.'s bolster springs and Diamond arch-bar trucks. Other specialties are: Hatch doors in roofs 10 ft. long to allow loading on wharves with cranes.

BRIDGE BUILDING.

ARKANSAS.—On April 5 the Upper House of Congress passed a bill authorizing the Tyronza Central Railroad to build a bridge over Little river in this state.

BELZONA, MISS.—Plans have been completed and bids will be asked by the Board of Aldermen April 30 for building an iron drawbridge over the Yazoo river. S. Castleman is Mayor.

CROWNPOINT, IND.—Bids will soon be asked by Charles A. Johnson, Auditor, for building a number of bridges in Lake County.

ELRENO, OKLA. T.—The new bridge which the Chicago, Rock Island & Pacific is to build over the South Canadian river at a point 10 miles south of this city will consist of five spans on concrete abutments, with a steel superstructure, to cost about $1,000,000.

FLORIDA.—A bill has been introduced in the Lower House of Congress authorizing E. L. Potter *et al* to build a bridge over the St. Johns river in this state.

JOLIET, ILL.—We are told by city officials that after more than six years' opposition and the passage of numerous compulsory orders, an agreement has been reached between the city and the railroads for extensive track elevation, with numerous subways at street intersections throughout the main portion of this city. An ordinance has been framed and has been accepted by the six railroads. Work is to be begun soon. It will probably extend over a period of two years and the cost will be about $2,500,000.

MISHAWAKA, IND.—Plans have been completed for building two steel bridges at a cost of about $80,000 each. The proposed structures will each have three S.H.H. spans. M. B. Russ is Commissioner.

MISSISSIPPI.—The Upper House of Congress on April 4 passed a bill authorizing a bridge over the Yazoo river, between the counties of Holmes and Washington, in this state.

NEW ORLEANS, LA.—Plans are again being revived for building a bridge over the Mississippi river a few miles north of New Orleans.

NEW YORK, N. Y.—Bids are wanted April 30 by James W. Stevenson, Commissioner of Bridges of the City of New York, for furnishing metal for the anchorages and for building the towers, cables, suspenders, and the suspended superstructure of the Manhattan bridge over the East river between the Boroughs of Manhattan and

Brooklyn. The work calls for the use of about 40,000 tons of steel. Bids were let last August by the Bridge Commissioner, but a permanent injunction was issued restraining him from carrying out the terms of that contract. The bids now being asked for are to be based on new specifications.

Peoria, Ill.—Permission has been granted to the McKinley syndicate by the Federal authorities to build a bridge over the Illinois river at this place. Bids were recently opened in Chicago for the work, but it is improbable that contractors will undertake to have the piers completed by September 1 of this year as specified, and new bids may have to be asked for.

Peterborough, Ont. Bids are wanted by S. R. Armstrong, City Clerk, April 14, for building a concrete steel bridge at Charlotte street.

Reading, Pa. Bids are wanted April 20 by H. F. Livingood, County Controller, for building a concrete arch bridge over Morlattin creek, in Berks County.

Souris, Man. Bids are wanted May 19 by J. W. Breakey for building a concrete culvert, also for two steel bridges 90 ft. each on concrete abutments, and for a steel bridge over the Souris river at Monteith Junction. Specifications can be had from the Public Works Department, Parliament Building, Winnipeg.

Strathcona, Alb.—An officer of the Canadian Pacific writes respecting the high level bridge to be built over the Saskatchewan river between this place and Edmonton, that it will be located at the foot of Ninth and Tenth streets, passing through the Hutchins Bay reserve at Edmonton. The bridge will be about 2,200 ft. long and 150 ft. above water level. Plans have not yet been decided upon as to the class of bridge to be built.

Woodstock, Ont.—Two bridges are to be built between North Norwich and Windham, one on the border of the county, and the other on the twelfth line.

Other Structures.

Altoona, Pa.—This company is to put up some new four-story buildings as additions to its shops at this place. The cost of the proposed structures and the machinery to be installed will be about $500,000.

Boston, Mass.—The New York, New Haven & Hartford, it is said, has bought land covering about 600,000 sq. ft. as a site for a new freight terminal.

East Somerville, Mass.—The Boston & Maine has decided to build extensive new shops. The company has owned the land, about 100 acres, for the past 10 years.

Fitzgerald, Ga.—This town has granted 200 acres of land to the Atlantic & Birmingham as a site on which the road will build large shops, to employ about 1,000 men.

Girardville, Pa.—The Schuylkill Traction Co.'s car barns were destroyed, also 13 cars, five of which were new, by fire April 3, with a loss of about $75,000.

Ottawa, Ont.—The Grand Trunk has plans ready for putting up a combined Central station and hotel east of the canal, to cost over $1,000,000.

Sacramento, Cal.—Plans have been completed by the Southern Pacific for the extension and rearrangement of its general shops here at a cost of about $3,000,000. About 100 acres of land will be bought to carry out these plans. It is probable that the present station will be abandoned and its site used for the shop extensions. The new erecting shop, completed last year, which is 80 ft. x 600 ft., will remain and be used as a base from which the new system of shops will be laid out. This building will be duplicated on the east and with its annex and adjacent shop will cover an area 320 ft. x 600 ft. There will be a new blacksmith shop 300 ft. x 600 ft. to replace the present structure, which is one-half that size. There will be a car-erecting shop 300 ft. x 600 ft., about double the capacity of the present shop; also a car shop 300 ft. x 600 ft., and new boiler shop 320 ft. x 600 ft. There will be a number of other buildings, each about 220 ft. x 600 ft., and two roundhouses of 32 stalls each.

Scranton, Pa.—An officer of the Lackawanna road says that no improvements are to be made in shop buildings at Scranton during the present year. The company will, however, put up some locomotive shops, but the general plans and details have not yet been decided upon.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alafia, Manatee & Gulf Coast.—This company has under construction 60 miles of road from Boca Grande Pass, on Charlotte Harbor, to Brownville, Florida. A bridge two miles long will be built over Gasparilla sound. Plans are being made for two steel and concrete drawbridges, one at Gasparilla sound and one at the Myakka river. The first lot of 70 lb. rails has been received and track is being laid north from Boca Grande. Extensive piers and docks are also under construction at Boca Grande. L. M. Fouts, 316 Duval Building, Jacksonville, Fla., is General Manager.

Bronx, Yonkers & White Plains (Electric).—The New York State Railroad Commissioners have issued a certificate to this company, which proposes to build a surface railroad from a point in the city of Yonkers to White Plains, about 11 miles.

Brush Creek & Crows Run.—A charter has been granted to this company in Pennsylvania, with a capital of $100,000, to build a railroad from a point of connection with the Pittsburgh & Western, near North Sewickley station, in Beaver County, to a point of connection with the Ohio River Junction Railroad, near New Sewickley. H. C. Parker, Pittsburg, Pa., is President. The Directors are: W. L. Shaw, Henry Culic, Edward Godfrey, H. W. Pratt, E. P. Rodgers, D. W. McNaugher, all of Pittsburg.

California & Oregon Coast.—This company, of which I. O'B. Gunn, of San Francisco, is President and Manager, and Colonel Wain-Morgan is Chief Engineer, is said to have completed surveys for its line and secured options on the necessary right of way, and on terminals and station grounds. The line of the proposed railroad is from Portland, Ore., south for a distance of about 250 miles (air line) to Takilma in the southwest corner of Oregon. The new road will cross the Rogue river, also the Applegate river, passing through a fine timber section as well as a rich copper belt. It will cross the Illinois river at Kirby. The southern terminus is now planned to be at Takilma, where the smelter of the Takilma Smelting Co., is located, but surveys have been made beyond this place over the Siskiyou into Del Norte County and across that county to Crescent City, where connection is to be ultimately made with a line from the south giving connection from Grant's Pass to San Francisco.

Canadian Pacific.—Contract is reported let by this company to J. D. MacArthur, of Winnipeg, Man., for building a 125-mile extension of the Kirkella, Manitoba, branch. Work is to be started at once.

A bill is before Parliament to authorize this company to build lines from New Westminster and Vancouver, and from Stonewall or Selden, in Manitoba, to the shores of Lake Manitoba.

This company has given a $1,250,000 contract to the Ross-Harris Company, Ltd., recently formed in Montreal. The contract calls for the building of a 50-mile section of this company's line between Parry and Byng Inlet on the new Toronto-Georgian Bay line, which is being built to give the Canadian Pacific a direct connection between Toronto and its main line to the west. The work is difficult and a large part of it will have to be built through rock. Work is to be started at once.

Canadian Roads.—Captain Edward Copp, of Detroit, who, with others has for the past two or three years been interested in the project, is planning to build a railroad from the north shore of Lake Superior north to Hudson's Bay. The proposed line will be about 550 miles long, starting at Nepigon, which is on the Canadian Pacific. The section to be traversed is rich in mineral resources, and much of it is adapted for agriculture.

Canyon City, Florence & Royal Gorge Interurban.—A contract has been let by this company to William White, of Florence, Colo., at about $24,000, for grading its proposed road from Canyon City, Colo., through Royal Gorge about 11 miles. Work is to be completed by July 1. (See Construction Record.)

Cape Charles.—Incorporation has been granted this company in Virginia to build a line 15 miles long. William A. Patton, of Radnor, Pa., is President.

Chicago & North-Western.—The Wyoming & North-Western line is now operated from Casper, Wyo., for a distance of 62.7 miles to Wolton.

Chicago, Rock Island & Pacific.—Plans, it is said, are being made for the development of the coal properties owned by this company in Williamson and Franklin Counties in Southern Illinois. It is proposed to build a new line, 95 miles long, connecting these coal properties with the Chicago & Alton at Springfield.

Colorado & Southern.—This company has opened a new line, called the Hamilton district, from Fort Collins, Colo., north to Hamilton, 10.8 miles.

Danville & Scottsville.—Incorporation has been granted this company in Kentucky, with a capital of $25,000, to build a railroad from Danville southwest through the counties of Boyle, Lincoln, Casey, Metcalf, Adai and Barren to Scottsville, in Allen County, about 100 miles. The incorporators are: J. G. Taylor, of Chicago; G. B. Cooper, Stanford; J. S. Murphy, McKinney; J. Brown, Liberty; J. B. Coffey, Columbus; J. H. Allen, Somerset, and J. Follette, M. M. Perkins, Ralph Leach and J. F. Allen, all of Cincinnati

EDMONTON & ATHABASCA.—Application has been made for incorporation by Cross, Short, Bigger & Ewing, Solicitors, of Edmonton, Alb. The company proposes to build a railroad from Edmonton, Alb., north along the Athabasca river to Lac la Biche, 110 miles.

EL DORADO & WESTERN.—An officer writes that this company, which was recently incorporated in Arkansas to build a railroad from El Dorado, in Union County, southwest to Wesson about 10 miles, will let contracts for grading and bridge work about the 18th of this month. It is intended to have the road in operation by October. James Harrington, of El Dorado, is Chief Engineer.

GRAND TRUNK PACIFIC.—Contracts to build 50 miles of this road from Saskatoon, Sask., east, have been let to J. H. Armstrong and S. D. Lake.

The Trans-continental Railway Commission will soon ask for bids for ties and rails for the sections of this road between Winnipeg and Lake Superior Junction, and between Quebec and the head waters of the St. Maurice river.

GREAT NORTHERN.—In a letter to the Winnipeg Board of Trade, President J. J. Hill announces that he is planning to build a transcontinental line through the Canadian Northwest.

GREAT NORTHERN OF CANADA.—This company is making surveys to build a new line from St. Eustache, Que., to connect with a line from Carrillon.

GULF, COLORADO & SANTA FE.—An officer writes that a contract has been let to A. Moore for building a branch line under the name of the Pecos & Northern Texas, from Canyon City in Randall County south to Plainville, Tex., 58 miles, and that 80 per cent. of the grading has been completed. H. T. McGee, of Canyon City, is Chief Engineer.

HAMILTON, GALT & GUELPH (ELECTRIC).—Application for incorporation has been made to the Dominion Parliament to build an electric railroad from Hamilton, Ont., northwest via Galt, Preston, Berlin, and Waterloo, to Elmira, about 50 miles, also from Hamilton northwest to Elora and Fergus via Guelph, an additional 40 miles.

HARTWELL & WASHINGTON.—Residents of Washington, Ga., have applied for a charter for a company under the above name to build a railroad from Washington, north to Hartwell, about 60 miles. Surveys are to be started at once.

KANAWHA & WEST VIRGINIA.—Bids are wanted April 29 by N. C. Van Natta, Chief Engineer, at Charleston, W. Va., for the grading, tunneling, bridging and track laying on a 12-mile extension of this road.

KANSAS ROADS.—W. D. Egolf, of Kansas City, and E. H. Abadie & Co., of St. Louis, and associates, are planning to organize a company with a capital of $4,000,000 to build railroads connecting all the cities in southeastern Kansas.

KENTUCKY & TENNESSEE.—This company has now extended its road from Stearns to Yamacraw, eight miles, and has under construction an additional 13 miles.

KNOXVILLE, SEVIERVILLE & NEWPORT.—Preliminary surveys have been completed and the right of way secured for 50 per cent. of the proposed line, and a distance of 20 miles has been located. Contracts are to be let shortly for building the line, which is to run from Knoxville, Tenn., via Sevierville to Newport. J. Templeton, of Knoxville, Tenn., is President.

KOOTENAY CENTRAL.—The British Columbia General Contract Co. desires to sublet eight miles of grading on this road.

LAKE SHORE ELECTRIC.—Under the name of the Sandusky, Fremont & Southern, this company has filed articles of incorporation for the purpose of building a line either from Sandusky to Clyde or from Sandusky to Fremont, about 22 miles.

LANCASTER & NORTHERN.—A charter has been granted this company in Pennsylvania, with a capital of $100,000, to build a railroad from a point near Lancaster, to a point at or near Millway, in the same county. The President is H. G. Seip, Easton, Pa., and the Directors are Frank Reeder, Jr., R. W. Bowlby, F. C. Rockafellow, A. Duckworth, S. Worthington, A. Sausser, W. Coyle, all of Easton, Pa.

LAS VEGAS & TONOPAH.—This road has been opened from Las Vegas, Nev., on the San Pedro, Los Angeles & Salt Lake, northwest to Indian creek, 44 miles.

LEHIGH VALLEY.—Contract has been given by this company to J. F. Nolan, of Elizabeth, N. J., for grading and masonry work in connection with the change of the line at Towanda, Pa. The cost will be about $300,000.

LORAIN & ASHLAND.—The road which Joseph Ramsey, Jr., and associates is planning to build from Lorain, Ohio, on Lake Erie, to the Hocking Valley and other coal fields along the Ohio river, will be known by this name. (March 29, p. 91).

MIDLAND VALLEY.—This road has been extended from Pawhuska, Okla. T., to Silverdale, Kan., from which point trains are run over the Missouri Pacific to Arkansas City, Kan.

MINNEAPOLIS & ST. LOUIS.—A contract has been given by this company to E. O. Wesley, of Sioux City, Iowa, for building 11 miles on its proposed extension from Watertown, S. Dak., northwest to Aberdeen. The same contractor has put in a bid for building the line between Evarts and Pierre, S. Dak.

MISSOURI PACIFIC.—On the Memphis division of the St. Louis, Iron Mountain & Southern, a new line, called the Latour district, has been opened; it extends from Latour, Ark., south to McGehee, 69.51 miles.

NEW YORK, NEW HAVEN & HARTFORD.—The directors of this company have authorized the construction of a line from a point on the main line between Greenwich, Conn., and Port Chester, N. Y., north through Ridgefield to a point on the Highland division west of Danbury, a distance of about 30 miles. The new line, which is to be double track, will shorten the distance from New York to Danbury and Berkshire summer resorts by about 15 miles. The cost of the work will be about $2,500,000. This is the old Danbury, Ridgefield & Port Chester project.

President Mellen, replying to an inquiry, announces that the line between New Haven and Willimantic is to be straightened so as to make the distance between New York and Boston by this line approximately 200 miles, and that over this line trains can be easily run through in four hours by steam, "and in less time by electricity." Mr. Mellen says that passengers can be carried for as low a fare as on any other road, either existing or proposed; that the engineers are now at work upon the plans, and that the financing has been provided for; and that the line will be available for use before the rival electric line, which has been talked of in Massachusetts, can even obtain its charter. As the distance between New York and Boston by the Willimantic route is now 214 miles, Mr. Mellen's statement implies a radical rebuilding of the 54 miles between New Haven and Willimantic.

OREGON SHORT LINE.—The papers report that plans have been made to build a new line south of the present line from Malad City, Idaho, west to Mountain Home on the main line. It is said that surveys are completed and that work is to be commenced this summer. The new line will shorten the distance as compared with the existing line, about 134 miles.

PACIFIC & IDAHO NORTHERN.—Surveys, it is said, are to be resumed at once by this company from a point where they were abandoned last winter, and to be run north to a connection with the Northern Pacific, somewhere in the neighborhood of Grangeville, Idaho. A number of grading contracts have already been let and work is to be started as soon as the snow is off the ground.

PECOS & NORTHERN TEXAS.—See Gulf, Colorado & Santa Fe.

PENNSYLVANIA.—A contract has been given by this company to the New York Contracting Co., at about $4,500,000, to excavate two blocks in the city of New York, bounded by Ninth and Tenth avenues and 31st and 33d streets, to a depth of about 65 ft., and to build retaining walls. The company originally intended to run a tunnel across this track, but has recently decided that this would be impracticable; and, moreover, that the whole of this territory will be needed for a wide approach to the new station. Most of the excavation will be in hard rock.

PESCADERO RAILWAY & IMPROVEMENT.—Incorporation has recently been granted a company under this name in California, with a capital of $60,000, to build a railroad up Pascadero creek, beginning at its intersection with the Ocean Shore Railroad, for a distance of eight miles. John R. Rogers, Chief Engineer of the Ocean Shore, is one of the incorporators. The new line will run through a rich timber section.

PHILADELPHIA ELEVATED & SUBWAY CO.—Application has been made in Harrisburg by a company under this name for incorporation, with a capital of $30,000, to build an elevated and subway passenger railroad between 63d street and the Delaware river in Philadelphia, practically over the same route as that of the recently abandoned project of the Philadelphia & Western. The new company is backed by Philadelphia and New York capitalists, including A. I. Du Pont, Vice-President of the Du Pont Powder Co.; E. L. Erlanger and M. Klaw, Theatrical Managers of New York, and Phelix Isman and Edward Davis, Jr., of Philadelphia. The elevated structure is to be about three miles long, and the subway about two miles.

QUEBEC MIDLAND.—A bill is now before the House to incorporate this company, which proposes to build a railroad from a point on the inter-provincial boundary between Quebec and Ontario to a point on the west shore of Lake Mattagami in the Province of Quebec. The office of the company will be in Ottawa. The directors are: J. E. Hurdman, A. Wilson, R. B. Owens and H. Mitchell of Montreal, and F. H. Chrysler of Ottawa.

RAWLEY & SOUTHPORT.—This road has been extended from Lil-

lington station, N. C., for a distance of 11 miles to Lower Little river.

St. Louis, Iron Mountain & Southern.—See Missouri Pacific.

Salina & Northwestern.—Surveys are under way for this road from Salina, northwest via Lincoln to Osborne, Kan., 70 miles. G. H. Whitcomb, Salina, Kan., is President.

Salina, Tipton & Northwestern.—Incorporation has been granted the above company in Kansas, with a capital of $2,500,000, to build a railroad from Salina, northwest through Salina, Lincoln, Mitchell, Osborne, Jewell and Smith Counties. The incorporators are said to be all residents of Kansas City.

Sandusky, Fremont & Southern (Electric).—See Lake Shore Electric.

Santa Rosa & Northern (Electric).—This company has been incorporated in California, with a capital of $500,000, by W. A. Cattell, E. T. McMurray, J. H. Sanford, W. G. Taylor and P. S. Scales, all of San Francisco. The company proposes to build a railroad from a connection with the Petaluna & Santa Rose Railway at Santa Rosa, Cal., to Healdsburg, and thence up the Dry Creek Valley. The road will probably be operated by electric power.

Saskatchewan & Alberta.—Incorporation has been asked for in Canada by a company under this name to build a railroad from Moose Jaw, Assin., south to the international boundary, about 100 miles, with a branch west to Swift Current, an additional 100 miles. This is said to be one of Mr. Hill's projects. Charles E. Armstrong, of Calgary, Alb., is solicitor for the company.

Southeastern.—Incorporation has been granted this company in Kentucky to build a railroad from Jackson, southeast to a point in Letcher County about 70 miles. Woodson Poor, G. Dennis, A. T. Holcomb, Jr., and L. J. Hopp, all of Cincinnati, are the incorporators.

Steubenville & East Liverpool.—This company, which was recently organized in Ohio by stockholders of the East Liverpool Traction & Light Co., will, it is understood, take over the property of the Steubenville Traction & Light Co., and build an eight-mile connecting line between Toronto and Wellsville. The incorporators are: Van Horn Ely, of Buffalo; E. McDonnell, C. A. Smith, J. C. Rothery and G. H. Owen.

Texas Railway.—An officer writes that this company, which was incorporated last month, with a capital of $1,000,000, will build a railroad from Port O'Connor, on the Gulf of Mexico, near Pass Calvallo, via Victoria, Yoakum, and Gonzales to San Antonio, Tex., with branches from Yoakum to La Grange and Seguin to New Braunfels, a total distance of 260 miles. The office of the company will be at San Antonio. F. W. Weeks is Chairman of the Board of Directors.

Tioga & Clinton.—A charter has been granted to this company in Pennsylvania, with a capital of $300,000, to build a railroad from a point of connection with the Arnot & Pine Creek Railroad at or near the village of Morris, Tioga County, Pa., to a point in Chapman Township, Clinton County, Pa. H. T. Hall, Lock Haven, Pa., is President. The Directors are B. F. Geary, James C. Smith, H. T. Hudson, C. O. Dunlap, John T. Cupper, H. T. Hall, all of Lock Haven, Pa., and E. S. McNaul and M. W. Denman, of Philadelphia.

Tombigbee Valley.—Bonds are being offered by this company to secure funds for extending its road from its present northern terminus, near Healing Springs, Ala., north to a point near Butler in Choctaw County. The proposed line will pass through a rich cotton and timber section.

Western Pacific.—Bids are wanted at once by Chief Engineer V. G. Bogue for building 109 miles of this line in Nevada. This will include practically all of the heavy work not yet let, between San Francisco and Salt Lake. This section extends from the Nevada-Utah boundary to Deeth on the Humboldt river, and includes about 25 miles or more of heavy rock work and all the tunnel work included in the plans in the eastern part of Nevada. Plans have been approved for a tunnel 12,000 ft. long through the Pequop range, and bids will soon be called for this work. It is expected to have about 8,000 men at work between Salt Lake and San Francisco during the summer.

Wisconsin Central.—Bids are wanted April 15 by C. N. Kalk, Chief Engineer, Milwaukee, Wis., for grading work at a point six miles south of Ashland, involving the removal of about 400,000 cu. yds. of earth.

Zitacuaro & Joconusco.—This road has been opened from Zitacuaro, Mex., to Galeras 9.3 miles.

Yreka Railroad.—This road, which is seven miles long, running from Montague, Cal., on the Southern Pacific, to Yreka, was recently sold to Scott & Van Arsdale, of San Francisco. The new owners are planning to spend about $800,000 extending the road to Etna, in Scott Valley, via Fort Jones and Greenview.

RAILROAD CORPORATION NEWS.

Alabama Great Southern.—This company has sold to Potter, Choate & Prentice, of New York, $1,479,000 4½ per cent. 10-year car trust notes, maturing in equal semi-annual instalments.

Chicago, Indiana & Southern.—This new company, under which name the Indiana, Illinois & Iowa and the Indiana Harbor are to be consolidated, will have $15,000,000 common, and $5,000,000 4 per cent. cumulative preferred stock. It is said that the Lake Shore & Michigan Southern has bought $17,000,000 of this stock and the Michigan Central the rest. The I., I. & I. owns or leases 250 miles of road; it has outstanding $5,000,000 capital stock, which is all owned by the Lake Shore, and $4,850,000 first mortgage 4 per cent. bonds of 1950. The Indiana Harbor was until recently a belt line, but this year has been extended and now connects Indiana Harbor, on Lake Michigan, with Danville, Ill., 110 miles south, opening up valuable coal lands for the New York Central Lines. It was built and equipped by the Lake Shore, and the Michigan Central at a cost of about $11,000,000.

Cincinnati, New Orleans & Texas Pacific.—This company has sold to Potter, Choate & Prentice, of New York, $1,938,000 4½ per cent. 10-year car trust notes maturing in equal semi-annual instalments.

Delaware & Eastern.—The Guarantee Title & Trust Co., Pittsburg, is offering at par the last $100,000 of an issue of $800,000 first mortgage 5 per cent. bonds of 1956, the total authorized issue being $1,000,000, of which $200,000 is reserved for future improvements. The proceeds of the sale of the bonds outstanding are being used to build the road from East Branch, N. Y., on the New York, Ontario & Western, northeast to Arkville on the Ulster & Delaware, about 40 miles, and a nine-mile branch from Union Grove to Andes, N. Y. Construction was begun Sept. 1, 1905, and about 15 miles of the road are now in operation. The capital stock of the company is $600,000.

Fort Wayne, Van Wert & Lima Traction.—E. H. Rollins & Sons, of Chicago, are offering the unsold portion of a block of $1,400,000 first mortgage 5 per cent. bonds of 1930. The interest of these bonds is guaranteed by the Lima & Toledo Traction Co., which leases the Fort Wayne, Van Wert & Lima. The last-named company owns 60 miles of interurban road between Fort Wayne, Ind., and Lima, Ohio.

Indiana Harbor.—See Chicago, Indiana & Southern.

Indiana, Illinois & Iowa.—See Chicago, Indiana & Southern.

Kansas City, Mexico & Orient.—The Texas Railroad Commission has given permission to this company to issue $10,984,400 bonds at $20,000 a mile on its road built and to be built in Texas. The application, it is said, makes the following statement of the present status of the work:

"According to the plans of the engineers, the road in Texas will eventually cost $34,500 per mile, or a grand total of $18,948,090, but it is desired to issue bonds at present only on a basis of $20,000 per mile. Of the 549 miles, the right of way has been acquired for 84 per cent., or 461 miles; 191 miles has been graded, viz., 160 from Sweetwater north to Red River, and 31 south from Sweetwater toward San Angelo; and 62 miles of track has been laid, from Sweetwater to Rule, Haskell County, 53 of which is in operation. Construction expense to date, $993,500; material on hand, $180,000; engineering and legal expenses, $150,000."

Missouri, Kansas & Texas.—This company has declared a semi-annual dividend of 2 per cent. on its $13,000,000 outstanding 4 per cent. non-cumulative preferred stock. This is the first dividend paid on any stock of the company since its reorganization in 1890.

New York Central & Hudson River.—Gross earnings for the quarter ended March 31 were $21,292,255, an increase of $2,849,166.

St. Louis, Rocky Mountain & Pacific.—This company, which was organized last year to build 120 miles of road from Des Moines, N. Mex., west and southwest to Colfax County, and which at that time owned or had mining rights in over 500,000 acres of coal lands, has, it is reported, bought 800,000 acres more in Colfax County for $15,000,000.

Southern.—This company has filed with the Secretary of State of Mississippi an equipment mortgage for $9,000,000, covering 100 locomotives and 10,000 cars.

Tonopah & Goldfield.—Charles D. Barney & Co., New York, are offering at 100½ the unsold balance of a block of $1,150,000 Tonopah & Goldfield first mortgage 6 per cent. bonds of 1921. According to the terms of the mortgage, 1/15 of the bonds issued shall be retired annually at 102½ and interest by lot; provision is also made that the entire issue is subject to redemption at the same price on any interest date after Jan. 1, 1907.

GENERAL NEWS SECTION

NOTES.

The Central Vermont has made a slight increase in the pay of 600 trainmen.

A freight agent at Fort Worth, Tex., has been indicted by a Grand Jury for compelling his subordinates to work on Sunday.

F. E. Behr, the monorail man, has asked the Rapid Transit Commission of New York City to consider a plan which he has in mind to establish a monorail between Brooklyn and Coney Island.

A demurrage bill of $2,500 accrued at Dunkirk, N. Y., recently; 80 carloads of stripped locomotives loaded there to go to the coast for shipment to the Isthmus of Panama were held a month for want of shipping directions.

A disagreement concerning wages between the Grand Trunk Railway and its locomotive engineers has been referred to a board of three arbitrators: Wallace Nesbitt, of Toronto; P. H. Morrissey, of Cleveland, and John F. Wallace, of Chicago.

The Railroad Commissioners of Texas propose to order all passenger fares in the state reduced to 2½ cents a mile, and will give a hearing on May 5, when the railroads can offer any objections which they may have. The rates at present are 3 cents a mile.

The Southern Railway, the Alabama Great Southern, the Alabama & Vicksburg, and the Vicksburg, Shreveport & Pacific, announce that a through train is to be run daily each way between Atlanta, Ga., and Shreveport, La., by way of Birmingham and Meridian. Existing trains will be connected and quickened.

The Wabash lines east of Toledo and the Baltimore & Ohio are reported to be in need of telegraph operators.



The upward inclination is looking up. Semaphore signals of this type, the Loree-Patenall patent, the arm to be moved upward from the horizontal to indicate proceed, are being installed on the River division (West Shore) of the New York Central & Hudson River road between West Cornwall, N. Y., and Newburg, a distance of five miles. These signals are a part of the extensive installation or normal-danger block signals being put in on the West Shore by the Hall Signal Company, and will be the first of the kind in the country to go into regular service.

The Boston & Maine has lately put in use the new automatic block signals between East Somerville, Mass., and North Beverly, which have been under construction for several months back. In these signals green is used for the night proceed indication, yellow in the distant signals when the arm is horizontal, and blue for the night stop indication in dwarf signals.

Reporting on a collision at Black Rock, near Buffalo, Feb. 26, the New York State Railroad Commission has recommended that the line of the New York Central at that point be equipped with a block signal system. The superintendent of the road has notified the commission that the recommendation will be complied with.

The opening of the Wind river or Shoshone Reservation public lands in Wyoming has been postponed until August 15, 1906, by joint resolution of Congress. Construction of the Chicago & North Western's line to the Reservation border is being pushed rapidly and will probably be finished within a few weeks.

President Mellen, of the New York, New Haven & Hartford, has notified a committee of citizens of Lyme, Conn., that the railroad company will present to the State of Connecticut, as a gift, the bridge across the Connecticut river at that town, on the completion of the new bridge which is now being built. The citizens want the old structure for a highway bridge. Mr. Mellen makes the proviso that if a trolley track is laid on the bridge it shall be used only by a company controlled by the New Haven.

The Louisville & Nashville, having reduced its passenger fares on a part of its line near Louisville to half the ordinary rates, to compete with an electric line, will be called before the State Railroad Commission to defend its action, complaint having been filed with the Commission that in making this reduction the L. & N. discriminates against the general public. The low rates apply only on certain new trains, running once an hour, which were put on specially to compete with the electric line.

The City of Chicago has won its suit in the Supreme Court of the United States to compel the removal or lowering of the street railway tunnel under the Chicago river at Van Buren street. The railway company contended that as the tunnel, when made, was a lawful structure, neither the state nor the city had power to compel its removal without compensation; but the Supreme Court decides that the order made by the city is a proper exercise of governmental authority in the interest of the common welfare. The opinion was by Justice Harlan.

The State Railroad Commissioner of Michigan has ordered the Michigan Central to reduce passenger fares on three lines where the passenger receipts have increased since the rate of fare was fixed under the law two or three years ago. On the line between Detroit and Bay City and that between Jackson and Bay City the reduction must be from 3 cents to 2.5 cents a mile, and on the line from Jackson to Grand Rapids the rate must be made 2 cents. On the last-named line the passenger earnings last year were $3,500 a mile, an increase of 75 per cent. since the former reduction from 3 cents to 2.5 cents.

The latest employee of the Baltimore & Ohio Railroad to be retired on a pension is Mrs. Mary L. Bounds, a car cleaner at Wheeling, W. Va. Mrs. Bounds began work Oct. 2, 1868, in the yard at Wheeling, and there she has remained. She has never made a single trip for pleasure and her only travel on the railroad was five trips to Weston, a distance of 109 miles from Wheeling, which she made to visit her invalid husband. She wants everybody to know that during her entire service with the railroad she has received the very best of treatment from her employers, and she is profuse in her praise of General Superintendent W. C. Loree and Division Superintendent A. W. Thompson. For the last five years she has received $30 a month; before that $25, except in hard times, when she was cut down to $23.

Floods in California and Nevada.

A recent blockade caused by landslides on the Valley division of the Southern Pacific, at the mouth of Tunnel No. 17 in the Tehachapi Range, about eight miles north of Bakersfield, Cal., blocked the road for eight days. It was finally raised by building a bulkhead of heavy timbers after removing a portion of the accumulated earth. As fast as a steam shovel made a hole in the pile of dirt, this timber retaining wall was extended, putting a stop to the slides, which had been occurring frequently for several days. Above the barrier, which somewhat resembles the frame of a snowshed, lie thousands of yards of loose earth, which are by this means kept from covering the tracks. The San Pedro, Los Angeles & Salt Lake has completed its reconstruction work where the tracks were washed out by the recent floods sufficiently to resume through passenger and freight trains. A force of 2,000 men has been at work, the largest gang being at a big washout near Caliente. Construction crews from the Tonopah and Las Vegas line were brought in to assist in clearing the line. Through travel was suspended over three weeks.

Grossly Unreasonable.

The latest decision issued by the Interstate Commerce Commission declares that a certain rate made by the Missouri Pacific on flour in Arkansas—42 cents per 100 lbs.—is grossly unreasonable, and that the reasonable rate for the service would be 11 cents per 100 lbs. The complainant was Moran, of Lamar, Mo., who shipped two cars of flour to Hope, Ark. The 42-cent charge was from Little Rock to Hope, the flour having been sent to Little Rock over the St. Louis & San Francisco. If it had been sent all the way by the Missouri Pacific it would have gone through for 25 cents per 100 lbs. (with the addition of $3 for switching to the Missouri Pacific tracks at Lamar). The distance from Little Rock to Hope is 112 miles, and the rate which is declared reasonable (11 cents) is that prescribed in the tariff of the Arkansas State Railroad Commission between those points. From Lamar to Little Rock the rate by both of the competing roads is 20 cents. The Missouri Pacific offered the shipper a rebate to 24 cents; and then a second reduction (to 19 cents instead of 24), but both were declined by the complainant.

Extensive Water Works.

The Pennsylvania Railroad is to pump water over the Allegheny mountains from Wilmore to Altoona 25 miles. An immense reservoir is being constructed at Wilmore, on the Pittsburg division, 92 miles from Pittsburg, a power station has been completed there, and pipe lines are now being laid to get the water to the reservoir and for pumping it over the mountains. This operation will be

one of the most important parts of the water supply scheme now being effected by the Pennsylvania on the main line between Pittsburg and Philadelphia. The establishment of an inexhaustible water supply was begun over a year ago, after the severe drought of the fall of 1904, and has been in progress since. The total cost of the system which the company has laid out is estimated at about $10,000,000.

A large number of charters on Cambria county streams were obtained last summer by underlying companies of the Pennsylvania. The American Pipe Manufacturing Company and the Mountain Water Supply Company are subsidiary concerns which are carrying out the Pennsylvania's plans, having been formed for that purpose. The scheme is one of the most extensive of its kind ever undertaken by a railroad company and will make the biggest system of pipe lines in use in the country.

At the big Wilmore reservoir, which is to have a capacity of about 40,000 gallons, the water secured from streams of several townships is to be centered, carried there by gravitation and by pumping. Five hundred carloads of pipe are now being shipped to Wilmore for the line, including the long stretch from Wilmore to Altoona. The pipe lines will extend as far west as Latrobe. Another reservoir will supply the Pitcairn shops from the Indian Creek watershed.

The pumping of water over the Alleghany mountains will be one of the greatest engineering feats in the history of the Pennsylvania. A power house 40 ft. x 86 ft., with a stack 120 ft. high, and of heavy equipment has been put under construction at Wilmore. From this station the water will be pumped 25 miles to supply the big car and locomotive shops of the Pennsylvania at Altoona. Contributing pipe lines to the Wilmore reservoir will be laid from Loretto and other points and a line has been finished from Beaverdale.

The Pitcairn shops will be supplied by a line from the Southwest branch, along which the Mountain Water Supply Company is now building dams and laying pipes. When the Pennsylvania's water system is finished (probably in 1907), an adequate supply for shops and locomotives will have been provided, even in the periods of most severe drought. Construction has been kept up all the winter and will be prosecuted more vigorously now that good weather is practically assured.—*Connellsville (Pa.) News.*

Inquiry as to Coal Traffic.

The Interstate Commerce Commission held an inquiry at Philadelphia last week in the investigation ordered by Congress to determine how far and in what manner railroads are interested in coal and oil which they transport as common carriers. The investigation, according to Philadelphia papers, established the fact that in three railroad statistical bureaus agreements exist governing the transportation and distribution of bituminous coal, and also fixing the percentage of coal to be carried by the different roads.

Testimony was brought out showing that these pooling agreements have been in operation for ten years, and that the Eastern New York and New England all-rail Bituminous Coal Traffic Association carries out an agreement that where agreed percentages are departed from, resulting differences shall be equalized either by diversion of traffic or suspension of shipping. Another bureau under the name of the Tidewater Bituminous Steam Coal Traffic Association governs all shipments to tidewater at New York, Philadelphia, Baltimore, Newport News and Norfolk. All bituminous coal shipped to New York harbor, except that going through all rail to New England, is regarded as tidewater coal, and commands a lower proportionate freight rate than when going to other ports, where only coal for points beyond the Capes gets the tidewater rate.

The testimony of officers of the Pennsylvania Railroad is summarized in the reports as showing that coal companies owning large numbers of cars have a decided advantage over shippers who have no cars, being able to contract for the delivery of coal at stated times; that railroad officers own stock in coal mining companies, and that it is often impossible to distribute the available supply of empty cars equitably. One statement is to the effect that the Pennsylvania refuses to run the private cars of shippers who own less than 500 cars.

Mr. White, statistician of the bureau of statistics of the Tidewater Bituminous Steam Coal Traffic Association, testified that the association was formed in 1896 and that it was subsequently agreed that the tidewater coal traffic should be apportioned among the roads in the association as follows: Pennsylvania, 46.65 per cent.; Beech Creek, 11.05 per cent.; Baltimore & Ohio, 11.35 per cent.; Chesapeake & Ohio, 12 per cent.; Norfolk & Western, 18.45 per cent. It appeared, however, that no settlements between the roads had been made since 1896.

It appeared that in 1902, when by reason of the anthracite coal strike, there was a great demand for cars in the bituminous coal trade, the Pennsylvania road sold 200 coal cars to the Berwin-White Coal Co.

Officers of the Pennsylvania Railroad having been asked to produce at a subsequent hearing certain books and papers from the company's offices, the counsel of the road the next day filed an appeal to the higher court against the granting of an order to compel the production of the books and papers.

At Baltimore testimony was taken concerning the relations of the Baltimore & Ohio with coal companies along the line of its road. A number of officers of the B. & O. own stock in coal companies.

Announcement was made by the Attorney-General at Washington last Tuesday that he had retained Messrs. Charles E. Hughes, of New York, and Alexander Simpson, Jr., of Philadelphia, to take under consideration all the facts now known, or which can be ascertained, relating to the transportation and sale of coal in interstate commerce; to advise what, if any, legal proceedings should be begun, and to conduct, under the direction of the Attorney-General such suits or prosecutions, if any, as may be warranted by the evidence in hand and forthcoming. Mr. Hughes was the counsel of the life insurance investigating committee in New York City last year.

This action by the Department of Justice is taken as a result of consideration of the subject by the Department for some time, and particularly in consequence of the evidence which has been taken by the Interstate Commerce Commission during the past two weeks, as noted above; and of the recent decision of the Supreme Court in Hale vs. Henkel, holding that the Federal government has the right under legal proceedings to examine the books and records of corporations engaged in interstate commerce.

London Tube Railways Permanent Way.

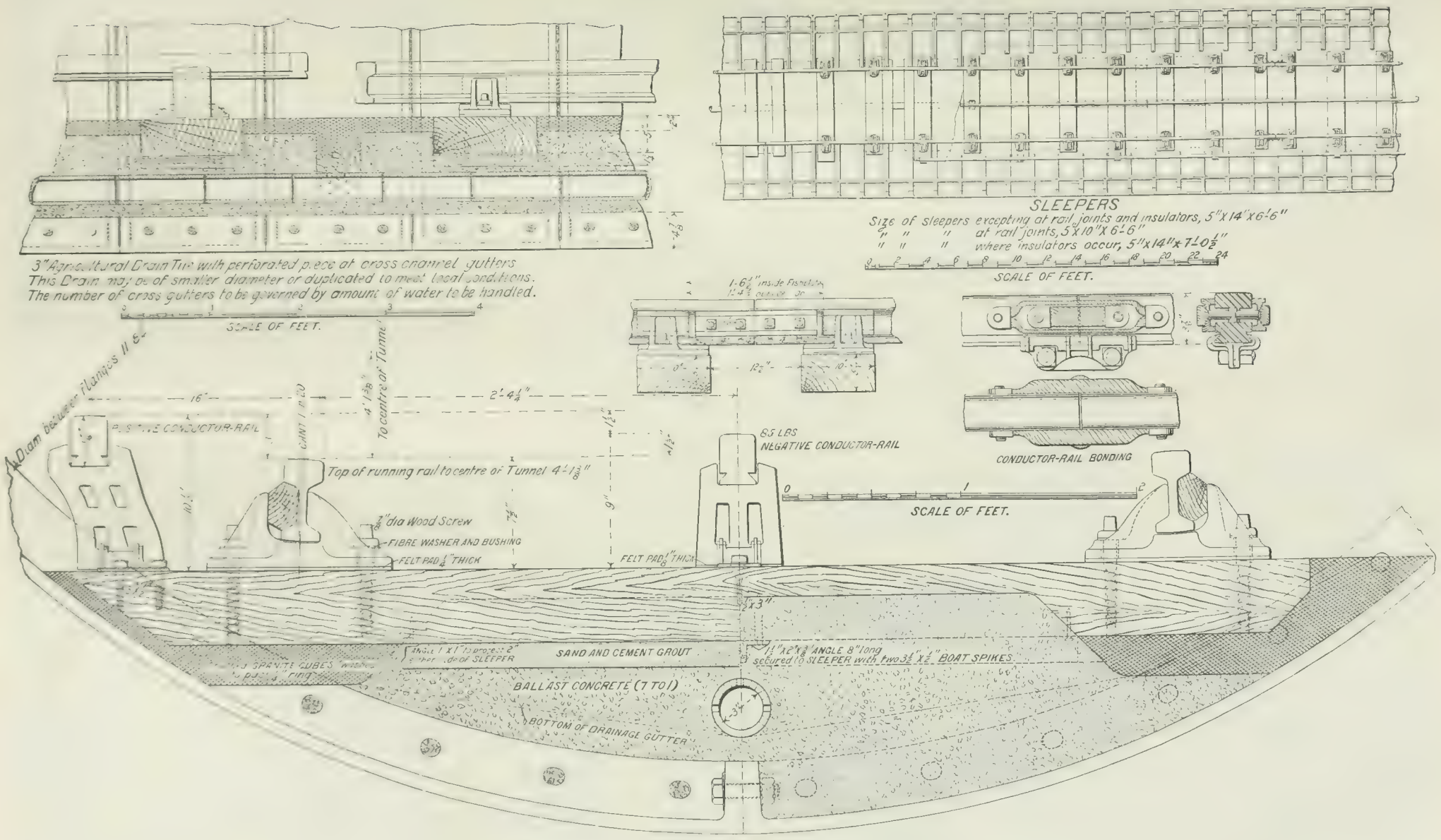
The accompanying drawings show in detail the permanent-way system already in place in the Baker Street & Waterloo Railway, and designed to be generally adaptable for tube railways. The dimensioned drawings show the whole matter so clearly that little else is needed for an understanding of the method designed by Mr. J. R. Chapman, Chief Engineer, for securing such a measure of elasticity and permanence as is desirable under these peculiar circumstances.

The rails are 35 ft. long and weigh 90 lbs. per yard. The reason for making this length of rail is that it is a maximum length which could be lowered down the river shaft, and turned horizontally in the tunnels. The rail section adopted for this purpose is a novel one, but that subject is referred to in another column.

The sleepers are 14 in. wide and laid 40 in. from center to center, so that there is one of these 14-in. sleepers in each alternate segment of the tube, except where the rail joints occur, and at this point 10-in. sleepers are placed in adjoining segments. The sleeper timber is Australian karri.

Both the positive and negative conductor rails rest upon glazed stone wire insulators. The flexible bonding is indicated in the drawings with terminals on the "Crown" principle, wherein the drift-pin is driven from the face of the bond. There are four bonds to each joint—that is, two bonds on each side of the rectangular rails, and the terminals of all bonds are 1 in. in diameter.

The support for the sleepers is, so far as the writer knows, absolutely novel. The drawings show a rigid support of sand and cement grout and of ballast concrete for the middle portion of the sleepers between chairs, also a comparatively elastic support of broken stone ballast underneath the running rails. Permanent way engineers will examine the details in our drawings with much interest, and they will probably note in the first instance that it departs radically from any previous practice, and is also apparently not in accordance with a basis principle in the making of railroad roadbed, in that it furnishes a rigid support for the sleepers for quite nearly the entire distance between the running rails, and at the same time leaves the load on the running rails to be carried upon the somewhat elastic and varying support of broken stone ballast. That is to say, the engineer will at once say that this is a "center-bound" track. The sand and cement grout gripped about the sleepers, supports the sleeper up to a point quite nearly under the inside of the rail chair, and at this point the grout is finished with an angle iron. At first sight it would appear that this furnishes a weak point where the sleeper, under severe or unusual stresses, at any time when the stone ballast under the rail is not wedged up tight, may be subjected to an undue shearing stress. Nevertheless, anyone inclined to make this criticism on the design must bear in mind that this broken stone ballast under the running rail is in a confined space in a tube in such a way that gravity will aid the ganger in keeping the sleeper well supported by the ballast. It is an experiment whose value, time and service will determine. The sleepers are intended to act as a spring, and karri sleepers are sufficiently strong and elastic to endure the strain, whereas other woods would not be suitable. It is evident that this departure from established practice is made for the purpose of preventing noise and vibration, which might subject the company to the payment of damages to property holders on or near the line. The engineer inclined to follow precedents only will have his fears as to the result of this somewhat bold and certainly novel undertaking, but Mr. Chapman's long experience in track work inclines one to have confidence in his design, and it should be borne in mind



Permanent Way—Baker Street & Waterloo Railway.

that tube conditions are quite different from those which obtain out-of doors.

In one other respect Mr. Chapman has made a departure. His rail section, not accurately shown in the drawing, does not conform in its essential lines to either the section adopted by the Engineering Standards Committee in England or to the adopted section of the American Society of Civil Engineers. The head of the rail is the American Society standard, the angle under the head being 13 deg. from the horizontal. The upper surfaces at the base of the rails have the same angle of 13 deg. from the horizontal, whereas the Engineering Standards Committee section has an angle of 20 deg. in both places. Undoubtedly Mr. Chapman, in using the 13-deg. instead of the 20-deg. angles at the points where the fishplate is intended to support the joint, has it in mind that the fishplates will be by so much the more enabled to support the joint against vertical stresses—and this is true. But the criticism might be made that the fishplate does little or no useful work in this vertical support at the joints.

Large Output of Anthracite.

The aggregate anthracite coal tonnage for March was 5,745,868 tons, showing that the anthracite operators rushed coal to market in anticipation of a possible strike. The tonnage exceeded that of the corresponding month of 1905 by nearly a half million tons. The Lackawanna was the heaviest gainer, with 237,471 tons, and the Reading second with 131,702 tons. The Lehigh Valley was the only one of the companies to show a falling off, having decreased 73,300 tons. The following table shows the distribution of the tonnage:

	March	
	1906.	1905.
Reading	1,175,941	1,044,239
Lehigh Valley	840,224	913,524
Central of New Jersey	716,872	687,825
Del., Lack & Western	993,153	755,682
Delaware & Hudson	592,850	557,520
Pennsylvania	497,985	405,345
Erie	520,579	493,340
New York, Ontario & Western	256,689	252,925
Del., Susquehanna & Schuylkill	151,575	148,167
Totals	5,745,868	5,257,567

	Feb. 28.	Mar. 31.	Dec.
Coal, at tide shipping points, tons	828,822	693,095	135,727

Manufacturing and Business.

The offices of the erecting department of the Westinghouse Electric & Manufacturing Company for Manhattan Borough have been moved from 111 Broadway to the Fuller Building, corner of 23d street and Broadway.

The Bucyrus Company, South Milwaukee, Wis., is building 61 steam shovels, three railroad wrecking cranes and one railroad pile driver for work at Panama. These are said to comprise all the equipment of this nature so far bought by the Isthmian Canal Commission.

The Holland-American Construction Company, a subsidiary Westinghouse corporation, has the contract to build an electric (trolley) railroad 115 miles long from the German frontier to the North Sea, touching Arnheim, Zaandam, Amsterdam, Utrecht, Rhenen and Zutphen. The cost of the line is estimated at $5,000,000, and it is designed to carry both freight and passengers.

The Westinghouse Machine Company, of East Pittsburg, received orders during February and March for 35 steam turbines, aggregating approximately 50,000 brake horse-power capacity. The most important equipments were those ordered by the Transit Development Co., Brooklyn, 7,500 k.w.; Toledo Gas & Electric Co., 3,000 k.w.; Los Angeles Pacific Railway Co., 2,750 k.w.; Detroit United Railways, 1,200 k.w.; Columbia (S. C.) Electric Street Railway Co., 3,000 k.w.; St. Paul Gas Light Co., 1,500 k.w.; Grand Trunk Railroad Co., for St. Clair Tunnel, 3,000 k.w.; Detroit, Monroe & T. S. L. Ry., 1,200 k.w.; Northern Heating & Electric Co., St. Paul, 1,000 k.w., and Griffin Wheel Co., Chicago, 1,000 k.w.

Iron and Steel.

The Grand Trunk Pacific has given a contract to the Algoma Steel Co., of Sault Ste. Marie, for 50,000 tons of 80-lb. rails, delivery to be commenced during the present year.

The New York Central has given an additional order for 20,000 tons of rails to the Lackawanna Steel Co., for 1906 delivery. The Southern Pacific has also closed an order for 25,000 tons. Eastern mills have been given orders aggregating about 5,000 tons in addition.

The Carnegie Steel Co. has let the contract for putting up two large blast furnaces at Rankin, Pa. They will cost about $2,000,000. Each will be 100 ft. high and 23 ft. in diameter at the base, and will have a capacity of 500 to 600 tons a day. It is expected to have them completed by the first of next year.

Alfred H. Merritt, of Duluth, Minn., of the Duluth Iron Works; J. Will Smith, of Los Angeles, who owns mines in the Lake Superior region, and Henry Hewitt and associates, of Tacoma, Wash., are planning to build at Tacoma, Wash., a steel plant to cost $5,000,000, and to employ about 5,000 men. A railroad is to be built by the new company to coal fields, which it already owns. It is expected to have the work completed within two years.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of this society April 19 a paper on "Stresses in Rivetted Connections" was read by C. R. Young.

Southern & Southwestern Railway Club.

At a meeting of this club April 19 in Atlanta, Ga., a paper on "Thermit Welding," by R. P. C. Sanderson, was presented.

Engineers' Club of Philadelphia.

At the meeting of this club, to be held April 21, there will be a paper on mechanical integration, with a special reference to the integraph, by C. O. Mailloux. Lantern views will be shown.

American Society of Civil Engineers.

At the meeting of this society April 18 the subject was "a complete analysis of general flexure in a straight bar of uniform cross section," a paper by L. J. Johnson being presented for discussion. This paper was printed in the Proceedings for February, 1906.

Western Railway Club.

The April meeting was held at the Auditorium Hotel, Chicago, Thursday evening, April 17, at 8 o'clock. The paper for discussion was "A Comparative Test Between a Simple and Compound Locomotive," by Mr. J. F. DeVoy, Mechanical Engineer of the Chicago, Milwaukee & St. Paul Ry.

American Railway Association.

The spring meeting of this Association will be held at the Auditorium Hotel, Chicago, on Wednesday, April 25. Reports will be presented by the Committees on Train Rules, on Car Service, on Safety Appliances, on Statistical Inquiry, on Standard Cipher Code, and on Transportation of Explosives. The election of a President and a Second Vice-President will take place at this meeting, and two members of the Executive Committee, three of the Committee on Train Rules, and three of the Committee on Nominations are to be elected.

Transportation and Car Accounting Officers.

The Association of Transportation and Car Accounting Officers will hold its May meeting at the Adams Hotel, Denver, Colo., on Thursday, May 17. Reports will be made by the Executive Committee, Committee on Per Diem, Committe on Car Service, Committee on Office Methods and Accounting, Committee on Handling Railroad Service Mail, and Committee on Conducting Transportation. A cordial invitation is extended to railroad officials interested in Transportation, Car Service and Car Accounting subjects to be present. The Secretary is G. P. Conard, 24 Park Place, New York; President, H. L. Hunter.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

St. Louis & San Francisco.—A. S. Greig has been appointed Assistant to the President, with office at St. Louis, Mo. Mr. Greig was on the Denver & Rio Grande from 1885 to 1896, acting successively as secretary to the Purchasing Agent, secretary to the Superintendent of Machinery, and secretary, chief clerk and assistant to the General Superintendent. He then went to the Santa Fe, Prescott & Phœnix as trainsmaster. After two years he was appointed Superintendent of the El Paso & Northeastern. He was later made General Superintendent and Traffic Manager, and then Assistant General Manager. In March, 1903, he retired from railroad service and engaged in other work until January, 1904, when he was assigned special duties in the office of the President of the Chicago, Rock Island & Pacific, where he has been until his recent appointment.

Operating Officers.

Central New England.—O. M. Laing, who was recently appointed Superintendent of this road, was born in 1872 at London, Ont. He entered railroad service in 1890 as a clerk in the Auditing Department of the Chicago, Burlington & Northern. The next year he went into the Assistant General Manager's office of the St. Paul & Duluth, becoming, in 1893, chief clerk of that office. In 1898 he was made cashier of the Seattle & International, later becoming also Purchasing Agent. In 1900 he was appointed Chief Clerk to the Superintendent of the Seattle division of the Northern Pacific, and after two years went to the Tennessee Central as Purchasing Agent and General Storekeeper. Later he was appointed also Assistant to the General Manager and was also elected Secretary. In December, 1905, he went to

the Central New England as Assistant Superintendent at Poughkeepsie, N. Y., from which position he was promoted to his present office.

Denver, Northwestern & Pacific.—G. R. Simmons has been appointed Assistant General Manager.

Interoceanic of Mexico.—F. W. Baldwin, Superintendent of Transportation, has resigned, effective May 1.

Missouri Pacific.—W. C. Watrous, Superintendent of Transportation, has resigned.

New Orleans & Northeastern.—S. E. Flanagan has been appointed Assistant Superintendent.

Traffic Officers.

Coal & Coke.—I. K. Dye has been appointed General Freight and Passenger Agent, with office at Elkins, W. Va.

Delaware, Lackawanna & Western.—T. W. Lee, General Passenger Agent, has resigned, the resignation to take effect July 1, on account of ill health.

Oregon Railroad & Navigation.—See Southern Pacific.

Southern Pacific.—James Horsburgh, Jr., Assistant General Passenger Agent at San Francisco, has been appointed General Passenger Agent, with office at that city. Paul Shoup, Assistant General Freight Agent of the Oregon R. R. & Navigation, succeeds Mr. Horsburgh.

Engineering and Rolling Stock Officers.

Atlantic Coast Line.—C. L. Meister, who was recently appointed Mechanical Engineer, graduated from Stevens Institute of Technology in the class of 1897. He began railroad work in the fall after graduation as a rodman on the Metropolitan Street Railway. After a few months he went into the Susquehanna shops of the Erie as a special apprentice, where he remained for two years. He was then draftsman until the end of 1901, when he went to the New York Central & Hudson River for a year. In 1902 he was appointed Chief Draftsman on the Atlantic Coast Line, where he has been until his recent promotion.

Chicago, Rock Island & Pacific.—W. C. Armstrong, hitherto Assistant Engineer of Construction of the Missouri Pacific, has been appointed Bridge Engineer. L. B. Holt, Assistant Division Engineer at Davenport, Iowa, has resigned to go to the Lake Shore & Michigan Southern.

Coal & Coke.—C. E. Turner has been appointed Superintendent of Motive Power.

New York Central & Hudson River.—J. C. Brackenridge has been appointed Consulting Engineer, in connection with electrification.

Purchasing Agents.

Coal & Coke.—J. A. Emmart has been appointed Purchasing Agent.

LOCOMOTIVE BUILDING.

The New York, Chicago & St. Louis is in the market for 15 locomotives.

The Manitou & Pike's Peak has ordered one locomotive from the Baldwin Locomotive Works.

The Pacific Portland Cement Co. has ordered one six-wheel switching locomotive from the Baldwin Works.

The Alafia, Manatee & Gulf Coast is in the market for five locomotives for immediate delivery. Address L. N. Foots, General Manager, Hull, Fla.

The State Board of Prison Directors, 331 Pine street, San Francisco, Cal., will receive bids up to April 30 for one 36-in. gage six or 10-ton contractor's locomotive.

The Boston Consolidated Mining Co. has ordered one 36-in. gage simple four-wheel locomotive from the H. K. Porter Co., for May delivery. The total weight of this locomotive is 18 tons, and has a working steam pressure of 150 lbs.

The Lehigh & Hudson River, as previously reported, has ordered one passenger locomotive, one light Consolidation locomotive, and four heavier consolidation locomotives from the Baldwin Locomotive Works. The latter are to weigh 286,000 lbs. each, including tender.

The A. B. Kaiser Co., Philadelphia, is in the market for eight standard gage six-wheel or eight-wheel switching locomotives. The specifications call for simple locomotives, with at least 80,000 lbs. on drivers; cylinders from 18 in. x 22 in. to 20 in. x 26 in.; diameter of drivers, 4 ft.; straight top boiler preferred, with a working steam pressure of 140 lbs. or over; tank capacity, 3,000 gallons or over; coal capacity, 5,000 tons or over; wheel base is not to exceed 11 ft. 6 in.

The Lima Locomotive & Machine Co. report the following orders for Shay locomotives for the past week: The Cook-Day Lumber Co., New Orleans, one 20-ton locomotive; the Pacific Lumber Co., San Francisco, one 55-ton locomotive; the American Lumber Co., Mobile, Ala., one 65-ton locomotive; the Copp Lumber Co., Shabuta, Miss., one 28-ton locomotive; the McGowan Co., Shivers, Miss., one 20-ton locomotive; the Blind River Transportation Co., Blind River, Ont., one 28-ton locomotive; the Raleigh & Southport Railway Co., Raleigh, one 70-in. x 20-in. consolidation locomotive.

The Wabash, as reported in our issue of April 13, has ordered 30 simple Consolidation (2-8-0) locomotives and 30 simple Prairie (2-6-2) locomotives from the Baldwin Locomotive Works, and 20 simple six-wheel switching (0-6-0) locomotives from the American Locomotive Co., all for July, August and September delivery. The Consolidation locomotives will weigh 214,000 lbs., with 191,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 58 in.; radial stay boiler, with a working steam pressure of 200 lbs.; 375 charcoal iron tubes, 2¼ in. in diameter and 14 ft. 6 in. long; steel firebox, 109 in. x 69 in.; tank capacity, 8,000 gallons, and coal capacity, 14 tons. The Prairie locomotives will weigh 208,000 lbs., with 151,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 70 in.; radial stay boiler, with a working steam pressure of 210 lbs.; 301 charcoal iron tubes, 2¼ in. in diameter and 19 ft. long; steel firebox, 109 in. x 73 in.; tank capacity, 8,000 gallons, and coal capacity, 16 tons. The switching locomotives will weigh 150,000 lbs.; cylinders, 21 in. x 26 in.; diameter of drivers, 52 in.; straight top boiler, with a working steam pressure of 180 lbs.; heating surface, 2,352 sq. ft.; 254 charcoal iron tubes, 2¼ in. in diameter and 15 ft. long; steel firebox, 72 in. x 60 in.; grate area, 30 sq. ft.; tank capacity, 4,500 gallons, and coal capacity, seven tons. The special equipment for all includes: Westinghouse air-brakes, Wabash standard bell ringer and headlights, magnesia sectional boiler lagging for Consolidation and Prairie locomotives and asbestos cement boiler lagging for switching locomotives, Waycott brake-beams and Perfecto brake-shoes for Consolidation and Prairie locomotives, Climax steel couplers, Wabash standard journal bearings for Consolidation and Prairie locomotives, Lewis & Kunzer piston and valve rod packings, Crosby safety valves, Leach sanding devices, Detroit sight-feed lubricators for Consolidation and Prairie locomotives and Chicago sight-feed lubricators for switching locomotives, Railway Steel-Spring Co.'s springs, Crosby steam gages, Gold Car Heating & Lighting Co.'s steam heat equipment for Prairie locomotives, and Standard Steel Works driving and truck wheel tires.

CAR BUILDING.

The Rutland, it is reported, has ordered 100 steel cars.

The Coal & Coke is receiving bids for 200 hopper cars.

The Cleveland & Southwestern Traction has ordered 15 additional cars.

The National of Mexico, it is reported, has ordered 200 additional box cars from the American Car Co.

The Barrett Manufacturing Co., Chicago, has ordered 14 tank cars from the Bettendorf Axle Co., for April delivery.

The Toledo & Ohio Central has ordered three cafe cars and seven day coaches from the Pullman Co. for August delivery.

The Mississippi River & Bonne Terre is in the market for 1,000 box cars of 80,000 lbs. capacity, and 200 box cars of 60,000 lbs. capacity.

The Egyptian Government, it is reported, will shortly order a number of passenger and freight cars. Address Major J. H. L'E. Johnstone, Cairo, Egypt.

The Atchison, Topeka & Santa Fe, it is reported, has ordered 60 steel underframe smoking cars and 200 gondola cars from the American Car & Foundry Co.

The Alafia, Manatee & Gulf Coast is in the market for 100 ventilated box cars and additional passenger equipment for immediate delivery. Address L. N. Foots, General Manager, Hull, Fla.

The Pennsylvania, it is reported, has recently placed an order for 616 freight cars. Five hundred and forty-six of these are to be built by the Pressed Steel Car Co., and the remaining 70 were ordered from the American Car & Foundry Co. Delivery, it is stated, is to be made this summer.

The Illinois Central has ordered 1,000 composite box cars of 80,000 lbs. capacity from the Standard Steel Car Co., for October and November delivery, and will build 531 box cars of 80,000 lbs. capacity at its Burnside shops, for July and August delivery, to fill vacancies in the company's authorized equipment. The composite box cars will weigh 41,500 lbs., and the other box cars will weigh 37,500 lbs. All cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements.

The Denver City Tramway has ordered 12 standard side opening passenger cars and two closed cars from the Woeber Carriage Co., for June delivery. The side opening cars will weigh 38,000 lbs., and measure 43 ft. 3 in. long, over all; 8 ft. 4 in. wide outside over belt rail, and 12 ft. 6 in. high from rail to trolley base. The closed cars will weigh about 39,000 lbs., and measure

44 ft. 5 in. long, over all. The special equipment for both includes: Christie type cast brake-shoes, Westinghouse brakes, Tomlinson Coupler Co.'s couplers, Forsyth curtain fixtures, Pantasote curtain material, Dorner trucks and Griffin Wheel Co.'s wheels. Other specialties are Nichols-Lintern air sanders.

The Chicago & Alton, as reported in our issue of April 13, has ordered 500 box cars of 80,000 lbs. capacity for October and November delivery; 250 stock cars of 60,000 lbs. capacity, and 250 flat cars of 80,000 lbs. capacity for September and October delivery. All of the box cars will be 40 ft. long x 8 ft. 6 in. wide by 8 ft. high, inside measurements. The stock cars will be 36 ft. 6 in. long x 8 ft. 9 in. wide by 8 ft. high, inside measurements. The flat cars will be 41 ft. 10 in. long by 9 ft. wide over all. The special equipment for all includes: Simplex bolsters, American Brake-Shoe & Foundry Co.'s brake-shoes, Spiral brasses, Climax couplers, Security door fastenings for box cars, Miner draft rigging, National journal boxes, and Railway Steel Spring Co.'s springs.

BRIDGE BUILDING.

Acca, Va.—The Richmond, Fredericksburg & Potomac will build a two-span iron bridge 100 ft. long, with approaches at each end of 100 ft. at Hill Monument avenue, at a cost of $20,000.

Atlanta, Ga.—At a special meeting of the General Council the Bridge Committee reported favorably on the construction of the Washington street viaduct. Work on the improvements is to be started at once. Under the terms adopted by the council the viaduct will cost $128,370, of which the city will pay $69,370, and the railroads $59,000. Contracts have been let to Grant Wilkins to built that part of the viaduct extending from East Hunter street to the northern end of the railroad tracks for $66,180, and the remainder of the viaduct to the Oliver Company, extending as far as Gilmar street, at $60,190.

Bath, Ont.—Bids are wanted by Max Robinson, Town Clerk, for building a steel bridge here.

Baton Rouge, La.—Announcement has been made that a company is being organized in New Orleans to obtain permission from Congress to build a bridge across the Mississippi river near this place.

Cap Rouge, Que.—A contract has been given to the Dominion Bridge Co., of Montreal, at $318,000 for building the 3,000 ft. steel viaduct over the Cap Rouge Valley near Quebec, for the Grand Trunk Pacific. Other bids were Locomotive & Machine Co., $331,000; Grand Trunk Pacific, $347,000, and Phoenix Bridge Co., $348,000.

Castlewood, S. Dak.—Bids are wanted May 8 by the County Commissioners for building six steel bridges over the Sioux river in Hamlin County. William Marshall is County Auditor.

Dayton, Ohio.—Plans are being made for building a concrete bridge over the Miami river. Three of the railroads which are interested are making independent plans for the same structure.

Desmet, S. Dak.—Bids are wanted May 16 by J. O. Purintin, County Auditor, for building a steel bridge 60 ft. long over the Vermillion river in Kingsbury County.

Forest, Ont.—Bids are being received by R. Kan, Village Clerk, for building several steel bridges.

Galveston, Tex.—A joint company is being formed by the railroads to build a stone causeway for two tracks from Galveston Bay to connect the island with the main line. The Missouri, Kansas & Texas and the Gulf, Colorado & Santa Fe are ready to join in this work, and if the Southern Pacific will co-operate construction will be started at once.

Greenbay, Wis.—The Chicago & North-Western Railroad bridge over the Fox river at this place is to be rebuilt at a cost of $1,000,000. Nine of the concrete piers will be replaced.

Haverhill, Mass.—The Miller-Collins Co., contracting engineers, of New York, tell us they have given a contract for the general work, piers, etc., at approximately $250,000, in connection with the new Haverhill bridge over the Merrimac river.

Jackson, Ky.—A contract has been given to the Central States Bridge Co. to build a steel bridge 185 ft. over the Kentucky river, to replace the structure recently carried away by the flood.

Newark, N. J.—Plans for a bridge at Clay street have been completed by the engineers of Essex and Hudson counties and approved by the Joint Bridge Committee. The plans call for a structure 320 ft. long, with an opening of 75 ft. The bridge is to be 56 ft. wide and is to cost about $150,000.

Peterborough, Ont.—Bids are being received by E. M. Elliott for building two steel bridges over the Indian river.

Portland, Ind.—A contract has been given to C. E. Walker for building a steel bridge, with concrete abutments, over the Salamonte river.

Revere Beach, Mass.—The Boston, Revere Beach & Lynn and the Boston & Maine will pay part of the cost of a steel bridge over the tracks. The Boston Bridge Works has the contract for the iron and steel. The cost of the work will be about $10,000.

Rutherfordton, N. C.—The County Commissioners have given contracts to the Virginia Bridge & Iron Co., of Roanoke, Va., and the Cope Bridge Co., of Chattanooga, Tenn., for building five steel bridges in Rutherfordton County, at a total cost of about $12,000.

Salina, Pa.—Bids are wanted May 2 at the office of the Superintendent of Public Grounds and Buildings, Harrisburg, Pa., for rebuilding the substructure and superstructure of the bridge over the Kiskiminitas river at this place. John M. Shumaker is Superintendent.

San Juan, Porto Rico.—The Bureau of Public Works of the Department of the Interior is asking bids May 19 for a steel-riveted pony truss highway bridge of 109 ft. span. Plans may be also seen at the Porto Rico Commercial Agency, 91 Wall street, New York. J. J. Jiminez is Superintendent of Public Works.

Toledo, Ohio.—The Council Committee at a recent meeting approved the building of a river bridge at Cherry street, to be of reinforced concrete 82.5 ft. wide, with a lift draw.

Valparaiso, Ind.—Bids are wanted May 7 by S. P. Corboy, Auditor, for building two bridges each 42 ft. long, also two, each 30 ft. long, and one 36 ft. long, all to be of iron, for Porter County.

Other Structures.

Brooklyn, N. Y.—The Delaware, Lackawanna & Western, it is said, has completed negotiations for taking over the properties of the Brooklyn Warehouse & Dry Dock Co. and the Brooklyn Dock & Terminal Co., in South Brooklyn. These are located on the Gowanus canal, extending back to Third avenue and from 24th to 25th streets. The railroad also gets from the first company two dry docks, machine shops, and two slips. From the Terminal company it has bought two large slips and waterfront property, two miles of track, float bridges, warehouses, etc., which have hitherto been used both by the Erie and the Lackawanna.

Enola, Pa.—A contract for making improvements to the shops of the Pennsylvania here, it is said, has been let to J. N. Bastress & Co., of Harrisburg.

Macon, Ga.—The Central of Georgia, it is said, is planning to put up a new freight house at the corner of Fifth and Cherry streets, and to make other improvements at a cost of about $500,000. The company is also considering the question of putting up new shops here.

New York, N. Y.—The Lehigh Valley has applied for permission to the Department of Docks and Ferries to build a steel freight shed on the bulkhead between 124th and 125th streets, East river.

Philadelphia, Pa.—The Baltimore & Ohio has let contracts for the erection of a machine shop, transfer shed, roundhouse, water tanks and other work in connection with the extensive East Side terminal improvements, to Roydhouse, Arey & Co. The work will cost between $600,000 and $700,000, including the enlarging of the terminal yards and the laying of a large amount of new track. The new buildings and yard improvements will be at Moore, Jackson and 36th streets and the Schuylkill river, and considerable filling will be required. The buildings include a machine shop 60 ft. x 120 ft.; blacksmith shop, 60 ft. x 70 ft., with engine and boiler room; trainmen's and shopmen's building, of brick, two stories high, 85 ft. x 35 ft.; yard office, two stories, 34 ft. x 40 ft.; transfer shed and platform with rolling steel doors; 25-stall roundhouse, 400 ft. in diameter; 80-ft. turn-table pit; store house with oil house, 106 ft. x 40 ft. and 35 ft. x 40 ft. respectively; offices and platform; sand house, coal tipple and approach; ash pit; water tanks; brick stack, 125 ft. high; bolt shed and locker room. Considerable car repair work will be done in the new shops.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—On the Belen cut-off the western section has been completed from Belen, N. Mex., east to Vaughn, about 120 miles. The line crosses the Santa Fe Central at Willard and connects with the El Paso & Southwestern at Vaughn. On the eastern end the cut-off is completed from Texico west to the Pecos river, about 76 miles, and work is being pushed on the remaining section, west 58 miles to Vaughn.

Cairo & Thebes.—Capital has been secured by this company for building its proposed road, and location surveys are now being made. Contracts for the work are to be let early in June. The proposed route is from Cairo to Thebes, Ill., 25 miles. The terminal at Cairo, which will be in the middle of the city, will include a large passenger and a freight station, a round-house, coaling facilities and yards. E. A. Smith, of Cairo, is President.

Canadian Northern.—A contract has been given to J. D. MacArthur, of Winnipeg, for grading an extension of this road from Wayburn, Sask., to Stoughton. Work is to be started at once.

Canadian Pacific.—This company has made appropriations for improvements to its lines in the Province of Alberta as follows: Between Calgary and Laggan, $10,000; on the Edmonton branch, $35,000; on the McLeod branch, $75,000; other work, $65,000.

A contract has been let to Hargrave Bros., of Winnipeg, to grade 40 miles of this company's branch line from Stoughton, on the Moose Mountain section, to Weyburn. Work is to be started at once and finished this fall. The line will extend over a level section, and run through some of the finest farming lands in the province.

Chesapeake & Ohio.—This company, it is said, will spend about $1,000,000 double-tracking various parts of its road. Some of the work is to be done between Richmond and Newport, Va., and the balance near Maysville, Ky.

Chicago & North-Western.—This company is planning to make improvements on its Iowa division at a cost of $320,000. The work includes the installation of Hall block signals between Clinton and Otis, and Logan to Council Bluffs, together 115 miles.

Chicago, Rock Island & Pacific.—Official announcement has been made by this company that it will spend during the present summer $1,250,000 for improvements on its main line between Davenport, Iowa, and Council Bluffs. About 50 miles will be reballasted, and the sections between Newton and Colfax, Booneville and Earlham, and Menlow and Atlantic, will be entirely rebuilt. All the bridges, about 20 in number, are to be strengthened or rebuilt. The work also calls for the laying of 250,000 new oak ties and the building of 50,000 rods of fence. About 2,500 yards of crushed stone will be used for rip-rapping embankments where there is danger from overflowing streams.

See St. Louis & San Francisco.

Chicago, Milwaukee & St. Paul.—A contract is reported let by this company to P. E. Shugart, of Nevada, for grading 180 miles on its extension west from the Missouri river in Dakota.

Colorado Roads.—George N. Davenport and others are planning to build an electric road from Golden, Colo., to the top of Lookout Mountain, 7,000 ft. above the sea level. The proposed route is along the side of the hill for a distance of 11 miles. No bridges will be required. The total rise from the starting point to the terminus on the mountain will be about 1,420 ft.

Crawford Bay & St. Marys.—This company, which has been granted permission to build a line from Crawford Bay to Fort Steele, B. C., is seeking authority to build an extension 200 miles beyond Fort Steele to Lethbridge. The route through the rockies will pass either north or south of Kootenay Pass.

Grand Trunk Pacific.—Contracts have been let by the Dominion Government for building two sections of this road, as follows: The western section from Winnipeg east to Peninsula crossing near the junction point of the Fort William branch, 245 miles, to J. D. McArthur, of Winnipeg, at 24 cents a yard for earth and $1.60 for rock; estimated total, $13,010,000. This was about $250,000 below the estimate of the government engineers. Other bids were: Pacific Construction Co., $13,028,000; McArthur Construction Co., $17,048,000, and Grand Trunk Pacific, $13,991,000. The contract for the eastern section is from the north end of the Quebec bridge in Quebec, to a point near La Tuque, 150 miles, to Hogan & McDonald, of Montreal, at 21 cents a yard for earth and $1.44 for rock, or $5,297,000. This is $750,000 below the engineers' estimate. Other bids were: O'Brien & Mullarky, $5,550,000; Grand Trunk Pacific, $6,459,000; M. P. Davis & J. T. Davis, $6,667,000; McConnolly, Jardine & Wilson, $7,081,000, and McArthur Construction Co., $7,940,000. Both these contracts were let to the lowest bidders. The work includes the grading and construction of bridges, but not the rails; and provides that all materials, machinery and supplies shall be of Canadian production as far as possible. The work is to be completed by October 1, 1907. Between these two sections there is a gap of 1,000 miles on which work will probably not be started until the Fort William branch has been built, and the Temiskaming & Northern Ontario extended to Lake Abitibi.

The first definite construction work for this road on the Pacific coast was commenced at Kaien Island, where the British Columbia Pine Timber Co. is erecting a saw mill to cut 50,000,000 ties, being the first order for the British Columbia section of the line. The ties are to be delivered at Port Rupert, B. C.

Hidalgo & Northern.—See Missouri, Kansas & Texas.

Illinois Valley Railway (Electric).—Bids are wanted by this company at its office in Lasalle, Ill., for grading 19 miles of its road. The work includes the excavation of 200,000 cu. yds. of earth and building 1,500 yards of concrete.

Indiana, Columbus & Eastern Traction.—Incorporation has been asked for by this company, with a capital of $1,000,000, in Ohio. The organizers propose to take over the Tucker-Anthony & Applevard rights, which were recently bought by a syndicate of which W. J. Schoepf was the head. The new owners are planning to build a line from Dayton southeast to Richmond, Ind., 100 miles air line. Negotiations for buying the Dayton & Western, which operates between these two points, have been abandoned.

Lake Erie Terminal & Southern (Electric).—An officer writes that a contract has been given by this company to the Terminal Traction Co., 406 American Trust Building, of Cleveland, for building its proposed electric road from Cleveland, Ohio, south to Akron, about 35 miles; and track has been laid for five miles. The work includes the building of two large bridges. H. B. Camp is President, and R. J. Wood, Chief Engineer.

Lehigh Valley.—Under the name of the Lehigh & Lake Erie, which was granted a charter some years ago, this company will build a line 10 miles long around Buffalo, N. Y. The proposed line will touch the Lackawanna Steel Co.'s plant and continue to where the Lake Shore and the terminal road of the New York Central connect. It will cross the Lake Shore, the Erie, the Pennsylvania and the Nickel Plate, and thence by William street to a connection with the main line of the Lehigh Valley.

Lehigh & Lake Erie.—See Lehigh Valley.

Louisville, Henderson & St. Louis.—An officer writes that this company is not making any important changes in its structures beyond the substitution of a few concrete culverts and earth fills for trestles and the reinforcing of some of the older steel structures. The new work to be carried out includes a small freight yard in Louisville, to include about two miles of track. This is between Main, Market, 13th and 14th streets. The yard will have six tracks each for outbound and incoming cars, and will include a house and team tracks. The contract for building the freight house was let in February to Lortz & Fray, of Louisville.

Louisville, South Pittsburg & Birmingham.—Incorporation has been granted this company in Tennessee, with a capital of $100,000, to build a railroad from Louisville to Birmingham. The incorporators are C. H. Glatzan and E. Ripley, of Pittsburg; J. W. Davis, of Falconer, N. Y., and J. A. Shillito, of Crossville, Tenn., and others.

Minneapolis & St. Louis.—Grading has been started on two important extensions of this road in South Dakota. The first is on the new line northwest from Watertown, S. Dak., through Bradley, Aberdeen, and Leola, into McPherson County, 150 miles. The other line will branch off from the Leola line at Conde, following in a westerly direction, toward the Missouri river, for 100 miles.

Minneapolis, St. Paul & Sault Ste. Marie.—This company has started work on a line from Detroit, Minn., west to Fargo, N. Dak., about 50 miles, paralleling the Northern Pacific.

Missouri, Kansas & Texas.—The Hidalgo & Northern is making surveys, and as soon as they are completed will let contracts for building the first section of the proposed line, from the mouth of the Rio Grande to Hidalgo, 60 miles. The M., K. & T. is supposed to be back of this project.

Nevada & California.—See Southern Pacific.

New York, Chicago & St. Louis.—This company, it is said, is planning to double track its road between Stony Island and Osborne, Ill., 22 miles, and to build a 20-mile extension near Chicago.

Oregon Railroad & Navigation.—A contract is said to have been let by this company to Erickson & Peterson for building 47 miles of its proposed line from Elgin down the Grand Ronde river to the junction of the Wallowa river, and thence up that river to Joseph in the center of the Wallowa valley, about 63 miles. The first 16 miles is being built by contractor McCabe.

Pennsylvania Lines West.—The directors have authorized the building of 43 miles of second track on the Pittsburg, Cincinnati, Chicago & St. Louis between Logansport, Ind., and Chicago, which will complete the double track between these points. Work has been begun. On the section between Columbus and Logansport there is double track for about two-thirds of the distance.

Philadelphia, Camden & Inter-City Link.—This company proposes to make a tunnel under the Delaware river from the foot of Walnut street, Philadelphia, to Delaware avenue in Camden, N. J. Soundings already made show that no rock excavation will be required. The Camden Terminal is to be near the present Pennsylvania station. The promoters say that contracts for the work are to be let soon.

Pittsburg, Westmoreland & Somerset.—See Western Maryland.

Rock Island-Frisco Terminal.—See St. Louis & San Francisco.

St. Louis & San Francisco.—A charter has been granted to the Rock Island-Frisco Terminal Railroad Co., of St. Louis, with a capital of $5,000,000. The incorporators are A. J. Davidson, President of the St. Louis & San Francisco; C. A. Gray, H. E. Hand, L. F. Parker and Leroy Kramer. The company was organized to build a railroad from the western boundary of St. Louis, Mo., at the intersection of the Wabash Railroad, thence east and south to a point on the southern city limits between Broadway and the tracks of the St. Louis, Iron Mountain & Southern. The company also intends to secure trackage rights from the Merchants' bridge across the Mississippi river, and to build terminal tracks in St. Clair County, Ill., also to build to a point on the east bank of the Mississippi river near East Carondelet, 30 miles. The road is intended to provide terminal facilities for the Rock Island system

in St. Louis, and it will connect with the Madison, Illinois & St. Louis Railway.

South & Western.—On the line from Marion, N. C., to Spartanburg, this company has 3,000 men at work. At one point there will be 17 tunnels within a distance of 18 miles.

Southern.—Surveys are being made by this company from Seneca, S. C., to Rosman to locate a cut-off between Asheville, N. C., and Atlanta, Ga.

This company has recently bought the projected Ohio River & Gulf and the Kentucky & Tennessee. The latter had already built 15 miles of road in a southwesterly direction from Stearns in Wheeley County, Kentucky. The new owners are planning to extend this line to Jamestown, which is to be the northern terminus of the Ohio River & Gulf, giving the Southern a direct line between its Tennessee Central division, at Johnson's, Tenn., and its Queen & Crescent route at Stearns, Ky. The new line will be about 60 miles long, and in addition to affording a new and shorter route between Cincinnati and Nashville, will reach a rich coal section. Grading has been commenced on the Ohio River & Gulf end of the line, and work is also under way on the Kentucky & Tennessee division. The section to be traversed is largely level, and construction will not be expensive.

Southern Pacific.—According to Southern Pacific engineers, work will be commenced at once on a branch of the Nevada & California from Hazen, Nev., to Fallon, through the agricultural lands of the Carson Sink, where the Government irrigation works are making much land valuable for farming. The rails are on hand at Hazen.

A supply of rails has been stored at Drain, Ore., for the construction of the first 30-mile section of the Drain-Coos Bay branch, and contracts will soon be let for the grading. Surveys have been completed along the entire route, and for the whole distance from Drain to the coast the ruling grades will be less than 1 per cent. The road will follow the Umpqua river valley.

Tampa & Jacksonville.—See Gainesville & Gulf.

Temiskaming & Northern Ontario.—Bids are wanted by H. W. Pierson, Toronto, April 24, for all the work, except the ballasting and track laying, on an extension of this road from North Bay Junction to Nipissing Junction, about three miles. Also for an extension from North Bay Junction to Regina street in the town of North Bay. Plans may also be seen at the office of the Chief Engineer at North Bay, Ont.

Toronto & York.—This company is seeking permission to extend its railroad to Stouffville, Whitby and Bowmanville, Ont.

Western Maryland.—The Pittsburg, Westmoreland & Somerset, it is said, will be built from Zufali to Somerset, and then taken over by the Western Maryland. This new road will give the Gould interests a connection to the Pennsylvania coal fields.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—This company has taken over the Denver, Enid & Gulf, and will operate it as part of its Panhandle division. The D., E. & G. runs from Guthrie, Okla., northwest to Kiowa, Kan., 119 miles, and control of it was acquired by the Atchison several months ago. (Jan. 19, p. 22.)

This company has also taken over the Texas & Gulf, which runs from Longview, Tex., to Timpson, 58 miles, and, it is said, will at once build an extension from Timpson 17 miles south to Center, the northern terminus of the Beaumont division of the Gulf, Colorado & Santa Fe.

Bald Eagle Valley.—A stock dividend of 9 per cent. has been declared payable on May 1 to the holders of the $1,535,000 capital stock. The Bald Eagle Valley is leased to the Pennsylvania, and this dividend is in addition to the regular annual dividend of 10 per cent.

Baltimore & Ohio.—The Board of Directors on April 13 authorized an issue of an additional $27,750,000 common stock, the present amount outstanding being $124,558,000. The new stock is to be offered at par to preferred and common stockholders to the extent of 15 per cent. of their holdings on April 27, making the rights worth about $1.50 per share.

Canadian Northern.—It is reported that this company has bought the Central Ontario, which runs from Picton, Ont., to Bancroft, 116 miles. The Central Ontario has been in the hands of a receiver, and there has been litigation as to whether the road could be sold absolutely under the mortgage.

Central Ontario.—See Canadian Northern.

Chicago Terminal Transfer.—J. N. Faithorn, President, has been appointed receiver. The holders of the $16,500,000 first mortgage 4 per cent. bonds of 1947 recently brought suit against the company on the ground that the semi-annual interest had been defaulted three times in succession.

Denver, Enid & Gulf.—See Atchison, Topeka & Santa Fe.

Kentucky & Tennessee.—See Southern.

Long Island.—The New York Stock Exchange has listed an additional $4,517,000 4 per cent. refunding bonds of 1949, making the total amount listed $22,408,000. Of the entire amount, $3,500,000 were issued for the rebuilding of the Bay Ridge division in Brooklyn; $4,500,000 for elimination of grade crossings and similar improvements; $9,020,000 for shop improvements, second and third tracks, additional equipment, electrification of lines and terminal improvements.

Minneapolis, St. Paul & Sault Ste. Marie.—The New York Stock Exchange has listed $6,050,000 first consolidated mortgage 4 per cent. bonds. Of this amount nearly all ($5,860,000) is to pay for the construction of most of the Thief River Falls extension, completed late last year.

National of Mexico.—Speyer & Co., of New York, have bought $3,000,000 4½ prior lien bonds of 1926. This amount completes the $23,000,000 covered by the mortgage. The proceeds are to pay for the Hidalgo & Northeastern.

New York, New Haven & Hartford.—This company has issued an additional $6,750,000 capital stock, making the total amount outstanding $96,036,300. The new stock is to pay for improvements and for subsidiary roads recently acquired.

The company has sold to J. P. Morgan & Co., New York, $15,000,000 4 per cent. non-convertible debentures of 1956. The proceeds will be used for electrification between Woodlawn, N. Y., and Stamford, Conn., and for improvements on the subsidiary roads recently acquired. Mackay & Co. and Lee Higginson & Co., New York, have bought an additional $1,500,000 4 per cent. bonds.

Pacific Coast Company.—This stock has advanced noticeably during the last week and a half, and it seems probable that some of the large systems are trying to get control. The company's terminal property in Seattle would be valuable to any railroad which wished terminal facilities in the city. Therefore it is likely that if the company changes hands it will go to either the Union Pacific or the Chicago, Milwaukee & St. Paul, each of which is to build a line into Seattle. Harriman and Hill interests are both at present represented in the directorate.

Rock Island Company.—It has been officially announced that the Rock Island Company has acquired a half interest in the Trinity & Brazos Valley, a 77-mile line in Texas running from Cleburne south to Mexia. This road is owned by the Colorado & Southern and is building for the Colorado & Southern its gulf extension from Fort Worth to Houston and Galveston. The Trinity & Brazos Valley has trackage rights over the Gulf, Colorado & Santa Fe from Fort Worth to its northern terminus and from Houston to Galveston. When completed, it will furnish a line for both the Rock Island and the Frisco systems to the gulf.

Through its Rock Island, Arkansas & Louisiana line, which now extends south from Little Rock to within 25 miles of Alexandria, La., the Rock Island proposes to build to a connection at or near Eunice or Opelousas, La., with the projected line of the Colorado Southern, New Orleans & Pacific, thus giving a New Orleans connection.

The St. Louis & San Francisco has bought the projected Colorado Southern, New Orleans & Pacific, which is now building a line, including trackage rights, from New Orleans to Houston. To finance the purchase and important needs of the Colorado Southern, New Orleans & Pacific, the St. Louis & San Francisco has sold $7,500,000 five-year, 5 per cent. notes, secured by a deposit of $8,500,000 first mortgage bonds of the Colorado, Southern, New Orleans & Pacific.

Southern.—This company has acquired the Kentucky & Tennessee, which has $100,000 capital stock authorized and $850,000 bonds. It is in operation from Stearns, Ky., to Yamacraw, 15 miles. See Southern under Railroad Construction.

Texas & Gulf.—See Atchison, Topeka & Santa Fe.

Toledo Railway & Terminal Co.—The protective committee representing the holders of the bonds on which interest has been defaulted consists of: A. T. Sullivan, President of the Nassau Trust Co., Brooklyn; R. E. James, President of the Easton Trust Co., Easton, Pa.; Daniel McCoy, President of the State Bank of Michigan, Grand Rapids, and S. C. Eastman, President of the New Hampshire Savings Bank, Concord. A fifth member will be added later.

Union Pacific.—There are now outstanding $1,877,000 first lien convertible 4 per cent. gold bonds and $194,152,900 common stock. The option to convert these bonds expires on May 1, 1906.

Wisconsin Central.—A special meeting of the stockholders has been called for May 8 to vote on the authorization of an issue of $8,500,000 30-year 4 per cent. first mortgage bonds, to be secured by a mortgage on the extension now under construction from Owen, Wis., to Superior and Duluth. Of this amount $7,000,000 will be issued at once, and the remainder will be reserved for improvement of terminals.

GENERAL NEWS SECTION

NOTES.

The Delaware, Lackawanna & Western has bought large tracts of land at Alden, N. Y., on which to plant trees for timber.

The newspapers say that in consequence of a new law intoxicating liquors are to be no longer sold on the cafe, buffet or dining cars of the Pennsylvania.

According to the *Toledo Blade*, Good Friday was this year recognized on the Pennsylvania Lines, for the first time in their history, by a suspension of local freight traffic.

The Fall River Line announces that the fare between New York and Boston is to be restored on the first of May to $4. Since last fall this fare has been twice reduced, first to $3 and very soon afterward to $2.

The Court of Appeals of the State of New York has sustained the act of the last Legislature, which took from the Board of Aldermen of New York City the power to grant railroad franchises and gave it to the Board of Estimate and Apportionment.

The State Railroad Commissioners of Texas have issued a rule empowering railroads to add 10 per cent. to the bill for the transportation of any freight which the shipper has under-billed or misdescribed for the purpose of securing an advantage over the carrier.

J. C. Lincoln, Assistant Freight Traffic Manager of the Missouri Pacific, has been appointed Traffic Commissioner of the St. Louis Traffic Bureau, and P. W. Coyle is to be Freight Traffic Commissioner of the St. Louis Business Men's League. Mr. Coyle is assistant General Freight Agent of the Wabash.

The Southern Pacific is to separate the freight claims departments from the traffic departments and will appoint freight claim agents in New Orleans, Houston and San Francisco for the lines having headquarters in those cities. Heretofore the claims have been handled by the general freight agents through claim clerks.

The Southeastern Passenger Association, at a meeting held in Chattanooga recently, voted to restrict the number of summer excursions out of commercial centers on account of the complaints of manufacturers that their workmen are too free in taking unauthorized vacations. It was the sense of the meeting that only one such excursion should be run by each of the roads out of any city.

In the case of the Planters' Compress Company against the Missouri, Kansas & Texas, the Interstate Commerce Commission, in an opinion by Chairman Knapp, has decided, in accordance with its former decision in the case brought by the same complainant against the C., C., C. & St. L., that the application by the carriers of uniform rates on cotton in any quantity and their refusal to concede lower rates based upon car loadings, is not in violation of the regulating statute. A dissenting opinion was filed by Commissioner Prouty.

The Interstate Commerce Commission this week continued at Washington its inquiry into the coal and oil traffic on the principal railroads. An officer of the Norfolk & Western testified to an arrangement by which, it appears, his road and the Chesapeake & Ohio had agreed to a division of the coal traffic going to Richmond and to Norfolk. To Richmond the Norfolk & Western makes a rate 25 cents higher than that of the C. & O., thus giving most of the business to the C. & O.; to Norfolk the C. & O. rate is 25 cents higher than that of the N. & W. Asked if this was the result of a definite agreement, the witness was not well informed.

British Railroad Accidents in 1905.

The report of the British Board of Trade for the 12 months ending December 31 last shows 39 passengers, six employees and one other person killed and 396 passengers, 112 employees and eight other persons injured in train accidents during the year. The accidents from other causes, including casualties to persons passing over railroads at level crossings, and trespassers, bring the total casualties for the year up to 1,100 killed and 6,460 injured, as compared with 1,073 killed, 6,889 injured in 1904. The number of fatal injuries to passengers in train accidents in 1904 was six, or less than one-sixth of the number in 1905.

Stakes for Lumber.

Officers of the National Association of Lumber Dealers, which has brought suits against certain railroads to compel them to supply stakes for cars of lumber, held a conference with officers of the defendant roads at Pittsburg, Pa., last week, and as a result the roads are going to equip 80 gondola cars with a "telescopic" steel car stake; and if these prove satisfactory, it is expected that an agreement will be reached to use them generally. It is probable also that 100 platform cars will be fitted with a receptacle beneath the floor for holding stakes. It is proposed to have the receptacle sealed so as to prevent misuse or loss of the stakes when the cars are used for commodities not needing stakes.

United States Steel Corporation.

The report of the United States Steel Corporation for the quarter ended March 31 shows net earnings of $36,634,490, an increase of $13,500,000 over the earnings of the corresponding period in 1905, and the largest ever reported for a first quarter. The unfilled orders on hand on April 1 were 7,018,712 tons, an increase of 1,421,152 tons, as compared with April 1, 1905. The surplus for the quarter, after dividends, was $16,067,000. About two-thirds of this has been appropriated for additional property, for construction and for the discharge of capital obligations. At the annual meeting plans were presented for the new steel mills of the Indiana Steel Company, and for the construction of the new model town of Gary, Ind., where the new plant is to be built. Over 5,000 acres of land have been acquired on the shore of Lake Michigan, and a square mile of this land is to be used for the steel mills alone. There will be 16 blast furnaces, 84 open hearth furnaces and 34 rolling mills. It is expected that the annual output of rails will be about 900,000 tons a year. The foundries will produce about 3,000,000 tons of pig iron, and from 2,500,000 tons to 2,700,000 tons of steel annually. The company's fleet on the Great Lakes will be increased to carry the additional freight and the Lake Shore & Michigan Southern, the Pennsylvania, the Wabash, and the Baltimore & Ohio, will all run tracks to the mills. The works will employ 15,000 men, and the new city should, within four years, have a population of 100,000. The estimated cost of the plant is $75,000,000, and it is expected that it will be in operation in three or four years. Work has already begun.

A $60,000 Fine.

At Chicago April 20, fines aggregating $60,000 were imposed on the Chicago, Burlington & Quincy by the United States District Court, Judge S. H. Bethea presiding. The offense was an unauthorized reduction in the rates on tin plate to Vancouver, B. C. The counsel for the road admitted the violation of the law, but said that the low rate was made to promote American industry. A fine of $40,000 was imposed on the railroad company; $10,000 on Darius Miller, Traffic Manager, and $10,000 on C. G. Burnham, Foreign Freight Traffic Manager. The tin plate was shipped by the United States Steel Products Export Company. The counsel for the road said: "Careful investigation of the prices at which tin plate was being sold in British Columbia and of the freight rates from British ports by steamers and sailing vessels convinced us that in order to compete not only would it be necessary for the American manufacturer to sell very close to the cost price, but also for the railroads to make a very considerable reduction in rates from mills to British Columbia points. The result of arrangements made by the railroads with the shipper was to promote American trade with injury to no American interest.

"When it is remembered that the Government itself gives a rebate of 99 per cent. of the duty paid on imported tin plates when they are manufactured into cans and exported in order to protect the American manufacturer against his foreign competitor, the departure from the tariff in this case finds full justification in principle, if not in law."

Judge Bethea in passing sentence said: "Most of the suggestions made by counsel for the defendants applies to the law making power, and not to the enforcement of the existing laws. It may be true that the law should be different, but I think it the duty of the court to enforce the law as it stands, and I must look at it in that light. There is too much practice in this country of people obeying what laws they please, and not obeying them all. It is not for me to say that a fine will be a sufficient deterrent to others. If there was a provision for imprisonment in the penitentiary, much more in that way might be accomplished. The defendants will stand committed until fines and costs are paid."

The fine was paid promptly, the defendants going to the office of United States Marshal Ames, where a check was made out for the full amount of the three fines. Under the law the court could have assessed a fine of from $1,000 to $20,000 under each of the six counts in the indictment.

Newark and New York.

The Public Service Corporation of New Jersey, which operates the electric street railroads of Jersey City and of Essex and Hudson Counties, has made an agreement with the Pennsylvania Railroad and the McAdoo tunnel interests by which it promises to abandon its own plans for a special Jersey terminal and high speed line to Manhattan. By the agreement the Pennsylvania Railroad

and the "Hudson Companies" (the McAdoo tunnels) will join in building a high-speed electric line that will take passengers of the Pennsylvania at Harrison, and of the Public Service Corporation at Park Place, Newark, and land them in Manhattan, at Church and Cortlandt streets, in 15 minutes. These two companies are to cooperate in building the main Jersey terminal at Harrison, just east of Newark. The Public Service Corporation has transferred to a real estate company owned by the Pennsylvania its large terminal site on Park Place, Newark, and agrees to operate its surface systems both in Essex and Hudson Counties so as to facilitate the transfer of passengers as conveniently as possible to the stations of the high-speed line. The line is expected to be finished and in operation in 1908.

Manufacturing and Business.

Frank H. Taylor, Vice-President of the Westinghouse Electric Company, has resigned.

The T. H. Symington Company has moved its Chicago office to 616-618 Railway Exchange.

The King-Lawson Car Company has moved its New York office from 32 Broadway to 17 State street.

The Young-Mann-Averill Company, Chicago, has moved from the Railway Exchange to Orchestra Building, 168 Michigan avenue.

The New York office of B. M. Jones & Co., Inc., has been moved from 143 Liberty street to Rooms 507 and 508, Washington Life Building, 141 Broadway.

The American Blower Company, Detroit, Mich., has been given an order by the New York, Ontario & Western for a good-sized heating outfit at Middletown, N. Y.

H. G. Ganson, formerly in the sales department of the Pullman Company, has been appointed Manager of the Car Department of M. H. Treadwell & Co., Lebanon, Pa.

Geo. P. Nichols & Bro., Chicago, makers of transfer tables, turntable tractors, drawbridge machinery, etc., will after May 1 be located at 1090 Old Colony Building.

L. F. Bower, formerly Manager of the electrical works of the Allis-Chalmers Co., in Cincinnati, has been appointed Comptroller of the company, with office at Milwaukee. Mr. Bower was born in Pennsylvania and graduated from Wesleyan University in 1879. For the next five years he was in the Treasurer's office of the Jackson & Woodin Manufacturing Co., at Berwick, Pa. He then became Principal of the Preparatory Department of Dickinson College at Carlisle, Pa., but after three years started a company there to make chains. He soon sold out his interest in this to the Standard Chain Co., and was then made superintendent of the car department of the Allison Manufacturing Co., of Philadelphia. In 1890 he was appointed manager and treasurer of the Carlisle Manufacturing Co., maker of cars and other railroad equipment. From 1896 to 1901 Mr. Bower was Secretary and Treasurer of the Dickson Manufacturing Co. (locomotive works), of Scranton, Pa. He remained manager of the machinery department of this plant when it was absorbed by the Allis-Chalmers Co., in 1901. In 1904 he went to Cincinnati as Secretary and Treasurer of the electrical department, and was appointed Manager in 1905. While at Scranton Mr. Bower was admitted to the bar of Lackawanna county.



L. F. Bower.

The Dayton Pneumatic Tool Company, Dayton, Ohio, has opened branch offices at 707 and 708 Lincoln Trust Building, St. Louis, Mo., with J. A. Prescott, Southwestern Manager, in charge.

C. Frank Schwep, who has been at the head of the purchasing department of the Ingersoll-Sergeant Drill Co. for the past 13 years, has been appointed General Purchasing Agent of the Ingersoll-Rand Company, with office at 11 Broadway, New York.

W. M. Wilson has been appointed Western representative at Chicago of the Flannery Bolt Company of Pittsburg, Pa. T. R. Davis has been appointed mechanical expert and traveling representative.

E. H. Sniffin and Arthur West have been elected to the new offices of Third and Fourth Vice-Presidents, respectively, of the Westinghouse Machine Company. Mr. Sniffin will be in charge of the sales department as heretofore. Mr. West, who has been Chief Engineer of the company, retains that title and position. William A. Bole, in consequence of his election to the Vice-Presidency of the Westinghouse Foundry Company, has resigned as Manager of Works of the Westinghouse Machine Company, but has been made Consulting Engineer. Henry L. Barton, formerly General Superintendent of the East Pittsburg works of the Machine Company, succeeds Mr. Bole as Manager of Works.

Iron and Steel.

The U. S. Steel Corporation's price for rails will remain $28 per ton during 1907.

Contracts for railroad bridges recently placed called for about 10,000 tons of structural steel. The Lehigh & Erie will use 3,500 tons for bridges in western New York, which contract has been given to the American Bridge Co., the Chicago & North Western has given contracts to the Pennsylvania Steel Co. for 1,500 tons; the Buffalo, Rochester & Pittsburg for a similar amount to the McClintic-Marshall Construction Co., and the Chicago, Milwaukee & St. Paul for 1,400 tons to the Wisconsin Bridge Co. The Chicago Bridge & Iron Works also has an order for 900 tons of steel.

The Louisville & Nashville has let a contract for 42,000 tons of rails to the Tennessee Coal & Iron Co., and the Erie has given a contract for 4,000 tons of structural steel for a large viaduct. The Pennsylvania Steel Co. will furnish 5,200 tons of fabricated steel for a bridge on the New York & Long Branch Railroad. The Buffalo, Rochester & Pittsburg has given an order for 2,000 tons of rails to the Cambria Steel Co. The New York Central has ordered 20,000 tons of rails, and is in the market for more. The Southern Pacific has ordered 25,000 tons, and the Lima & Toledo Traction Co. 13,000 tons; the Southern has ordered 60,000 tons from the Tennessee Coal & Iron Co., for 1907 delivery. The Tennessee Coal & Iron Company's orders aggregate nearly 150,000 tons of rails. The large amount of steel which will be required to rebuild San Francisco will create a demand which it may be impossible to meet in this country. The Carnegie Steel Co., and the Jones & Laughlins Co., it is said, have orders for all that they can make in the next eight months.

OBITUARY NOTICES.

W. M. S. Dunn, who died recently at his home in Nelson County, Virginia, was, up to 1889, General Superintendent and Engineer of the Chesapeake & Ohio. During the Civil War he was in the Engineering Corps of the Confederate Army, and was later for several years Engineer and Superintendent of part of the Richmond & Danville, now the Southern.

Benjamin Collins, one of the oldest bridge builders in the country, died at Dover, N. H., on March 24, at the age of 85. In 1839 he, in partnership with the late Thomas H. Cushing, built some railroad bridges for the state of Illinois. Between 1840 and 1855 the firm built many bridges on different railroads in New England, including the Boston & Maine, Vermont Central, and the Fitchburg. Mr. Collins continued this work until Mr. Cushing's death in 1868. He also practiced as a civil engineer and surveyor, making both railroad and land surveys, and was an authority on Howe truss bridge construction.

C. M. Bennett, Inspector of Maintenance of Way on the Southwest System of the Pennsylvania Lines West, died recently at Urbana, Ohio. Mr. Bennett began railroad work in the Engineering Department of the Pennsylvania, and after a few years was appointed Engineer of Maintenance of Way of the Pittsburg division of the Pittsburg, Cincinnati, Chicago & St. Louis. He was later made Superintendent of the Indianapolis division, and in 1890 was promoted to be Superintendent of the Southwest System at Logansport, Ind. Three years later he was Superintendent of the Cincinnati & Muskingum Valley, a subsidiary of the P., C., C. & St. L. He resigned from this office at the end of 1904 on account of ill health and was then appointed to the position which he held at the time of his death.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Franklin Institute.

At a meeting of the sections April 26, a paper on High Pressure Steam Tests of a Locomotive Injector, by Strickland L. Kneass, was presented.

The Railway Signal Association.

The next meeting of this Association will be held at the Grand Union Hotel, New York, Tuesday, May 8, at 10.30 a.m. The new constitution, which was presented at the March meeting in Chicago and corrected, will be brought up for final adoption. Papers will be presented by L. R. Clausen (C., M. & St. P.), on "The Upward

Indication of the Semaphore Arm"; by W. H. Arkenburgh (U. P.), on "Electric Locking at Electric Interlocking Plants"; by H. W. Lewis (L. V.), on "Substitution of Track Circuits for Detector Bars," and by J. M. Waldron (Interborough Rapid Transit), on "Alternating Current Track Circuits in the New York Subway."

Iron and Steel Institute.

The annual meeting of this institute will be held at the Institute of Civil Engineers, Great George street, Westminster, London, May 10 and 11. At this meeting the Bessemer gold medal for 1906 will be presented to Floris Osmond, of Paris, and the awards of the Andrew Carnegie gold medal and Research Scholarship for 1906 will be announced. The papers to be presented include:

"The Influence of Silicon, Phosphorus, Manganese and Aluminium on Chill in Cast Iron," by E. Adamson (West Hartlepool).
"The Influence of Manganese on Iron," by Prof. J. O. Arnold (Sheffield).
"The Relation between Type of Fracture and Microstructure of Steel Test Pieces," by C. O. Bannister, Assoc. R. S. M. (London).
"Compression of Steel Ingots in the Mold," by A. J. Capron, M. Inst. M. E. (Sheffield).
"The Manufacture of Rolled Solid Steel Car Wheels and Tires," by P. Eyermann (Wisconsin).
"Brittleness in Thin Steel Sheets," by E. F. Law, Assoc. R. S. M. (London).
"Chainmaking Machinery," by E. Lelong (Couillet, Belgium).
"The Use of Oxygen in Removing Blast Furnace Obstructions," by C. de Schwarz (Liége).
"Volume and Temperature Changes Occurring During the Cooling of Cast Iron," by Prof. Thomas Turner, M. Sc., Assoc. R. S. M. (Birmingham).
"The Influence of Copper in Steel," by F. H. Wigham (Wakefield).

The following reports on work carried out during the past year by holders of Carnegie Research Scholarships will be submitted:

"Hardness of the Constituents of Iron and Steel," by Henry C. Boynton, D. Sc. (Cambridge, U. S. A.)
"Heat Treatment of Wire," by J. Dixon Brunton (Musselburgh).
"Quarternary Steels," by L. Guillet, D. Sc. (Paris).
"Influence of Carbon on Cast Iron," by W. H. Hatfield (Sheffield).
"The Preparation of Carbon free Ferromanganese," by E. G. Ll. Roberts and E. A. Wright, Assoc. R. S. M. (London).
"Deformation and Fracture in Iron and Steel," by Walter Rosenhain, B. A., B. C. E. (Birmingham).

Arrangements have been made to hold a joint meeting of members of the American Institute of Mining Engineers and of the Iron and Steel Institute in London, commencing July 23, 1906. The London Reception Committee will provide entertainments and excursions. Meetings will be held for the reading and discussion of papers on the mornings of July 24, 25 and 26, and visits will be made in the afternoons. A reception will be given by the Lord Mayor at the Mansion House on the evening of July 24. On the evening of July 25 there will be an entertainment at the Earles-Court Exhibition, and on the following evening at the Crystal Palace. On July 27 the annual dinner of the institute, to which the American visitors are invited, will be held at the Guildhall, and on the following day a visit will be made to the glass furnaces of Butlin & Co., at Wellingborough. After the London meeting the American visitors will go to York, Middlesborough, New-Castle-on-Tyne, Glasgow, and Edinburgh. An alternative excursion for the American visitors has also been arranged; to the summer meeting of the Institute of Mechanical Engineers at Cardiff. Bennett H. Brough, 28 Victoria street, London, S. W., is Secretary.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Pennsylvania.—J. S. Donaldson, Assistant Auditor of Miscellaneous Receipts and Accounts, has been appointed Auditor of Miscellaneous Receipts and Accounts. F. E. Shallenberger succeeds Mr. Donaldson.

Texas & Gulf.—W. C. Nixon, Second Vice-President and General Manager of the Gulf, Colorado & Santa Fe, has been elected also President of the T. & G., succeeding G. M. D. Grigsby. J. H. Keefe, assistant to Mr. Nixon, has been elected Vice-President and General Manager, succeeding, as Vice-President, W. B. Ward. G. A. Rogers has been elected Secretary and Treasurer, succeeding F. T. Rembert.

Operating Officers.

Missouri Pacific.—T. E. Byrnes, Inspector of Transportation, has been appointed Superintendent of Transportation, with office at St. Louis, Mo., succeeding W. C. Watrous, resigned.

Oregon Railroad & Navigation.—L. F. Pennington, Chief Despatcher at Starbuck, Wash., has been appointed Acting Assistant Superintendent at that place, succeeding D. B. Smith, resigned.

Traffic Officers.

Chicago, Milwaukee & St. Paul.—G. S. Marsh, First Assistant General Passenger Agent, has resigned.

Nashville, Chattanooga & St. Louis.—E. T. Eckles, chief rate clerk of the Freight Traffic Department, has been appointed to the new position of Assistant General Freight Agent.

Texas & Gulf.—C. L. Taylor, Auditor and General Freight and Passenger Agent, has been appointed Traffic Manager.

Lehigh Valley.—H. C. Burnett, who was recently appointed General Freight Agent, began railroad service in 1883 as a clerk in a freight office of the Denver & Rio Grande. In 1887 he went to the Colorado Midland as Agent at Leadville, Colo., and in 1891 was made General Agent at Salt Lake City. Two years later he was appointed to the same position on the Atchison, Topeka & Santa Fe, and in 1896 went to the South Jersey. In 1898 he went to the Lehigh Valley as Division Freight Agent at Buffalo, where he remained for six years. He then went to New York as Assistant General Freight Agent, which position he held until his recent promotion. J. S. Wood has been appointed Assistant General Freight Agent at New York, succeeding Mr. Burnett, effective May 1.



H. C. Burnett.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—W. F. Buck, recently appointed Mechanical Superintendent of the Eastern Grand division, entered railroad service as a machinist on the Northern Pacific. In 1893 he was made shop foreman on that road, and two years later general foreman of shops at Missoula, Mont. In 1899 he was transferred, with the same title, to Helena, Mont., and three years later was made Master Mechanic of the Rocky Mountain division. In 1904 he went to the Atchison, Topeka & Santa Fe as Master Mechanic at Needles, Cal., where he has been until his recent promotion.

Erie.—G. H. Burgess, Assistant Engineer, has been appointed Engineer of Terminal Improvements, with office at New York.

Kansas City Southern.—W. H. Bush, Assistant Engineer at Pittsburg, Kan., has resigned to become Chief Engineer of Construction of the Louisiana Central, with office at New Iberia, La.

LOCOMOTIVE BUILDING.

The Alabama Great Southern, it is reported, has ordered a number of new locomotives.

The Maryland Steel Co., Philadelphia, Pa., has ordered two saddle tank switching locomotives from the Baldwin Locomotive Works.

The National of Mexico has ordered 12 consolidation and three six-wheel switching locomotives from the Baldwin Locomotive Works.

The National Lines of Mexico have ordered one Pacific balanced compound passenger locomotive from the Baldwin Locomotive Works for purposes of trial.

The Lima Locomotive & Machine Co. reports the following orders during the last week for Shay locomotives: Lee Lumber Co., Louisiana, one 45-ton locomotive; E. R. Spotswood Lumber Co., Lexington, Ky., one 10-ton locomotive, and the Bell Logging Co., of Deepwater, Wash., one 37-ton locomotive.

The Mexican International has ordered 15 consolidation locomotives from the Baldwin Locomotive Works and five Pacific passenger locomotives, one of which will be a balanced compound from the American Locomotive Co. This balanced compound locomotive has been ordered for experimental purposes.

The New York, Chicago & St. Louis has ordered 10 simple consolidation (2-8-0) locomotives, and five simple 10-wheel (4-6-0) locomotives from the Brooks Works of the American Locomotive Co. for October delivery. The consolidation locomotives will weigh 157,100 lbs., with 138,600 lbs. on the drivers; cylinder 19 in. x 28 in.; diameter of drivers 62 in.; radial stayed extended wagon top boiler with a working steam pressure of 200 lbs.; heating surface 2,417 sq. ft.; 306 Worth tubes, 2 in. in diameter and 11 ft. 9¼ in. long; firebox 96 in. x 74 in.; grate area, 46.25 sq. ft.; tank capacity 5,500 gallons and coal capacity, 14 tons. The 10-wheel locomotives will weigh 136,300 lbs.

with 104,000 lbs. on the drivers; cylinders, 19 in. x 24 in.; diameter of drivers, 62 in.; radial stayed extended wagon top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,783 sq. ft.; 244 tubes, 2 in. in diameter and 13 ft. 4⅛ in. long; Otis steel fire-box, 102⅛ in. long and 39¼ in. wide; grate area, 28.54 sq. ft.; tank capacity, 5,500 gallons, and coal capacity, 14 tons. The special equipment for both includes: Westinghouse air-brakes, Sansom bell ringer for 10-wheel locomotives, Keasbey & Mattison boiler lagging, Sterlingworth brake-beams, Corning brake-shoes and Climax couplers for 10-wheel locomotives, Tower couplers for consolidation locomotives, Star headlights, Monitor injector, Magnus journal bearings, U. S. piston and valve rod packings, Kunkle safety valve for consolidation locomotives, Star safety valve and steam gages for 10-wheel locomotives, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel-Spring Co.'s springs, Crosby steam gages for consolidation locomotives, and Midvale driving wheel tires.

CAR BUILDING.

The Central of New Jersey is building a business car in its Elizabethport shops.

The Alabama Great Southern, it is reported, has ordered 2,000 freight cars.

The Western Maryland, it is reported, is asking prices on 500 steel hopper coal cars.

The Missouri, Kansas & Texas has ordered 10 chair cars and 10 baggage cars from the American Car & Foundry Co.

The Duluth & Northeastern has ordered 50 flat cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Alabama & Vicksburg has ordered 150 box cars of 60,000 lbs. capacity from the American Car & Foundry Co.

The Nashville, Chattanooga & St. Louis has ordered 500 wood underframe box cars from the American Car & Foundry Co.

The Minneapolis & St. Louis has ordered three 60-ft. combination mail and baggage cars from the American Car & Foundry Co.

The Chicago & Alton has ordered 700 additional box cars and 2,000 freight and refrigerator cars from the American Car & Foundry Co.

The Toledo, St. Louis & Western has ordered 750 wood underframe box cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The White Pass & Yukon Route, it is reported, will shortly build a branch line, and will need additional equipment, especially second-hand cars.

The National of Mexico denies having ordered 300 additional box cars from the American Car & Foundry Co., as reported in our issue of April 20.

The Vicksburg, Shreveport & Pacific has ordered 150 box cars and 50 hopper coal cars, all of 60,000 lbs. capacity, from the American Car & Foundry Co.

The Barrett Manufacturing Co., Chicago, has ordered 30 tank cars of 10,000 gallons capacity from the American Car & Foundry Co., to weigh 100,000 lbs.

The Jeanerette Lumber & Shingle Co., Jeanerette, La., has ordered eight logging cars of 80,000 lbs. capacity from the Marshall Car Wheel & Foundry Co.

The Cincinnati, New Orleans & Texas Pacific has ordered 500 box cars, 12 first-class coaches, and six baggage cars from the American Car & Foundry Co. and is reported as about to order additional freight cars and a large amount of other equipment amounting in all to about $4,000,000.

The New Orleans & Northeastern, as reported in our issue of April 6, has ordered 600 box cars of 60,000 lbs. capacity; 200 flat cars of 80,000 lbs. capacity, and 150 double hopper coal cars from the American Car & Foundry Co.

The Southern has ordered twenty-five 61-ft. combination baggage and express cars; four 70-ft. combination baggage, mail and express cars; six 65-ft. passenger and baggage cars, and ten 61-ft. postal cars from the American Car & Foundry Co.

The National of Mexico, as reported in our issue of March 9, has ordered three first-class vestibule coaches, three second-class vestibule coaches, there third-class vestibule coaches, and five combination baggage, mail and express cars from the Pullman Co. Pintsch gas is to be used in all these cars.

The St. Louis, Rocky Mountain & Pacific has ordered 100 gondola cars of 80,000 lbs. capacity, and 100 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for September delivery. All cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment for both includes: American Car & Foundry Co.'s bolsters, Westinghouse brakes, Tower steel couplers, Miner draft rigging, Harrison dust guards, McCord journal boxes and Diamond arch-bar trucks.

The Houston Electric Co., Houston, Tex., has ordered 20 Brill semi-convertible grooveless post cars from the American Car Co., for June 15 delivery. These cars will weigh about 34,000 lbs., and measure 38 ft. long, over all. The special equipment includes: Brill axles, bolsters, brake-beams, brake-shoes, brasses, couplers, door fastenings, doors, draft rigging, dust guards, journal boxes, platforms, springs, trucks, vestibules and wheels, National Electric Co.'s air-brakes, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Sherwin-Williams paint, Monitor roofs and Heywood seats.

The Dominion Atlantic has ordered 25 flat cars of 60,000 lbs. capacity and one conductor's van from Rhodes, Curry & Co., for June delivery. The flat cars will be 35 ft. long and 9 ft. 3 in. wide, over all, and 2 ft. 10½ in. high from top of rail to center of drawbar. The van will be 36 ft. long, 8 ft. 10 in. wide, over all, and 14 ft. 9 in. high to top of monitor. The special equipment for both includes: Simplex brake-beams, Christie brake-shoes for flat cars, Westinghouse brakes, Tower couplers, Miner draft rigging for flat cars, Ryan dust guards, Adams & Westlake light for van and Diamond trucks for flat cars.

The St. Louis & San Francisco has ordered 2,000 box cars of 80,000 lbs. capacity, 500 coal cars of 80,000 lbs. capacity, and 500 freight cars of 60,000 lbs. capacity, and 250 flat cars of 80,000 lbs. capacity. The box and furniture cars will be 40 ft. long, the stock cars will be 36 ft. long, and the flat cars will be 43 ft. long. All of the above will have steel underframes with the exception of the furniture cars, which will have steel center sills, and in addition to this the box cars will have a steel upper frame. Orders have also been placed with the American Car & Foundry Co. for 50 cabooses, and an order has been placed with the Pullman Co. for 10 chair cars and six combination mail and passenger cars.

BRIDGE BUILDING.

Arkansas.—Both Houses of Congress have passed the bill authorizing the Tyronza Central Railroad to build a drawbridge across Little river in this state. (April 13, p. 113.)

Atlanta, Ga.—The Southern has filed a bond with the city authorities, which insures the immediate building of the Nelson street bridge. The plans call for the building of a structure from Madison avenue to the western end of the present bridge. The contract for the work has been let to W. W. Griffin, and will be completed in about nine months.

Bellefouche, S. Dak.—Bids are wanted May 15 at the office of the United States Reclamation Service for building five steel highway bridges. R. F. Walter is Engineer in charge.

Bridgeport, Ont.—A new steel bridge will be erected here.

Camden, Tenn.—Bids are wanted May 22 by Judge W. T. Marris for building an iron bridge about 309 ft. long over Big Sandy river in Benton and Henry counties. W. D. Cooper is County Clerk.

Canton, Ga.—Bids are wanted May 19 by W. J. Webb, Ordinary, for building a steel bridge 242 ft. long in the county Cherokee.

Clarkville, Tenn.—The bill authorizing a bridge across the Cumberland river at this place has been passed by the U. S. Senate. (April 6, p. 105.)

Florida.—A bill is before the Committee on Interstate and Foreign Commerce of the House of Representatives authorizing E. L. Potter and others to build a bridge across the Halifax river in this state.

Goderich, Ont.—The Huron & Perth county council will build two steel bridges on the boundary between Grey and Elmer townships. Ansley & Donaldson, C. E., are preparing plans.

Grand Forks, N. Dak.—Bids are wanted by H. Anderson, County Auditor, May 5, for building all the steel bridges that may be needed in Grand Forks County for one year.

Indianapolis, Ind.—Bids are wanted May 7 by Captain B. F. Cheathan, Construction Quartermaster at Lawrence, Ind., for building a reinforced concrete arch bridge.

Kentucky.—The House of Representatives has passed the bill authorizing the Borderland Coal Co. to build a combined railroad, wagon and foot bridge across the Tug Fork of the Big Sandy river where it forms the boundary line between this State and West Virginia.

London, Ont.—The Grand Trunk, in connection with the work

of raising its tracks to avoid grade crossings, will build 10 concrete subways at this place.

MINNESOTA.—A bill has been introduced in the House of Representatives authorizing the Minnesota, Dakota and Pacific Railway Co. to build a bridge across the Missouri river.

MISSISSIPPI.—A bill was introduced in the House of Representatives on April 20 authorizing a bridge across the Tallahatchie river in Tallahatchie County, this State.

MONTREAL, QUE.—An overhead steel bridge is proposed to be built from Berrie street to the ferry landing at a cost of $15,000. The Parks and Ferries Committee oppose the building of this structure.

NASHVILLE, TENN.—The U. S. Senate has passed the bill authorizing Davidson County to build two highway bridges across the Cumberland river at or near this city.

PENNSYLVANIA.—On April 11 the United States Senate passed a bill authorizing the Fayette Bridge Co. to build a bridge across the Monongahela river between the counties of Fayette and Washington in Pennsylvania.

ST. CATHERINES, ONT.—A number of permanent bridges will be erected by the Niagara, St. Catharines & Toronto Railway.

ST. CHARLES, MAN.—The municipality is planning to build a steel suspension bridge over the Assiniboine river at a cost of $100,000.

SANDWICH, ONT.—Bids are being received for the erection of a steel riveted truss bridge, 120 ft. clear span, 16 ft. clear roadway, the bridge to be erected over the river Canard, between the townships of Anderson and Sandwich West, in the county of Essex, six miles from Amherstburg. John F. Miller, County Clerk of Essex, this place, may be addressed.

SOUTH OMAHA, NEB.—On April 10 a bill was introduced in the House of Representatives authorizing a bridge across the Missouri river at or near this place.

WASHINGTON, D. C.—The bridge to be built over the eastern branch of the Potomac river is to be 1,200 ft. long, with a drawer 100 ft. wide in the middle, and is to cost about $900,000.

Other Structures.

BIG SPRING, TEXAS.—The Texas & Pacific will shortly build new steel shops and a 40-stall roundhouse, for which plans have been completed. The company is also planning to build new steel shops and a 60-stall roundhouse for its Louisiana division at a point about 90 miles west of New Orleans. On this the work may be started shortly.

ELIZABETHPORT, N. J.—The Central of New Jersey has given the general contract to the Miller-Collins Co., of New York, for the foundations, structural steel, masonry, roofing work, etc., for its new boiler house and coal bins to be put up at this place.

HARAHAN, LA.—The Southern Pacific has under consideration the question of building large terminals at this place, and is also planning to remove its shops to the New Orleans side of the river near Harahan. The cost of these improvements will be about $3,000,000.

MANITOWOC, WIS.—The Wisconsin Central and the city officials are planning to let a contract for dredging the river at a cost of $80,000, preparatory to the building of a large coal dock by the Wisconsin Central. The proposed dock will be 1,000 ft. long and 400 ft. wide, and it will have a storage capacity of 250,000 tons and a handling capacity of 500,000 tons.

MEMPHIS, TENN.—All but four of the railroads interested in the proposed new union terminal passenger station, to be built at this place, have agreed to the plans, and the work is to be carried out under the name of the Memphis Railway & Terminal Co., which will be incorporated for this purpose. It is expected that an agreement will shortly be reached and the work started.

MONTREAL, QUE.—Work will soon be started on a large office building for the Grand Trunk Pacific here.

NEWPORT, VA.—The Chesapeake & Ohio, it is said, will put up a coal pier at this place, at a cost of $300,000.

PORT ARTHUR, ONT.—The Canadian Pacific will put up a large new passenger station here.

VALDOSTA, GA.—The Southern is putting up a new freight house here, to cost $15,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BRUSH CREEK & CROW'S RUN.—Incorporation has been granted a company under this name in Pennsylvania, with a capital of $100,000, to build a railroad from Park Quarries in Beaver County to North Sewickley, about 10 miles, forming a connecting link between the Fort Wayne at Conway and the B. & O. at North Sewickley. The incorporators are: D. W. McNaugher, E. Godfrey and others at Pittsburg.

CANADIAN NORTHERN.—This company has applied to Parliament for permission to build a line from its Toronto-Sudbury line to connect with the National Transcontinental.

Surveys being made for this company for its proposed line to Hudson's Bay have reached a point near the water shed of the Churchill river.

CANADIAN PACIFIC.—A contract has been given by this company to Hargrave Bros., of Winnipeg, for grading 40 miles of its Moose Mountain branch from Stoughton, Sask.

CENTRAL OF LOUISIANA.—Incorporation has been granted this company in Louisiana, with a capital of $1,000,000, to build a railroad from New Orleans west to the state line. C. C. Henshaw is President.

EASTERN RAILWAY.—A bill has been passed by the Nova Scotia House of Assembly authorizing U. A. Allen and A. A. Allen, of Montreal, and C. J. Coll, manager of the Acadia Coal Co., Stellarton, and associates to build a railroad along the eastern shore of Nova Scotia from Halifax to Guysboro, about 220 miles; also to build a branch from Stellarton to Country Harbor. Such a line will provide the Acadia Coal Co., with a tidewater terminal which can be used throughout the year. The company is incorporated for $2,000,000, and has been granted a loan of $2,000 per mile by the government.

GAINESVILLE & GULF.—This company, which operates 48 miles of railroad in Florida, from Fairfield north to Sampson City, has organized the Gainesville & Gulf to build a line from its northern terminus northeast to Jacksonville, about 50 miles.

GASSAWAY, ELK RIVER & HUTTONVILLE.—A charter has been granted a company under the above name in West Virginia to build a railroad from Gassaway, W. Va., south for a distance of 25 miles to Webster Springs. The incorporators are: E. B. Carlin and L. H. Kelley, of Sutton; T. M. Jackson, of Clarksburg; J. M. Hoover, of Webster Springs, and Elihu Hutton, of Huttonsville. The office of the company is to be at Clarksburg.

GRAND TRUNK PACIFIC.—A sub-contract has been given to M. C. Cance of Rainy River, Ont., for building some of the company's main line a few miles east of Saskatoon, Sask.

F. W. Morse, General Manager of this company, is quoted as saying that bids will soon be asked for building an additional 200 miles of its proposed road between Edmonton, Alb., and the Rocky Mountains. It is expected to have the road in operation between the Rocky Mountains and Fort William, Ont., in time to handle part of the 1907 crops.

GREAT NORTHERN.—A. E. Hogeland, St. Paul, Minn., is quoted as saying that he will start work next month laying track on the Similkameen line of this company, from Midway, B. C., to a point near Princeton, about 100 miles.

HARTWELL & WASHINGTON.—Incorporation has been granted a company under this name in Georgia to build a railroad 56 miles long through Hart, Elbert and Wilkes counties. The capital of the company is $250,000 and the incorporators are W. O. Jones, W. J. Anderson and others.

MADISONVILLE, HARTFORD & EASTERN.—This company has practically secured all the right of way for its proposed railroad to be built from Madisonville, Ky., northeast to Hartford, 60 miles. A bridge will be built over Green River in Ohio County.

MINNEAPOLIS & ST. LOUIS.—The stockholders of this company, at a special meeting, have approved the proposition of the directors to build, under the name of the Minnesota Dakota & Pacific, an extension from Watertown, S. Dak., to Le Beau, S. Dak., with a branch from Conde to Ecla in the same state, approximately 240 miles.

MINNESOTA, DAKOTA & PACIFIC.—See Minneapolis & St. Louis.

MONCLOVA & PANUCA.—According to reports from Monclova, Mex., work has been started on this proposed road, which is to be built from Monclova to Panuca, about 50 miles, at an approximate cost of $1,000,000. The road will furnish transportation facilities for the rich copper mines at Panuca.

NEW YORK, NEW HAVEN & HARTFORD.—An officer confirms the report that this company has bought 600,000 ft. of land fronting on Massachusetts avenue as a site for a freight terminal in Boston, Mass. Provision has been made for 23 tracks and a freight house 35 ft. x 150 ft., also for freight sheds between the several groups of tracks. The company intends to only lay 12 of these tracks at first and the remainder as the demand requires. It is expected to have the yard in operation in about three months.

NORTH & SOUTH TEXAS.—Bids are wanted May 10 for building

... be from Lufkin, Tex., southwest to Groveton, 35 miles. Surveys are being made and ... of way has been secured for two-thirds of the distance. P. V. McCarthy, of Lufkin, Tex., is Chief Engineer.

North River Railway.—A company under this name has been incorporated at Harrisonburg, Va., with a capital of $5,000, to build a railroad. R. M. Gillespie, of New York, is President, and C. B. Williamson, of Harrisonburg, is Secretary and Treasurer.

Oregon Roads.—Plans are being made to build an electric road from Portland, Ore., to Mount Hood, 46 miles, and up the slope of the mountain to the snow line. It is estimated that the cost of the road and equipment will be over $1,000,000. At the terminus on the mountain a hotel is to be built at an additional cost of $350,000. The names of the projectors are not given.

St. Louis & San Francisco.—This company has completed surveys for the proposed line from the Missouri river to New Orleans. It will be 171 miles shorter than that of any existing road from St. Louis to New Orleans. The line will be in three divisions, the end of the first division being at Shorepaugh. The maximum grades will be .3 per cent. The end of the second division will be at Mississippi crossing, and the maximum grades on this division will be .2 per cent. The end of the third division will be at New Orleans, on which the maximum grade will be .1 per cent. There will be no curves over two degrees. The line is to be completed in 1907.

Salina & Northwestern.—An officer writes that the proposed route of this road is from Salina, Kan., northwest through Saline, Lincoln, Mitchell, Osborne, Jewell, Smith and Phillips Counties, and through Franklin, Harlan, Phelps, Gosper, Dorson, Custer and Logan Counties in Nebraska, approximately 250 miles. Preliminary surveys, which were started two months ago, have reached Alton, Kan., and will be continued from that point to Kirwin and Phillipsburg, the line passing through Lincoln, Tipton and Osborne. The work is to be pushed as rapidly as possible. The contracts have not as yet been let. The maximum grade will be .6 per cent. going west, and .5 per cent. going east, with a maximum curvature of three degrees. George H. Whitcomb is President, J. W. Going Vice-President and C. Hamilton Secretary and Treasurer, Topeka, Kan. (April 13, p. 116.)

San Pedro, Los Angeles & Salt Lake.—Plans, it is said, are being made by Senator Clark and associates to build a railroad from a point on this road into Arizona, to connect with Senator Clark's copper mines at Jerome and eventually with the Southern Pacific in the southern part of Arizona. The proposed line will cross the Grand Canyon at Lees Ferry.

Shenango Valley Traction.—New York capitalists, who are interested in this road, are planning to extend the line from South Sharon, Pa., to New Castle, about 18 miles. The ties and rails have been bought and work is to be started shortly.

Southeastern Electric.—An officer writes that a contract has been let to E. H. Abodie & Co., of St. Louis, for building this proposed electric road from Chanute, Kan., to Coffeyville, also a line from Chanute to Galena. The work includes the building of four or five bridges. R. C. Rawlings is President and Mr. Stevens Chief Engineer, all of Kansas City. (See Kansas roads, April 13, p. 115.)

Strathcona Radial Tramway.—Application has been made by a company under this name for incorporation to build a number of lines from Strathcona, Alb. F. C. Jamieson, Strathcona, is Secretary and Treasurer.

Tioga & Clinton.—Incorporation has been granted this company in Pennsylvania, with a capital of $300,000, to build a railroad from Morris, Tioga County, to a point in Chatman township in Clinton County. The incorporators are residents of Lockhaven, which place is on both the Erie and the New York Central; and it is thought that the new road is to be connected with a line being built by the same interests further south.

White Pass & Yukon.—Announcement has been made by N. J. Heaney, the contractor, who built this Alaska road, that plans are ready for building an additional railroad in Alaska, to be financed by Close Bros., of London, and the W. P. & Y. interests. Work will shortly be started. The proposed route is from the coast to Orca, through the Copper River Valley, about 70 miles; thence into Fairbanks. G. M. Rice has been appointed Chief Engineer in charge of the construction.

RAILROAD CORPORATION NEWS.

Chicago, Milwaukee & St. Paul.—It is reported that this company ... lease for 99 years that part of the road of the Columbia & Puget Sound which runs from Maple Valley, Wash., to Seattle, 27 miles. The St. Paul is to pay about $20,000 annual rental, a share of taxes and other fixed charges, and a share of the cost of building additional tracks when they are needed. This arrangement will not interfere with the regular train service of the C. & P. S., which is owned by the Pacific Coast Company. (See Pacific Coast Company, April 20, p. 124.)

Cincinnati, Hamilton & Dayton.—The receiver reports total receipts for the month of February $1,027,230, and total disbursements $1,053,149, leaving a deficit of $25,919. The surplus on hand on February 28 was $138,365.

Cleveland, Cincinnati, Chicago & St. Louis.—Gross earnings for the year ended December 31, 1905, were $22,517,763, an increase of $376,653; net earnings, $5,638,417, a decrease of $371,580. The surplus available for dividends was $1,870,424, a decrease of $508,411, leaving a surplus of $41,549 as compared with a surplus for the previous year of $759,298.

Grand Trunk.—This company has bought the Pembroke Southern, which runs from Pembroke, Ont., to Golden Lake, 21 miles, and has $107,800 capital stock outstanding. The purchase price was $150,000. The P. S. was leased to the Canada Atlantic, which the Grand Trunk took over last October.

Indiana, Columbus & Eastern Traction.—This company has been incorporated in Ohio with an authorized capital of $1,000,000. It is understood that it will take over the Appleyard lines and other roads recently acquired by the Schoepf syndicate. These lines are as follows: Central Market, 16 miles; Columbus, Buckeye Lake & Newark, 39 miles; Columbus, Newark & Zanesville, 42 miles; Columbus, Grove City & Southwestern, 15 miles; Columbus, London & Springfield, 75 miles, and Dayton, Springfield & Urbana, 57 miles. It is possible that the Urbana, Bellafonte & Northern and the Columbus & Lake Michigan will also be absorbed. It is announced that a line will be built from Dayton, Ohio, to Richmond, Ind., 40 miles, which will make the total system about 290 miles long and make, by connecting at Richmond, Ind., with other Schoepf lines, a through traction line between Zanesville, Ohio, and Terre Haute, Ind., 320 miles.

Minneapolis, St. Paul & Sault Ste. Marie.—Gross earnings of this road for the year ended December 31 were $10,209,593, an increase of $1,426,636, as compared with the figure for the year ended June 30, 1905; net earnings were $5,201,424, an increase of $921,074; and surplus, after charges, $2,870,392, an increase of $806,977.

Old Colony (N. Y., N. H. & H.).—The Massachusetts Railroad Commission has authorized this company to sell $500,000 additional stock for the purchase of the Nantasket Beach Railroad, and for general improvements. The Nantasket Beach has long been leased to the Old Colony, and last January the O. C. bought the road for 60 per cent. of the face value of the outstanding bonds.

Pacific Coast.—See Chicago, Milwaukee & St. Paul.

Pembroke Southern.—See Grand Trunk.

Pennsylvania & Ohio (Electric).—An officer of the Pittsburg & Lake Erie, which is controlled by the Lake Shore & Michigan Southern, has bought a majority of the $700,000 capital stock of the Pennsylvania & Ohio. It is said that it is intended to consolidate the P. & O. with the Ashtabula & Lake Shore Electric and the Woodland Beach Park Co., of both of which L. A. Robinson, the officer referred to above, is President.

Toledo, Canada Southern & Detroit.—This company has sold to J. P. Morgan & Co. $1,600,000 50-year first-mortgage 4 per cent. bonds, part of an authorized issue of $4,500,000. The proceeds are to retire the $1,500,000 7 per cent. bonds due January 1, 1906. The bonds are guaranteed by the Michigan Central, which leases the property from the Canada Southern, which owns all the $1,547,662 capital stock. This stock will be taken up by the Michigan Central in 1913. The T., C. S. & D. owns 59 miles of main line between Detroit and Toledo, and these bonds are a lien on this track, as well as on 94 miles of second track and sidings.

Toronto Railway (Electric).—The authorized capital stock has been increased from $7,000,000 to $8,000,000. The stock of this company was recently put on a 6 per cent. basis.

Trinity & Brazos Valley.—The Texas Railroad Commission has authorized the issue of $526,000 bonds covering 26 miles of completed road from Mexia, Tex., south.

Wabash.—The Supreme Court of Ohio has decided that the $600,000 7 per cent. equipment bonds of the Toledo & Wabash, issued in 1863 and due 1883, are a lien on the main line of the Wabash from Toledo, Ohio, to the Indiana state line. According to the statement of the plaintiff there can be no appeal from this decision. The Wabash is, under this decision, liable for nearly $4,000,000, this being the amount of the principal with compound interest since 1883 and the 7 per cent. coupons in default since 1875.

GENERAL NEWS SECTION

NOTES.

The Louisville & Nashville is to haul from Louisville to New Orleans 20,000 carloads of cement for the Panama Canal.

At Washington, April 27, the house committee on interstate and foreign commerce, held hearings on a number of bills which have been introduced to limit the working hours of railroad trainmen.

The Chicago, Milwaukee & St. Paul has put on a new train each way daily between Chicago and Milwaukee and has quickened the time of others so that four trains each day traverse the distance (85 miles) in 1 hour, 45 minutes.

Horace E. Winchell, Chief Geologist of the Amalgamated Copper Company, has resigned, to take charge of a department of geological reasearch which has been started by the Great Northern Railway.

At Clarksburg, W. Va., April 28, the grand jury in the Federal Court returned five indictments against the Baltimore & Ohio for alleged discrimination in the distribution of cars to the Philippi, the Pennsylvania, the Meadowbrook and the Hutchinson Coal companies.

The Supreme Court of Somerset County, Maine, has awarded damages of $25,208 to a man injured in a collision on the Maine Central two years ago, the largest sum ever awarded for such an accident in the state of Maine. The railroad company will, no doubt, appeal.

The American Rio Grande Land & Irrigation Company, which proposes to irrigate a million acres of land in Hidalgo and Cameron counties, in the soutnern part of Texas, is said to be backed by interests connected with the Rock Island road, who hope to promote the prosperity of that road.

The Independent Order of Tie-Tampers, long expected, has at last appeared; or at least an agitator representing the "International Brotherhood of Maintenance of Way Employees" is trying to arouse interest in "organization" among track repair men on the Southern Railway in Tennessee.

The New York Central has extended and made more stringent the regulations for the physical examination of applicants for employment, with a view, among other things, to the establishment of a pension system. The payment of pensions to superannuated employees will probably begin the first of July.

The Chicago City Railway has increased the pay of its conductors and motormen to a scale which is said to be higher than that of any other street railway in the United States. Twenty-five cents an hour will be paid after the first year. Other employees of the company have received an increase of 5 per cent.

A press despatch from Chicago says that an attempt is to be made to make some profitable use of the "Stickney tract" freight transfer yards at Chicago, which have been idle for five years. It is said that over $5,000,000 has been expended on this property already, and that Mr. John F. Wallace has now been engaged to study the problem.

According to an enterprising and truthful reporter in Middletown, N. Y., the Erie Railroad not only encourages its employees to play baseball and to organize teams, but promises to allow them to play on the company's time and to provide transportation for teams from one town to another along the line. The team which makes the best record this season "will receive a gold cup"; but the reader is left in delightful uncertainty as to who is to put up the money for the cup.

A press despatch from Baltimore says that the Baltimore & Ohio Railroad, following the recent inquiries made by the Interstate Commerce Commission, has disposed of its ownership in the Consolidated Coal Company, and that the president and two vice presidents of the road have resigned as directors in the coal company. This coal company controls eight subordinate coal companies. It is said that the B. & O. owned 53 per cent. of the coal company stock and that the sum now received for this stock is about $5,000,000.

The North & South Dispatch Company is the name of a fast freight line, which has been formed by the New York Central Lines and the Mobile & Ohio. By the use of three New York Central lines — the Lake Shore & Michigan Southern, the Indiana Harbor and the C., C., C. & St. L. — a pretty direct line is formed from Chicago, by way of Cairo, to the southern terminus of the Mobile & Ohio; and by the use of the New Orleans & Northeastern a Chicago-New Orleans line is formed. The headquarters of the Dispatch will be at New Orleans, and the General Manager is J. H. Brown. The line will begin business with 2,000 cars.

The American Shippers' Association, said to be an organization which was formed sometime since for opposing the uniform bill of lading that was agreed upon by the railroads, is to be reorganized, if the president of the association succeeds in his present purpose. He proposes to secure a general reduction in freight rates. In a prospectus which has been issued, it is declared that the changes in classification which have been made during the past few years, with the withdrawal of rebates, has greatly increased the burden of freight charges on shippers. The railroads, it is alleged, have shown a grasping disposition, which has grown stronger month by month.

The newspapers report that the disagreement between the railroads and the International Harvester Company concerning the payment of $200,000 demurrage on freight cars has been settled, and that the suits begun by the railroad companies against the harvester company have been withdrawn. The reports say that the settlement was a compromise; but, from the details given, the "compromise" was apparently all in favor of the railroads. The railroads agree to treat the Illinois Northern, the harvester company's railroad, as a common carrier, so far as concerns cars delivered to it for industries other than the harvester works; but on cars for the harvester company itself the payment must be $1 a day, the regular demurrage rate, which is what the railroads have claimed from the first. It is said that there are only two other concerns on the Illinois Northern tracks.

The Debate in the Senate.

There is a tendency in certain quarters to set an extraordinary value on the debate now running in the Senate on the Railroad Rate bill. It has been said that not during the present generation has the Senate shown in its discussion of a public question more of the qualities of statesmanship than its members have exhibited in the last few weeks. It would be a pleasure to agree with so flattering a judgment, but giving the Senate all the credit which is its due we can hardly admit that its reputation has been enhanced by its uncertain, hesitating and altogether feeble-forcible treatment of the rate problem. The debate has been full of legal pyrotechnics, of brilliant academic disputation, of demonstrations and counter-demonstrations of undoubted cleverness. But we doubt whether these legal and constitutional clashes have helped materially to clear the situation, or have resulted in definite parliamentary progress. The discussion has turned on technicalities, and has tended to obscure rather than develop the real points at issue. Extraordinary stress has been laid by the opponents of the Hepburn bill on its unconstitutionality. Yet if it is unconstitutional that vice ought to commend it especially to its enemies, who could well afford to help it joyously through the Senate. The question of granting or not granting a complete court review has also been greatly befogged. There is nothing mysterious about the matter. Congress has only to choose between fortifying the power of the commission by reducing the right of review to its narrowest constitutional limits and weakening the commission's power by granting the broadest review rights possible. . . .—*New York Tribune.*

Strikes on the Great Lakes.

Press despatches of May 1 from Chicago and other points on the Lakes reported almost complete paralysis of lake traffic, in consequence of strikes. The Licensed Pilots' Association is attempting to force recognition of its union and 45,000 men are said to have left their work. At Cleveland the tug firemen struck, and passenger steamers had difficulty in getting to and from their docks. At Ashtabula the longshoremen struck, and business was so paralyzed that the railroads laid off many of their switching crews.

From the Unrevised Version.

It is more blessed to receive a rebate than to give one, and the other fellow takes the risk.—*Puck.*

All Serene in Jersey.

Pennsylvania Railroad annual passes gladdened the hearts of members of the New Jersey Legislature yesterday. They arrived in the morning mail, and were in the nature of a surprise. The members knew the law entitled them to free transportation during the session of the Legislature and the passes given at that time expired on Monday last 10 days after adjournment. That new passes, good until December 31 next, should be sent in their stead was unexpected. The evening mail brought annuals from the Central Railroad of New Jersey and from the West Shore. In view of the fact that the Legislature had increased the taxes of the railroads four-fold, or more than $3,000,000 per annum, the members are at a loss to account for this outburst of generosity.—*Philadelphia North American.*

The Enterprise Transportation Co.

The Interstate Commerce Commission has reported on the alleged unlawful discrimination against the Enterprise Transportation Company. Commissioner Prouty in the opinion, says: "It appears that railroad lines leading west from New York City make joint through rates with the New England Navigation Company, controlling the Fall River line of steamers, which plies between New York and Fall River, Mass., and some other New England cities, and also controlling other important steamer lines operating on Long Island Sound. Such joint rates apply in both directions between western and New England points. The New England Navigation Company is owned and operated by the New York, New Haven & Hartford. The rail lines centering in New York and running westerly thereof refuse, for stated business reasons, to make the same or any joint rating arrangement with the Enterprise Transportation Company, a steamship line plying between Fall River and New York City. The Fall River line may, by reducing rates on local traffic, force out of business the Enterprise Transportation Company, while obtaining a lucrative and supporting business from through traffic, and upon disappearance of such competition, restore the former charges. The existence of the Enterprise Transportation Company as a competitive factor is of distinct value to the public, and that existence may depend upon its right to engage in through business. This investigation was made with the understanding that the Commission is without power to grant any relief, and no opinion as to whether the through routing arrangement should be extended to the Enterprise Company is expressed, but the Commission is of the opinion that if the public is to have the legitimate benefit of water competition, it is evident that authority should be provided to establish through routes between rail and water carriers, or at least to prevent unjust discrimination by rail carriers between connecting water lines."

Improvements at Parkersburg.

The Baltimore & Ohio is to make extensive improvements at Parkersburg, W. Va., to cost about $150,000. The work includes the enlargement of the freight yard to more than double its present capacity, and the building of a roundhouse, a machine shop and an oil house. Bids will soon be asked for these improvements and the work started as soon as the contract is let. This improvement is mainly required by the abandonment of Belpre, Ohio, as a freight terminal and the making up and handling of all freight trains at Parkersburg. The bridge over the Ohio river has been so strengthened that train engines can be run over it. Heretofore the bridge was so light that eastbound trains had to be set off at Belpre and westbound at Parkersburg and taken over the bridge by small engines.

Telegraph Lines in Europe.

According to the *Moniteur Industrielle* the length of the telegraph lines of the world is about twice that of the railroads, so that, as there are about 540,000 miles of railroad, there are about 1,080,000 miles of telegraph lines. The telegraph lines of the principal countries of Europe have been developed as follows:

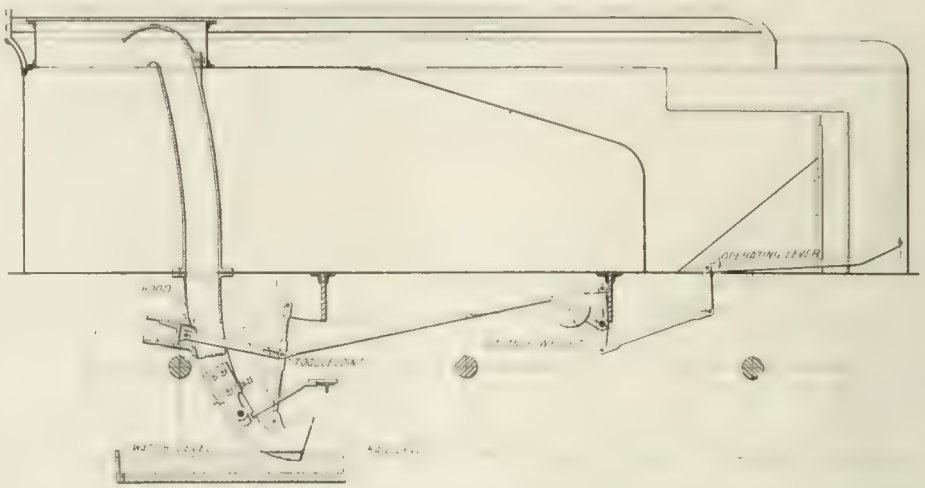
	Length of line, in miles.	Miles of single wire.
Russia	108,445	335,456
France	92,917	354,170
England	83,125	308,153
Germany	48,966	177,850
Italy	26,978	86,048
Austria	21,475	69,247
Spain	20,687	51,155
Hungary	14,393	74,184
Sweden	5,931	18,052
Portugal	5,293	11,670
Belgium	4,053	21,839
Holland	4,000	16,149

Time Limit—April 3, 1907.

"Thank the Lord!" exclaimed the fourth oldest Senator in point of service on Monday, when arrangements were at last made for a vote on the rate bill. The country, however great its admiration for the ability and industry demonstrated in the long debate, will cordially echo the exclamation. Yet even the agreement to debate the amendments seriatim under a fifteen-minute rule does not indicate undue precipitancy. If the Senators use to the full their privileges under the special rule, we may have to wait several days yet for the final verdict. Each of the ninety senators can speak fifteen minutes on each of the ninety pending amendments. That makes a possible maximum of 121,500 minutes' debate, or 338 legislative days of six hours each. This is what the Senate means by "strictly limiting debate" and "putting the screws on."—*Evening Post*, New York.

A New Water Scoop.

A new design of water scoop has been invented by H. A. Ivatt, Locomotive Engineer of the Great Northern (England). The novel feature is the cylinder shown in the drawing, into which part of the ascending water is deflected by a hood, and puts enough pressure on the piston to offset the tendency which the water in the trough has to drag down the scoop when traveling at high speed. This arrangement also makes it easy to lift the scoop with the operating lever. The balance weight is sufficient to lift the scoop clear automatically as soon as the trough is passed. This apparatus is now in operation on the Great Northern.



Water Scoop on the Great Northern, England.

Manufacturing and Business.

L. C. Chase & Co. (Sanford Mills) makers of the Goat brand of mohair plushes, have moved their office from 129 Washington to 89 Franklin street, Boston, Mass.

The New York office of the National Paint Works has been moved from 92 William street to 100 William street.

The East St. Louis Locomotive & Machine Shop Co., East St. Louis, Ill., has just purchased from the Southern Railway 13 locomotives of different classes and weights. It is also building a brick and steel structure to be used as a boiler shop, which will be equipped with new rolls and machinery. A new 150 h.p. boiler and a 125 h.p. Corliss engine are also being installed.

Iron and Steel.

The Trans-Continental Railway Commission of Canada will soon ask for bids for 50,000 tons of rails and 2,500 fastenings.

The Vandalia has given a contract for 6,800 tons of rails for 1906 delivery. The Tidewater Railroad is negotiating for 27,000 tons to be delivered next year.

A joint resolution was introduced in both Houses of Congress on April 23 suspending for one year the duty on structural steel and other building materials, for use in buildings in San Francisco and other California cities destroyed or damaged by the recent earthquakes.

The demand for rails in Canada is so great and unusual that the steel works at Sault Ste. Marie cannot fill its orders. The company has booked 185,000 tons. One order has been given by the Hill roads for 50,000 tons. The Canadian Pacific has also a 50,000 ton order being filled.

The Pacific Electric Railway has given a contract for 2,000 tons of rails additional for 1906 delivery, making its total purchases 14,000 tons. The Spokane & Inland has ordered 7,000 tons; the Delaware & Hudson 16,000 tons; the Oklahoma Railway 1,300 additional, and the Louisville & Indianapolis Traction Co., 4,500 tons.

OBITUARY NOTICES.

Brigadier General E. W. Serrell died in New York on April 25. He was born in London in 1826. He worked in the Engineering Department of the Central Railroad of New Jersey and on the Erie, and then, when only 22 years old, was sent to Panama, where he surveyed the route of the present Panama Railroad. In 1850 he was Chief Engineer of the construction of the Niagara suspension bridge, and later of the Hoosac Tunnel. He commanded a regiment of volunteer engineers during the Civil War.

Henry C. Rouse, Chairman of the Board of the Missouri, Kansas & Texas, died at Cleveland on April 30 after an illness of two weeks.



H. C. Rouse.

Mr. Rouse was born in 1853. In 1885 he joined the syndicate which built the Chicago, Wisconsin & Minneapolis. He was later interested in the development of what is now the Chicago Terminal Transfer, and in 1891 was elected Chairman of the Board of Directors of the M., K. & T. The next year he was elected also President of the Missouri, Kansas & Texas of Texas, which position he held at the time of his death. From 1892 to 1904 he was President of the Missouri, Kansas & Texas, and from 1893 to 1896 acted as receiver of the Northern Pacific. Mr. Rouse has also been President of several other railroads. In 1903 he inspected the Chinese Eastern and the Trans-Siberian; in 1895 he investigated the railroads of India.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Engineers' Club of Philadelphia.

At the meeting of this club to be held May 5, there will be a paper on Corrugated Concrete Piles by Frank B. Gilbreth, illustrated with lantern slides.

St. Louis Railway Club.

At the annual meeting of this club officers for the ensuing year were elected as follows: John J. Baulch, President; S. D. Webster, First Vice-President; Geo. Hannauer, Second Vice-President; B. W. Frauenthal, Secretary, and Chas. H. Scarritt, Treasurer.

International Railway General Foremen's Association.

The next annual convention of this Association will be held at St. Louis, Mo., beginning May 8. All sessions will be open to those who are interested in the mechanical department of railroad service. The programme includes the following list of topics to be discussed: Reasons Why An Organization of Foremen Should Exist, by D. E. Barton; Modern Machine Shop Practice, by Lee R. Laizure; The Duties of the Foremen, by G. W. Keller; Broken Frames, by C. H. Voges; Pooling Engines, J. C. Wilkinson; Electric Lights, A. S. Abbott; Motive Power by Electricity, L. H. Raymond; Leaky Flues, B. E. Greenwood; Qualities of a First-Class Roundhouse and Division Foreman, G. H. Gates. W. H. Graves is President, and E. C. Cook, Secretary.

American Society and International Association for Testing Materials.

The ninth annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 21-23. The next Congress of the International Association for Testing Materials will be held at Brussels, Belgium, September 3-8, 1906. Members of the American Society may become members of the International Association by being proposed by two members of the Association. The total membership of the American Society is now 786, of whom 240 are members of the International Association. Among the papers to be presented at the Brussels meeting are the following:

"Methods for the Examination of Welding and Weldability," by Prof. Reinhold Krohn, of Danzig.

"Report on the Progress of Metallography Since the Congress at Budapest, 1901," by F. Osmond and G. Cartaud, of Paris.

"Report on the Relation of Chemical Composition to the Weathering Qualities of Building Stones; the Influence of Smoke and Especially Sulphurous Acid, on Building Stones; the Weathering Qualities of Roofing Slates," by Prof. A. Hanisch, of Eaurat.

"Examination and Evolution of the Resolutions of the Conferences from 1884-1893, Concerning Adhesive Strength of Hydraulic Cements," by R. Feret of Boulogne.

"Determination of the Liter Weight of Cement; the Strength of Real Hydraulic Cements," by Prof. F. Schule, of Zurich.

"A Uniform Method for the Separation of the Finest Particles in Portland Cement by Liquid and Air Processes," by Prof. M. Gary.

"On the Behavior of Cements in Sea Water," by H. le Chatelier, Paris.

"On Accelerated Tests of the Constancy of Volume of Cements," by E. Blount.

"Tests to Determine Durability of Wood," by Dr. C. V. Tuleut.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atchison, Topeka & Santa Fe.—Victor Morawetz, Chairman of the Executive Committee and General Counsel, has resigned as General Counsel. W. D. Hines, formerly Vice-President and General Counsel of the Louisville & Nashville, succeeds Mr. Morawetz, effective May 15.

Operating Officers.

Chicago, Burlington & Quincy.—A. N. Willsie, who was recently appointed Superintendent of the St. Joseph division at St. Joseph, Mo., began railroad service in 1880, being then 16 years old, as an errand boy in the office of the Master Mechanic of the C., B. & Q. at Galesburg. He was made timekeeper next year, and then worked in various positions in the same office until 1890, when he took a place as locomotive fireman. He was promoted to be engineman in 1892, and in 1898 was made assistant road foreman of engines. He was appointed road foreman of engines of the Galesburg division in 1900, and Master Mechanic at Brookfield, Mo., in December, 1905. On March 1 of the present year he was made Master Mechanic at Aurora, Ill., from which position he was recently promoted.

Chicago, Lake Shore & Eastern.—M. G. Nowak has been appointed Superintendent at Bay View, Wis., succeeding E. H. Hosler, who has resigned to take an office in the Illinois Steel Co., which controls the railroad.

Missouri Pacific.—W. E. Brooks has been appointed Inspector of Passenger Service, with office at St. Louis. He will investigate the conditions affecting passenger train schedules, the condition of passenger equipment, and the efficiency of passenger trainmen and enginemen. He reports to the Assistant General Manager.

Southern.—A. M. Smith, formerly Superintendent of the St. Louis division of the St. Louis-Louisville Lines, has been appointed Assistant Superintendent at Columbia, S. C.

Traffic Officers.

Chicago, Burlington & Quincy.—See Chicago, Cincinnati & Louisville.

Chicago, Cincinnati & Louisville.—William Fitzgerald, Jr., heretofore Assistant General Freight Agent of the Chicago, Burlington & Quincy at St. Joseph, Mo., has been appointed General Freight Agent of the C., C. & L., with office at Cincinnati, Ohio, succeeding T. C. Beyland, Acting General Freight Agent.

Delaware, Lackawanna & Western.—G. A. Cullen, General Western Passenger Agent, has been appointed General Passenger Agent, succeeding T. W. Lee, resigned, effective July 1.

Wabash.—P. W. Coyle, Assistant General Freight Agent at St. Louis, has resigned, to become Traffic Commissioner of the Business Men's League of St. Louis.

Engineering and Rolling Stock Officers.

Delaware, Lackawanna & Western. D. L. Stewart, Superintendent of Bridges and Buildings at Bath, N. Y., has resigned to go into other business.

Denver, Northwestern & Pacific. L. D. Blauvelt has been appointed Assistant Chief Engineer of the Colorado-Utah Construction Co., which is building the D., N. & P.

Illinois Central.—J. H. Wynne, Mechanical Engineer, has resigned.

Wheeling & Lake Erie.—A. C. Hezlep, Engineer of Maintenance of Way, has resigned to engage in other business at Cleveland, Ohio.

Purchasing Agents.

Wheeling & Lake Erie. G. L. Pollock has been appointed Purchasing Agent of this road and of the Wabash Pittsburg Terminal and the West Side Belt, succeeding J. P. Stark, resigned.

LOCOMOTIVE BUILDING.

The Central of Peru has ordered six 12-wheel cross-compound locomotives from the American Locomotive Co.

The Green Bay, Oshkosh, Madison & Southeastern is reported in the market for locomotives. Address C. H. Hartley, General Manager, Oshkosh, Wis.

The United Railways of Havana have ordered one suburban tank locomotive from the American Locomotive Co.

The Northern Pacific has ordered 30 Pacific type locomotives from the American Locomotive Co., and 15 switching locomotives from the Baldwin Locomotive Works.

The Southern of Peru has ordered 29 twelve-wheel cross-compound locomotives from the American Locomotive Co.

The Gulf & Ship Island has ordered six locomotives. Four of these are to be of the 10-wheel (4-6-0) type, and will be built by the American Locomotive Co., for May delivery. The remaining two, one 70-ton switching locomotive and one Atlantic (4-4-2) type locomotive, have been ordered from the Baldwin Works and are to be delivered in July.

The Nippon Railway, Japan, has ordered 12 Consolidated (2-8-0) locomotives from the American Locomotive Co.

The Lima Locomotive & Machine Co. report the following orders for Shay locomotives for the week ending April 28: Globe Lumber Co., Yellow Pine, La., one 60-ton locomotive; Clark Creek Logging Co., Catlin, Wash., one 37-ton locomotive; Oak Point Piling & Lumber Co., Oak Point, Wash., one 28-ton locomotive, and J. H. Weinkle, Moffitt, Pa., one 10-in. x 16 in. six-wheel switching locomotive.

The Kyushu Railway, Japan, has ordered 12 Mogul locomotives and 24 (2-6-2) side tank locomotives from the American Locomotive Co.

The Maine Central has ordered three six-wheel switching locomotives from the American Locomotive Co., for September delivery. These locomotives will weigh 126,500 lbs.; cylinders, 19 in. x 24 in.; diameter of driving wheel centers, 44 in.; Wootten boiler, with a working steam pressure of 180 lbs.; firebox, 108 in. long by 90¼ in. wide; 209 tubes, 2 in. in diameter by 11 ft. 7 in. long; total heating surface, 1,388 sq. ft.; grate area, 67.7 sq. ft.; capacity of tender, 4,000 gallons, and seven tons of coal. The special equipment will include: Midvale tires, Railway Steel-Spring Co.'s springs, Franklin boiler covering, Hancock injectors, Tower couplers, Westinghouse brakes, National Hollow brake-beams, Ashton safety valves, Star Brass Co.'s steam gages, and Leach sanding devices.

The Texas & Pacific is building two simple Atlantic (4-4-2) locomotives at its own shops. These locomotives will weigh 194,000 lbs., with 110,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers (outside), 79 in.; radial stay wagon top boiler, with a working steam pressure of 210 lbs.; heating surface, 2,935 sq. ft.; 326 National tubes, 2 in. in diameter and 16 ft. long; carbon steel firebox, 99 in. x 67¼ in.; grate area, 45.3 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The special equipment includes: Westinghouse air-brakes, Carnegie steel axles, Gollmar bell ringer, Sterlingworth brake-beams, Texas & Pacific brake-shoes and journal bearings, Gould and National couplers, Pyle-National electric headlights, Detroit injector, U. S. metallic piston and valve rod packings, Coale safety valve, Smith sanding devices, Nathan sight-feed lubricators, U. S. Spring Co.'s springs, Ashcroft steam gages, Gold steam heat equipment, Latrobe driving, truck and tender wheel tires, and Scullin-Gallagher steel wheel centers.

The Mexican Central, as reported in a previous issue, has ordered 20 simple Consolidation and five six-wheel switching locomotives from the American Locomotive Co. The Consolidation locomotives will weigh 198,700 lbs., with 179,000 lbs. on drivers; cylinders, 21 in. x 26 in.; diameter of driving wheels, 55 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; tank capacity, 6,000 gallons, and fuel oil capacity, 3,000 gallons. The switching locomotives will weigh 126,000 lbs.; cylinders, 19 in. x 24 in.; diameter of driving wheels, 50 in.; Belpaire boiler, with a working steam pressure of 180 lbs.; heating surface, 1,793 sq. ft.; 272 charcoal iron tubes, 2 in. in diameter by 11 ft. 7 5/16 in. long; firebox, 90 in. long by 38⅞ in. wide; grate area, 24 sq. ft.; tank capacity, 3,900 gallons; fuel oil capacity, 1,200 gallons. The special equipment for both locomotives includes: Westinghouse air-brakes, National Hollow brake-beams, Tower couplers, Friedman injectors, Mexican Central piston and valve rod packing, Ashton safety valve, Leach sanding devices, Detroit sight-feed lubricators, Pittsburg Spring & Steel Co.'s springs, Crosby steam gages, and Franklin Railway Supply Co.'s automatic driving box lubricators for the Consolidation locomotives.

The Long Island is having built at the Altoona shops of the Pennsylvania R. R. 21 simple (4-4-0) locomotives and has ordered four six-wheel simple switching (0-6-0) locomotives from the Baldwin Locomotive Works. The 4-4-0 locomotives will weigh 138,000 lbs., with 97,100 lbs. on the drivers; cylinders, 18½ in. x 26 in.; diameter of drivers, 68 in.; Belpaire boiler, with a working steam pressure of 185 lbs.; heating surface, 1,912.8 sq. ft.; 310 tubes, 1⅞ in. in diameter and 136¾ in. long between flue sheets; firebox, 119⅝ in. long and 40 in. wide; grate area, 33 sq. ft., and tank capacity, 5,500 gallons. The switching locomotives will weigh 123,100 lbs.; cylinders, 19 in. x 26 in.; diameter of drivers, 51 in.; straight boiler, with a working steam pressure of 180 lbs., heating surface, 1,684 sq. ft.; 270 tubes, 2 in. in diameter and 130¾ in. long between flue sheets; firebox, 103⅛ in. long and 33¼ in. wide; grate area, 23.81 sq. ft., and tank capacity, 4,000 gallons. The special equipment for both includes: Westinghouse air-brakes, Gollmar bell ringer, magnesia sectional boiler lagging, Diamond special brake-beams for 4-4-0 locomotives and Sterlingworth brake-beams for switching locomotives, Janney couplers, Dressel headlights and Sellers and Nathan simplex injector for 4-4-0 locomotives; Ajax Metal Co.'s journal bearings for switching locomotives, U. S. piston and valve rod packings, Ashton safety valve, Nathan sight-feed lubricators, Utica steam gages and Mason regulator steam heat equipment for 4-4-0 locomotives; Consolidated safety valve, Leach sanding devices, and Pittsburg Spring & Steel Co.'s springs for switching locomotives, and Latrobe driving wheel tires.

CAR BUILDING.

The Tionesta Valley has ordered 12 tank cars from Robt. M. Burns & Co.

The Oregon Short Line has ordered 15 standard coaches from the Barney & Smith Car Co.

The Pennsylvania, it is reported, will shortly order upwards of 20,000 steel cars for 1907 delivery.

The Denver, Northwestern & Pacific, it is reported, has ordered 75 box, 75 stock and 50 flat cars from the Pullman Co.

The Chicago, Burlington & Quincy has ordered six tank cars of 12,000 gallons capacity from the American Car & Foundry Co.

The Western Maryland, as reported in our issue of April 27, has ordered 500 steel hopper cars from the American Car & Foundry Co.

The Rutland, as reported in our issue of April 20, has ordered 100 80,000 lbs. capacity side dump ballast cars from Haskell & Barker.

The Baltimore & Ohio, it is reported, will shortly give orders for upwards of $7,000,000 worth of rolling stock, including 6,500 freight cars and a large number of passenger cars.

The Newburgh & South Shore has ordered 100 steel gondola cars of 100,000 lbs. capacity from the Middletown Car Works, for June, July, August and September delivery. These cars will weigh 33,000 lbs. and measure 36 ft. long, 9 ft. 11½ in. wide and 6 ft. high, over all.

The Illinois Central Traction Co. has ordered five fruit cars of 40,000 lbs. capacity from the St. Louis Car Co. These cars will weigh 30,000 lbs. and measure 39 ft. 9 in. long, 8 ft. 6 in. wide and 9 ft. 8 in. high, over all. The special equipment includes St. Louis Car Co.'s standard draft rigging.

The Long Island has ordered 100 swing side gondola cars of 100,000 lbs. capacity and 100 box cars of 100,000 lbs. capacity from the American Car & Foundry Co. The gondola cars will be 37 ft. 5 in. long, 9 ft. 4¼ in. wide and 3 ft. 10½ in. high, inside measurements. The special equipment includes: Sterlingworth brake-beams, Westinghouse brakes and draft rigging, Ajax Metal Co.'s brasses, Tower steel couplers, Soule dust guards, Symington journal boxes, and Pittsburg Spring & Steel Co.'s springs. The box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment includes: Davis solid brake-beams and Westinghouse automatic brakes.

The New York Central has ordered for the Lake Erie & Western 17 coaches and eight smoking cars from the Pullman Co. The coaches will weigh 110,000 lbs. and measure 70 ft. long, over sills, and 9 ft. 8 in. wide, over all. The smoking cars will weigh 100,000 lbs., and measure 61 ft. long, over sills, and 9 ft. 8 in. wide, over all. The special equipment for both includes: Pullman axles and vestibules, Diamond special brake-beams, Lappin brake-shoes, Westinghouse brakes, Lake Erie & Western brasses, Tower couplers, Forsyth curtain fixtures, Pantasote curtain material, Lake Erie & Western door fastenings, paint and trucks, Harrison dust guards, Gold heating system, Symington journal boxes, Pintsch light, Gould platforms, Railway Steel-Spring Co.'s springs and Paige wheels.

The Southern, as reported in our issue of April 27, has ordered four mail, baggage and express cars; six passenger and baggage cars, and 25 baggage and express cars, and 10 postal cars from the American Car & Foundry Co., for January, 1907, delivery. The mail, baggage and express cars will measure 69 ft. 1⅞ in. long by 9 ft. wide; the passenger and baggage cars will be 64 ft. 3½ in. long by 9 ft. wide; the baggage, express and postal cars will be 69 ft. 1⅞ in. by 9 ft. wide, all inside measurements. The special equipment for all includes cast-steel double body bolsters, Westinghouse high-speed automatic air-brake, Janney and Buhoup three-stem couplers, Harrison dust guards, Gold heating system, Southern Railway standard type journal boxes, Pintsch lighting system, American Car & Foundry Co.'s steel platform for mail, baggage and express cars, and Standard steel platforms for the remaining cars, Railway Steel-Spring Co.'s springs, Southern Railway standard six-wheel trucks for mail, baggage and express, passenger, baggage and postal cars, and four-wheel trucks for the baggage and express cars; Buhoup short vestibules and McKee-Fuller car wheels.

The Brooklyn Heights Railroad Co. has ordered 10 box cars and 20 gondola cars of 60,000 lbs. capacity from the McGuire-Cummings Manufacturing Co. These cars will measure 40 ft. long by 8 ft. wide. The bodies and underframes are of wood. The special equipment includes, 10 in. built-in transom bolsters; 10 in. automatic air-brake equipments and hand brakes; Standard Coupler Co.'s couplers; Pennsylvania R. R. metallic paint; Diamond frame trucks, and Schoen 33 in. rolled steel wheels. The company is also sending out blue prints and specifications for 100 surface cars. The specifications call for 100 convertible motor surface cars, with a seating capacity for 48 persons; weight, 48,000 lbs.; length, 30 ft. 7¼ in.; width, 7 ft. 6¼ in., and height, 7 ft. 8⅜ in., all inside measurements. The bodies are to be of wood, and the underframes are of wood, with a steel side plate. The special equipment will include 8 in. reinforced built-up transom bolsters, Buffalo Brake-Beam Co.'s brake-beams, steel backed flanged Lappin type brake-shoes, Westinghouse air-brakes and hand air-brakes fitted with anti-rattling brake hangers, standard M. C. B. brasses, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Wallace Supply Co.'s operating devices for doors, Symington dust guards, Gold double coil electric heaters, Symington journal boxes, built-in vestibules, and 33 in. solid Schoen steel wheels.

BRIDGE BUILDING.

AKRON, OHIO.—At a meeting of the Canal and County Commissioners and the City Engineer it was decided to raise all the bridges over the Ohio and Erie canal at least one foot. The same agreement will be asked of Commissioners in every county through which the canal passes.

ALABAMA.—A bill was introduced in the House of Representatives April 25 and referred to the Committee on Interstate and Foreign Commerce authorizing the Mobile Railway & Dock Co. to build bridges across Dog river and Fowl river, in Mobile County, Alabama.

ASHTABULA, OHIO.—Bids are wanted May 17 by P. C. Remick, Auditor, for building a steel bridge over Mill creek in Dorsett township, Ashtabula County.

ATLANTA, GA.—The Southern Railway has let the contract to W. W. Griffin for building a bridge in Atlanta at Nelson street.

CHENEYVILLE, LA.—The Rapides Police Jury will receive bids May 22 to build a steel bridge over Bayou Boeuf here.

COLUMBUS, OHIO.—A contract has been given to Cook, Grant & Fritz Bros., at $42,273 for building the substructure for the Reed avenue viaduct. The Commissioners have refused all the bids submitted for the roadways, for encasing the columns, and for the approaches.

GALVESTON, TEX.—A charter has been filed at Austin, Tex., of the Galveston Toll Bridge & Causeway Co., with a capital of $100,000. The company has been formed to build a causeway to connect Galveston Island with the mainland. The plans call for a structure to carry six tracks, in addition to a roadway and sidewalks, at a cost of about $1,000,000. R. Clark and J. Young, of Galveston; O. T. Holt and F. L. Dana, of Houston, are interested.

GRAND FORKS, B. C.—A bridge is to be built, at a cost of $30,000, to a connection with the Kettle Valley Railway.

GUELPH, ONT.—A bridge over Speed River will be replaced by a steel structure.

KANSAS CITY, MO.—On April 23 a bill was introduced in the House of Representatives authorizing the Kansas City, St. Joseph & Excelsior Springs Ry. Co. to build a bridge across the Missouri river.

LAWTON, OKLA. T.—The Board of County Commissioners has directed the County Clerk to ask bids May 14 for building four steel bridges in Comanche County.

LOUISVILLE, KY.—An ordinance has been drafted calling for an appropriation of $50,000 for building the Oak street viaducts. One of the viaducts, at Ninth street, will receive $25,000 of the appropriation and will cost, when completed, about $59,000. The viaduct at Fourteenth street will receive the other half of this appropriation, and will cost, when completed, $61,000. At the latter point the Illinois Central tracks are to be raised.

NEW WESTMINSTER, B. C.—A steel bridge will replace the present Carnarvon street structure at this place. Mayor Kreary may be addressed.

NEW YORK, N. Y.—The Bridge Commissioner, who advertised for bids for the Manhattan bridge to be built over the East river, a work which will cost about $8,000,000, and who was to receive the bids on April 30, was served with an injunction on the morning of that date, obtained by a taxpayer, restraining the Commissioner from receiving, opening or accepting any bids. The injunction, which was dated April 26, it appears, was not served until it was almost too late to have the terms of the injunction modified. But Bridge Commissioner Stevenson met the situation by communicating with the judge who issued the injunction and prevailed upon him to modify its terms so that all bids could be received, sealed and filed until the injunction was dissolved. The work on this structure has already been delayed a year by litigation, and Commissioner Stevenson was anxious to be in a position to receive the bids advertised for, and not be compelled to readvertise for the same.

NORFOLK, VA.—The Willoughby Bay Railroad Co. is seeking permission to build two bridges with draws over Bush and Masons creeks between Sewell's Point and Ocean View, in accordance with the plans submitted to Captain E. E. Winslow, U. S. Engineer.

OCEAN CITY, N. J.—Surveys are being made to locate the site for a bridge between this place and Somers Point over the bay, to carry electric cars.

PHILADELPHIA, PA.—Bids are wanted May 15 by Thomas L. Hicks, Director, for building the Walnut Lane bridge.

PORTAGE LA PRAIRIE, MAN.—The Canadian Northern, it is said, will build a steel swing bridge over White Mud river on its Oakland extension.

PORTLAND, ORE.—Plans, it is reported, have been completed by City Engineer D. W. Taylor for building a steel bridge on concrete abutments over Sullivan Gulf, to cost about $65,000.

RICHMOND, VA.—The Citizens' Rapid Transit Co. is planning to build a viaduct along Marshall street to Churchill.

ST. FRANCOIS-XAVIER.—Bids are being received by P. Lavallie for building three steel bridges.

SALINA, CAL.—According to reports from this place the Salinas river has sunk 10 or 12 feet for miles along its course and nearly all the bridges over the river will have to be rebuilt. The disturbance accompanied the recent severe earthquake.

SANDWICH, ONT.—Bids are wanted by John F. Miller, County Clerk of Essex, for building a steel bridge 120 ft. long, with 16 ft. roadway.

SOURIS, MAN.—Bids are wanted May 15 by J. W. Breakey for building a concrete bridge over the Souris river.

TENNESSEE.—Bills have been introduced in both Houses of Congress authorizing the South & Western Ry. Co. to build bridges across the Clinch river and Holston river, in the States of Virginia and Tennessee.

TOLEDO, OHIO.—F. G. Consul, City Engineer, writes us that the date for asking bids for building a reinforced concrete steel bridge 1,200 ft. long over Maumee river, has not yet been decided upon. Bids when asked for will be received by the Secretary of the Board of Public Service.

WILKESBARRE, PA.—Bids are wanted May 25 by F. H. Gates, City Clerk, for building a steel bridge.

WILMINGTON, DEL.—The Water Commission and the Park Commission are planning to jointly build a bridge over the Brandywine near Van Buren street.

XENIA, OHIO.—Bids are wanted May 17 by the Joint Board of County Commissioners of Clark and Green Counties, Ohio, for building an inter-county bridge 189 ft. long, to carry a single track, over Mad river.

YOUNGSTOWN, OHIO.—According to local reports, the Erie has reached an agreement with the city authorities providing for the building of a viaduct to take the place of Hazel street, and to put up a new passenger station. The railroad company will pay $100,000 towards the bridge, besides spending $250,000 for the passenger station.

Other Structures.

ATLANTA, GA.—Plans have been completed for building a new freight house for the Louisville & Nashville at the corner of Waverly place and Central avenue, this city, to cost between $250,000 to $300,000.

BIRMINGHAM, ALA.—The Southern Railway, it is said, is seeking a site in some southern city for locomotive shops to cost about $3,000,000.

ELKINS, W. VA.—The Western Maryland will, it is said, build a passenger station here to cost $50,000.

FITZGERALD, GA.—The Atlantic & Birmingham has contracted for shops to be built at this place. A tract of 200 acres of land has been bought. The shops will cost about $600,000.

JACKSONVILLE, FLA.—The St. Johns River Terminal Co., during the coming summer, is to spend about $150,000 in improvements. Of this $40,000 will be used for new freight yards, a new freight

station; also a pier 100 ft. long and 150 ft. wide, together with a new coaling station, are included in the improvements.

KNOXVILLE, TENN.—The Southern has given a contract to the Oliver Solitt Co., of Chicago, for putting up a new machine shop at its Lonsdale plant near this city. The American Bridge Co. has the contract for the structural steel to be used. The cost of the improvement will be about $300,000. The work is to be finished by September of this year.

LITTLE ROCK, ARK.—The St. Louis, Iron Mountain & Southern will build the new union passenger station at this place.

LYNN, MASS.—Plans have been submitted by the Boston, Revere Beach & Lynn Railroad for a new passenger station to be built at Market and Sea streets. The proposed building, which will be a combined station and hotel, will have a frontage of 70 ft. on Market street and 200 ft. on Sea street. In addition a train shed is to be built.

NEW ORLEANS, LA.—The Texas & Pacific is negotiating with the Belt Railroad Commission for a site at Canal street on which to build a $100,000 passenger station.

NEW YORK, N. Y.—The Interborough Rapid Transit Co. is to build a new station on the elevated line at Eighth avenue and 130th street, for the use of northbound passengers. There is a station at this point for the southbound traffic.

NIAGARA FALLS, N. Y.—The New York Central has plans made for building a new freight house here, to cost approximately $80,000.

NORFOLK, VA.—The Atlantic Coast Terminal Co. is planning to build a large railroad terminal here at a cost of about $5,000,000.

OSWEGO, N. Y.—Plans are under consideration by the railroads interested and the city authorities for putting up a passenger station here to cost about $30,000.

SANDUSKY, OHIO.—The Baltimore & Ohio Railroad will build here a modern passenger station 76 ft. x 36 ft., to cost about $15,000. Work will be started as soon as the contract can be let.

SHEBOYGAN, WIS.—The Chicago & North-Western will put up a new passenger station here, at a cost of $75,000.

WARREN, OHIO.—The Baltimore & Ohio and the Erie, it is said, will jointly build a union passenger station here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ADIRONDACK & ST. LAWRENCE.—Under this name a new company has been incorporated in New York, with a capital of $100,000, to build a railroad from De Kalb Junction southeast to Herman in St. Lawrence County, approximately five miles. The directors include: F. B. Van Vorst, A. Kimber and S. H. March.

ARGENTINE CENTRAL.—This company is building a railroad to carry ore from the Waldorf and other mines at Silverplume, Colo., to Mt. McClellan, 71 miles. The line will cross two mountain ranges. From Silverplume it is said the road will cross Leavenworth mountain along the southeast side until it reaches the Waldorf mining region at the foot of Argentine Pass, thence up Mt. McClellan to Gray's region, at an altitude of 14,000 ft. Nine miles of the road is completed. E. J. Wilcox, Colorado Building, Denver, is President, and A. H. Osborne, of Georgetown, is Chief Engineer.

ARKANSAS, ANTHRACITE & WESTERN.—Incorporation has been granted this company in Arkansas, with a capital of $2,500,000, to build a railroad from Fort Smith east to Prairie View, in Logan County, 65 miles. The proposed road will parallel the Arkansas river in Sebastian, Franklin and Logan Counties. The directors are: R. M. Remmel, C. McKee, G. Heim and others. The Arkansas-Anthracite Coal Co. is interested in this project.

CAIRO & THEBES.—An officer writes that this road will be built and that contracts for the work will probably be let within two months. Preliminary surveys have been completed over the entire route from Cairo, Ill., northwest to Thebes, about 25 miles. E. A. Smith is President and J. L. Armstrong Chief Engineer, Cairo, Ill.

CANADIAN NORTHERN.—This company has started surveys from Edmonton, Alb., to the Rocky Mountains for its proposed line to the Pacific coast.

CENTRAL OF NEW JERSEY.—Plans have been made by this company for new yards to be built in East Allentown, Pa. There are to be a series of three yards containing 20 miles of track, each connected with the other, extending from the East End to Bethlehem Junction.

CHEROKEE, UNION & SPARTANBURG.—At a recent meeting of the incorporators of this company at Gaffney, A. N. Wood of Gaffney, was elected President and Treasurer, and W. C. Hambrick, Vice-President. Arrangements were completed at this meeting to at once secure the necessary right of way for building the proposed road in South Carolina.

CHEYENNE, OKLAHOMA & TEXAS.—A contract has recently been let by this company to the Stubbs Construction Co., of Kansas City, for building 215 miles of its proposed road. The contract calls for building from Caney, Kan., southwest to Kingfisher, Okla., via Pawhuska, Blackburn, Perry and Guthrie. The projected line of the road is from Caney, Kan., to El Paso, Tex., 900 miles. S. M. Potter, Caney, Kan., is President.

CHESAPEAKE & OHIO.—The following table shows the double-track work completed since July 1, 1905, and under way for this company:

	Miles.
Placed in operation since July 1st, 1905:	
Whitcomb to Charleston	13.0
Russell to Riverton	7.8
Total	20.8
Under construction:	
Allegheny to Tuckahoe	1.5
Charleston to St. Albans	11.9
Dayton to Silver Grove	5.7
Walker to Norge	11.2
Sewell Bridge	0.8
Lynchburg to Tyro	3.2
Total	34.3
Contracts just let:	
Greve to Morrison	15.8
Norge to Williamsburg	7.6
Greenway to Riverville	9.0
Jerry's Run to Lewis Tunnel	1.1
Hawks Nest to Cotton Hill	1.2
Gauley to Mt. Carbon	8.4
Maysville to Lawrence Creek	5.4
St. Albans to Barboursville	29.2
Total	77.7
Bids wanted for:	
Concord to Crooked Creek	10.3

CHICAGO, ROCK ISLAND & PACIFIC.—The Roswell Construction Company has been organized to build a railroad from Roswell, N. Mex., to Tularosa, and it is said that the project is being built in the interests of the Rock Island. The proposed road will connect with the Rock Island at Tularosa. U. S. Bateman, J. A. Cottingham, G. T. Veal and H. W. Stevens, all of Roswell, are interested.

CUMBERLAND & NORTHERN.—See Louisville & Nashville.

FORT SMITH, INDIAN TERRITORY & TEXAS.—The charter which was granted this company about two years ago in Arkansas has been sold to the Western Land & Construction Co., of Memphis. The new owners will at once begin the construction of a railroad from Panama southwest to Wilburton, Ind. T., about 50 miles, to connect with the M., K. & T. The route from Fort Smith to Panama, about 20 miles, has not yet been decided upon.

GEORGIA NORTHERN.—Surveys are being made by this company for an extension south from Boston, Ga., the present terminus of its new division to Monticello, Fla.

HILLCREST RAILROAD & COAL CO.—Incorporation has been asked for by a company under this name to build a railroad from Morrisey, B. C., to Hillcrest Junction, and thence to Cardston and Pincher creek., Alb., with branches to the adjoining coal and oil fields near Little Kootenay Lake. Work is to be started as soon as incorporation has been secured.

HOT SPRINGS, OUACHITA & MENA.—See Kansas City Southern.

ILLINOIS CENTRAL.—This company has begun the operation of trains into Indianapolis over the Indiana Southern, which runs from Switz City northeast to Indianapolis. The road will be operated as a branch of the Illinois Central. The Indiana Southern has been building for the past two years, and is about 50 miles long.

INDIANA SOUTHERN.—See Illinois Central.

KANSAS CITY & BELTON.—Incorporation has been granted this company in Missouri to build a railroad from Kansas City south to Belton in Cass County, about 20 miles. The incorporators are: W. J. Bales, D. W. Scott, T. A. Gill, W. Withers and E. S. Yoeman, all of Kansas City and Belton.

KANSAS CITY SOUTHERN.—A contract has been given to Myrick & Andrews for building 270 miles of track on the Central of Louisiana, which was chartered in Louisiana in the interests of this company. The projected road will run from Leesville, La., southeast through New Iberia and thence east to New Orleans. From a point near Rayne, La., the line practically parallels the Southern Pacific to New Orleans. Work has been begun by the contractors at New Iberia and at Baldwin, La., and the work will be rushed to completion.

Under the name of the Hot Springs, Ouachita & Mena, this company has obtained a charter in Arkansas to build a railroad from Mena, Ark., on the Kansas City Southern, east through Montgomery County to Hot Springs, 70 miles air line.

LEHIGH & LAKE ERIE.—See Lehigh Valley.

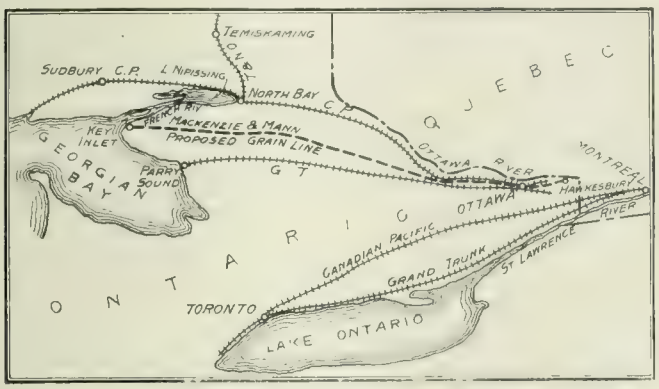
LEHIGH VALLEY.—An officer of the Lehigh & Lake Erie writes that all contracts have been let for building this proposed road. F. D. Hyde, of New York City, has contracts for the grading, masonry

and bridge superstructure. The line will extend south from the Lehigh Valley main line near East Buffalo through Sloan, Cheektowga, and West Seneca, and north through the city of Buffalo on the lake side to the Lehigh Valley at Tifft Farm Terminal, 12 miles. About three miles of track has been laid. Part of the road will be elevated, requiring a large amount of filling. The entire road will be double-tracked. Maximum grades will be 0.4 per cent., and maximum curvature three degrees. The work includes the building of 19 steel bridges and two concrete arches. (April 20, p. 123.)

LOUISIANA & ARKANSAS.—This company has track laid for 25 miles on its extension from Packton, La., south to Alexandria, 36 miles. The company expects to make a connection with the Texas & Pacific at Alexandria this month. (See Construction Record.)

LOUISVILLE & NASHVILLE.—This company is reported to be planning to build, under the name of the Cumberland & Northern, a line from Scottsville, Ky., the present northern terminus of the Chesapeake & Nashville, northeast through Columbia and Greensburg to Lebanon, Ky., where connection is to be made with the Louisville & Nashville.

MACKENZIE-MANN SYSTEM.—The Mackenzie & Mann interests are credited with having another line in view. Announcement has been made semi-officially that they intend to begin at an early date building a railroad to haul grain from the mouth of the French river, on Georgian Bay, to Ottawa, and thence to Hawkesburg, where connection will be made with the Great Northern, which runs from that point into Montreal. The distance from French River to Hawkesburg in 370 miles, and from Hawkesburg to Montreal about



Proposed Mackenzie & Mann Grain Line.

60 miles. This is the route of the proposed Georgian Bay canal which the promoters have promised to have completed in 1914.

According to reports from Ottawa, Mackenzie and Mann, under a charter granted to them some time ago, will build a railroad from the south side of Quebec bridge to Moncton, N. B. Such a line would run practically over the same route surveyed by the Grand Trunk Pacific. The Dominion Government, it is said, will grant a subsidy to this Atlantic extension.

MAINE RAILROADS.—Incorporation has been asked for by a company to build a street railroad from a point in South Portland to the Government Reservation at Cape Elizabeth; also at a branch line in South Portland. The capital of the company is to be $32,000, and the promoters are E. C. Reynolds, J. True, N. True and Charles Dalton, all of South Portland, Me.

MARIETTA & LAKE.—We are told that this company, which was recently organized in Ohio, is making surveys to build a railroad from Jewett, Ohio, south to Marietta through the coal section, about 80 miles. The plans include the building of an extension from McCleary's southwest to Chillicothe an additional 100 miles. W. H. Young, Chicago, is President, and R. S. Blinn, Chief Engineer, Freeport, Ohio.

MIDLAND CENTRAL.—This company has completed surveys and profiles for its proposed road, and bids for the work are to be shortly asked for at the office of the company, Newport, Neb. The proposed line will run through a section 20 to 40 miles distant from any existing road and will be 150 miles long. Lyman Waterman, Newport, Neb., is General Manager.

MILWAUKEE SOUTHERN.—President H. C. Wood confirms the report that this company is making surveys for building a line from Tippecanoe, Wis., southeast to Cudahy and thence north to Bay View and to the works of the Illinois Steel Co. The company plans to touch the various manufacturing sections in Milwaukee and in the immediate vicinity of that city. Construction work is to be started next month.

MUHLENBERG & EASTERN.—Incorporation has been granted this company in Kentucky, with a capital of $25,000, to build a railroad from Central City, Ky., east to Rochester, 20 miles, through a new coal section. The incorporators are: G. T. Westerfield and T. O. Jones, of Central City; W. F. Ennis, N. Murray and J. R. Drake, of Bowling Green.

NEVADA ROADS.—Residents of Salt Lake, Utah, are planning to build an air line railroad from that city to Ely, Nev., about 200 miles, at a cost of $2,000,000. There is no road at present entering Ely, but the Nevada Northern is now being built from Toano 240 miles to the north. A direct line from Salt Lake to Ely would shorten the distance to that place over 100 miles.

NEW YORK CENTRAL.—This company is to build a new freight yard between Syracuse and Warner, N. Y., at a cost of $1,000,000, to relieve the yard at Dewitt. The company has bought some land at Warner, and has options on much more.

OREGON RAILROAD & NAVIGATION.—The Executive Board of this company has authorized an expenditure of $600,000 for the elimination of curves and rebuilding the line of the Oregon Short Line from Troutdale, Ore., east to Bonneville, 17 miles. The line, which at present runs along the base of the bluffs which skirt the Columbia river, was one of the most difficult and expensive to build. The company is planning to reduce the present maximum curvature of 10 deg. so that the new line will only have curves of 4 deg., and will also do away with about 30 ft. of up and down grades in the 17 miles. The work includes a number of extensive fills, with occasional cuts and the blasting of rock bluffs. Several trestles will be filled in.

An officer writes that this company has given a contract to Erickson & Peterson, of Elgin, Ore., for extending its road from Elgin, Ore., east to Wallowo, Lestine, Enterprise and Joseph. The work includes about 20 miles of road through canyons. There will be four 60 ft. deck girder bridges, three 60 ft. wooden spans, and two 150 ft. steel span bridges.

PACIFIC & EASTERN.—Application has been made to Parliament by Sir Henry Pellatt and others of Toronto, for the incorporation of a company under this name, to build a railroad from Victoria to the easterly end of Vancouver, thence to the main land, and continuing northeast to Edmonton; thence east to Prince Albert and northeast to Hudson Bay.

PENNSYLVANIA.—Contracts for new construction work at a cost of $2,100,000 have been let by this company. These contracts include the rebuilding and double-tracking of the West Penn between Funnelton and Blairsville, nine miles. When this work is completed the West Penn will be double-tracked throughout except over the bridge at the Kiskiminetas river. The contract includes the building of six stone bridges containing 94,000 sq. ft. of masonry and the boring of a tunnel 600 ft. long. The contractors are: Charles A. Sims, H. S. Kerbaugh and McMenamin & Sims.

PITTSBURG, HARMONY, BUTLER & NEW CASTLE (ELECTRIC).—Application has been made by S. C. Vickers, E. L. Balsinger, T. G. Hamilton, C. C. Gerber and H. Ethridge for the incorporation of a company under this name to build an electric railroad from Allegheny through New Castle to Butler.

SALEM & WESTERN.—This is the name of a new company which has been organized in the interest of the St. Louis & San Francisco, with $1,000,000 capital, to build a line into the coal fields of Southern Illinois.

SALEM, SPRINGFIELD & PEORIA.—Incorporation has been granted this company in Illinois, with a capital of $100,000. The company plans to build a line from a point on the Chicago & Eastern Illinois north through the counties of Marion, Fayette, Montgomery, Christian, Sangamon, Menard, Logan, Mason and Tazewell to Peoria in Peoria County, approximately 200 miles. The incorporators are E. H. Sennet, A. N. Trueb, J. W. Dueck, F. W. Krohn and Jonathan Proves, all of Chicago.

SCHOODIC STEAM RAILWAY.—Plans are being made by the Great Northern Paper Co. to build a railroad from its mills on the west branch of the Penobscot river, Maine, on the Bangor & Aroostook in Millinocket, to a point near the junction of the east and west branches of the Penobscot river in Medway, 18 miles. Construction work is to be started as soon as surveys, now under way, are completed.

SEABOARD AIR LINE.—The company is planning to make extensive improvements on its road between Wilmington, N. C., and Lincolnton, N. C., a distance of about 200 miles. Heavier rails will be laid and the track made [illegible] in every respect.

SOUTHERN.—The company has received new [illegible] for additions to its yards at Asheville, N. C., where $150,000 improvements will be made.

Valdosta & Nashville.—A charter has been granted this company in Georgia, with a capital of $300,000. H. B. Peeples, J. A. Alexander, J. W. E. Poell, of Nashville; R. D. Stevens and others of Valdosta, Ga., are incorporators.

Virginia Air Line.—This company has been chartered at Charlottesville, Va., with $25,000 capital. T. O. Troy, Amherst, Va., is President, and J. M. Robertson, Secretary, Charlottesville, Va.

Washington, Idaho & Montana.—Work is to be started at once by this company on the building of its proposed line through a timber belt of Latah County, Idaho. The line has been located from a point near Avon east to Janesville, about 17 miles.

West Virginia Midland.—This company, incorporated last year, with a capital of $50,000, to build a railroad from Sutton, W. Va., to Marlinton, about 50 miles, has bought the Holly River & Addison Railway, operating a line from Holly Junction, W. Va., to Webster Springs, 30 miles, with a branch four miles long. The road is to be extended at once up the Elk River Valley above Webster Springs for a distance of about 20 miles.

Wichita Mountain & Orient.—Incorporation has been granted this company in Oklahoma, with a capital of $5,000,000, to build a railroad in Oklahoma and Indian Territories. The incorporators are all residents of Lawton, and include W. M. Smith, H. A. Loyd, E. W. Moll, J. E. Thomas and C. A. Rising. The proposed route is from Lawton, Okla. T., north through Fort Sill, thence northwest, touching the Kansas City, Mexico & Orient near Hobart, through the counties of Comanche, Caddo, Kiowa, Washita, Greer, Roger Mills and Day, and east of Lawton to Atoka, Ind. T.

Youngstown & Ohio River.—This company has secured funds and will begin construction work on its road within 30 days. Work is to be started at the southern end of the road at East Liverpool, and a length of 20 or 25 miles is promised to be in operation this fall. The entire road is to be completed between Youngstown and East Liverpool and other Ohio river towns early in 1907.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—Gross earnings for the nine months ended March 31 were $58,322,293, an increase of $7,669,235; net earnings, $22,172,129, an increase of $4,900,253.

Birmingham Railway Light and Power.—It is reported that this company will be consolidated with the street railway companies of Little Rock, Ark., Memphis, Tenn., Nashville, Tenn., Houston, Tex., and Knoxville, Tenn. A new holding company will be formed. The combined capitalization of the six systems is $21,745,500, and they operate 376 miles of road.

Chicago, Burlington & Quincy.—See Chicago, Rock Island & Pacific.

Chicago, Milwaukee & St. Paul.—An officer of this road is quoted as saying that the company will acquire the Montana Railroad, which runs from Lombard, Mont., to Lewiston, 157 miles, and has authorized $3,500,000 capital stock and $2,000,000 first mortgage 5 per cent. bonds of 1930.

Gross earnings of the C., M. & St. P. for the month of March were $4,537,679, an increase of $246,054; net earnings, $1,808,468, a decrease of $7,707. Gross earnings for nine months ended March 31 were $41,965,279, an increase of $4,084,700; net earnings, $14,781,630, an increase of $635,433.

Chicago, Rock Island & Pacific.—This company has secured trackage rights over the C., B. & Q. from Kansas City to Rushville, Mo., 48 miles. The Rock Island already has a road from St. Joseph, Mo., to Rushville, so that this new arrangement gives it a through line from St. Louis to St. Joseph.

Colorado & Southern.—See Rock Island Company.

Colorado Southern, New Orleans & Pacific.—A meeting of the stockholders has been called for May 15 to vote upon a proposition to decrease the authorized capital stock from $12,000,000 to $2,000,000.

Erie.—Gross earnings for the nine months ended March 31 were $37,880,906, an increase of $4,435,739; net earnings, $10,709,965, an increase of $2,072,331.

Great Northern of Canada.—Application will be made on May 30 for authority to merge with this company the Quebec, New Brunswick & Nova Scotia and the Chateaugay & Northern. The C. & N. runs from Montreal, Que., to a connection with the Great Northern, at Joliette, 37 miles. Its authorized capital stock is $2,000,000; there are also authorized $1,110,000 5 per cent. bonds, none of which have been issued.

Hocking Valley.—Plans are under way for the retirement of the $15,000,000 preferred stock by, probably, an issue of 4 per cent. bonds. The $11,000,000 common stock, on which 3 per cent. is now paid, can then be put on a 6 per cent. basis. It is expected that in July, if this readjustment is made, there will be a change in the status of the Kanawha & Michigan, a company controlled by the Toledo & Ohio Central which is, in turn, owned by the Hocking Valley. The committee formed some months ago to protect the interests of the K. & M. minority stockholders has offered the Hocking Valley $75 a share for the majority stock, about $15 more than the present market price. If this is refused, as seems likely, the committee will offer to sell the stock deposited with it, $2,800,000 of the total $9,000,000 outstanding, at a price considerably above the present market valuation.

Interborough Rapid Transit.—According to the contract between this company and New York City, the company agreed to pay the city annually 1 per cent. on the $46,116,000 bonds which the city issued to pay for the construction of the subway, these instalments to be deposited as a sinking fund for the ultimate retirement of the stock. Payment was to begin at the end of five years from the beginning of operation, or at any time when the company's "profits" should exceed 5 per cent. of the cost of the road. The question has now been brought up as to whether such profits have been earned, and the decision depends on whether or not the $1,249,453 interest on bonds paid to the city as rental, is to be included in operating expenses. If it is so included, the net earnings of the company amount to less than the 5 per cent. mentioned.

Kanawha & Michigan.—See Hocking Valley.

Maryland, Delaware & Virginia.—This company, a subsidiary of the Pennsylvania, owns 77 miles of road in Maryland and Delaware, and over 1,000 miles of steamship lines. It is a reorganization, effected February 1, 1905, of the Queen Anne's Railroad and of two steamboat companies; it has just assued its first annual report, covering the 11 months ended December 31, 1905. The gross earnings for this period were $659,513, and the net earnings $27,864. A year ago the bankers who bought the bonds of the new company stated that it was expected that the gross earnings, which had been about $750,000, would increase to about $1,200,000, and that the operating ratio would be about 70 per cent. The actual unfavorable showing was mostly due, it is stated, to the short crops, and the decrease in the traffic peculiar to the region served by the company.

Missouri, Kansas & Texas.—The New York stock exchange has listed $3,448,000 additional first and refunding 4 per cent. bonds of 2004. Of this amount $1,500,000 were issued for rolling stock, $500,000 for lands, terminals and shops at Parsons, Kan., and Phillips, Ind. T., and the remainder for terminals at Kansas City.

Montana.—See Chicago, Milwaukee & St. Paul.

Panama.—The Senate Panama Canal Committee has recommended an appropriation to buy $2,251,000 of the $2,879,000 outstanding first mortgage 4½ per cent. bonds of 1917 of the Panama Railroad.

Pennsylvania & Ohio (Electric).—A meeting of the stockholders has been called for May 26 to act on a proposition to increase the capital from $700,000 to $1,600,000. (April 27, p. 130.)

Rock Island Company.—An agreement has been made between this company and the Colorado & Southern by which the two companies will make up equally any deficiency in the earnings of the Trinity & Brazos Valley necessary to meet the interest on the $9,000,000 bonds to be issued under the C. & S. refunding and extension mortgage for completing the T. & B. V.

Temiskaming & Northern Ontario.—The Government of the Province of Ontario will issue in July $3,000,000 stock or bonds to pay for 50 miles of construction of the T. & N. O. This road is being extended 100 miles north from Liskeard to a connection with the surveyed line of the Grand Trunk Pacific.

Trinity & Brazos Valley.—See Rock Island Company.

Union Pacific.—The option to convert the first lien convertible 4 per cent. bonds into common stock expired on May 1. There are now outstanding $880,000 of these bonds which the company can redeem at 102½ per cent. and interest. As the Union Pacific stock is now quoted at about 141, the bond holders who failed to take advantage of the privilege of conversion lost about $385 per bond, paper value.

United Railways Investment Co. of San Francisco.—The directors have decided to pay the expected 4% per cent. dividend on the $15,000,000 preferred stock in scrip instead of cash, in order that the cash in the treasury may be available for immediate needs in San Francisco. The scrip will draw interest at 6 per cent. from May 1, and will be redeemed at par and accrued interest before any cash dividends are paid.

GENERAL NEWS SECTION

NOTES.

The New York City office of the New York State Railroad Commission has been moved from Battery Place to the Metropolitan Life Insurance Building, Madison Square.

In the first 27 days of April the Missouri, Kansas & Texas carried north over the Fort Worth division 4,783 cars of cattle. The largest number handled in any one day was 503 cars.

A press despatch from Jackson, Miss., says that the State Railroad Commission has fined the Mobile, Jackson & Kansas City $500 for not complying with an order of the commission concerning the running of trains on the Decatur branch, which is two miles long.

The New York agent of the Panama Railroad announces that the serious congestion of freight on that line, which has existed for several months, has been relieved, and that the traffic is now moving normally. Part of the road has been double-tracked, the terminal yards have been enlarged and new cars and engines have been provided.

At Van Buren, Ark., a power plant is to be put up to run the "intermittent-vacuum" process for cooling refrigerator cars. By the use of flexible pipes a car, after being loaded, is to be exhausted of its air, while at the same time air which has been cooled is to be forced in. The process is to be repeated times enough to reduce the temperature of the fruit in the car to the desired coolness.

In the nine days following the San Francisco earthquake—April 18 to April 26 inclusive—the Southern Pacific Company carried away from the city 300,000 passengers free and 185,000 who paid their fare. Of those carried free 67,000 went to interior California points, 7,684 to other states, and 226,000 to suburban points. The value of the free transportation given by the Southern Pacific Company is estimated at $456,000.

The heavy oak aprons of the ferry slips at East Thirty-fourth street, New York City, have been undermined and damaged to the extent of $25,000 by "geysers" formed by the escape of compressed air from the tunnels which are being excavated beneath the bed of the river at this point. Large quantities of clay have been dumped into the water, with the hope of stopping the openings in the river bed, so as to prevent the escape of air, but thus far this work has not been successful.

In New York City last week a locomotive engineman of the New York Central, whose engine struck and killed a track walker, was arrested and held in $5,000 bail for trial. The arrest of enginemen and trainmen on the occasion of fatal accidents for which they are plainly not responsible is, and for years has been, common in New York City; but the requirement of heavy bail by the coroner is a new feature. Heretofore, men arrested in such cases have been released in the custody of their counsel.

National Machine Tool Builders' Convention.

The spring meeting of the National Machine Tool Builders' Association was held at Atlantic City May 1 to 3, with headquarters at the Chalfonte. President E. M. Woodward presided at the meetings of the several sections. The principal business transacted was that of fixing prices. The shaper and planer builders voted to advance the prices 5 per cent. This advance on planers is in addition to the 5 per cent. advance made at the December meeting, which was held in New York. The upright drill builders committee at its meeting in Chicago on April 20 also decided on an immediate advance of 10 per cent. in upright drills.

Indictments in New York for Rebating.

In the United States Court at New York City, May 4, the Grand Jury handed down a number of indictments for rebating on sugar. Six of the seven indictments are brought under the Interstate Commerce Law for giving or receiving rebates on the freight bills on shipments of sugar from New York City to a wholesale house in Detroit. The indictments are against the New York Central & Hudson River Railroad; the American Sugar Refining Company; Nathan Guilford, Vice-President of the New York Central; F. L. Pomeroy, Freight Traffic Manager of the same road; C. G. Edgar, of Detroit, and Edwin Earle, of the same city. The seventh indictment is brought under Section 5,440 of the Revised Statutes, and charges conspiracy to violate the Interstate Commerce Law on the part of Guilford, Pomeroy and Edgar & Earle. This is the most serious indictment of the seven, for the penalty for conspiracy to violate a Federal law (under Section 5,440) may be imprisonment. The newspaper reports say that the information was filed with the Attorney-General last February. It is charged that the trunk lines had agreed upon a division of the westbound sugar traffic. The New York Central normally gets 25 per cent. of the sugar shipments from New York, but in 1903 the differential lines secured most of the sugar, the strong lines having refused to grant the low rates asked by the shippers. After going six months without the business the stronger lines acceded to the shippers' terms. Among the men who were brought before the Grand Jury were T. P. Riley, Traffic Manager of the sugar company; Lowell M. Palmer, President of lighterage companies in New York; R. W. Parker, H. T. Leeming, and a number of officers of the New York Central.

Height of Couplers.

There was a discussion at the March meeting of the Canadian Railway Club on the proposed change in the standard height of couplers, which resulted in the adoption of the following resolution:

That it is the sense of this meeting that the variation in height of couplers shall be 3½ in., making the measurements from top of rail 35 in. maximum and 31½ in. minimum.

The General Storage Battery Company's Exhibit.

A new exhibitor at the Master Mechanics' and Master Car Builders' Convention this year will be the General Storage Battery Co., New York. The company, among other of its devices, will have on exhibit its Bijur "High-Duty" type standard car lighting cells, in double compartment tanks, as provided for the Pennsylvania Railroad; two types of its charging boosters, for charging Bijur "High-Duty" storage batteries, consisting of a constant speed motor driving a separately excited generator; several sizes of its one and two-cell types of Bijur storage batteries; its standard battery case for railroad signals which are installed in duplicate so that one set may be charging while the other set is operating the signal system and a switchboard demonstrating on a miniature scale the operation of fluctuating loads such as met with on electric elevators, electric hoists and electric cars and trains.

Fuel Tests at the University of Illinois.

A series of investigations of unusual interest to Illinois manufacturers and coal operators is about to be undertaken at the State Engineering Experiment Station recently established at the University of Illinois. An extensive and somewhat elaborate series of experiments with the different Illinois coals is contemplated for the purpose of determining the most economical methods for their utilization. Tests of fuels will be made: (a) under power plant boilers; (b) in residence heating boilers; (c) in gas producers; (d) to determine their chemical composition and heating values.

The fact that Illinois is the second coal-producing state in the Union, and also the fact that in the period from 1850 to the present year Illinois has advanced in rank among the manufacturing states from fifteenth to third render these investigations of peculiar importance.

Manufacturing and Business.

The New York office of the Railway Materials Co. is now at 141 Broadway.

The New York offices of the General Railway Signal Company have been moved to 527 Fifth avenue.

The Berger-Carter Co., formerly at 3440 Beale street, San Francisco, has temporary offices at Third and Washington streets, Oakland, Cal.

The Strauss Bascule & Concrete Bridge Co., Chicago, has moved its offices from Chicago Opera House block to 903-904 Fort Dearborn Building.

The New York office and salesroom of the Star Brass Manufacturing Co., makers of steam engine and boiler appliances, has been removed from 38 Cortlandt street to 70 Cortlandt street.

The San Francisco sales office of the Electric Storage Battery Co., Philadelphia, Pa., has been transferred to 525 Thirteenth street, Oakland, Cal. All business connected with the Pacific coast territory will be handled from this office.

James L. Howard, the veteran Connecticut dealer in railroad supplies, died at his home in Hartford on May 1, at the age of 89. Mr. Howard was an eminent and public spirited citizen. He had held many public and semi-public offices of trust and honor, and in 1888 was Lieutenant Governor of the state.

The Alafia, Manatee & Gulf Coast Railway is in the market for approximately 15,000 lineal feet of vitrified or cement pipe or other effective protection for covering piles in a bridge about two miles long now under construction across Gasparilla Sound, Fla.

Address L. M. Fouts, General Manager, Room 316, Duval Building, Jacksonville, Fla.

The San Francisco representative of the Expanded Metal & Corrugated Bar Co., St. Louis Mo. John B. Leonard, M. Am. Soc. C. E., advised that reinforced concrete construction made a wonderfully satisfactory showing in the earthquake and fire catastrophe. The Los Angeles representative, Carl Leonardt, one of the most prominent contractors in southern California, who was in San Francisco on an inspection tour, advised to the same effect, confirming the other report.

William S. Logue, General Sales Agent of the Edison Mfg. Co., of New York, died in Chicago, April 25, after a sickness of only three days. Mr. Logue was an old time telegrapher and enjoyed a wide acquaintance among railroad men. He had suffered more or less ill health for several years, but with great courage continued to devote himself actively to business. He was born in Frederick, Md., in 1847, and in 1863 was an operator on the government military telegraph lines.

Robert J. Gross, Vice-President in charge of domestic and foreign sales of the American Locomotive Company, was born in Brighton, Canada, in 1850. He learned telegraphy and entered the service of the Montreal Telegraph Company. He was later a railroad telegraph operator and train despatcher at the age of nineteen on the Erie in Buffalo and Dunkirk. In 1873 he became chief train despatcher of the Denver & Rio Grande, with office at Pueblo, Colo., and was soon after appointed Superintendent of Transportation, which position he filled until 1881, when he returned to the Erie. In 1882 Mr. Gross left railroad service to become assistant to Horatio G. Brooks, the founder of the Brooks Locomotive Works. He was a highly successful salesman, and his promotions were rapid. In 1892 the directors of the Brooks Locomotive Works elected Mr. Gross Vice-President of the company, and in this capacity he served until 1901. Upon the formation of the American Locomotive Company in June, 1901, Mr. Gross was elected Second Vice-President, retaining his headquarters in Dunkirk. In his present capacity his office is in New York.



R. J. Gross.

The controlling interest in the Engineering Agency, Inc., Chicago, which was organized in 1893 by Frederick A. Peckham, has been bought by A. G. Frost. At the last directors' meeting Mr. Frost was elected President. R. D. Smith, Vice-President, and P. W. Herring, Secretary and Treasurer, retain their office as heretofore. The agency has a branch office in Pittsburg and contemplates opening within the next 30 or 60 days offices in New York and Denver. The agency reports an unprecedented growth in the securing of competent engineering assistants by the better grade of employers. On an average of 250 men are placed through its Chicago office. The Pittsburg office, which has only been running about three months, this month will place between 75 and 100 men. The salaries of these positions range from $75 to $500 per month and include all sorts of mechanical, electrical, civil, mining and architectural engineers and draftsmen; superintendents for contractors, managers of technical enterprises, etc. The demand at the present time for engineers and draftsmen is very great and good men are at a premium. It is no uncommon thing for employers to offer $10 to $25 per month more for a man than their present employer pays them for doing the same work. Through the J. G. White Company, New York, the agency recently sent a party of 20 men to the Philippines on the Government railroad work there. Men are constantly being sent to Mexico, South America and Far West.

Iron and Steel.

The Pennsylvania has given orders for rails aggregating 143,000 tons for 1907 delivery, to the Carnegie, the Cambria and the Lackawanna Steel Companies. It is also said that the Pennsylvania Steel Co. has received an order for from 40,000 to 50,000 tons from the same road, and the Tennessee Coal & Iron Co. will probably be given an order for openhearth rails aggregating 200,000 tons. There are large orders pending for 1907 delivery aggregating between 500,000 and 600,000 tons, which may shortly be settled. Several large consumers are planning to at once give orders for rails to be delivered in 1907. The New York Central and its subsidiary lines are in the market for 100,000 tons for 1907 delivery.

The New York Central has given to the Lackawanna Steel Co. a supplementary contract for 6,000 tons of rails for 1906 delivery. The New York Central will probably shortly order an additional 10,000 tons. The Michigan Central has ordered 2,000 tons and the Boston & Maine 6,000 tons; the New York, Chicago & St. Louis 5,000 tons. Orders have recently been given by western railroads aggregating 190,000 tons for 1907 delivery, as follows: Chicago, Milwaukee & St. Paul, 100,000 tons; Chicago & North-Western, 50,000 tons, and the Northern Pacific 40,000. The total of orders for the next two years already booked, which includes 140,000 tons for the Louisville & Nashville and the Southern Railways, is 330,000 tons. Negotiations are pending for 200,000 tons additional, 50,000 tons for eastern lines and a similar amount for southern lines, and 100,000 tons for lines in the central west.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Bangor & Aroostook.—F. C. Plaisted, Cashier, has been appointed General Auditor, with office at Bangor, Me.

Blaney & Southern.—The general offices have been moved from Chicago, Ill., to Blaney, Mich.

Chicago, Cincinnati & Louisville.—H. C. Starr, General Counsel, has been elected Vice-President and a Director, succeeding H. A. Christy. G. A. Dodge has been elected Secretary and Treasurer.

Chicago, Indiana & Southern.—M. C. Tully has been appointed Auditor of Freight Accounts, F. A. Wyman, Auditor of Passenger Accounts, and P. L. Fisher, Auditor of Disbursements, all with offices at Cleveland, Ohio.

Cleveland & Marietta.—W. A. Baldwin, President, has retired.

Delaware & Hudson.—J. A. Linen, President of the First National Bank of Scranton, Pa., and Dumont Clarke, of New York, have been elected Directors, succeeding James H. Hyde and James W. Alexander.

Kansas City Southern.—Hugo Blumenthal, of Hallgarten & Co., and A. J. Miller, of D. G. Boissevain & Co., have been elected Directors, the board being increased from 13 to 15 members. Y. Van den Berg, of Ladenburg, Thalmann & Co., has also been elected a Director.

Lake Shore & Michigan Southern.—R. M. Huddleston, Assistant Auditor, has been appointed Auditor, with office at Cleveland, Ohio, succeeding R. H. Hill, resigned.

Metropolitan Street Railway.—Oren Root, Jr., General Manager, has been elected First Vice-President.

Michigan Central.—W. C. Brown has been elected a Director, succeeding Ashley Pond.

Missouri, Kansas & Texas.—C. N. Whitehead has been elected Secretary, with office at New York, succeeding S. Halline.

Missouri, Oklahoma & Gulf.—R. P. Dunbar has been appointed Auditor, with office at Kansas City, Mo.

Mobile, Jackson & Kansas City.—J. F. Ingalls has been appointed Acting Auditor, with office at Frascati, Ala., succeeding E. R. Stewart, resigned.

Rio Grande, Sierra Madre & Pacific.—C. T. Carson, Assistant Auditor, has been appointed Auditor.

Texas & Gulf.—L. B. Jones has been appointed Auditor, with office at Longview, Tex.

Operating Officers.

Chicago, Burlington & Quincy.—E. P. Bracken, Assistant Superintendent at Lincoln, Neb., has been appointed Superintendent at Sterling, Colo., succeeding D. F. McFarland.

Chicago, Rock Island & Pacific.—J. F. Sugrue, Superintendent at Eldon, Mo., has been appointed Superintendent at Dalhart, Tex., succeeding C. M. Jones.

Grand Rapids & Indiana.—The office of the Superintendent of the Southern division has been moved from Fort Wayne, Ind., to Grand Rapids, Mich.

Grand Trunk.—M. C. Sturtevant, Car Service Agent, has resigned, and the office has been abolished. Frederick Price has been appointed Superintendent of Car Service, with office at Montreal, taking the position formerly filled by the Car Service Agent.

Kansas City Southern.—George Geiger, Superintendent at Texarkana, Tex., has resigned. W. H. DeFrance, Trainmaster at Shreveport, La., succeeds Mr. Geiger.

Missouri River & Northwestern.—R. A. Watts has been appointed Superintendent, with office at Rapid City, S. Dak.

Pittsburg, Shawmut & Northern.—F. B. Lincoln has been appointed Assistant to the Receiver, with office at New York.

Sierra of California.—W. B. Blanton has been appointed Superintendent, succeeding W. C. Potts, resigned.

Texas & Gulf.—K. S. Hull, heretofore Superintendent of Bridges and Buildings of the Gulf, Colorado & Santa Fe at Beaumont, Tex., has been appointed Superintendent of the T. & G., with office at Longview, Tex.

Toledo & Indiana.—The general offices have been removed from Delta, Ohio, to Toledo.

Traffic Officers.

Missouri Pacific.—W. B. Knight, General Freight Agent, has been appointed Assistant Freight Traffic Manager, with office at Kansas City, Mo., succeeding J. C. Lincoln, resigned. E. B. Lane, Assistant General Freight Agent at St. Louis, succeeds Mr. Knight. D. R. Lincoln has been appointed Assistant General Freight Agent at St. Louis.

New Orleans & North-Eastern.—H. B. Hearn has been appointed Assistant General Freight Agent, at Shreveport, La., of this road, of the Alabama & Vicksburg, and of the Vicksburg, Shreveport & Pacific.

Wabash.—R. N. Collyer, General Agent at Buffalo, has been appointed Assistant General Freight Agent at St. Louis, succeeding P. W. Coyle, resigned.

Engineering and Rolling Stock Officers.

Chicago, Indiana & Southern.—H. F. Ball has been appointed Superintendent of Motive Power, with office at Cleveland, Ohio.

Cleveland, Cincinnati, Chicago & St. Louis.—W. M. Duane, who was recently appointed Chief Engineer, was born at Bridgeport, Conn., in 1867. He graduated from the Massachusetts Institute of Technology in the class of 1889, and in the same year began railroad service as Assistant Engineer of the Cincinnati & Muskingum Valley. In 1890 he was appointed Assistant Engineer of the Indianapolis division of the Pennsylvania Lines West, and the next year was made Assistant Chief Engineer of the Peoria & Eastern, which is controlled by the Cleveland, Cincinnati, Chicago & St. Louis. Later in the same year he was appointed Engineer of Maintenance of Way of the Indianapolis division of the C., C., C. & St. L., and in 1893 was transferred to the St. Louis division with the same title. He was made Superintendent of this division in 1899, and in 1902 was appointed Superintendent of Construction, which position he has held until his recent promotion.



W. M. Duane.

Grand Rapids & Indiana.—E. H. Barnes, Resident Engineer, has been appointed Chief Engineer; J. E. Keegan, Master Mechanic, has been appointed Superintendent of Motive Power. The offices of both are at Grand Rapids, Mich.

Indiana Harbor.—See Chicago, Indiana & Southern.

Pennsylvania Lines West.—W. C. A. Henry, Master Mechanic at Wellsville, Ohio, and Cambridge, Ohio, has been appointed Master Mechanic at Columbus, Ohio, succeeding S. W. Miller, resigned. A. C. Davis, Electrical Engineer of the Northwest system, succeeds Mr. Henry.

Tacoma Eastern.—D. J. McNerney has been appointed Master Mechanic, with office at Bismarck, Wash., succeeding H. F. Weatherby.

Texas & Gulf.—L. P. Goodwyn has been appointed Master Mechanic, succeeding G. K. Smith, with office at Longview, Tex.

Union Pacific.—R. T. Guppy, who was recently appointed Principal Assistant Engineer, was born in California in 1872. He graduated from the University of California in 1895 and began railroad work as axeman in a surveying party of the Southern Pacific. After having worked on construction and in an office, he served for a time as instrument man on the reconstruction of an electric road in San Francisco, and then went to the maintenance of way department of the Western division of the Southern Pacific. He was later Assistant Engineer on the construction of a mining railroad, and was then appointed Assistant to the Resident Engineer of the Tucson division of the Southern Pacific. After two years he was transferred to the Coast division, and then worked under the Consulting Engineer to the City Attorney of San Francisco. In October, 1904, he was put in charge of the office force of the Engineer of Bridges of the Southern Pacific, where he remained until promoted to be Principal Assistant Engineer of the Union Pacific.

Purchasing Agents.

Mexican Central.—E. A. Mason has been appointed Assistant Purchasing Agent, with office at New York.

Missouri, Oklahoma & Gulf.—G. H. Bacon, Car Accountant, has been appointed also Purchasing Agent, with office at Kansas City, Mo.

LOCOMOTIVE BUILDING.

The St. Louis & San Francisco is in the market for additional locomotives.

The Nippon Railway of Japan has ordered 12 locomotives from the Baldwin Works.

The United Railways of Havana have ordered six locomotives from the Baldwin Works.

The Duluth & Northwestern has ordered two locomotives from the American Locomotive Co.

The Minnesota Transfer has ordered five switching locomotives from the American Locomotive Co.

The Newburgh & South Shore has asked bids on one mogul and one six-wheel switching locomotive.

The Cuba Railroad has ordered six 10-wheel locomotives from the American Locomotive Works and three switching locomotives from the Baldwin Works.

The Central of Peru has ordered ten 10-wheel simple locomotives from the American Locomotive Co. instead of six 12-wheel cross-compound locomotives, as reported in our issue of May 4.

The Italian Government has ordered 20 locomotives from the Baldwin Works. Ten of these will be of the Consolidation type for freight service, with cylinders 20 in. x 26 in., and driving wheels 55⅛ in. in diameter. The remaining 10 will be of the 10-wheel type and will be used for passenger service. They will be fitted with balanced compound cylinders. The high-pressure cylinders will be 15½ in. x 24 in., and the low-pressure cylinders will be 25 in. x 26 in.; the driving wheels will be 72⅞ in. in diameter. Shipment will be made in the early part of July.

CAR BUILDING.

The Denver & Rio Grande has ordered nine passenger cars from Barney & Smith.

The Toledo, St. Louis & Western, it is reported, has ordered 500 flat cars from Barney & Smith.

The Terre Haute Traction & Light Co. has ordered 10 closed cars from the American Car Co.

The Tampa Northern has ordered 10 flat cars of 60,000 lbs. capacity from F. M. Hicks & Co.

The Wheeling Traction Co., Wheeling, W. Va., has ordered five cars from the G. C. Kuhlman Car Co.

The Oregon Short Line has ordered 15 passenger cars from Barney & Smith for September delivery.

The King-Lawson Car Co. has orders for 50 King-Lawson all steel cars, for the building of which it is now asking bids.

The Cleveland & Southwestern Traction Co., as reported in our issue of April 20, has ordered 15 cars from the Niles Car & Manufacturing Co.

The Toledo, Port Clinton & Lakeside (Electric) has ordered two passenger cars and one express car from the Niles Car & Manufacturing Co.

The Atlantic Shore Line (Electric), it is reported, has ordered 25 freight cars. The cars are not to be equipped with trolley arms but will be drawn by electric locomotives.

The American Steel and Roofing Co. has ordered eight gondola cars of 80,000 lbs. capacity and six gondolas of 60,000 lbs. capacity from M. H. Treadwell & Co., Lebanon, Pa.

The City of Winnipeg has ordered six Hart convertible 80,000 lbs. capacity ballast cars from the Dominion Dump Car Company, Ltd., Montreal. These cars will measure 34 ft. over all.

The Isthmian Canal Commission is asking for proposals on 1,000 wooden flat cars. Bids will received until 10.30 a.m. May 19, 1906, by D. W. Ross, General Purchasing Officer, Washington, D. C.

The Kansas City, Mexico & Orient has ordered 400 box cars of 60,000 lbs. capacity; 100 flat cars of 80,000 lbs. capacity, and 100 stock cars of 60,000 lbs. capacity from the American Car & Foundry Co.

The Butte, Anaconda & Pacific has ordered 75 steel hopper ore cars of 100,000 lbs. capacity from the Standard Steel Car Co. These cars will be 25 ft. 10 in. long by 9 ft. 5/8 in. wide by 8 ft. 9 in. high, inside measurements.

The Sydney & Louisburg has ordered 15 box cars of 60,000 lbs. capacity from Rhodes, Curry & Co. These cars will be 36 ft. long by 8 ft. 6 in. wide by 8 ft. high, and will be equipped with automatic couplers and air-brakes.

The Western Maryland has ordered 700 all steel hopper cars of 100,000 lbs. capacity from the Pressed Steel Car Co. for November and December delivery instead of 500 from the American Car & Foundry Co., as reported in our issue of May 4.

The Boston & Maine has ordered 20 first class passenger cars from the Pullman Co., for August delivery. These cars will measure 60 ft. long over sills by 14 ft. 4 in. high, and will have a seating capacity for 72 passengers. They will have wood bodies and wood underframes. The special equipment includes: Westinghouse air-brakes, Gould couplers, Miner draft rigging and side bearing, Gold heating system, Pintsch lighting system, Pullman vestibules and Allen car wheels.

The Colorado & Southern has ordered two first class coaches and two combination mail and passenger cars from the Pullman Co. The special equipment for both includes: Pullman axles, paint and vestibules, Commonwealth Steel Co.'s bolsters, National-Hollow brake-beams, Hewitt special brasses, Janney couplers, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Safety heating system, Pintsch light, Scarritt seats, Railway Steel-Spring Co.'s springs and Standard Steel Co.'s wheels.

The Lake Erie & Western has ordered 17 passenger cars and eight smoking cars from the Pullman Co. The passenger cars will be 70 ft. long over end sills, and will have a seating capacity for 84 passengers. The smoking cars will be 61 ft. long over end sills and will have a seating capacity for 76 passengers. The special equipment includes: Westinghouse air-brakes, Diamond special brake-beams, Tower couplers, Railway Steeel-Spring Co.'s springs, Magnus journal bearings, Symington journal boxes, Harrison dust guards, Perry side bearings, Pintsch gas lighting system, Gold heating system, and Pullman vestibules.

The Nashville, Chattanooga & St. Louis has ordered 500 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for September and October delivery. These cars will weigh 34,000 lbs., and will measure 36 ft. long by 8 ft. 6 in. wide by 8 ft. high, all inside dimensions. The bodies and underframes will be of wood. The special equipment includes: Commonwealth cast-steel bolsters, Simplex brake-beams, Westinghouse air-brakes, Tower couplers, Security door fastenings, National doors, Thornburgh draft rigging, American Car & Foundry Co.'s dust guards and journal boxes, Winslow roofs, Railway Steel-Spring Co.'s springs, and American Car & Foundry Co.'s cast-iron wheels.

BRIDGE BUILDING.

BERRY, KY.—Bids are wanted May 15 by L. W. Swann for building a steel bridge, 275 ft. long, over Licking river.

BRANDON, MAN.—The City Engineer has been instructed to prepare plans for a new steel bridge on Eighteenth street.

CAMDEN, N. J.—The Camden Board of Freeholders has accepted the proposition of the Public Service Corporation to pay $20,000 towards building a lift bridge over Cooper's creek at Federal street. The cost of the completed structure will be about $80,000. The Public Service Corporation will in addition furnish the electric power for the operation of the bridge in return for the privilege of running its street cars over it.

KANSAS CITY, MO.—The bill authorizing the Kansas City, St. Joseph & Excelsior Springs Ry. Co. to build a combined railroad and highway bridge and approaches over the Missouri river at Kansas City has been passed by the Upper House of Congress.

LA GRANGE, MICH.—According to local reports, Highway Commissioner W. H. Stretch is having plans made to build a concrete bridge over the Dowagiac creek to replace the present structure.

MILTON, ONT.—J. A. Waldie is receiving tenders for the erection of a steel bridge on Main street.

MONTANA.—A bill was introduced last week in both Houses of Congress authorizing the Chicago, Milwaukee & St. Paul to build a railroad bridge over the Missouri river in Broadwater and Gallatin counties, Montana.

NEW YORK, N. Y.—The injunction which restrained Bridge Commissioner Stevenson from opening bids the day they were received, April 30, for the new Manhattan bridge, to be built over the East river between the Boroughs of Manhattan and Brooklyn, has been dissolved, and bids were opened May 7. The Ryan-Parker Construction Co., New York, was the lowest bidder; it offers to do the work for $6,493,223. The other bidders were John Peirce Co., $6,596,638; the General Erecting Co., $6,769,983; Milliken Brothers, $7,566,191, and the American Bridge Co., $8,312,146. The bid of the Pennsylvania Steel Co., which was awarded the contract last August, was $7,284,739. The latter bid was thrown out by the Supreme Court. The company is now appealing from that decision and refusing to submit a new bid.

NIAGARA FALLS, N. Y.—Bids are wanted by the Board of Public Works for the building of a steel truss highway bridge of 164 ft. span and a width of 65 ft.; also for remodeling and erecting one old highway bridge of 141 ft. span and 30 ft. in width. Plans and specifications at the office of W. W. Read, City Engineer in the Convention Hall. Walter P. Horne is City Clerk.

SOUTH DAKOTA.—The Upper House of Congress has passed a bill authorizing the Minnesota, Dakota & Pacific to build a railroad bridge over the Missouri river between the mouth of the Moreau river and the southern line of Walworth County in South Dakota.

TENNESSEE.—The Upper House of Congress has passed a bill authorizing bridges over the Clinch and Holsten rivers in Virginia and Tennessee.

The bills authorizing two bridges over the Cumberland river at Nashville and one bridge over the Cumberland river at Clarksville in Tennessee, have been passed by both Houses of Congress and signed by the President.

THAMESFORD, ONT.—B. B. McCarthy is receiving bids for the erection of five bridges in the Township of East Missouri.

VANCOUVER, B. C.—The Council has decided to build two bascule bridges over False creek to cost about $350,000.

WELDON, N. C.—A bill is before the Committee on Interstate and Foreign Commerce of the House of Representatives authorizing the Northampton & Halifax Bridge Co. to build a bridge over the Roanoke river, at or near this place.

Other Structures.

FITZGERALD, GA.—An officer of the Atlanta, Birmingham & Atlantic writes that the new shops to be built for this company are to be of brick, located half a mile from Fitzgerald, and are to be put up by the company's forces. The buildings are as follows: Oil house, 40 ft. x 50 ft.; scrap bin, 50 ft. x 450 ft.; sand house, 25 ft. x 50 ft.; coal bunker, 125 ft. x 200 ft.; pilot, tender and cab shop, 50 ft. x 175 ft.; machine shop, 75 ft. x 300 ft.; smith's shop, 75 ft. x 300 ft.; freight car repair shop, 100 ft. x 400 ft.; boiler house, 40 ft. x 52 ft.; planing mill, 75 ft. x 150 ft.; dry kiln, 50 ft. x 50 ft.; hard wood storage, 75 ft. x 175 ft.; coach shop, 80 ft. x 300 ft.; paint shop, 75 ft. x 280 ft.; paint house, 20 ft. x 30 ft.; store house, 75 ft. x 150 ft.; office, 30 ft. x 60 ft.; pattern shop, 50 ft. x 75 ft.; foundry, 75 ft. x 100 ft., and roundhouse with 400 ft. diameter.

MITCHELL, MINN.—The Duluth, Missabe & Northern has given a contract to L. D. Campbell & Co., of Duluth, for putting up a machine shop, 260 ft. by 60 ft., to cost about $60,000.

NEW YORK, N. Y.—In addition to the temporary terminal now under construction at the Manhattan end of the Williamsburg bridge, plans have been adopted to build an underground station in the Delancey street plaza. The new work will necessitate the removal of a considerable part of the elevated structure. The terminal will extend from Norfolk to Clinton streets.

TOLEDO, OHIO.—The Toledo Ship Building Co. has given a contract to the Great Lakes Dredging & Docking Co., of Chicago, to build a dry dock 600 ft. long and 105 ft. wide.

WINNEPEG, MAN.—The Grand Trunk Pacific has bought a large tract of land two miles east of this city as a site for shops.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

CANADIAN NORTHERN.—This company will shortly let contracts for the building of the line from French river, near Sudbury, east to Ottawa and Hawkesbury, Ont., about 370 miles.

CHICAGO, MILWAUKEE & ST. PAUL.—Work on an extension of this road from Presho west to the Black Hills, which is about the same distance as that by the Chicago & North-Western from Pierre, is being rushed so that the work can be finished before the C. & N.-W. completes its line.

Survey of the main coast line west of Evarts is being pushed as rapidly as possible, but very little construction work will probably be done on this line during the present year. The company is also extending a few stub lines in various sections of South Dakota into new local territory or to connect existing lines.

CHICAGO & NORTH-WESTERN.—Plans are being made by this company to build an extension of the Bonesteel branch of the Fremont, Elkhorn & Missouri Valley from Bonesteel, S. Dak., the present western terminus, northeast to a point on the north line of Gregory County, about 40 miles. Surveys are being made.

Work is being pushed on the extension of this company's line from Pierre, S. Dak., west to the Black Hills.

COLORADO & SOUTHERN.—It has been decided to have the articles of incorporation amended so as to permit the construction of a line from Trinidad in Las Animas County, Col., north to Florence in Fremont County, about 120 miles. Florence is reached by the Atchison, Topeka & Santa Fe, the Denver & Rio Grande, and the Florence & Cripple Creek.

CONEMAUGH & BLACKLICK.—A charter has been granted this company in Pennsylvania, with a capital of $50,000, to build a railroad five miles long from a point on the Buffalo, Rochester & Pittsburg at Josephine to a point on the West Penn Branch of the Pennsylvania, near the mouth of Tom's Run, in Indiana County, Pa. Walter F. Arma, Punxsutawney, Pa., is President. The directors include P. J. McGovern, Josephine, Pa.; Thomas E. Hilliard, Punxsutawney, Pa., and Henry H. Alderfer, Plumville, Pa.

CYNTHIANA & CLAYSVILLE.—Incorporation has been granted a company under this name in Kentucky, with a capital of $14,000, to build a railroad from Claysville southwest to Cynthiana, Ky., in Harrison County, about 12 miles.

DENVER & KANSAS NORTHERN.—See Missouri Pacific.

DENVER NORTHERN (ELECTRIC).—Incorporation has been asked for by this company in Colorado, with a capital of $3,000,000. The proposed route is from Denver north via Louisville, Lafayette, Boulder, Longmont, Bethoud, Loveland, Fort Collins and other towns in northern Colorado to Cheyenne, Wyo. W. C. Brown, of the New York Central; M. J. Jones, of Boulder; R. S. Law and C. W. Waterman, of Denver, are interested.

EAST LIVERPOOL TRACTION.—Surveys have been made by this company, and rights of way have been secured for the proposed electric line to be built from East Liverpool south to Steubenville, Ohio, about 30 miles.

FRANKLIN SOUTHEASTERN.—Incorporation has been granted this company in Georgia to build a railroad from Franklin to either Hogansville or LaGrange. The capital of the company is $200,000, and the incorporators are: W. Nussbaum, N. W. Wick, A. J. Crovatt, J. S. Wright and J. Y. Brame, of Brunswick, Ga., and C. W. Demming, of LaGrange, Ga., and E. Brovston, of Jacksonville, Fla.

FREMONT, ELKHORN & MISSOURI VALLEY.—See Chicago North-Western.

GOSHEN, SOUTH BEND & CHICAGO (ELECTRIC).—Incorporation has been granted this company in Indiana, with a capital of $150,000, to build a railroad across the north end of the State of Indiana. The proposed route is from the Ohio and Indiana state line, crossing DeKalb, Noble, LaGrange, Elkhart, St. Joseph, LaPorte, Porter and Lake Counties to Hammond, about 140 miles. The line is to form a part of the proposed Chicago-New York Electric Air Line.

GULF & SHIP ISLAND.—Announcement has been made that the Columbia division of this road from Mendenhall, Miss., south to Columbia, 105 miles, has been opened for traffic.

HARTWELL & WASHINGTON.—This company has been granted a charter in Georgia, with a capital of $250,000, to build a railroad 56 miles long. The incorporators are W. O. Jones, J. D. Matheson and others.

HAYS CITY & GREAT NORTHERN.—A charter has been granted a company under this name in Kansas, with a capital of $500,000, to build a railroad from Greatbend northwest through Barton County to Hays, and thence north to a connection with the Oakley branch of the Union Pacific, either in Rooks or Graham County, a distance of 90 miles. E. L. Peckham, of Blackwell, Okla. T.; J. H. Ward, H. T. Shaffer and others of Hays City are interested.

HUDSON & MANHATTAN RAILROAD.—An agreement has been filed in Jersey City ending the controversy between this company and the Delaware, Lackawanna & Western concerning right of way. The H. & M. will build a subway under the tracks of the Lackawanna to connect Hoboken with the tunnel from Jersey City to Manhattan. By the terms of the agreement, the Hudson & Manhattan is to pay $175,000 to the Lackawanna, for which it grants to the tunnel company subsurface rights of way from the middle of Twelfth street, Jersey City, to the intersection of Bloomfield and Ferry streets, Hoboken. The grant is 50 ft. wide and 2,625 ft. long.

ILLINOIS, INDIANA & GARY.—Chicago and St. Louis capitalists have applied for the incorporation of a company under this name and for another under the name of the Milwaukee, Rockford & Eastern, to build a railroad from the proposed town of Gary, Ind., near the site of the new steel works at Indiana Harbor through Joliet, Aurora, Dekalb and Rockford to Milwaukee, approximately 230 miles. The line is to be double-tracked for the entire distance. The incorporators include: B. H. Harris and F. Clark, of Chicago; J. C. Duffin, of DeKalb, Ill., and H. W. Seaman, of Clinton, Iowa.

JAMES BAY.—This company, which had a bill reported in the Canadian House of Commons last year authorizing it to build a line from Toronto northeast to Ottawa and thence to Montreal, has prepared plans showing the route of its proposed line around Ottawa. It will run along the south shore of the Ottawa river until close to that city, thence south, crossing the Canadian Pacific, Grand Trunk and Ottawa & New York Railroad outside the city limits, thence making a considerable detour to a crossing of the Rideau river, some miles out of the city, in which section connection is to be made with the proposed Canadian Northern grain line from Montreal to Georgia Bay.

KETTLE VALLEY LINES.—These companies, which operate a line from Republic, Wash., north to Grand Forks, B. C., 40 miles, are making surveys for building an extension from the southern terminus, at Republic, southeast to Spokane, about 145 miles. The proposed line follows the Columbia river to the mouth of the Spokane river, and along that stream to Spokane.

KLONDIKE ROADS.—The Railway Commission of Canada has granted a concession to a company to build a railroad from Dawson City for a distance of 80 miles into a section at present only reached by dog sleds. It is hoped to have 30 miles of the road in operation within six months. The company, which is capitalized at $3,500,000, has an office at Ottawa. H. B. McGiverin is Vice-President and General Manager; Andrew Hayden, Secretary, and H. Blackfieldsmith, Consulting Engineer.

LONG ISLAND.—This company is laying an extra track across the Flushing Meadows, so that its Port Washington branch will be double tracked from Long Island City to Main street, Flushing. Plans for electrifying this part of its system have been completed and work started widening the right of way. The new track is being put in to facilitate the operation of express trains.

MIDLAND & MANITOBA.—Work has been started by Barnes Bros. on this road, which is being built north from the international boundary to Portage la Prairie. Plans have been filed by James Fisher, President of this road, showing the route between Portage la Prairie and Winnipeg, 53 miles.

MILWAUKEE, ROCKFORD & EASTERN.—See Illinois, Indiana & Gary.

MISSOURI PACIFIC.—Surveys are being made under the name of the Denver & Kansas Northern, which was incorporated a year ago to build a number of lines in West Kansas. Work, it is said, will shortly be started on a line to be built from Stockton in Rooks County, Kansas, the terminus of the South Solomon section of the Missouri Pacific, southwest to some point on the Colorado division of the same road near Scotts City, approximately 125 miles. The survey crosses the Salina branch of the Union Pacific near Palco and the main line at Wakeeney.

NEWTON & NORTHWESTERN.—A contract has been given by this company to Murray Bros., of Cedar Rapids, for grading its proposed line to Fort Dodge. The work calls for the removal of approximately 300,000 cu. yds. of earth. The contractors for the line from Kelly to Des Moines are pushing the work.

NORFOLK & SOUTHERN.—E. S. Gannon, President of the merged Norfolk & Southern and Virginia & Carolina Coast, announces that the new Norfolk & Southern lines, extending from Norfolk, Va., to Raleigh via Washington, Greenville and Wilson, N. C., will be completed by May 1, 1907, and that the new line from Washington to Newberne, N. C., will be completed January 1, 1907. The transfer of trains across the Albemarle Sound at Mackey's Ferry by floats will be eliminated by the building of a steel bridge five and one-half miles across the Sound. The new line will give the northeastern section of North Carolina direct connection with the State capital.

NORTH & SOUTH TEXAS.—Preliminary surveys have been completed by McCarthy, Starnes & Co., of Lufkin, Tex., for 34 miles of this proposed road from Lufkin southwest to Groveton, Tex. It is proposed to build this portion of the road and to have it in operation by January of next year. McCarthy, Starnes & Co. want bids from

contractors for carrying out this work as follows: Earth excavation, 20,000 cu. yds. per mile, land to be cleared, 350 acres, and an additional 125 acres of suburban work, four trestles, aggregating 7,000 ft., with one span 112 ft. long, 27 lines of drain pipe, aggregating 2,000 ft., and two water stations. The work also calls for 3,700 tons of rail, wire, angle bars, bolts, spikes, switches, switch stands, etc. P. A. McCarthy, Lufkin, Tex., is Chief Engineer. (April 27, p. 129.)

Northern Pacific.—A contract has been given to Dale & Baumgardner, contractors of St. Paul, for double-track work on this road from Perham, Minn., northwest through Frazee to Oak Lake, about 30 miles. Work is to be started at once. The high bridge southeast of Frazee over the Ottertail river will be enlarged, and a great amount of filling work will be carried out near that place. The main work will be straightening the line and relocating it from the lake northeast to Frazee, where a large amount of filling will be needed.

North River.—This road has been chartered in Virginia. R. M. Gillespie, of New York, is President and C. B. Williamson, of Harrisonburg, Va., Secretary and Treasurer.

Ohio & Licking Valley.—At the recent meeting of the directors of this company preliminary plans were decided upon, and work is to be started within 60 days on a new line from Cannel City, Ky., northwest to Hillsboro, Fleming County, 72 miles. Surveys have been completed. Hillsboro is on the Cincinnati, Flemingsburg & Southeastern, through which the new road will secure connection with the Louisville & Nashville, at Johnson Junction. From Cannel City a line is to be built southeast via Jackson to Elkhorn creek in Letcher County to reach coal fields.

Oklahoma City & Shawnee Traction.—A charter has been granted in Oklahoma to this company, with a capital of $1,000,000, to build an electric railroad from Oklahoma City southeast to Shawnee, about 40 miles. Two routes are under consideration, for which preliminary surveys have been made. The incorporators are: Sherman Collins, Ithaca, N. Y.; O. P. Wortman, W. F. Young and others, of Oklahoma City; W. H. Crane and Samuel Ketchum, of Adrian, Mich.

Omaha, Lincoln & Beatrice.—This company is negotiating with contractors to build its proposed line from Bethany to Omaha, Neb.

Pittsburg & North-Eastern.—Incorporated in Pennsylvania with a capital of $500,000 to build a railroad from the Monongahela river at Elizabeth street in Pittsburg, Pa., to South Bend in Armstrong County, Pa., 40 miles. The directors include W. H. Craig, Wallace Wilson, D. M. Sloan, Wm. S. Graham, all of Pittsburg, Pa., and W. F. Melhuish, Jr., Allegheny, Pa.

St. Louis, Brownsville & Mexico.—An agreement, it is reported, has been reached by which the St. Louis, Brownsville & Mexico will build a bridge at Brownsville, and connection will be made with the Mexican National at Brownsville and Matamoras. The Mexican National has also consented to a modification of its exclusive right to occupy a narrow strip of territory bordering the Rio Grande from Matamoras to a point opposite Del Rio, so that the Yoakum roads may build across the strip and along the coast of Mexico to Tampico. At Tampico connection is to be made with the new line to be established by the National to that port, from the City of Mexico, through the extension of the Hidalgo & Northwestern, which the National recently bought. It is said that the St. Louis, Brownsville & Mexico has passed into the hands of the Rock Island-Frisco management, and that it will be operated as a part of that system.

This company has extended its road for 98 miles from Refugio, Tex., north to Bay City, which is 70 miles from Brownsville. Work is being pushed on the extension to Galveston and Houston, and it is hoped to have trains in operation to these points about the first of next month.

Southern.—This company will spend about $5,500,000 on improvements in the neighborhood of Chattanooga, Tenn., and will raise the necessary funds from sales of bonds. An important part of the work is the Stevenson extension, which includes a tunnel through Lookout Mountain. Two-thirds of this has been completed and the balance is to be finished in 10 months. There is also a drawbridge over the Tennessee river; double-track work between Ooltewah and Chattanooga, 15 miles, and a new passenger station and terminal to cost $1,000,000. The Stevenson extension will be about 30 miles.

Spokane Pend D'Oreille Rapid Transit.—Bids are wanted May 21 by M. F. Mendenhal, Secretary of this company, for clearing the right of way and grading 46 miles of road from Spokane, Wash., northeast to Lake Pend d'Oreille, Idaho, also for building a steel bridge, with a span of 180 ft., over the Spokane river east of Greenacres.

Susquehanna & New York.—An officer writes that work is progressing rapidly with the revision of this company's line between Ellenton, Pa., and Short Run. Eight miles of new road will be built and laid with 80 lb. rails. This work is being done to reduce the present grade to accommodate the heavy and increasing traffic. Trains will be operated over the new part of the line by October of this year.

RAILROAD CORPORATION NEWS.

Atlantic & Birmingham.—See Atlanta, Birmingham & Atlantic.

Atlanta, Birmingham & Atlantic.—This company has bought the Atlantic & Birmingham, which owns 141 miles of road in Georgia. The A., B. & A. has authorized an increase of its capital stock to $11,565,800, of which $4,812,000 is 5 per cent. non-cumulative preferred. One share of this preferred stock, and two shares of the common stock will be exchanged for the 19,248 shares of the A. & B. common stock now outstanding. Of the $30,000,000 A., B. & A. first mortgage 5 per cent. bonds of 1936 recently authorized, $4,090,000 is to be reserved to retire A. & B. bonds outstanding, and $1,969,900 is to be exchanged, with three years' coupons detached, for the same amount of A. & B. preferred stock now outstanding.

Baltimore & Ohio.—It is announced that this company has sold its holdings of 53,532 shares of stock of the Consolidation Coal Co., of Maryland, whose total capital stock is $10,250,000.

Baltimore, Chesapeake & Atlantic.—Gross earnings for the year ended December 31, 1905, of this company, which is a subsidiary of the Pennsylvania, were $866,864, an increase of $51,325; net earnings, $172,276, an increase of $63,751. A 2 per cent. dividend was paid on the $1,500,000 preferred stock, which left a surplus of $89,072.

Bay Shore Terminal.—The property of this company has been sold under foreclosure to Edward B. Smith & Co., Philadelphia, for $765,000. Mr. Smith is quoted as saying that the property will be operated independently.

Brooklyn & Rockaway Beach.—This company, which owns 3½ miles of road between Brooklyn and Jamaica Bay, Long Island, N. Y., has been bought at foreclosure sale by the bondholders. The capital stock is $150,000, and there are outstanding $338,000 6 per cent. bonds of 1931, on which interest has been in default since November, 1899. It is reported that the property will be leased to the Brooklyn Rapid Transit Co.

Detroit, Toledo & Ironton.—Gross earnings for the nine months ending March 31, including those of the Ann Arbor, were $3,158,834, an increase of $530,725; net earnings, $1,070,819, an increase of $417,419. The surplus was $216,388, an increase of $190,536.

Great Northern.—Interests identified with this company have incorporated seven iron mining companies under the laws of Minnesota, each with $50,000 capital stock. The Oliver Mining Co., a subsidiary of the United States Steel Corporation, has incorporated 10 iron mining companies, each with $50,000 capital stock.

Georgia Railway & Electric.—A dividend of 1½ per cent. on the $6,014,600 common stock outstanding has been declared, payable out of the net earnings for the quarter ended March 31, 1906. In February of this year 2 per cent. was paid out of the net earnings for the six months ending Dec. 31, 1905.

Hudson Valley Railway.—This company, which operates 120 miles of electric road extending north from Waterford, N. Y., has been reorganized with E. Clarence Jones & Co. and C. W. Morse in control. The intention is to operate the line in connection with the Hudson Navigation Co.'s steamer line between New York and Troy. An issue of $4,000,000 consolidated first mortgage 50-year 5 per cent. bonds has been authorized, of which $2,228,000 will be issued, and the balance held as security for collateral trust bonds and to retire some divisional bonds.

Pittsburg, Shawmut & Northern.—An injunction has been granted restraining the receiver from issuing the $3,800,000 receiver's certificates authorized recently. The injunction was asked by minority bondholders, who declared that the amount was excessive. It is reported that a new reorganization plan is under consideration.

St. Louis & San Francisco.—This company has filed an equipment mortgage for $3,556,000, covering 45 locomotives, about 3,000 freight cars and five postal cars.

Tonopah & Goldfield.—A dividend of 3½ per cent. on both preferred and common stock has been declared. This is the first dividend.

Wheeling & Lake Erie.—The stockholders have authorized the acquisition of the Lorain & West Virginia, now under construction from Wellington, Ohio, north to Lorain, 20 miles, and of the Sugar Creek & Northern, under construction from Bolivar, Ohio, northwest to Orrville, 26 miles.

GENERAL NEWS SECTION

NOTES.

During four days, May 4, 5, 6 and 7, the Canadian Pacific carried 4,850 immigrants from Montreal to Calgary, Alb.

At Roswell, N. Mex., a grand jury in the Federal Court has indicted the Pecos Valley & Northwestern Railroad for paying illegal rebates to secure shipments of wool.

The Atlantic Coast Line has given to the city of Florence, N. C., a tract of land embracing 137 acres and valued at more than $10,000, to be used as the site of a state reformatory.

The striking longshoremen, pilots and other transportation men on the Great Lakes resumed work on May 10, an agreement having been reached between the proprietors and the workmen by which the differences which led to the strike will be soon settled.

A train load of bananas, consisting of 31 carloads, which started from Hoboken, N. J., on April 26, was run through to Minneapolis, Minn., about 1,344 miles, in 63 hours, or at the rate of 21⅓ miles an hour. The train was run over the Delaware, Lackawanna & Western, the Michigan Central and the Chicago, Milwaukee & St. Paul.

It is announced that the Grand Trunk is to abolish all of its fast freight lines except the National Despatch. The business of the other lines, the Commercial Express, the Lackawanna-Grand Trunk, and the others, all of which work east of Buffalo in connection with American lines, will be looked after by the officers and agents of the National Despatch.

Near Kamloops, B. C., on May 9th, an express train of the Canadian Pacific was stopped by robbers and the valuables in the registered mail department were carried off. The robbers cut off the mail car and hauled it forward a mile, and did not discover, until they had opened the car, that they had left the express car behind; and they apparently did not dare to go back to get it. It was reported the next day that the robbers had been caught.

Representative Mann, of Illinois, has introduced in Congress a resolution directing the Interstate Commerce Commission to investigate and report on the use of and necessity for block signals and appliances for the automatic control of railway trains in the United States; and in reporting, to recommend such legislation as may seem advisable.

English Investigation of Safety Appliances.

A committee consisting of Lieut.-Col. Yorke, chief inspecting officer of railways; Mr. Robert Turnbull, of the London & North-Western, and Mr. Richard Bell, M. P., has been appointed by the English Board of Trade to examine and test appliances designed to diminish danger to railroad employees.

Proposed Michigan-Superior Canal.

A bill has been introduced in the House of Representatives granting a franchise to Thomas Dolan, Jr., F. B. Sprague and others, to build a ship canal between Lakes Michigan and Superior via Whitefish river, Mud Lake and Au Train river and lake, in the state of Michigan.

Erie Canal Contracts.

Contract No. 8 for building part of the Erie Canal has been let to the Eastern Contract Co., Troy and Pittsburg, for $1,433,817; contract No. 11, to the Fort Orange Construction Co., Albany, for $1,359,475.

A New Westinghouse Company.

The Electric Properties Co. was incorporated under the laws of New York on May 10, with a capital of $6,000,000 preferred and $6,000,000 common stock. Its purpose is to acquire, finance and develop properties, especially electric power, traction and lighting undertakings. It owns the entire capital stock of Westinghouse, Church, Kerr & Co., and through that company will do general engineering and construction. No changes in the organization or personnel of the subsidiary company are intended. The new company will also make use of other engineering companies and consulting engineers when it is desirable.

John F. Wallace has been elected President and a Director. The other directors are: Charles H. Allen, Vice-President of the Morton Trust Co., New York; Paul D. Cravath, of Cravath, Henderson & De Gersdorff, New York; H. D. Giddings, New York; N. W. Halsey, of N. W. Halsey & Co., New York; George C. Smith, Vice-President of the Security Investment Co., Pittsburg; John A. Spoor, President of the Union Stock Yard & Transit Co., and President of the Chicago Junction Railway Co., Chicago; Moses Taylor, of Kean, Van Cortlandt & Co., New York; R. B. Van Cortlandt, of Kean, Van Cortlandt & Co., New York; E. G. Tillotson, Vice-President of the Cleveland Trust Co., Cleveland, and F. D. Underwood, President of the Erie Railroad, New York.

Temporary Station at Forty-Third Street.

The architects of the new Grand Central Station, New York City, have filed with the City Building Department plans of the station which is to be used for passengers while the present station is being torn down and replaced. The temporary station is to be in the basement of the "Grand Central Palace" east of the present station and at the extreme eastern limit of the enlarged yard. The "Palace" fronts on 43d street on the south and Lexington avenue on the east. The rooms to be used for passengers are on the two lower floors, and the tracks will be 20 feet below the grade of Lexington avenue. The main waiting room will be 100 ft. x 200 ft., and this and the other rooms will afford about as much space as is assigned for the same purpose in the present station. The "concourse" between the head house and the tracks will be at what is now 44th street, and immediately north of this will be a cab stand, above the tracks. It is expected to occupy this building as a station for two years.

Decoration for Secretary Allen.

Mr. W. F. Allen, of New York City, Secretary of the American Railway Association, has received from the King of Belgium the decoration of Chevalier of the Order of Leopold. This honor is conferred in recognition of Mr. Allen's distinguished services as Secretary of the American Section of the International Railway Congress. The headquarters of the Congress are in Belgium. King Leopold by this act recognizes not only Mr. Allen's efficient management of the Sessions of the Congress in this country in 1905, but, as well, his prominence as a representative of American interests at the sessions of 1895 and 1900, held in Europe.

New Shops for the Coal and Coke at Gassaway, W. Va.

The Coal & Coke Railway has about completed its shops at Gassaway, W. Va., consisting of a steel frame machine and erecting shop, 192 ft. by 113 ft., with one 120-ton electric crane, 65 ft. long, with a traverse of 192 ft. in the erecting shop, with five-ton auxiliary hoists on each trolley, and a 10-ton traveling crane, 40 ft. long, with a traverse of the entire length of the machine shop, 192 ft.; brick paint shop, 50 ft. by 200 ft.; brick wood working shop, 50 ft. by 250 ft., with a 75 ft. transfer table, having a traverse of 320 ft. between erecting shop and wood working and paint shops; brick power house, 40 ft. by 60 ft., and coaling station. All the machinery is to be electrically driven, the large machines with individual drive. A store house, oil house and tin and upholstering shop are now being built. All the work is being done by company's forces.

Vox Populi.

Senator Dolliver, of Iowa, has shown his fellow congressmen a letter concerning the railroad rate bill from one of his constituents, an old farmer of Grundy County, which reads: "Don't never forget, my good senator, that we, the people, are keeping our eye on this thing down there. Settle it if you can, but for God's sake, senator, settle it right. Don't fix it so when it is all over we, the people, will have to bet under which shell we shall have to look for the goods."

The Earthquake on the North Shore Railroad.

A California signal engineer writes as follows: "The North Shore Railroad of California is a short electric third-rail line, running northward from Sausalito to San Anselmo. Sausalito is a harbor on the north side of San Francisco Bay. In 1903 thirty automatic signals were installed on this line, this being the first installation of signals controlled by alternating current track circuits. The signals are of the Union Switch & Signal Company's style "B" type, the company's standard electric motor semaphore, and they work by storage batteries placed in the lower compartment of the signal case. These batteries are charged through high resistance by current taken from the power rail. These signals did not suffer from the earthquake, except that one storage battery jar was broken, putting one signal out of service. The power went off at 5.13 on the morning of the 18th from the fact that the Bay Counties' power system was put out of business by the earthquake, but the signals went immediately into service again when steam was raised in the North Shore power house, again supplying current. The ground around some of the signal foundations was sunk and disturbed.

"The ground around the new ferry building at Sausalito sank about a foot. The tracks and interlockings at Sausalito yard were put out of shape and alone, the road all bridges were thrown out of alinement and one large bridge was broken down. Incidentally, it is interesting to note that a little time before the earthquake, the signals at the entrances to a tunnel on the North Shore railroad

gave trouble from intermittent failures. After considerable search, a broken rail was found at the south portal of the tunnel, where there is a very sharp curve."

The writer of the letter speaks of the swishing wind during the earthquake, and says that an electric light in his bedroom glowed up a few seconds, although it was turned off. There have been other reports of similar observations.

A Roll of Honor.

On the Louisville & Nashville, "Brown's Discipline" has been in force for the last 10 years, and the officers' favorable opinions of the plan have been published in the *Railroad Gazette*. Mr. T. E. Brooks, Division Superintendent of the road at Birmingham, Ala., has lately issued the regular annual circular reporting the results of discipline for 12 months, and the list of names of men who come out with clear records is given in full. This is reprinted in the *Montgomery Advertiser* and takes up two columns of that paper. Besides trainmen, yardmen and station agents, the list embraces also the section foremen. Each man, who at the end of a year has less than 50 demerits on his record has 15 taken off; so that if he has only 15 he begins the next year with a clear record.

A Bit of Fatherly Advice.

The South Carolina Railroad Commission has sent a letter to President Spencer, of the Southern, complaining that on a majority of the mileage of its lines from Columbia to Greenville, Hodges to Abbeville, Alston to Spartanburg, Columbia to Charleston, Branville to Augusta, and Kingville to the North Carolina line the rails are so light and the cross-ties so decayed that the roadbed is in no condition to stand the heavy rolling stock used and that this more than anything is responsible for the congestion of traffic and failure of trains to make schedule time. In view of the great increase in business afforded the road in the state the last five years the commission requests President Spencer to at once relay all of the main lines with heavier rails and otherwise build up and ballast the roadbeds for the safety as well as the facility of traffic.

The letter goes on to urge that the shop force be not cut during the summer, but run to their full capacity and on full time in order to prepare for the fall business, as "it is not so much the want of cars as increase in sidetrack room and in motive power that the business of our state is suffering from to-day."

The letter commended the work of the two superintendents working in South Carolina, and says: "Give them more yard and side-track room, allow them to increase their section force by paying full (more) wages; furnish heavier rails and sufficient locomotive power and we believe they can and will do the rest; and we will experience again no such conditions as obtained last winter."—*Richmond Leader.*

If an Agent Doesn't Make Good.

An agent or an applicant for an agency may consider himself capable of handling a station, and yet after taking charge find himself up against a stone wall which he is unable to break through. Inexperience, inability to procure proper help or an increase of business may be the cause of this. All who have been up against propositions of this kind know the feeling that is apt to get the better of the agent, and that it will grow as he gets farther behind with his work, causing the work to be more or less tangled.

In the face of such difficulties, give yourself a fair trial, take the matter up with the Superintendent, telling him the situation as it appears to you, and take the privilege, which is yours, of resigning and asking for something that you can hold. In this way a good record is retained, which is more than one could expect by hanging on until matters gets in such form that it will be necessary for the traveling auditor to make a transfer. After leaving, watch the outcome. If your successor takes up the tangled affairs and gets along all right, you must be lacking somewhere. If he does not and if more help is given him notwithstanding he is known to be a good, all-round man, your record is all the better.—*North-Western Bulletin.*

Manufacturing and Business.

J. W. Duntley, President of the Chicago Pneumatic Tool Co., sailed for Europe on May 3d.

The offices of Dodge & Day, Engineers, of Philadelphia, have been moved to 597 Drexel Building.

Robt. M. Burns & Co., Chicago, are delivering 20 steel tank cars to the Santa Fe Railroad to be used in construction work.

The Lehigh Valley Testing Laboratory has recently been given by railroad companies several contracts for testing cement.

Lewis F. Shoemaker & Co., Philadelphia, makers of steel buildings and bridges, have opened a branch office at 45 Broadway, New York.

J. H. Wynne, formerly Mechanical Engineer of the Illinois Central, has been appointed Western Manager of the Atlantic Equipment Co., Chicago.

The Independent Pneumatic Tool Co., Chicago, has moved its Pittsburg office from the Germania Bank building to the Farmers' National Bank building.

The Abner Doble Co., San Francisco, whose shops and offices were entirely destroyed by the fire, has temporary offices at 2611 Broadway, San Francisco. Work on new permanent shops in the Potrero district has begun.

The O. M. Edwards Co., Syracuse, N. Y., is building, in that city, a new factory which will have 100,000 sq. ft. of floor space, six times the size of the present main plant. It is expected to be finished about September 1.

Fairbanks, Morse & Co., Chicago, have recently sold a large number of their standard mine cars to the Republic Iron & Steel Company, Nassau Ore Company, La Rue Mining Company and the Rhodes Mining Company, for use in these companies' iron mines in Minnesota.

The Sullivan Machinery Co., Chicago, announces that its temporary San Francisco address is 1010 Washington street, Oakland, Cal., where it will carry an increased stock of rock drills and parts and air compressors. The company is prepared to give prompt attention to all business through H. T. Walsh, Pacific Coast Manager.

The Canadian Westinghouse Company, Ltd., has been given a contract for alternating-current single-phase equipment for about 35 miles of the Windsor, Essex & Lake Shore Rapid Railway Company. For the present, five cars equipped with two 100 h.p. motors each, will be operated; in addition to these, the order covers a 500-k.w., single-phase, 25-cycle generator.

Some rapid construction work is now going on at the new plant of the Lidgerwood Manufacturing Company, at Waverly, N. J. This plant is being constructed by the Miller-Collins Co., New York. The complete plant covers about nine acres of ground and the cost of the buildings alone will be $500,000. When completed and equipped the plant will represent a total outlay of upwards of $1,250,000.

The Arnold Company, of Chicago, Electrical, Civil and Mechanical Engineers-Constructors, heretofore located in the Marquette Building, has moved to the new Borland Building at the corner of La Salle and Monroe streets. This company is building the entire Elgin & Belvidere Electric Ry., a 35-mile interurban line forming the connecting link between two electric railway systems in northern Illinois. It is preparing plans and specifications for the buildings and entire equipment of the repair shops of the Kansas City Southern at Pittsburg, Kan. The company has also been retained by the Big Four as consulting engineers for new shops at Indianapolis. Some interesting work has recently been done in calculating first cost and economy which would result from the electrification of several steam road branches. It is doing the preliminary engineering and report work upon three large hydro-electric plants in Colorado, Utah and Idaho. One of these plants to be used as the source of power for the operation of electric "helper" locomotives on a heavy limiting grade of one of the mountain steam roads. The officers of the company are: B. J. Arnold, President; W. L. Arnold, Vice-President; Ralph J. Arnold, Secretary-Treasurer; George A. Damon, Managing Engineer.

Iron and Steel.

A number of small orders are being given daily for structural and fabricated steel for highway bridges, railroad turn-tables and extensions to manufacturing plants ranging from 25 to 200 tons, keeping the mills extremely active.

Orders have recently been given for rails to be delivered in 1907 by the Chicago, Milwaukee & St. Paul for an additional 10,000 tons, making an aggregate of 160,000 tons; and by the New York, Ontario & Western for 4,000 tons. The Boston Elevated has bought 1,800 tons, and the Ann Arbor 1,000 tons for delivery this year. Other large orders for next year are pending.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Southern Agents.

The Local Agents' Association of the Southern Railway held its eighth annual meeting at Nashville, Tenn., May 8 and 9. Interesting papers were read by W. H. Tayloe, J. G. Mattison, L. L. McClesky, E. H. Shaw, F. B. Pelter, L. J. Duff, W. H. Gatchell, W. L. Pierce, E. H. Lea, J. N. Seale, H. E. Hutchins, and G. A. Barnes. All of these papers were in prose, and no poets were in attendance, so far as we can learn; but the poet of the *Nashville Banner* was

present, or near by, for we read in that paper that the meeting was fraught with great interest. In the evening following the convention there was a banquet at the Maxwell House; and then the members went home and fraught box cars once more.

American Society of Civil Engineers.

At a meeting of this society May 16 a paper on The Scranton Tunnel of the Lackawanna & Wyoming Valley Railroad, by Messrs. George B. Francis and W. F. Dennis, illustrated with lantern slides, was presented. This paper was printed in the "Proceedings" for March, 1906.

International Railway General Foreman's Association.

The second annual convention of this Association was held in St. Louis, Mo., May 8-10, with a good attendance. The following officers were elected for the ensuing year: President, C. A. Swan, Jr. (C. & A.), Roodhouse, Ill.; Secretary, E. C. Cook (*Railway Journal*), St. Louis, Mo.

Engineers' Club of Philadelphia.

At a business meeting of this club to be held May 19 there will be a paper on the Water Works at Charleston, S. C., by J. W. Ledoux; also one on A Comparison of the Cost of Pumping Machinery, Driven by Steam and Oil Engines, by Francis Head. Both papers will be illustrated by lantern slides.

Society for the Promotion of Engineering Discussion.

The fourteenth annual meeting of this society will be held at Ithaca, N. Y., June 29 to July 4. This meeting will be held in affiliation with section D of the American Association for the Advancement of Science. Among the papers to be discussed will be one on Technical Books for Libraries. The present membership of the Association is 400.

Lake Superior Branch Engineering Association.

The Lake Superior Branch Engineering Association was organized at Fort William, Ontario, Canada, on Friday, May 4. The membership is made up of men directly engaged in the location and construction of the Lake Superior Branch of the Grand Trunk Pacific Railway. Meetings are to be held bi-monthly, when papers on engineering subjects will be read and discussed. The opportunity for social reunion is also one of the objects of the organization, as such gatherings are believed to be conducive to unity of opinion and purpose. At the first meeting Mr. A. Woods, Assistant Chief Engineer, made an address, and Geo. A. Knowlton, Division Engineer, was appointed Honorary Chairman. E. W. Cameron was made Secretary, and C. H. E. Rounthwaite, Treasurer. The business session was followed by a banquet.

Franklin Institute.

At a stated meeting of the Institute May 16, the program included papers on the Panama Canal, treating on the engineering and sanitary features by Dr. Henry Emerson Wetherill, of Philadelphia, also one on the Recent Earthquake in San Francisco by Messrs. Williams, Brown and Earle, illustrated with lantern slides.

At the meeting of the Electrical Section on May 17, the program included a paper on the Value and Design of Water Power Plants as Influenced by Load Factor, by Dr. Frederick A. C. Perrine, of New York. At the Mining and Metallurgical Section to be held later, a paper on methods of inspecting and testing railroad supplies by Robert Job, of the Philadelphia & Reading, will be presented, and at the Electrical Section, one on the Development of the Electric Furnace by Messrs. John Meyer and C. J. Russell, of the Philadelphia Electric Co., will be presented.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chicago Great Western.—H. Ernest, Freight Auditor, has been appointed Ticket Auditor, succeeding Otto Schaffer, resigned.

Missouri Pacific.—A. C. Bird, who has been in poor health for over a year, has had his leave of absence extended for six months further.

Pittsburg, Shawmut & Northern.—B. C. Mulhern, Trainmaster, has been appointed Superintendent, with office at St. Marys, Pa., succeeding A. M. Lane, General Superintendent, which title has been abolished.

Raleigh & Western.—The office of the President has been removed from New York to Cumnock, N. C.

Operating Officers.

Alabama Great Southern.—R. E. Boswell, Superintendent of Transportation of this road and of the Cincinnati, New Orleans & Texas Pacific, has been appointed Superintendent of the Alabama Great Southern, with office at Birmingham, Ala., succeeding A. Griggs, resigned. E. C. Tomlinson succeeds Mr. Boswell as Superintendent of Transportation of both roads, with office at Cincinnati, Ohio.

Birmingham & Atlantic.—O. F. Pattberg has been appointed Assistant General Manager, with office at Talladega, Ala.

Boston & Albany.—N. Wales, Assistant Superintendent at Springfield, Mass., has resigned, effective June 1.

Cincinnati, New Orleans & Texas Pacific.—See Alabama Great Southern.

Grand Trunk.—S. Ennes, Trainmaster at Durand, Mich., has been appointed Master of Transportation, with office at London, Ont., succeeding Frederick Price, transferred.

Traffic Officers.

Lake Shore & Michigan Southern.—The office of the Chief Assistant General Passenger Agent has been moved from Buffalo, N. Y., to Cleveland, Ohio.

Engineering and Rolling Stock Officers.

Bessemer & Lake Erie.—E. J. Randall, Principal Assistant Engineer, has resigned. F. R. Layng, Engineer of Bridges, succeeds Mr. Randall, with the title of Engineer of Track. H. H. Harman has been appointed Acting Engineer of Bridges, succeeding Mr. Layng. The offices of both are at Greenville, Pa.

Pennsylvania.—F. T. Hepburn, Assistant to the Principal Assistant Engineer at Altoona, Pa., has resigned, to become General Manager of an electric railroad.

Pennsylvania Lines West.—N. M. Loney, Assistant Master Mechanic at Fort Wayne, Ind., has been appointed Electrical Engineer of the Northwest system, with office at Fort Wayne, Ind., succeeding A. C. Davis, transferred.

Purchasing Agents.

Grand Rapids & Indiana.—Henry Sullivan, Paymaster, has been appointed Purchasing Agent, with office at Grand Rapids, Mich.

LOCOMOTIVE BUILDING.

The Wisconsin Central, it is reported, is in the market for 15 or more locomotives.

The Mobile & Ohio has ordered 10 locomotives from the Baldwin Works. The special equipment will include Barber trucks.

The Butte, Anaconda & Pacific has ordered two switchers, two Decapods and two Consolidation locomotives from the American Locomotive Co.

The New Orleans Great Northern, it is reported, has ordered 12 locomotives, six from the Climax Manufacturing Co. and six from the Baldwin Works.

The Royal Siamese State Railways are asking bids on nine passenger locomotives and seven freight locomotives, including spare parts. Bids will be opened at 10 a.m., Sept. 12, 1906. Further information can be obtained from the Siamese Legation, Washington, D. C.

The Lima Locomotive & Machine Co. report the following orders for Shay locomotives for the week ending May 12: Stacey E. Wright, Getchell, Wash., one 10-ton locomotive; Iall Lumber Co., Colfax, La., one 28-ton locomotive; Sulphur Lumber & Timber Co., Winnefield, La., one 33-ton locomotive; Sligo Furnace Co., Sligo, Mo., one 65-ton locomotive; the Consolidated Lumber Co., Elk, Wash., one 23-ton locomotive; Standard Lumber & Shingle Co., Green Spur, Wash., one 45-ton locomotive; Ed Rand Lumber Co., Alexandria, La., one 37-ton locomotive; Dry Fork Lumber Co., Lanesville, W. Va., one 37-ton locomotive, and the Horse Shoe Lumber Co., River Falls, Ala., one 17-in. x 24-in. 10-wheel locomotive.

The Minnesota Transfer, as reported in our issue of May 11, has ordered five simple switching locomotives from the American Locomotive Co., for September delivery. Three of these locomotives will each weigh 130,000 lbs., one will weigh 138,000 lbs., and one will weigh 119,000 lbs. The cylinders of the 130,000-lb. locomotives will measure 19 in. x 26 in., and the cylinders on the other two locomotives will be 20 in. x 26 in. The diameter of drivers on four of the locomotives will be 51 in., and on the remaining one locomotive the drivers will be 55 in. in diameter. The boilers will be of the extended wagon top type, with a working steam pressure for four locomotives of 180 lbs. per sq. in. and for one locomotive of 175 lbs. per sq. in.

The Queen & Crescent, as reported in our issue of April 6, has ordered two simple 10-wheel (4-6-0) locomotives for the Cincinnati, New Orleans & Texas Pacific, and one simple 10-wheel (4-6-0) locomotive for the Alabama Great Southern from the Baldwin Locomotive Works. The Cincinnati, New Orleans & Texas Pacific locomotives will weigh 122,000 lbs., with 84,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 68 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface,

1,953.85 sq. ft.; 214 Detroit steel tubes, 2 in. in diameter and 14 ft. 1 in. long; carbon steel firebox, 108 in. x 43 in.; grate area, 32.2 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, 9½ tons. The Alabama Great Southern locomotive will weigh 172,000 lbs., with 130,000 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 69 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,818.5 sq. ft.; 336 Detroit steel tubes, 2 in. in diameter and 14 ft. 11 in. long; carbon steel firebox, 102 in. x 66 in.; grate area, 44 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 12 tons. The special equipment for both includes: Westinghouse air-brakes, Simplicity bell ringer, Buffalo brake-beams, Tower couplers for Cincinnati, New Orleans & Texas Pacific locomotives, and McConway & Torley coupler for Alabama Great Southern locomotive; Pyle-National electric headlights, Monitor injector, Jerome piston and valve rod packings for Cincinnati, New Orleans & Texas Pacific locomotives, and U. S. piston and valve rod packings for Alabama Great Southern locomotive; Hayden safety valve, Chicago sight-feed lubricators, Pittsburg Spring Co.'s springs, Ashton steam gages and Gold steam heat equipment.

CAR BUILDING.

The Canadian Pacific, it is reported, is in the market for 50 steel hopper cars.

M. H. Treadwell & Co., Lebanon, Pa., is asking prices on material for 300 cars.

The Schenectady Railway (*Electric*) will soon order additional passenger equipment.

The Norfolk & Western, it is reported, will shortly order 500 stock cars and nine mail cars.

The Cincinnati Northern Traction has ordered 20 open cars from the Cincinnati Car Co., for June delivery. The special equipment includes: Westinghouse brakes, Curtain Supply Co.'s curtain fixtures and Elliott trucks.

The Royal Siamese State Railways are asking bids on 67 passenger cars, seven guards and luggage vans, and 265 goods wagons. Bids will be opened at 10 a.m., Sept. 4, 1906. For further information address Siamese Legation, Washington, D. C.

The Athens Electric Railway has ordered two 12-bench Narragansett cars from the American Car Co. These cars will weigh 19,000 lbs., and measure 34 ft. ⅜ in. long and 8 ft. 3 in. wide, over all. The special equipment includes: Christensen air-brakes and Brill trucks.

The Ann Arbor since January 1st has built at its Owosso, Mich., shops twenty-six 36-ft. box cars of 80,000 lbs. capacity and five cabooses, and has under construction two 65-ft. combination mail and passenger cars. The American Palace Car Co. has ordered two cars from the St. Louis Car Co., to be operated over this line.

The Denver City Tramway has ordered 15 trailer cars from the Woeber Bros. Car Co., for July 10 delivery. These cars will weigh 13,000 lbs. and measure 38 ft. 1 in. long and 8 ft. 2 in. wide, over all. The special equipment includes: Westinghouse brakes, "Tomlinson" automatic couplers, Forsyth curtain fixtures, Pantasote curtain material, Woeber steel arch-bar trucks and Griffin wheels.

The Norfolk & Western has ordered 500 steel frame stock cars of 80,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co. These cars will weigh about 38,000 lbs., and measure 35 ft. 11¼ in. long, 8 ft. 3¾ in. wide and 8 ft. high, inside measurements. The special equipment includes: Westinghouse brakes, Ajax brasses, Butler draft rigging, American Railway Steel-Spring Co.'s springs and Barber trucks.

The New York City Railway has ordered 43 double-truck closed type cars from the J. G. Brill Co., for September, 1906, delivery. These cars will measure 36 ft. long by 7 ft. 6 in. wide by 11 ft. high over all. The bodies and underframes will be of wood. The special equipment includes: Sterling brakes, electric heating system, Monitor roofs, Perforated Veneer seats, Brill trucks and National Car Wheel Co.'s wheels.

The Harriman Lines have ordered six postal cars for the Union Pacific and three postal cars for the Oregon Short Line from the Pullman Co., for September delivery. All cars will weigh 101,500 lbs., and measure 60 ft. 7¼ in. long, 9 ft. 8 in. wide and 14 ft. 1⁹/₁₆ in. high, over all. The special equipment includes: Diamond special brake-beams, Christie brake-shoes, Janney couplers, Symington journal boxes, Pintsch light and Pullman dummy vestibules.

The San Francisco, Oakland & San Jose is building 10 coaches at its Oakland, Cal., shops, for September delivery. These cars will weigh 40,000 lbs. and measure 44 ft. 2 in. long, 8 ft. wide and 8 ft. 7½ in. high, inside measurements. The special equipment includes: Diamond special brake-shoes, Westinghouse brakes, Gould couplers and platforms, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Adams & Westlake door fastenings, Low Bros.' paint and Midvale wheels.

The Western Maryland has ordered 700 steel hopper cars of 100,000 lbs. capacity from the Pressed Steel Car Co., for November and December delivery, as reported in our issue of May 11. These cars will weigh 37,500 lbs., and will measure 32 ft. 3 in. long by 10 ft. 1⅜ in. wide by 10 ft. high, over all. The special equipment will include: The Pressed Steel Car Co.'s axles, doors and wheels; Scullin-Gallagher Iron & Steel Co.'s bolsters, Damascus Brake-Beam Co.'s brake-beams, Pittsburg Brake-Shoe Co.'s brake-shoes, Westinghouse air-brakes, National Supply Co.'s brasses, Climax steel couplers, Lind door fasteners, Farlow & Session draft rigging, Harrison dust guards, Symington journal boxes, Heath & Milligan tank, Railway Steel-Spring Co.'s springs and Barber trucks.

The Chicago, Rock Island & Pacific has ordered five observation smoking cars for October delivery and two dining cars for August delivery from the Pullman Co. The observation cars will be 72 ft. 6 in. long, over sills, and the dining cars will be 70 ft. long, over sills. The special equipment for both includes: Pullman steel axles, National-Hollow brake-beams, Streeter safety brake-shoes, Magnus brasses, Janney couplers, Forsyth curtain fixtures, Pantasote curtain material, Waugh draft rigging, Pullman and Safety heating system, Symington journal boxes, Pintsch light, Murphy paint, Railway Steel-Spring Co.'s springs and Pullman trucks and vestibules. Other specialties are: Chaffee centering device, Acme diaphragms, attachments and curtain rollers, and Woods roller side bearings.

The Boston & Worcester Street Railway has ordered six semi-convertible cars from the J. G. Brill Co. These cars will have a seating capacity for 60 persons. They will weigh about 6,500 lbs. empty, and will measure 53 ft. 5¼ in. long over all by 8 ft. 2 in. inside by 8 ft. 1½ in. high inside. The bodies will be all wood and the underframes will be of both wood and metal. The special equipment will include Brill steel bolsters, Brill non-chattering brake hangers, General Electric Co. semi-automatic air-brakes, Van Dorn couplers, National Lock Washer Co.'s pinch handle curtain fixtures, Consolidated Car Heating Co.'s trust plank pipe electric system, Brill journal boxes, steel car type of Monitor top roofs, Brill 27-E-1-½ special trucks, Railway Steel-Spring Co.'s steel tired wheels with cast-iron spokes, four GE-73 motor type M Sprague General Electric control. There will also be a special folding motorman's compartment in each vestibule.

The Denver, Northwestern & Pacific, as reported in our issue of May 4, has ordered 75 box, 75 stock and 50 flat cars, all of 60,000 lbs. capacity, from the Pullman Co., for September and October delivery. The box cars will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The stock cars will measure 36 ft. 6 in. long, 8 ft. 4 in. wide and 8 ft. high, inside measurements. The flat cars will measure 36 ft. 8 in. long and 8 ft. 10 in. wide, over sills. The special equipment for all includes: Pullman axles, Commonwealth steel bolsters for box and stock cars and Enterprise steel bolsters for flat cars, Christie-Congdon brake-shoes, Westinghouse brakes, More-Jones brasses, R. E. Janney couplers, Positive door fastenings for stock cars, Security doors for box cars, Transom draft rigging for box and stock cars, and Republic friction draft rigging for flat cars, McCord journal boxes, Sherwin-Williams paint, improved Winslow roofs for box cars, Railway Steel-Spring Co.'s springs and Diamond arch-bar trucks.

BRIDGE BUILDING.

Alexandria, La.—Bids are wanted May 22 by the Police Jury of Rapides, Paris, for building a steel bridge over the Bayou Boeuf.

Batavia, N. Y.—Bids are wanted May 19 by John Thomas, Supervisor, for building the steel superstructure and concrete flooring for the highway bridge over Tonawanda creek.

Chattanooga, Tenn.—Plans are under way for building a railroad bridge over the Tennessee river at this place, to cast about $200,000. The project is in the hands of Theodore Crewdson, of Manchester, England, one of the stockholders of the Chattanooga Company, Ltd., who, in connection with the business men of this place, is planning to reach coal deposits.

Harrisburg, Pa.—Bids are wanted May 28 by the State Highway Department of Pennsylvania for building a reinforced concrete bridge in South Union township, Fayette County, also on the same date for a reinforced concrete bridge at Vienna Station in Donegal township, Washington County. Joseph W. Hunter is State Highway Commissioner.

Leland, La.—Separate bids are wanted June 30 by J. C. Haddin, Clerk of the Police Jury, for building for steel bridges.

Louisville, Ky.—Bids will be asked for by the Board of Public Works for building an underpass 730 ft. long under the Louisville

& Nashville track, also one 837 ft. long under the Illinois Central tracks both in Oak street, Louisville. They are to be of reinforced concrete, with steel superstructures. J. P. Claybrook is City Engineer.

NEW YORK, N. Y.—The Board of Estimate and Apportionment has authorized an issue of $2,000,000 corporated stock, to secure funds for building the memorial bridge at Spuyten Duyvil. The cost of the proposed structure will be about $3,000,000.

PARKERSBURG, W. VA.—Definite arrangements have been completed for building the Little Kanawha bridge during the present year over East street.

STERLING, ILL.—A special election was recently held to vote on an appropriation of $45,000 for rebuilding the Avenue G bridge, which was carried away by high water and ice last winter.

TACOMA, WASH.—Bids are wanted June 1 by the County Commissioners for building a combination wood and iron bridge 168 ft. long, over Carbon river, near Melmont, in Pierce County. I. M. Howell is County Auditor.

TOLEDO, OHIO.—Bids will soon be asked by the County Commissioners for building a steel highway and electric bridge 60 ft. wide to replace the present structure over Ten Mile creek at Detroit avenue.

WHEELING, W. VA.—Incorporation has been granted the Back River Bridge Co. to build a bridge from the corner of Zane and Huron streets, on the island, to the Ohio side across the Back river. The company has a capital of $10,000. The incorporators are: L. F. Stifel, B. W. Peterson, G. O. Nagle and others.

Other Structures.

BEATRICE, NEB.—Work has been started by H. C. Wortham on the new Burlington station here, to cost about $50,000. It is proposed to have the structure completed by October of this year.

DEVIL'S LAKE, WIS.—A contract has been given to Schmidt Bros. & Hill for building the new Great Northern works at this place. The buildings include one for offices, a boiler house and a machine shop, also a turntable. The cost of the improvement will be about $160,000.

LEWISTON, ME.—The Lewiston, Brunswick & Bath Street Railway Co. is to put up a combined station and office building here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AMERICAN ASIATIC RAILWAY.—See Washington, Alaska Transportation Railroad Co.

ARGENTINE CENTRAL.—An officer writes that track has been laid for a distance of nine miles on the line which is being built from Silver Plume in Clear Creek County, Colo., via Waldorf to Johnson Ice Palace, about 13 miles. The work is through a mountainous country. The maximum grade will be 6 per cent. and the curvature 30 deg. There will not be any bridges or tunnels. (May 4, p. 136.)

ASHVILLE LOOP.—A charter has been granted this company in North Carolina, with a capital of $100,000, to build a railroad 50 miles long. F. Culver and R. H. Kinkley, of New York, and W. B. Gynn are interested.

ATCHISON, TOPEKA & SANTA FE.—Under the name of the Liberal & Englewood, which was recently incorporated by this company, with a capital of $6,000,000, an extension of its line is to be built west from Englewood, Kan., to Liberal, thence southwest through Beaver County, Okla., and west to Des Moines, N. Mex., and thence northwest to Raton, approximately 300 miles. Surveys have been begun for this line under the direction of Max L. Cunningham, of Oklahoma City. The line is being built to reach coal fields in the neighborhood of Trinidad, Colo.

BALTIMORE & OHIO.—The contract for improvements to this company's terminals at Brunswick, Md., has been let to F. H. Clement & Co., of Philadelphia, Pa. The new yard for the handling of eastbound freight will be west of the present yard, and will extend from Brunswick to Knoxville, between the main tracks and the Chesapeake & Ohio Canal. The work, which will be started at once, includes about 600,000 yards of grading, 3,500 yards of concrete masonry, and about 700 tons of iron pipe culverts. When completed this yard will have about double the present facilities, as it will have track room for about 7,500 cars. The cost will be between $700,000 and $750,000. About 32 miles of tracks will be laid and the main line tracks through the entire yard will be increased from two to four, the additional tracks being used exclusively for freight. Each track will be about two and a quarter miles long. The present main tracks through the yard will be used entirely by passenger trains.

This company is improving its Newark division by putting in a third track from Central City, which is four miles west of Newark, Ohio, to Outville, and from Big Walnut, which is seven miles east of Columbus, to Summit. The contract has been let to Allen & Kefauver, of Washington, D. C., and the work will aggregate 14 miles. Between Central City and Outville, the third track will be used for westbound freight, and between Big Walnut and Summit for eastbound freight. On both these sections the grades are heavy. The work is being done to facilitate passenger service. This line is used jointly by the Baltimore & Ohio and the Pittsburg, Cincinnati, Chicago & St. Louis. The curves are to be reduced to a maximum of 1 deg., but no change will be made in the grades. The work is to be pushed to an early completion.

BALTIMORE, FREDERICK & HAGERSTOWN (ELECTRIC).—Contracts for the construction of 26 miles of a trolley line between Hagerstown and Baltimore, 78 miles, have been let to Westinghouse, Church, Kerr & Co., of New York City. Arrangements have also been made for a $10,000,000 issue of first mortgage 5 per cent. bonds. The company has $15,000,000 stock. It was incorporated several years ago. The contract let covers the section from Frederick to Hagerstown. As soon as this is finished it is proposed to build the rest of the line from Frederick to Baltimore, 52 miles. The whole line is to be completed and in operation within two years. There will be two tunnels, one at Braddock Height, about five miles from Frederick, which will be 4,000 ft. long, and the other at South Mountain, near Hagerstown, about 6,000 ft. long.

CANADIAN PACIFIC.—The various sections on which important track work is now under way are the Saskatoon east, the Strassburg north, the Winnipeg Beach, Teulon, Sheho, Wolseley-Reston, Saskatoon west, Wetaskiwin east, and the Medicine Hat sections. The Saskatoon east and the Strassburg north sections are being built by the British Columbia General Contracting Co., while the work on the Teulon, Winnipeg Beach, Sheho, Wolseley-Reston, Saskatoon west, Wetaskiwin east and Medicine Hat grade reduction work is being done by J. D. MacArthur.

CHICAGO, BURLINGTON & QUINCY.—A contract is reported let by this company to Kilpatrick Bros. & Collins for making new yards in Lincoln, Neb., also for rebuilding and double-tracking the line from that place west to Milford, 19.7 miles. The cost of the improvements will be about $2,000,000.

CHICAGO, MILWAUKEE & ST. PAUL.—According to local reports this company has given a contract to Reynolds Bros. for building 160 miles of its Pacific extension in Montana. The contract is from Forsythe west to Harlowton, the junction point with the Montana Railroad. The work is to be completed in about one year.

CHICAGO, ROCK ISLAND & PACIFIC.—It is announced that the Rock Island, Arkansas & Louisiana, formerly the Little Rock & Southern, will be opened for traffic June 3 from Little Rock, Ark., south to Fordyce, about 50 miles. (See Construction Record.)

CLEVELAND, ASHLAND & MANSFIELD (ELECTRIC).—Incorporation has been granted this company in Ohio, with a capital of $500,000, to build an electric railroad from Ashland, Ohio, southwest to Mansfield, about 15 miles. The incorporators are T. Farham, E. S. Avery and others.

DUBLIN & SOUTHEASTERN.—At a recent meeting of the directors of this company it was voted to extend the road south from Eastman, Ga., the present southern terminus, for a distance of about 35 miles either to Cordele, Fitzgerald, or Barrows Bluff. Preliminary surveys will be started at once to determine which route shall be followed.

GEORGIA, FLORIDA & ALABAMA.—This company, which operates a line from Carabelle, Fla., north to Cuthbert, Ga., and has practically completed a branch from Havana, Fla., to Quincy, 12 miles, has asked the city of Columbus, Ga., to which point it is building, to furnish land as a site for its terminals in that city.

GEORGIA NORTHERN.—An officer writes that the prospects of building an extension southwest to Monticello, 19 miles, are very good. The work will probably be done by the company's forces.

HOLSTON RIVER.—This company, incorporated some time ago to build a railroad from Rogersville, Tenn., northeast to Bristol on the Tennessee-Virginia state line, about 15 miles, has given the general contract to the Callahan Construction Co., and grading has been begun. A subcontract has been let to J. R. Oates, of Asheville, N. C., for building about 10 miles of the road near Moccasin Gap. (See Construction Record.)

KANSAS CITY, MEXICO & ORIENT.—According to reports, this company is planning to organize a company to build a line from Altus, on the St. Louis & San Francisco and the K. C. M. & O. west to points in Greer County and southwest to Frederick thence either to Wichita Falls, Tex., or Waurika, Okla. T., a total distance of about 100 miles.

LEWISTON, BRUNSWICK & BATH (ELECTRIC).—This company is

planning to lay several miles of second track in the cities of Lewiston and Auburn, Me.

Liberal & Englewood.—See Atchison, Topeka & Santa Fe.

Little Falls & Canada Lakes (Electric).—Incorporated in New York, with $200,000 capital, to build street railroads. R. S. Starrs, S. R. Bestron and E. E. Wetherly, New York City, are incorporators.

Louisville & Eastern (Electric).—Louisville and Indianapolis capitalists, it is said, have bought this road and increased the capital stock from $350,000 to $2,400,000. The increase in the capital was made to extend the line from Beard, Ky., northeast to LaGrange in Oldham County, and from Lakeland in Jefferson County east to Shelbyville, thence to Frankfort, also to build a line from the proposed extension at Shelbyville north via Eminence to Newcastle in Henry County, a total of about 75 miles. Percival Moore, who was Vice-President and General Manager of the old company, will be the General Manager for the new company.

Maine & New Hampshire (Electric).—A company has been organized under this name at Portland, Me., to build an electric railroad from Standish south to Hollis, on the west side of the Saco river, about 10 miles. G. B. James, of Boston, is President; E. E. Hastings, of Fryeburg, Me., Clerk, and A. C. Kennett, of Conway, N. H., is Treasurer.

Mattawamkeag & Northern.—Incorporation has been asked for in Maine by a company under this name to build a railroad from Mattawamkeag, Me., which is on the Maine Central and Canadian Pacific, northwest to Millinockett, 22 miles. F. A. Greenwood and A. Wetherby, of Lincoln, are interested.

Missouri, Kansas & Texas.—Contracts are reported let by this company to the Patton & Gibson Co., of Pittsburg, for reducing the grades to 0.4 per cent. on its line from Dennison, Tex., north to South McAlester, Ind. T., about 100 miles. The work calls for the handling of about 5,000,000 cu. yds. of earth, and must be completed by the end of 1907.

New York, Chicago & St. Louis.—A contract is reported let by this company to B. F. Douglas, of Monroe, Ohio, for double-tracking the line between Cleveland and Lorain. The work is to be started this month and completed by the end of this year.

Norfolk & Western.—Contracts are reported let by this company for double-tracking 22.5 miles of its road between Concord and Forest, Va., as follows: W. H. Quigg & Co., Roanoke; J. R. Malone, Washington City; E. G. Nabe Bros. & Co., Portsmouth, Ohio; H. H. George, Jr., Richmond, Va., and G. W. Flickwir, Roanoke, Va.

Pennsylvania Lines West.—An officer writes that work is under way as follows: On the Southwest system, completion of second track on the Indianapolis division from Columbus to Bradford, and on the Logansport division from Logansport to Chicago. The company is building a new eastbound yard at Cincinnati and is adding to the yard facilities at various other places. On the Northwest system, additional ore-handling facilities at Ashtabula and at Cleveland, and some minor grade changes on the lake lines; also engine houses and terminal facilities at various points are under way. The company is carrying out track elevation work at Cleveland, Chicago, Indianapolis and Cincinnati.

Philadelphia & Reading.—This company will, on May 27, open its "New York Short Line," extending from Newton Junction, Pa., to Neshaminy Falls, 10 miles. This line slightly shortens the distance over the Reading between Philadelphia and New York.

Rock Island, Arkansas & Louisiana.—See Chicago, Rock Island & Pacific.

Southwestern Traction.—This company has been organized at Augusta, Me., with a capital of $2,000,000 to operate railroads. I. L. Fairbanks, of Augusta, Me., is President and Treasurer.

Utah & Idaho.—Incorporation has been asked for in Utah by a company under this name to build a railroad from Provo, Utah, north through Utah, Salt Lake, Davis, Weber, Boxelder and Cache Counties to Logan, approximately 150 miles. The capital named is $200,000, and it is estimated that the road will cost $1,800,000. David Eccles is President; M. S. Browning, Vice-President; C. H. Kircher, Secretary, and H. H. Spencer, Treasurer. The office of the company is to be at Ogden.

Virginia Air Line.—Under this name a company has been granted a charter in Virginia to build a railroad from some point on the Chesapeake & Ohio between Keswick and Gordonsville, Va., south to a point near Bremo on the James River division of the same road, about 30 miles, thence south an additional 30 miles to Farmville and probably to Danville. The track is to be laid with 85-lb. rails, and it will have low grades. T. O. Troy, of Amherst, is President, and J. M. Robertson, Charlottesville, Secretary.

Washington, Alaska Transportation Railroad Co. Under this name a company has asked for incorporation in Phoenix, Ariz., to build a railroad from Nome City, Alaska, northwesterly to Cape Prince of Wales, for the northern division; from Nome City northeasterly to Council City, thence easterly to Koyukuk in Norton Bay; thence southeasterly up the Yukon and crossing it, to Tanana river; thence south to White Pass, crossing a portion of the Dominion of Canada to Skagway and Juneau; thence crossing Stikine river to Vancouver. The total length of line is approximately 2,000 miles. The project is believed to be that of the American Asiatic Railway.

RAILROAD CORPORATION NEWS.

Ames & College. See Newton & Northwestern.

Atlanta & Charlotte Air Line.—A stockholders' protective committee has been formed for protection when a readjustment is made next year for the refunding of the $5,500,000 of bonds maturing then. The road is leased to the Southern for 7 per cent. on the $1,700,000 A. & C. A. L. stock.

Canadian Pacific.—This company's sales of land during April aggregated 90,231 acres, at an average price of $5.92. This is an increase of 68,041 acres as compared with April, 1905, when the average price was $5.66. The greatest increase in sales was in the districts of Saskatchewan and Alberta.

See Delaware & Hudson.

Cleveland, Cincinnati, Chicago & St. Louis.—The Big Four Warehouse Co. has been incorporated with a nominal capital of $5,000 to build a grain elevator for this road in Cincinnati.

Buffalo Southern (Electric).—This company, which operates 21 miles of interurban road out of Buffalo, N. Y., and has outstanding $447,200 capital stock and $300,000 first mortgage 5 per cent. bonds of 1934, has been sold to Chicago capitalists. The controlling interest has been held by the Fidelity Trust Co., of Buffalo.

Delaware & Hudson.—This company has arranged for trackage rights over the Canadian Pacific road from Adirondack Junction, Que., to Montreal, nine miles. Heretofore the D. & H. has run into Montreal over the Grand Trunk. The D. & H. will build from Rouse's Point, N. Y., on its own line, to Adirondack Junction, about 40 miles.

Detroit Tunnel Co.—This company, which is building the double-track tunnel under the Detroit river for the Michigan Central, has been authorized to issue $15,000,000 bonds to reimburse the Michigan Central for the advances it will make to the construction company.

Exeter, Hampton & Amesbury Street Railway.—A receiver has been appointed for this 21-mile road in New Hampshire. Its capital stock is $275,000, and it has outstanding $225,000 funded debt. It is controlled by the New Hampshire Electric Co.

Michigan Central.—See Detroit Tunnel Company.

Newton & Northwestern.—This road, which runs from Newton, Iowa, to Rockwell City, 102 miles, has taken over the Ames & College, a two-mile road running from Ames, Iowa, to College, and having $20,000 capital stock outstanding.

New York, New Haven & Hartford.—Gross earnings for the quarter ended March 31, 1906, were $12,153,551, an increase of $1,054,340; net earnings, $3,053,721, an increase of $1,350,558.

Oneonta & Mohawk Valley (Electric).—This company has been incorporated as a reorganization of the Oneonta, Cooperstown & Richfield Springs, which was recently sold under foreclosure, it having been in the hands of a receiver since July, 1903. It operates 68 miles of road between Oneonta, N. Y., and Cooperstown, Richfield Springs and Mohawk. There was outstanding $1,464,000 capital stock and $1,364,000 first mortgage 5 per cent. bonds of 1942. The new company is capitalized at $1,800,000.

Oneonta, Cooperstown & Richfield Springs (Electric).—See Oneonta & Mohawk Valley.

Pennsylvania Company.—This company has sold to Kuhn, Loeb & Co. $50,000,000 4½ per cent. 18-months' notes, guaranteed by the Pennsylvania Railroad Co. The notes have all been sold by the bankers at 99¾ and interest. The proceeds are to be used for the Pennsylvania Railroad's tunnels under the Hudson river and the East river at New York, and for cut-offs and improvements.

Springfield & Western (Electric).—The foreclosure of the mortgage securing the $155,000 of first mortgage 5 per cent. bonds of 1921, the interest on which has been in default since June, 1905, has been asked by the New York Trust Co. The Springfield & Western is leased to the Dayton, Springfield & Urbana, one of the "Appleyard" lines recently sold.

GENERAL NEWS SECTION

NOTES.

The Pennsylvania Railroad has abolished seven passenger and freight stations on the West Penn division, and, in connection with the announcement, it is said that within the past year in the vicinity of Pittsburg 25 stations altogether have been abolished, largely on account of the increased facilities offered by competing electric lines. It is said, however, that most of the stations abolished were flag stations, which would seem to contradict the other statement that they were freight as well as passenger stations.

The claim of the Michigan Central that to get its share of through passenger business it should charge a lower fare than the Lake Shore & Michigan Southern, has been settled, it is said, and the Erie and the Grand Trunk, threatening to maintain low rates to keep below those of the Michigan Central are for the time being appeased. The settlement is reported to be as follows: Rates to be restored to tariff June 1; the Michigan Central's differential to be used only as a basing rate for business originating west of Chicago, and not to apply from Chicago to New York and Boston; any road thinking it has cause for dissatisfaction, or that it has a just grievance on the question of standard and differential fares to appeal to Lucius Tuttle, president of the Boston & Maine, who, in the capacity of a referee, shall hear, try and determine the case.

The State Railroad Commission of Texas has refused to permit the Texas & New Orleans to make an increase of 20 per cent. in the freight rates on its line from Sabine to Dallas, 318 miles long; although, according to the application presented by the road, this line has been operated at a loss for more than two years. The General Manager of the road estimates that the total increase in income by the proposed advance would be only $32,161, basing the estimate on the business of last year, and the total deficit on the division for the year ending June 30 last was $180,787. The deficit is progressively increasing, and the lumber traffic, which the road has depended on, is rapidly falling off, so that, on the whole, it would seem that the commissioners are in this case exceptionally hard-hearted. The present rates, which are declared to be barely above the actual cost of transportation, were put in effect to relieve a depressed lumber market, and it is declared that the conditions in the lumber market no longer warrant their continuance.

Sinking of Ferryboat Baltimore.

On the evening of May 16, the ferryboat "Baltimore," of the Pennsylvania Railroad, was sunk at the company's slip at Desbrosses street, New York city, as a result of a hole stove in her side by a heavy steam lighter, which struck the "Baltimore" when she was approaching the slip and within about 150 feet of it. The passengers were safely landed on the dock, though not without the aid of a tug; and when the tug started to tow the "Baltimore" into another slip it was found impossible to do so, and the ferryboat sank within about five minutes.

Pennsylvania's Enormous Passenger Traffic.

With the new time-table of May 27 the Pennsylvania Railroad will put on four additional two-hour trains between Philadelphia and New York, to leave Broad Street Station weekdays at 7 a.m. and 8 a.m., and to leave New York at 12 noon and 2 p.m. An additional two-hour train from New York to Philadelphia will be run Sundays. A fast daylight express will be put on in each direction between New York and Pittsburg, leaving New York at 9.55 a.m., arriving at Pittsburg at 7 p.m.; leaving Pittsburg at 10 a.m., arriving at New York at 7 p.m.* This increase in facilities is made because of the unprecedented increase during the present year in passenger traffic, the months of January, February and March showing an increase over the corresponding months of 1905 of over 12 per cent. For the first quarter of 1906 the travel on the Pennsylvania has been just double that of the first quarter ten years ago.

In 1896 there were seven through trains from Philadelphia to Pittsburg. In 1901 two had been added. Now there will be 14 through trains from Philadelphia to Pittsburg, and the running time of the fastest has been reduced from 8 hours and 55 minutes in 1896 to 7 hours and 3 minutes in 1906 (nine hours between Pittsburg and New York).

In 1896 there were 29 trains every weekday from Philadelphia to New York, only one of which made the run in two hours. In 1901 the service had been increased to 31 trains, five of which made the run in two hours. Now there will be 41 trains from Philadelphia to New York, 13 of which will make the run in two hours. From 7 a.m. until 10 a.m. there will be five two-hour trains and one train making the run in two hours and 13 minutes. This practically provides a two-hour train every half hour during the busy morning hours.

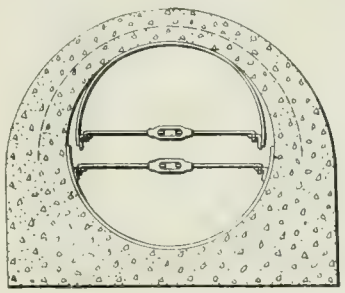
In 1896 the present "Chicago Special" was a fast mail train to which one sleeping car was attached in that year. Soon the train was divided into two sections, one for mail and one for passengers; now parlor cars and coaches will be attached to the mail section. In 1898 a fast night train, leaving Pittsburg at 10 p.m. and arriving New York at 8 a.m., was placed in service. This train has proved so popular that in place of the one train, four heavy trains are now running every night on practically the same schedule.

In 1905 the first 18-hour train between New York and Chicago, the "Pennsylvania Special," was established, and has been a pronounced success. Its exceptionally fast schedule has been maintained with phenomenal regularity.—*Philadelphia Press. Condensed.*

*These New York-Pittsburg runs are only 20 minutes slower than the 18-hour Chicago trains; or about 50 miles an hour west of the Hudson River.

Blaw Collapsible Steel Centering.

The accompanying drawing shows the application of a new system of collapsible steel centering for concrete culverts, drains or sewers which does away entirely with wood centering and which is practically indestructible. It is made in short sections, of steel plate bent to any form of cross-section desired, round, elliptic or egg-shaped. The centering is built in two parts, top and bottom, which have lap joints fastened with wedges and hasps. Each part is sprung outward to shape by spreaders forced apart with a turn buckle in the center. To prepare the centers for concreting the lower half is leveled upon blocking the trench, the upper half is put on and the joint wedges driven home. The turn buckles are then turned to force the centering out to its true cross-section. The exterior surface is perfectly smooth and gives a good finish to the inside of the culvert. After the concrete has set the wedges are driven out, the turn buckles loosened and the centering removed in sections. It is claimed that by this method culverts and sewers can be built quicker and cheaper than with wood centers, and the steel centering has the additional advantages that it is practically indestructible with ordinary care, can be easily and quickly moved from place to place and can be put up and taken down by unskilled laborers. It is made by the Blaw Collapsible Steel Centering Co., Pittsburg, Pa.



Blaw Collapsible Steel Centering.

TRADE CATALOGUES.

Portable Electric Hoists.—The Yale & Towne Mfg. Co., New York, has issued an attractive small catalogue describing a line of portable electric hoists which it has recently begun to make. These hoists are intended to take the place of hand hoists wherever power is available for operating them. They are made in sizes of from one to six tons capacity and using either wire ropes or chains. They are light and compact and simple to operate. The special features include single point suspension on a swiveling ball-bearing hook which permits making a dragging lift at a 45-deg. angle; steel suspension, the entire tensile strain being carried by wrought metal parts; turntable collector rings on the hook which permit the hoist to swivel freely without fouling the feed wires. Special trolleys for hand, chain wheel or electric motor propulsion are also illustrated.

Diaphragms, Curtain Rollers, Etc.—An attractive little pamphlet of the Acme Supply Co., Chicago, illustrates and describes several of the specialties of this company. These include the "Acme" diaphragm, Pullman and Gould types, the "Acme" diaphragm attachment, "Acme" vestibule curtain roller, and "Acme" metallic dustproof weatherstrip. Several of the illustrations are in colors, adding much to the general good appearance of the book.

Bolt Cutters. Bulletin No. 20 of the National Machinery Co., Tiffin, Ohio, is devoted to "National" multiple-spindle bolt cutters. It is $8\frac{3}{8}$ x $10\frac{3}{4}$, and its 24 pages contain half-tone views of the different styles of machines, with information relative to the details of construction, operation, advantages, etc. Tables of dimensions are given also.

Ideal Power.—The May number of this little magazine of the Chicago Pneumatic Tool Co., devoted to compressed air and electrical appliances, contains 20 pages of reading matter. There are numerous short articles in the field to which the magazine is devoted, and there are included two half-tone interior views of The

Pneumatic Tool Company's plant at St. Petersburg, Russia, a subsidiary company of the Chicago Pneumatic; also two views of the plant of the Francis Smith Co., of San Francisco, destroyed in the recent fire.

Lock-Nut and Washer.—The Capitol Lock-Nut & Washer Co., Columbus, Ohio, issues a little 10-page pamphlet describing the Gaines automatic lock-nut. Tables of sizes and prices are included.

Panel-Back Chairs.—A folder of the Richards Chair-Panel Co., Chicago, shows the Richards Filipino fibre-rush chairs—a summer chair provided with the fit-the-back panel of this company.

Manufacturing and Business.

The Sullivan Machinery Co. has appointed Randolph D. Talmage local manager at Joplin, Mo., succeeding S. A. Allison.

The General Superintendent of Motive Power of the Southern Pacific, Oakland, Cal., requests manufacturers to send him catalogues on mechanical matters, to replenish the files destroyed in the San Francisco fire.

H. C. Baker, formerly in charge of the Atlanta office territory of Crocker-Wheeler Company, has started for San Francisco, where he will take charge of the Pacific Coast territory of the Crocker-Wheeler Company.

The Northwestern Car & Locomotive Co., Chicago, has bought the old Chicago Car & Locomotive works at Hegewisch, Ill. It will rebuild and repair all classes of cars and locomotives and will make car forgings. The city office is 542 Monadnock Building.

The American Axle Works has engaged Dodge & Day, engineers, of Philadelphia, to investigate the condition of its plant and report on just what changes should be made to its present layout and what additional building should be undertaken to enable it to increase its capacity about 50 per cent.

During the Master Car Builders' and Master Mechanics' Conventions at Atlantic City, the Niles-Bement-Pond Company will have on exhibition and in full operation one of its extra heavy 90-in. driving wheel chucking lathes. Owing to its great weight, this machine cannot be shown on the Steel Pier. Therefore a special booth has been built, two minutes' walk south from Pennsylvania Station on New York avenue, near Atlantic avenue, where all those who are interested are cordially invited to witness a demonstration of the machine.

Iron and Steel.

The Illinois Central has given a contract for 40,000 tons of rails to be delivered in 1907. It is said that the rails ordered for 1907 delivery aggregate 562,000 tons, including orders given by the Great Northern, Northern Pacific, St. Paul, Illinois Central and Wisconsin Central. The Florida East Coast has given an order for 9,000 tons for this year's delivery, and the Tidewater an order for 27,000 tons for 1907 delivery. The Chicago, Milwaukee & St. Paul order is for 130,000 tons for 1907, and the Chicago, St. Paul, Minneapolis & Omaha's for 10,000 tons.

OBITUARY NOTICES.

W. H. Lewis, Treasurer of the Chicago, Indianapolis & Louisville, died at Chicago, Ill., on May 11. He was 70 years old. Mr. Lewis was elected Treasurer of the Louisville, New Albany & Chicago, which is now the C. I. & L., in 1858, and had held that office ever since through the various changes in the organization of that property.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

New York Electrical Society.

At the meeting of this society May 23, Max E. Schmidt lectured on the Moving platform railway in city transportation, and F. B. Behr spoke on his Mono-rail.

Master Car Builders' and Master Mechanics' Conventions.

Rates at a fare and a third for round trip have been secured from the railroad passenger associations. Tickets to Atlantic City (one way) must be bought not earlier than June 9 nor later than June 15. Take from the agent a certificate and surrender it at headquarters on the steel pier at Atlantic City not later than June 20. Both the Pennsylvania and the Baltimore & Ohio will run special trains from Chicago to the conventions.

Western Railway Club.

At the annual election of officers held at the close of the regular May meeting, H. T. Bentley (C. & N. W.) was elected President; C. A. Seley (Rock Island), First Vice-President; M. K. Barnum (C., B. & Q.), Second Vice-President; P. H. Peck (C. & W. I.), Treasurer (re-elected); J. W. Taylor, Secretary (re-elected). The Executive Committee is C. B. Young, W. E. Sharp and G. H. Bryant. The Library Trustees are C. A. Seley, Chairman; W. F. M. Goss and F. W. Sargent.

New York Traffic Club.

The railroad freight and passenger agents and shippers' traffic agents, of New York city, who have held large and enthusiastic annual dinners for several years, have formed a permanent organization, called the New York Traffic Club, and it is expected that henceforth the organization may have not only a social value but an influence in a business way. The President of the club is B. D. Caldwell (D., L. & W.); Vice-Presidents, George T. Smith (P. R. R.), E. W. Donnalley (Diamond Match Co.), C. F. Daly (N. Y. C.), H. L. Joyce (Interstate Lighterage Co.), and R. Ten Broeck (U. P.). The Treasurer is E. G. Warfield (Mallory Lines); Recording Secretary, C. A. Swope (L. & N.), and Corresponding Secretary, C. H. Tiffany (West Virginia Pulp & Paper Co.).

American Society of Civil Engineers.

The thirty-eighth annual convention of this society will be held at the Frontenac at the Thousand Islands, Frontenac, N. Y., June 26-29. Hotel rates will be from $4 to $4.50 a day, and railroad fares will be at the rate of a fare and one-third on the certificate plan. Tickets should be bought more than three days before the time of meeting, and return tickets not later than three days after the date of adjournment. The New York Central is to run a special train, leaving Grand Central Station, New York, at 9.30 a.m., June 25. At the meeting on June 27, the following subjects will be discussed: What is the Best Preparatory Education for the Civil Engineering Profession? Is Technical Training the Best Education for Executive Work? Prof. George F. Swain, of Boston, will open the discussion on these subjects. Protection of the Intellectual Property of Civil Engineers will be discussed by D. A. Usina. On the evening of June 28 the following subjects will be discussed: Sewage disposal; discussion opened by George C. Whipple; Best means for the prevention of conflagration in large cities, opened by John R. Freeman; and Filtration of water.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Cripple Creek Central.—M. Rollins, A. H. Day and C. E. Goldman have resigned from the Board of Directors. C. M. MacNeill and C. C. Hamlin, Vice-President and Counsel respectively for the United States Reduction & Refining Co., have been elected Directors, leaving one vacancy to be filled later.

Montana.—M. S. Gunn has been elected President, succeeding R. A. Harlow.

New York Central Lines.—W. C. Brown, Vice-President in charge of operation, was, on May 18, elected Senior Vice-President of the New York Central Lines. He will "perform such duties in the general management of the property and the business of the company as may be assigned to him by the Board of Directors, the Executive Committee, or the President." His offices will be in New York, instead of Chicago as heretofore. Mr. Brown was born in 1853 and began railroad service as a section laborer on the Chicago, Milwaukee & St. Paul in 1869. After serving as train despatcher on the Illinois Central, and later on the Chicago, Rock Island & Pacific, he went to the Chicago, Burlington & Quincy in 1876, on which road and its affiliated lines he remained until 1901, acting as Chief Despatcher, Trainmaster, Assistant Superintendent, General Manager of several subsidiary roads, and finally General Manager of the C., B. & Q. He then went to the Lake Shore & Michigan Southern as Vice-President and General Manager. In February, 1902, he was elected Vice-President of the New York Central & Hudson River, and since February, 1905, he has been Vice-President of all the New York Central Lines. President Newman expects to be abroad for some two months, and Mr. Brown, will, in his absence, be the ranking executive official. In printing this sketch of Mr. Brown's life,



W. C. Brown.

we should add that he has just been elected President of the American Railway Association.

New York, New Haven & Hartford.—James F. Hemingway has been elected a Director, succeeding A. D. Osborne, resigned.

Tombigbee Valley.—The office of the President has been moved from Aliceville, Ala., to Mobile.

Operating Officers.

Alabama Great Southern.—See Cincinnati, New Orleans & Texas Pacific.

Argentine Central.—The office of the General Manager has been removed from Denver, Colo., to Silverplume.

Astoria & Columbia River.—See Corvallis & Eastern.

Cincinnati, New Orleans & Texas Pacific.—J. H. Nelson, Superintendent of the Chattanooga Belt, has been appointed also Superintendent of Terminals at Chattanooga for the C., N. O. & T. P. and the Alabama Great Southern.

Cleveland, Cincinnati, Chicago & St. Louis.—J. Q. Van Winkle, General Superintendent, has been appointed Assistant General Manager. H. F. Houghton, Assistant General Superintendent, succeeds Mr. Van Winkle. Mr. Van Winkle was born in 1851 and began railroad service in 1861 as a messenger on the Indianapolis, Pittsburg & Cleveland, which is now a part of the Big Four. After being clerk and station agent, he was, in 1873, appointed Chief Clerk in the Superintendent's office. He was later agent at Union City, Ind., then general yardmaster at Indianapolis, and later agent at Mattoon, Ill. In 1881 he was made trainmaster at Indianapolis, and the next year appointed agent at East St. Louis, Ill. Two years later he was made Agent and Division Freight Agent at Indianapolis, and in 1888 Superintendent. In 1892 he was appointed General Superintendent of the Terminal Railroad Association of St. Louis, but in 1893 returned to the C., C., C. & St. L. as General Superintendent.

Mr. Houghton was born in Vermont in 1859 and began railroad work in 1872 in a section gang on the Atlantic & Great Western. The next year he was a telegraph operator, and in 1874 went to the Wabash as an operator. He remained on this road until 1886, serving as Train Despatcher, Clerk to the Superintendent and Chief Despatcher. He then went to the Baltimore & Ohio as Despatcher and later Chief Despatcher. In 1887 he was appointed Chief Despatcher and Trainmaster on the Wabash. He left in 1893 and went to the Big Four as Assistant Superintendent of the Chicago division; he was appointed Superintendent of that division in 1898, and promoted to be Assistant General Superintendent in 1902.

Corvallis & Eastern.—G. W. Talbot has been appointed General Manager, with office at Astoria, Ore., succeeding T. H. Curtis, resigned.

St. Louis, Iron Mountain & Southern.—H. G. Clark has been appointed Superintendent of the White River division, with office at Aurora, Mo., succeeding Hugh Wilson, resigned.

Seaboard Air Line.—Walter Hale, Superintendent of the Fourth division, with office at Jacksonville, Fla., has resigned, to go to the Durham & Southern. H. W. Stanley, Trainmaster at Atlanta, Ga., succeeds Mr. Hale.

Traffic Officers.

Colorado & Southern.—George Geiger, heretofore Superintendent of the Kansas City Southern at Texarkana, Tex., has been appointed Superintendent of the Northern division of the Colorado & Southern, with office at Denver, Colo.

Louisiana & Pacific.—C. M. Boswell has been appointed General Superintendent, with office at De Ridder, La.

Missouri, Kansas & Texas.—F. B. Drew, General Passenger and Ticket Agent in Kansas and Indian Territory, has resigned, effective June 1, to go into other business.

Engineering and Rolling Stock Officers.

Central of New England.—W. J. Backes has been appointed Chief Engineer, with office at Hartford, Conn., succeeding W. B. Chapin.

Chattanooga Southern.—H. S. Lloyd has been appointed Master Mechanic, with office at Alton Park, Tenn., succeeding A. D. Folmer.

Lehigh Valley.—A. E. Mitchell, Superintendent of Motive Power, has resigned, effective June 1. Frank N. Hibbits, Mechanical Superintendent of the New York, New Haven & Hartford, succeeds Mr. Mitchell. Mr. Hibbits was born in Indiana in 1866 and is a graduate of the Rose Polytechnic Institute. He began railroad service in 1886 as machinist and draftsman on the Cleveland, Columbus, Cincinnati & Indianapolis. In 1891 he was appointed Engineer of Tests on the New York, Lake Erie & Western, and was made Mechanical Engineer of that road the next year. In 1894 he was appointed Master Mechanic of the Rochester division of the same road, and in 1895 was made Freight Trainmaster of the New York division. Four years later he was promoted to be Superintendent of the Jefferson division, but in 1901 left and went to the Union Pacific as Mechanical Engineer. In 1903 he was appointed Superintendent of Motive Power and Machinery of the U. P., and the next year went to the Southern Railway as Consulting Mechanical Engineer; but after a few months he went to the New Haven road as Mechanical Superintendent.

Mexican Central.—L. F. Whitbeck, Assistant Division Engineer, has been appointed Resident Engineer of the Guadalajara, the Cuernanaca and the Panuco divisions, with office at Guadalajara, Mex.

R. D. Gibbons has been appointed Master Mechanic at Monterey, Mex., succeeding G. W. Cooper, resigned.

New York Central & Hudson River.—Azel Ames, Jr., has been appointed Signal Engineer of the Electric Zone, New York City, succeeding W. H. Elliott, assigned to other duties.

New York, New Haven & Hartford.—F. T. Hyndman, General Master Mechanic, has been appointed Mechanical Superintendent, with office at New Haven, Conn., effective June 1, succeeding F. N. Hibbits, resigned, to go to the Lehigh Valley. Mr. Hyndman was born in 1858 and began railroad service in 1872 in the Ashley shops of the Central of New Jersey. Later he was an apprentice for three years in the Wilkesbarre shops of the Lehigh Valley, and then was brakeman and fireman on the Central of New Jersey. In 1880 he went to the Atchison, Topeka & Santa Fe as a machinist, and the next year went to the Pittsburg & Western. From 1883 to 1895 he was engineman on the last named road, and was then appointed trainmaster. A year later he was Master Mechanic at Allegheny, Pa. In 1902 he went to the Baltimore & Ohio, with the same title, and then to the Buffalo, Rochester & Pittsburg, where he was promoted to be Superintendent of Motive Power. In 1904 he went to the New York, New Haven & Hartford as General Master Mechanic.

Pennsylvania Lines West.—G. B. Fravel, Master Mechanic at Chicago, Ill., has been appointed Master Mechanic at Logansport, Ind., succeeding G. C. Bishop, resigned to go to the Long Island. J. J. Walsh, General Foreman at Toledo, Ohio, succeeds Mr. Fravel.

C. B. Young, Assistant Inspector of Motive Power of the Southwest system, has been appointed Assistant Master Mechanic at Fort Wayne, Ind., succeeding N. M. Loney, promoted.

Special Officers.

Chicago, Rock Island & Pacific.—C. B. Schmidt has been appointed Commissioner of Immigration of this road and of the St. Louis & San Francisco.

LOCOMOTIVE BUILDING.

The Chicago, Burlington & Quincy has ordered 50 simple Prairie (2-6-2) locomotives from the American Locomotive Company and 15 simple Pacific (4-6-2) locomotives from the Baldwin Works. The Prairie locomotives will weigh 216,000 lbs., with 153,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 69 in.; wagon top boiler, with a working steam pressure of 210 lbs.; heating surface, 3,599 sq. ft.; 305 tubes, 2¼ in. in diameter and 19 ft. long; firebox, 9 ft. x 6 ft.; grate area, 54 sq. ft.; tank capacity, 8,000 gallons, and coal capacity, 13 tons. The Pacific locomotives will weigh 222,000 lbs., with 153,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 74 in.; wagon top boilers, with a working steam pressure of 210 lbs.; heating surface, 3,950 sq. ft.; 305 tubes, 2¼ in. in diameter and 21 ft. long; firebox, 9 ft. x 6 ft.; grate area, 54 sq. ft.; tank capacity, 8,000 gallons, and coal capacity, 13 tons.

CAR BUILDING.

The Isthmian Canal Commission is asking prices on passenger cars.

The North & South Despatch, it is reported, has ordered 2,000 freight cars.

The Wisconsin Central has ordered 200 box cars from the Haskell & Barker Car Company.

The Atchison, Topeka & Santa Fe, it is reported, has ordered 61 baggage cars from the American Car & Foundry Co., and is also reported as having increased its order with the Pullman Co. for two passenger coaches.

The Denver & Rio Grande has ordered nine day coaches, five chair cars and four dining cars from Barney & Smith. 250 ore dump cars of 100,000 lbs. capacity, and 250 coke dump cars of 80,000 lbs. capacity from the National Coal Dump Car Co.

The Victoria, Fisher & Western has ordered 30 logging cars of 60,000 lbs. capacity from the Marshall Car Wheel & Foundry Co.

These cars will weigh 14,000 lbs., and measure 28 ft. long and 10 ft. wide, over all. The special equipment includes Marshall wheels.

The Chicago, Burlington & Quincy has ordered 1,900 of the 2,000 box cars of 80,000 lbs. capacity, for which it was in the market, from the Pullman Company. These cars will weigh 34,000 lbs., and measure 40 ft. 5⅝ in. long, 8 ft. 6⅛ in. wide, and 8 ft. high, inside measurements.

The Terre Haute Traction & Light Co., as reported in our issue of May 11, has ordered 10 closed cars from the American Car Co., for August delivery. These cars will measure 30 ft. 8 in. long, 6 ft. 2 in. wide and 8 ft. 10½ in. high, over all. The special equipment includes: Consolidated Car Heating Co.'s heating system.

The Norfolk & Western is preparing plans for nine postal cars. The cars will be 60 ft. long, 9 ft. wide and 9 ft. 4⅞ in. high, inside measurements. The special equipment includes: Diamond special brake-beams, Westinghouse brakes, Ajax brasses, McConway & Torley Co.'s couplers, Gould draft rigging, Pintsch light and Railway Steel-Spring Co.'s springs.

BRIDGE BUILDING.

ALBANY, N. Y.—The Advisory Board of Engineers in charge of the Barge Canal are trying to reach an agreement with the Delaware & Hudson for the building of a bridge over the canal at Waterford. The engineers are completing arrangements for the building of about 20 new bridges over the canal, each of which is to cost between $80,000 and $200,000. The state is required to build these bridges, but hopes to save a share of the cost by making agreements with the various steam railroad companies for the use of some of the structures.

BOURBON, Mo.—Bids are wanted June 5 by G. L. W. Smith, of Hinch, Mo., at Steelville, Mo., for building a steel bridge 300 ft. long over Meramec river in Crawford County. William C. Evans is County Clerk.

CLEVELAND, OHIO.—The Cleveland Belt Line, it is said, will soon ask bids for building about 40 bridges, the largest of which will be 2,400 ft. long over Cuyahoga river, and to be 165 ft. above water. Another bridge over the Hill Creek valley will be 1,200 ft. long and 90 ft. high. Most of the others will be over streets. W. R. Hopkins, in the Society for Savings Building, is interested in the company.

DAYTON, OHIO.—Plans, it is said, have been completed by the Pennsylvania Co. for building a concrete bridge over the Miami river for the use of that company, the C., C., C. & St. L., and the Cincinnati, Hamilton & Dayton.

ELGIN, B. C.—A steel drawbridge is to be built over the river at this place. Address Councillor Johnson.

FORT SNELLING, MINN.—The Board of Officers, appointed by the War Department, has practically agreed to recommend the construction of a bridge 300 ft. below the present structure. A bridge at this point will cost about $250,000. It is understood that the city will be willing to pay $100,000 towards the cost and the street car company $25,000.

FREMONT, OHIO.—Preliminary arrangements are being made by the Lake Erie & Western for building a bridge over Sandusky river on the site of the present structure. The new bridge will be of steel. The west bridge will consist of four 140-ft. spans and one 129½ ft. span, with 35 ft. deck girders. The east bridge will consist of three spans each 145 ft. 8 in., with a pile approach of 149 ft. Work is to be started shortly, and it is proposed to have the structure completed by the first of next year.

HAVRE DE GRACE, MD.—The new bridge of the Philadelphia, Washington & Baltimore, over the Susquehanna river, between this place and Perryville, is to be put in use May 27.

HOLTON, KAN.—Bids are wanted June 5 by N. P. McConnell, County Clerk, for building three steel bridges in Jackson County. George L. White is Chairman.

INDIANOLA, MISS.—A contract has been given to the Southern Bridge Co., of Birmingham, Ala., at $25,400, for building a steel drawbridge over the Sunflower river at Boyer's Mill, the work to be completed by Jan. 1 next.

MAUCH CHUNK, PA.—Bids are wanted June 4 by the County Commissioners for building a steel bridge over Hickory creek in Carbon County. D. Ross is a Commissioner.

MENOMINEE, MICH.—Menominee County and Marinette County, Wis., officials will jointly build three steel bridges over the Menominee river during the coming summer. One will be at Wallace, one at Pembine Falls and the other at Wausaukee Bend.

MONTANA.—On May 9 the United States Senate passed the bill authorizing the Chicago, Milwaukee & St. Paul Ry. Co. to build a railroad bridge over the Missouri river between Broadwater and Gallatin counties in this state. (May 11, p. 142.)

PHILADELPHIA, PA.—The bids recently opened for building the bridge over the Wissahickon Valley, on the line of Walnut Lane, to connect Germantown and Roxborough, were: Reilly & Riddle, $253,551; New York Continental Filtration Co., $269,880; Millard Construction Co., $270,000; District Construction Co., $285,900; Michael O'Rourke, $337,000; Schofield Co., $339,300, and Sullivan & Co., $368,894. The time for completing the work was given by four of the bidders at 18 months, one at 20 months, and two at 24 months.

PORT GIBSON, MISS.—Bids are wanted June 4 by R. C. McCay, Chancery Clerk, for building a 60-ft. steel approach to the bridge over Clark's creek, near Martin, in Claiborne County.

PORTLAND, ORE.—D. W. Taylor, City Engineer, writes that plans have been completed and bids are wanted June 8 for building the bridge on Grant avenue across Sullivan Gulch, which is about 65 ft. deep and through which the tracks of the Oregon Railway & Navigation Co. enter the city. The bridge is to be built for the city of Portland; it will be of steel on concrete piers 350 ft. long and 40 ft. wide, with 12-ft. sidewalks. The estimated cost of the entire work will be $52,000. Bids will be received by the City Auditor. Plans and specification to be furnished by the bidders.

WACO, TEX.—An officer of the Texas Central denies the report that several bridges are to be built along the line of its proposed extension, and that only a 75 ft. span will be put up. For this the material is already on the ground.

WARREN, PA.—The Warren Street Railway Co. is to build a combined highway and street railroad bridge about 1,400 ft. long over Allegheny river at Glade Run. Contract has been let to the Penn Bridge Co.

WASHINGTON, D. C.—Both Houses of Congress have passed the bill authorizing the Pend d'Oreille Development Co. to build a bridge over Pend d'Oreille river, in Stevens County, Wash.

ZANESVILLE, OHIO.—Bids are wanted by the County Commissioners for building the superstructure of a highway bridge over the South Fork of Jonathan creek in Roseville, Ohio, to consist of one 105 ft. span, with 18 ft. roadway and 5 ft. sidewalks. L. E. Brelsford is County Auditor.

Other Structures.

BRADDOCK, PA.—Bids are wanted May 31 by the Baltimore & Ohio for putting up a one-story stone passenger station 34 ft. by 120 ft. Bids are also wanted for a new frame freight house, with slate roof, to have rolling steel doors.

CHICAGO, ILL.—According to local reports the Chicago & North-Western is planning to build its new passenger station on Canal street. The new station is to be used for through service only, the present structure on the north side being retained for suburban traffic. The proposed station and trainshed is to extend from Madison to Randolph streets, the trains reaching the station over an elevated structure.

FOSTORIA, OHIO.—Bids are wanted May 26 by the Baltimore & Ohio for putting up a brick passenger station on concrete foundations.

HADDON HEIGHTS, N. J.—The Philadelphia & Reading has given a contract to J. Simms Wilson, of Philadelphia, Pa., for building a stone freight house, one story high, 22 ft. by 42 ft. 10 in.

LOS ANGELES, CAL.—The Atchison, Topeka & Santa Fe, it is said, has given a contract to Carl Leonardt for building a reinforced concrete freight house to be 1,320 ft. long by 91 ft. wide, with spans between columns of 60 ft., to cost $250,000.

MENASHA, WIS.—The Chicago, Milwaukee & St. Paul and the Wisconsin Central, it is reported, will jointly build a union passenger station and freight house here, at a cost of $35,000.

PITTSBURG, PA.—According to local reports arrangements have been made by the Baltimore & Ohio for starting work on a new passenger station and freight house to be built east of Try street. The company is to spend about $4,000,000 on the stations and terminals in this city.

ST. LOUIS, ILL.—The Illinois Central improvements include a 16-stall roundhouse to cost $25,000; a turntable and pit, oil houses, cinder pits and ice warehouses.

SANDUSKY, OHIO.—Bids are wanted May 25 by the Baltimore & Ohio for building a new stone and brick passenger station here.

SEATTLE, WASH.—The union station to be used by the Great Northern and the Northern Pacific has been completed, and is now in use.

TOLEDO, OHIO.—The Great Lakes Dredging & Dock Co. has taken the contract to build a new dry dock for the Toledo Ship Building Co., 600 ft. by 105 ft.; also a contract to extend the company's present dry dock to the same dimensions. Also for building sundry

docks along the shipyard slips and river fronts, and for deepening the slips, at a total cost of about $200,000.

WALLA WALLA, WASH.—Announcement has been made that the Oregon Railroad & Navigation Co. will during the coming summer put up a new station, a warehouse, and some side tracks at the foot of Main street. The cost of these improvements will be about $50,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AUGUSTA CONNECTING.—Incorporated in Georgia, with a capital of $100,000, to build a railroad from Augusta six miles to a connection with the proposed line of the Augusta & Florida, now under construction. J. S. Williams and J. W. Middendorf, of Augusta, are interested.

BALTIMORE & OHIO.—An officer writes that work now in progress on the Washington branch includes the completion of the work that was planned several years ago to improve the line so that trains may be run faster. New 100-lb. rails are being laid both here and on the line between Philadelphia and Baltimore. With the completion of this work the entire "Blue Line" from Washington to New York will be laid with 100-lb. rails. New ballast has been put in at many places on the Washington branch. It is also the intention to complete the ballasting of the line from the belt line to Bay View, and on the freight tracks from Huntington avenue to Henrietta street. The company expects, on the completion of the terminal work at Washington, to reduce the time of the fastest passenger trains between Baltimore and Washington from 45 minutes to 35 minutes.

BALTIMORE, FREDERICK & HAGERSTOWN (ELECTRIC).—The officers of this company, organized to build an electric line from Baltimore, Md., to Hagerstown, 78 miles, are as follows: J. E. Ingram, Jr., of Baltimore, is President; J. R. McSherry, Vice-President; T. R. Howard, Treasurer, and H. Coblentz, Secretary, all of Frederick, and R. P. Graham, of Baltimore, Counsel.

CHICAGO, ROCK ISLAND & PACIFIC.—This company will in future use the track of the Chicago, Burlington & Quincy between Kansas City and St. Joseph. This will give the Rock Island a direct line to Fairbury, Neb. The Rock Island has its own line between St. Joseph and Fairbury, 155 miles. Between Kansas City and St. Joseph the Rock Island has no direct line, but runs by way of Cameron Junction or Topeka. The total distance between Kansas City and Fairbury over the new route will be 218.8 miles. The agreement with the Burlington will permit the Rock Island to do a local business between Kansas City and St. Joseph. The new line will also give the Rock Island a through service to Colorado and the Southwest from St. Joseph by way of Kansas City.

CINCINNATI & COLUMBUS TRACTION.—This company, operating 54 miles of road from Cincinnati, Ohio, east to Hillsboro, is considering plans for extending the road from the eastern terminus at Hillsboro north to Washington C. H., 30 miles.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—A contract has been given by this company for double-tracking its road from Batesville, Ind., west to Greensburg, six miles. The cost of the work will be about $40,000.

DAVIS & TURNER FALLS.—Incorporation has been granted a company under this name, with headquarters at Oklahoma City, with a capital of $50,000, to build a railroad from Davis, Ind. T., to Turner Falls, 10 miles. The incorporators are: A. L. Welch, Robert Chowning, J. W. Grant, R. H. Wilkins and W. M. Demeryx, of Oklahoma City, and John Watts, of Newton, Kan.

DELAWARE, LACKAWANNA & WESTERN.—An officer writes that this company has authorized work covering a change of line and new third track from Moscow, south to Gouldsboro, Pa., 8½ miles. The contract has been let to Burke Bros., of Scranton, Pa. The company, some time ago, gave a contract to the Williams-Grace Co., of New York, for the construction of a second tunnel through Bergen Hill, Hoboken. Arrangements are also under way for starting improvement work at Scranton.

GATES CITY TERMINAL.—Incorporated in Georgia, with a capital of $500,000, by P. S. Arkwright and Harry Atkinson, President of the Atlantic & Birmingham and the Atlanta, Birmingham & Atlantic, to build terminals in Atlanta. Also to improve the right of way of the A., B. & A. from Howells to Atlanta, about three miles.

GULF & SHIP ISLAND.—An officer writes that the Silver Creek branch of this road was completed April 19. This branch runs from Silver Creek to Columbia, Miss. Train service was started on the 29th. This branch, in connection with the Columbia and Mendenhall branches, forms the Columbia division of the Gulf & Ship Island. The new loop line, which is west of the main line, starts at Maxie, 4 miles north of Gulfport, and joins the main line at Mendenhall, 31 miles south of Jackson, Miss., making this division 104.5 miles long. Train service is now in operation from Gulfport to Jackson.

KLONDIKE MINES.—An officer writes that this company, which was granted a concession to build a railroad about 80 miles long from Dawson City, has let a contract to the Dawson, Grand Forks & Stewart River Railroad Corporation, Limited. A sub-contract has been let to O'Brien & Mackenzie, of Dawson City. The company has three or four miles of track laid already, and is planning to complete about 30 miles this year. The work includes the building of one steel bridge. J. A. C. Seybold is President and H. Blackfield Smith, Chief Engineer, Ottawa, Can. (May 11, p. 143.)

LAUREL VALLEY.—A charter has been granted this company, with a capital of $10,000, in Tennessee, to build a railroad from a point on the East Tennessee and Western North Carolina in Carter County, near Hampton, Tenn., east to Elk river, in North Carolina, by way of the Laurel Fork of the Doe river. The incorporators are: J. C. Tipton, B. C. Shelton, C. F. Camp, C. C. Collins and J. R. Fletcher.

LOS ANGELES INTERURBAN (ELECTRIC).—The Long Beach line of the Pacific Electric system is to be four-tracked for eight miles.

MERIDIAN & TOMBIGBEE.—Residents of Meridian, Miss., have applied for a charter under the above name to build a railroad from Meridian northwest through Lauderdale, Newton and Neshoba Counties to Philadelphia, which is on the Mobile, Jackson & Kansas City, a distance of about 50 miles. Surveys are now being made. C. F. Woods, J. M. McBeath, A. D. McCraven, Frank Heiss, of Meridian, and Dr. J. P. Phillips are interested.

MINNEAPOLIS & ST. LOUIS.—The Minnesota, Dakota & Pacific, which is the Western extension of this road, has filed, in South Dakota, plans of its new lines in that state showing where they cross the State lands. From Watertown the lines run northwest across Codington and Clark counties to Conde, in Spink County, thence west through Mellette and Northville, in Spink County, Cresbard, in Feulk County, to Hogan, on the northern boundary of Potter County, thence northwest to Lebeau, opposite the mouth of the Moreau river on the Missouri river, in Walworth County. This will give the line a valley route across the west part of South Dakota, if it is intended to extend west of the Missouri river. A branch is to be built from Conde northwest through Aberdeen and Brown counties to Leola, in McPherson County.

MINNESOTA, DAKOTA & PACIFIC.—See Minneapolis & St. Louis.

NEW YORK & PORT CHESTER (ELECTRIC).—This company, after contending with strong opposition for three or four years, has at last been granted a franchise by the New York City Board of Estimate and Apportionment for its four-track electric line through the Borough of the Bronx. The company has already been granted franchises by the various municipalities through which it proposes to build in Westchester County to the Connecticut state line. The officers of the company say that work is now to be begun.

NEW YORK ROADS.—A syndicate in which Frederick Nichols, E. R. Wood and Sir Henry Pellatt, all of Toronto, Ont., are interested, has recently been formed to build an electric railroad from Rochester, N. Y., west to Lockport, about 60 miles. The contract for building the road, it is said, has been given to J. G. White & Co., of New York. The cost of the work will be about $2,000,000.

NORTHERN PACIFIC.—Rights of way are being secured by this company for an additional line east and west of Valley City in Barnes County, N. Dak. The new line will leave the main track at Alta, running west and again joining the main line near Berea, and will be one-half mile shorter than the existing line. The new cut-off, which will cost about $1,250,000, is to be used for freight traffic only. It will take about two years to build it.

PARIS & MT. STERLING (ELECTRIC).—Incorporated in Kentucky, with a capital of $100,000, to build from Paris, Ky., on the Louisville & Nashville southeast, 25 miles to Mt. Sterling on the Chesapeake & Ohio. Surveys have been completed and rights of way are nearly all secured. H. A. Powers, R. J. Neely, of Paris; J. T. Collins, of Middletown; H. C. McKee and J. M. Bigstaf, of Mt. Sterling, are interested.

PAYETTE VALLEY.—A. B. Morse, President of this company, is quoted as saying that 13 miles of the road has been completed. The route is from Payette to Plymouth, Utah, through a rich agriculture section. H. E. Dunn, of Salt Lake, Utah, is Vice-President and General Manager.

PHILADELPHIA & READING.—An ordinance has been introduced authorizing this company to change the location of its Steelton branch in Harrisburg. The company seeks permission to leave the present line near Hanna street, and build through a private right of way to the main line, west of the old Robert street bridge, crossing Cameron street near its present intersection at Paxton by a bridge. It also agrees to abolish the grade crossings at Sycamore and Hemlock streets by elevating the tracks 13½ ft. at Sycamore

and 15 ft. at Hemlock [illegible]. It also asks the city to vacate the present Poorhouse lane from Cameron street to a point near the present coal wharf of the company, west of Robert street bridge, and agrees in return to furnish a street 80 ft. wide from a point on Cameron [illegible] south to Poorhouse lane and to assume all the damages. The ordinance has been sent to the Railroad Committee.

Philadelphia Rapid Transit.—A contract has been given to the Millard Construction Co. for building the eastern section of the Market street subway. The contract also includes the laying of two large sewers, one on each side of Market street, between the City Hall and Front street. The work is to be completed within 18 months.

Port Townsend Southern.—See Northern Pacific.

St. Louis, Champaign & Decatur.—Incorporation has been granted a company under this name to build a line from Litchfield, in Montgomery County, Ill., northeast to Champaign, about 125 miles. The incorporators are: C. A. Wright, W. H. Burke, Charles A. Wright and George M. Mattis, all of Champaign.

San Antonio & Aransas Pass.—An officer writes that this company is planning to replace the present 50-lb. rails with 70-lb. rails on the line from Cuero to Kenedy, Tex., 41 miles. The company has already made a similar change on the line between Yoakum and Cuero, 18 miles.

San Francisco Roads.—Rapid progress is being made by this company and the Ocean Shore Co., laying a network of tracks throughout the Mission district of San Francisco, including McAllester street and lower Market street. New tracks now extend on Fourth street to Townsend street into Market and from Market to the water front near the ferry depot. The Ocean Shore has completed tracks from the main line at Twenty-fifth street, down Howard to the water front. Crossings will be put in so that lines can be extended north from Market street to reach the wholesale district.

Spokane & Inland.—This company is making plans to build a line to connect the line under construction to Palouse City with the Colfax line. The line begins at a point on the Palouse City line about 2½ miles south of Oakesville, and runs southwest along the base of Steptoe Butte, connecting with the Colfax line 2½ miles from the new town of Steptoe.

Rockport, Langdon & Northern.—This company, operating a line 5.6 miles long from Langdon northeast to Rockport in Atchison County, Mo., will at once extend its line from the northern terminus, at Rockport, north 30 miles to Shenandoah in Page County, Iowa. Preliminary surveys have been made, and this extension, which was projected some years ago, will be carried out by new capitalists who have recently become interested in the company.

Waycross, Baxley & Vidalia.—Under this name a company is projected to build a railroad from Vidalia, Ga., south through Montgomery via Baxley, in Appling County, to Waycross, 55 miles. W. H. Buchanan, George W. Deen, J. M. Cox and W. R. Beach, of Waycross; C. G. Edwards, of Savannah, and W. T. McArthur and George M. Mathews, of Vidalia, are incorporators.

RAILROAD CORPORATION NEWS.

Atlanta & Charlotte Air Line.—The Southern, which operates this road, has submitted to the stockholders' Protective Committee a proposition for issuing $15,000,000 50-year first mortgage bonds, bearing not more than 4 per cent. interest, to be used to refund the $5,500,000 bonds maturing January 1, 1907, and to provide for double-tracking. The Committee will not consent to any plan for increasing the bonded indebtedness of the road unless provision is made for an increase in the rate of dividend upon the stock.

Chicago Subway.—This company, which controls the Illinois Tunnel Co., which has built 38 miles of narrow gage tunnels in Chicago for freight transfer, plans to issue $50,000,000 4 per cent. bonds, about December 1. The $17,000,000 outstanding Illinois Tunnel Co. first mortgage 5 per cent. bonds of 1928 will be retired.

Chicago Terminal Transfer.—The Receiver has been authorized to issue $3,500,000 5 per cent. receiver's certificates. Of this amount not more than $750,000 can be issued before November, 1906. The company needs funds to comply with the order of the city of Chicago, compelling it to elevate its tracks on the west side.

Delaware, Lackawanna & Western.—The stock of this company was quoted at 437¾ on May 2, and rose to 485 until May 16. On May 16 and 17 it rose 15 points and has continued since then, making a new high record of 550 on May 22. The road is estimated to have earned last year 52 per cent. on the $26,000,000 outstanding stock, on which 20 per cent. in dividends was paid in 1905.

Georgia & Florida.—Under this name, a syndicate organized by Middendorf, Williams & Co., New York, the International Trust Co., New York, and John L. Williams & Sons, Richmond, Va., will consolidate the following roads, recently purchased: Douglas, Augusta & Gulf, Millen & Southwestern, Augusta & Florida, Nashville & Sparks, Valdosta Southern, the Midvale, Swainsboro & Redbluff, and a 30 mile division of the Ocilla & Valdosta. The aggregate mileage is about 230, and, when certain connecting links are built, the company will extend from Augusta, Ga., to Madison, Fla.

Grand Trunk Pacific.—The Grand Trunk Pacific Railway Telegraph Co. has been incorporated with $10,000,000 capital.

Michigan United Electric.—This company, which was recently organized with $5,000,000 capital stock, of which $1,000,000 is 6 per cent. cumulative preferred, has taken over the Michigan Traction Co., the Michigan Traction Extension Co., the Jackson & Battle Creek Traction Co., the Lansing & Suburban Traction Co., and the Lansing & Jackson Railway Co., the last named being under construction. These companies operate an aggregate of 153 miles of road. The new company has given a mortgage to the Knickerbocker Trust Co., New York, securing an issue of $7,500,000 5 per cent. bonds of 1936, subject to call after May 1, 1916, at 110. Of this amount $1,600,000 has been issued, $2,400,000 is reserved to retire the underlying bonds of the subsidiary companies, $1,000,000 is to be issued in exchange for the bonds of the Lansing & Jackson Railway Co., $500,000 is reserved for the building of power plants and the remainder is to be issued for extensions and betterments.

Missouri, Kansas & Texas.—The *Wall Street Journal* gives the following details of the mortgage securing the $20,000,000 4½ per cent. general mortgage bonds of 1936, of which $10,000,000 were sold some time ago. See *Railroad Gazette* of Feb. 16, p. 56. By the provisions of the mortgage the bonds can be declared due and payable on the request of the holders of 25 per cent. of them, after default in interest or sinking fund for a period of three months, but the holders of 75 per cent. of the bonds have the right to direct and control the method of all proceedings for sale, foreclosure, or the appointment of a receiver.

The security of the bonds is as follows:

	Miles.
(1) Subject to 1st mortgage 4's and 2d mortgage 4's	796
(2) Subject to 1st ext. mort. and refunding mort.	162
(3) Subject to Kansas City & Pacific 1sts	131
(4) Subject to Mo., Kan. & Okla. 1st. and M., K. & T. ref	277
(5) Subject to Tex. & Okla. and Mo., Kan. & Tex. ref.	117
(6) Subject to M., K. & Eastern 1st mort. M., K. & E. 2d mort., and M., K. & T. (St. Louis Div.) ref mort.	162
(7) Subject to Denison & Wichita Valley mort. and Mo., Kan. & Texas refunding mortgage	5

All depots, telegraphs and other appurtenances of these lines are also pledged.

The bonds also have a lien on all the lands that the company may own or acquire in Oklahoma and Indian Territory, subject to the first and second mortgages of the M., K. & T. The following stocks are also pledged:

Mo., Kan. & Tex. of Texas*	$10,142,500
Beaumville R. R. bridge	998,400
Terminal R. R., St. Louis	205,600
Union Depot of Kansas City	44,000
Missouri & Illinois Bridge and Belt	14,900
Hannibal Union Depot	1,700

*Subject to Mo., Kan. & Texas 1st and 2d mortgages.

The following bonds are pledged, subject to the M., K. & T. first and second mortgages:

Henrietta & Western Railway	$1,400,000
Trinity & Sabine Railway	1,340,000
Dallas & Greenville Railway	1,040,000
Taylor, Bestrop & Houston	2,055,000
Sherman, Shreveport & Southern	2,000,000

The Texas Railroad Commission has refused to let the M., K. & T. issue $25,000,000 bonds secured on its lines in Texas. Representatives of the company are quoted as saying that this contemplated issue was not needed for some time.

Pennsylvania.—This company has borrowed in Paris $25,000,000 through an issue of bonds of a French investment company secured by Pennsylvania securities. Arrangements have been made to borrow $25,000,000 more.

Pere Marquette.—The Receiver has issued $1,200,000 5½ per cent. receiver's certificates, maturing in equal amounts each six months up to August, 1909. These certificates were issued to provide funds to pay taxes; they constitute a first lien on the entire property of the road. They have all been sold at par.

Pittsburg, Shawmut & Northern.—The Receiver has been authorized to issue $1,100,000 receivers' certificates for improvements. An issue of $3,800,000 was originally authorized for this purpose, but on the petition of a bondholder this amount was held to be excessive, and an injunction was issued restraining the receiver from issuing the large amount.

Seaboard Air Line.—This company has sold to S. D. Loring & Son, Boston, $1,750,000 5 per cent. equipment trust notes, maturing serially during the next 10 years and secured on 437 box cars, 1,000 gondolas and 40 locomotives.

GENERAL NEWS SECTION

NOTES.

In the Sundry Civil Appropriation bill before Congress there is an item of $25,000 to pay traveling expenses of the President of the United States.

According to a South Carolina paper, the superintendent of the Savannah division of the Southern Railways wants 500 additional negro laborers to lay new track, mostly side tracks, and is unable to find them, although the rate of pay has recently been advanced.

An officer of the Great Northern has announced at Great Falls that substantial reductions are to be made in freight rates to and from points in Montana on the first of July; and it seems to be the understanding that all of the three principal roads in the state will make reductions.

The State Railroad Commission of Alabama, having been asked to decide a question of fares on the Birmingham Railway, Light & Power Company has issued an opinion, concurred in by the Attorney-General of the state, that it has no authority to regulate street railways, even though they carry freight.

It is announced in California that on both of the railroads carrying fruit eastward the rates for icing have been reduced. It is expected that the green fruit shipments this season, including grapes, will amount to 7,000 cars. The number of cars of oranges already shipped east is 25,000, and the number yet to be shipped 5,000.

At Carlisle, Pa., May 23, George O. Sarvis, trainmaster of the Philadelphia & Reading, was sentenced to $1,500 fine and costs, amounting to $243, for criminal negligence in causing the collision at Moor's Mill, on Sept. 21, 1905. Sarvis was acting as pilot of a pay car train and miscalculated the time for reaching a meeting point, by reason of the failure of his watch, which had stopped. Five persons were killed in the collision.

The Supreme Court of the United States has sustained the Southern Railway in its defense of the suit brought by the State of North Carolina to compel the railroad to obey the order of the State Commission in placing cars for interstate traffic on a private siding. The suit was instituted by the State Commission against the railroad because of its refusal to obey an order directing that coal cars be placed on a certain track at Greensboro, N. C. The company expressed its willingness to place the cars on other tracks, but pleaded inability to comply with the demand as to the particular track. The railroad company attacked the law as unconstitutional on the ground that it involved an interference with interstate commerce, and the Circuit Court sustained this position. That decision is now affirmed. Justice White said that the State Railroad Commissioners have authority reasonably to regulate the delivery of freight within the state, but not to the extent of imposing a burden on commerce between the states, as was the case in this instance.

George L. Thomas, a freight broker of New York city, and L. B. Taggart, his clerk, tried at Kansas City, have been found guilty of conspiracy to secure unlawful freight rates. Thomas acted as the New York agent for western consignees, a number of these testifying that they paid him annual salaries. One merchant paid Thomas $500 a year, another one $1,000, and others different amounts. These merchants received large sums of money, sometimes by express and sometimes by the hand of an unknown messenger, but always from some source which the witnesses declared was unknown to them; but the impression produced by the testimony as a whole was that these moneys came from Thomas, who had received them from the railroads in the shape of rebates on goods shipped. One firm, according to the testimony of one of its members, had received $43,000 in this way within the space of three years. One witness testified that Thomas's business had been going on for four years and that rebates amounted to 25 per cent. of the freight rates; but another, a wholesaler in Kansas City, said that it had been going on not four years but 25 years, and that the rebates amounted more nearly to 40 per cent. than to 25 per cent. George H. Crosby, of the Burlington road, tried at the same time, was discharged, the court sustaining a demurrer alleging that no evidence had been given to connect him with a conspiracy.

At a hearing in Cleveland, May 24, Interstate Commerce Commissioners Prouty and Clements took further testimony concerning the relations of the railroads to the oil business. J. W. Lee, of Pittsburg, Pa., told of forming a number of oil companies and of being obliged to do business at a loss because the railroads aided the Standard Oil Company in taking business away from other oil companies. Had it not been for the establishment of an independent pipe line to the sea coast the independent oil companies in western Pennsylvania would have been killed off. F. B. Westgate, of Titusville, Pa., who has been a producer of oil for 19 years, testified that up to 1886 the railroads gave low through rates to New England, but in that year made an advance from 28½ cents per 100 gallons to 40 cents; and the high rates have continued until the present month, when a reduction has been made. Frank B. Fretter, Secretary of the National Refining Company of Cleveland, and President of the National Pipe Line Company of Ohio, testified that for over three years his companies had trouble in making shipments from Memphis to points in Arkansas, and he found that the agents of the roads were also agents of the Waters-Pierce Oil Company of Missouri, a Standard adjunct. These agents, he said, deliberately side-tracked shipments in order to destroy his trade. Mr. Fretter said, concerning the lubricating oil contract which he attempted to get from the Rock Island ten years ago, that he offered his oil at a figure low enough to enable the railroad to save a large amount of money, but that, notwithstanding, he was "turned down" in favor of the Standard. Black oil, for which the Standard Company obtained 12 cents a gallon, his company would be glad to sell at 5 or 6 cents in bulk.

Single-Phase Railway Equipment for Anderson, South Carolina.

The Anderson Traction Company, Anderson, South Carolina, is building the first section of an interurban electric road which will eventually extend to Greenville, 35 miles. Anderson is the center of the cotton mill district in the south and this line will connect it with the surrounding cotton mill towns and with the main line of the Southern Railway. In the city there is already a direct-current railway and the first branch of the interurban is a continuation of the present line as far as Belton, ten miles. Complete station apparatus and motor equipments for single-phase operation have been ordered for the extension. The new cars are of the heavy interurban type and are each equipped with four G.E.A.-605 (75-h.p.) single-phase motors, adapted for operation at 3,300 volts alternating current on the interurban section of the road, and at 550 volts direct current on the present direct current city lines. Each car is fitted with air-brakes, for which the motor compressors are adapted for operation on either direct or alternating current, this apparatus also being furnished by the General Electric Company. Power for the operation of this road will be purchased from the Savannah River Power Company, delivered at a sub-station in Anderson at 66⅔ cycles. In the sub-station there will be a three-unit motor-generator set, consisting of an induction motor driver, direct-connected to an AC generator for the single-phase portion of the line and a direct-current machine to supply the present city line. The driving motor consists of a two-phase, 66⅔ cycle, 1,150 volt induction motor, receiving its current from the 66⅔ cycle supply above mentioned. Direct-connected to this is a 300 kilowatt, 25-cycle, single-phase, 3,300 volt, alternating current generator which will furnish the 10-mile single-phase section now under construction with current directly to the trolley at 3,300 volts without sub-stations. The remaining machine for furnishing the direct current consists of a 250-kilowatt, 600-volt railway generator, complete with an exciter on the same shaft as the other three machines. The officers of the Anderson Traction Company are: J. A. Brock, President; F. G. Brown, Vice-President; Dr. Geo. E. Coughlin, General Manager. The road is being built under the direction of Mr. J. E. Sirrine, Engineer, Greenville, S. C., with Mr. E. F. Lilly, Columbia, as Consulting Electrical Engineer. General Electric Company apparatus is being used throughout.

Derailment at Louisville.

A press despatch from Louisville, Ky., May 28, says that a passenger train of the Louisville & Nashville, from Knoxville, backing toward the Union Station, was derailed in the yard in Louisville on that day, at Seventh and Hill streets, causing the death of eight persons and injury of 15 others. Three passenger cars, after jumping the track, crashed into freight cars standing on the siding.

English Import Rates on Agricultural Produce.

A committee appointed to inquire whether preferential treatment was accorded to foreign agricultural produce as compared with home produce in its report just issued finds that while lower rates and greater facilities exist which constitute a preference to colonial and foreign product, this *prima facie* preference is justified, for "the local trader cannot expect for small, irregular and often ill-packed consignments, the same rates and facilities as are given to the large, regular and well-packed consignments, with which he is in competition." In order to claim comparatively equal rates and facilities, "he must organize something like a reasonable approach to the conditions under which the competing trade is carried on." Then the British trader is held to be entitled "to demand as a right"

such rates and facilities as will place him on a comparative equality with his foreign or colonial rival. No legislative measures were considered necessary.

Tax on New York Central Cars.

The New York Central has lost its suit against the Controller of the state of New York contesting the taxes on its freight cars. Under a law of 1896 the railroad is taxed on its capital stock representing its cars at the rate of 1.5 mills on the dollar on the valuation of equipment employed in the state of New York. The road contended that ⅓ of its cars were in service outside of the state, but the Supreme Court of the United States sustains the opinion of the state court that the tax must be paid, the situs of the cars being in New York, notwithstanding their absence much of the time. The opinion, by Justice Holmes, says: "We are bound by the construction given by the state court. In this case we are to assume that the statute purports and intends to allow no deduction from the capital stock taken as the basis for the tax unless some specific portion of the corporate property is outside of the state during the whole tax year. We must assume further that no part of the corporate property in question was outside the state during the whole tax year. The reports show only that the cars made so many miles, and it might be ten and it might be fifty cars that made them. Certainly no inference whatever could be drawn that the same cars were absent from the state all the time. We are not curious to inquire exactly what kind of a tax this is to be called. If it can be sustained by the name given to it by the local courts it must be sustained by us. It is called a franchise tax in the act, but it is a franchise tax measured by property."

The case covered the taxes for 1900, 1901, 1902, 1903 and 1904, and the amount involved was $889,375.

Contracts for Mammoth Stations in New York.

The contract for building the great Pennsylvania Passenger Station at Seventh and Eighth avenues and 31st and 33d streets, New York, has been let to the George A. Fuller Company, of New York. Just when work will be started on the building is not stated, as the excavation is not finished; but there is nothing to hinder the beginning of foundations within a few weeks.

A contract has also been let to the George A. Fuller Co. for putting up the large terminal building for the Hudson Companies' (Cortlandt street) Hudson River tunnel. This building is to occupy two blocks on the west side of Church street from Cortlandt to Fulton street. The ground is already partly cleared of the old buildings. This building is to be 21 stories high, all the floors above the street level to be rented for offices.

New York City Rapid Transit.

Bids are wanted June 4 by the Board of Rapid Transit Commissioners for making test borings on the lines of the proposed rapid transit routes in the Boroughs of Manhattan, Bronx, Brooklyn and Queens, New York City. Alexander E. Orr is President of the Commission.

Baltimore & Ohio Improvements at Cleveland.

The Baltimore & Ohio Railroad is to make extensive improvements to its terminals at Cleveland, Ohio, and plans and specifications have been sent out to contractors. A ten-stall brick roundhouse is to be built; a gravity coal tipple with capacity for 360 tons; frame sand house with a capacity for 45 tons of dry sand; engine room, 20 ft. by 60 ft.; boiler room, 40 ft. by 60 ft.; machine shop, 60 ft. by 90 ft.; oil and store house, 30 ft. by 45 ft., and office, 15 ft. by 70 ft. There will be a trainmen's building 35 ft. by 50 ft., with bath and locker rooms for the enginemen and trainmen. The second floor will have lounging and bunk rooms. There will also be a standard 80-ft. turntable pit and a double ash pit, 150 ft. long, to be equipped with hoisting crane and automatic grab buckets.

New Atchison Freight Sheds at San Francisco.

General Manager A. G. Wells, of the Atchison, Topeka & Santa Fe Coast Lines, has let contracts for the erection of two large freight sheds at China Basin on the San Francisco water-front near Kentucky street. A 30-ton electric traveling crane and two 15-ton electric derricks for handling freight will be put in. About $300,000 will be spent on the improvements for this terminal. A large number of new sidings will be laid in the yards.

Bids for Tunnel Work in New Zealand.

The New Zealand Government is asking for bids for piercing a tunnel over five and one-quarter miles long, much longer than any railroad tunnel in the southern hemisphere. The tunnel is to be bored through the main central range of mountains of the Middle Island at Arthur's Pass. It will pass under the coach road through Otira Gorge, a well-known scenic spot. The tunnel will form part of a railroad now under construction connecting the east and west coast districts of the Middle Island. The lowest passes in the dividing range are 2,000 ft. high. The ascent from the western side is steep, through a difficult country for railroad building. The road has been completed and opened for traffic to a point about two miles from the western end of the tunnel. It is proposed to operate the tunnel section of the road, when completed, by electricity generated by power obtained from the Otira river.

TRADE CATALOGUES.

White Pass & Yukon.—The traffic department of the White Pass & Yukon Railroad reprints from "Alaska and the Klondike," by John S. McLain, a tempting description of the journey between Seattle and Dawson, which is accompanied by 23 quite remarkable photographic reproductions of this northern country. The account is well written and the pictures are distinctly worth seeing.

Northern Pacific.—The passenger department of the Northern Pacific has issued a fascinating pamphlet descriptive of the Shasta-Northern Pacific route to and from California. The illustrations throughout have been selected with great care and are printed in the most artistic manner. This is one of the best examples of good railroad advertising that we have seen.

Hand and Push Cars and Velocipedes.—A pamphlet of 44 pages just issued by the Buda Foundry & Manufacturing Co., Chicago, fully illustrates and describes the various styles of hand and push cars and velocipedes made by this company. A complete list of repair parts and prices is given, and sizes, prices and a detailed description of Buda pressed steel wheels.

Air Compressors and Appliances.—The Ingersoll-Rand Co., New York, has issued a small pamphlet describing and illustrating air compressors, pneumatic hammers, drills and pumping systems for railroad use. Lists are given of railroad companies using each type of machine.

Manufacturing and Business.

Swift & Company have asked prices on lumber for 150 refrigerator cars to be built at their own shops.

The current issue of the *Electrical World* contains a full illustrated description of the electric and mechanical equipments for the new Engineers' Club, on West Fortieth street, New York.

John T. Bramhall, formerly advertising agent for the Michigan Central, and before that with the Monon Route, has embarked in business for himself as a compiler of railroad and resort literature. His office is at 6310 Harvard avenue, Chicago.

The Bettendorf Axle Co., Davenport, Iowa, has an order from Swift & Co. for the steel underframes and trucks for twenty 30-ton tank cars, the tanks for which will be built at the latter's shops. Also, an order has been received from the Mineral Paint Zinc Co. for the steel underframes and trucks for fifty 40-ton tank cars.

Iron and Steel.

Bids are wanted June 7 by P. E. Ryan, Ottawa, Ont., Secretary of the Transcontinental Railroad Commission, for 65,000 tons of 80-lb. rails, open hearth or Bessemer, with the necessary fastenings, and for 1,545,000 ties.

The Great Northern is negotiating for 50,000 tons of rails and the Chicago, Burlington & Quincy for an additional 35,000 tons. Inquiries for rails aggregating 250,000 tons are being made. The orders for structural steel given for May amount to 100,000 tons. There is a strong demand for steel making iron, and raw steel continues scarce. The American Bridge Co. has taken the order of the George A. Fuller Co. for the steel for the tunnel terminals of the Hudson Companies in New York, about 28,000 tons. The steel will be delivered from the Pencoyd and the Trenton works of the company, deliveries to be made at the rate of from 3,000 to 5,000 tons a week after the initial shipment.

The Baltimore & Ohio has given an order to the Baltimore Bridge Co. for putting up its new steel pier at Locust Point, Md., requiring about 2,000 tons of steel. The American Bridge Co. has received an order for 500 tons of elevated railroad structure from the Chicago & North-Western in Chicago, and the Erie is negotiating for 7,000 tons of steel to be used in two large viaducts, one of which will be over the Genesee river. Orders for rails recently given for this year's delivery include, the Norfolk & Western, 10,000 tons; Grand Trunk, 5,500 tons; Boise City & Idaho, 2,100 tons, and Los Angeles & Pacific, 2,500 tons. The Tennessee Coal, Iron & Railroad Co. has received a contract for 50,000 tons of rails from the Southern Pacific for 1907 delivery. Large exports of rails are being made to Mexico, Brazil, Argentine Republic and other South American countries.

OBITUARY NOTICES.

R. L. Holliday, Superintendent of the Delaware division of the Philadelphia, Baltimore & Washington, who died recently, was a graduate of Rensselaer Polytechnic Institute. His first railroad

work was in 1869 as a rodman on the Bell's Gap. He was Assistant Engineer on that road until 1873. Since 1876 he has been on the Pennsylvania system, having been Supervisor of different divisions, then Assistant Engineer of the Pittsburg division and later Engineer of Maintenance of Way at Altoona. Since 1883 he has been consecutively Superintendent of the Bedford and Lewistown divisions, Superintendent of the Central division of the Philadelphia, Wilmington & Baltimore, now the P., B. & W., and finally Superintendent of the Delaware division of that road.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Engineers' Club of Philadelphia.

At a business meeting of this club to be held June 2 there will be a paper on "The Fireman and His Relation to Maintenance of Way Organization," by S. W. Kapp; also one on "The South & Western Railway," illustrated by lantern slides, by Edward S. Hutchinson.

Freight Claim Association.

The fifteenth annual meeting of this Association was held at St. Louis May 16, 17 and 18, President Robt. L. Calkins (N. Y. C.) in the chair. About 130 members were present. The President delivered an address congratulating the Association on the increase in membership during the past year. It is the success of this association that has led to the organization of the several claim conferences in the principal railroad centers. . . . That there is great need for some effectual but reasonable action which will insure a more expeditious return of claim papers to the carrier against which the claim is made all members will doubtless admit. It is our plain duty to find a remedy for this evil.

An amendment was made to Section 1, Article II., of the Constitution, making the membership of the Association to include General Freight Agents, Freight Claim Agents, or other authorized representatives having charge of the freight claims of such railroads, transportation lines or companies as shall be admitted to membership.

Three morning and two afternoon sessions were well filled with profitable discussions, the reports considered being those of the committees on constitution, on loss and damage rules, on overcharge rules, on uniform blanks and on methods and topics.

The Secretary's report showed 275 members, representing 196,000 miles of railroad. Twenty-eight new members joined the Association during the period from May 1, 1905, to May 1, 1906. The following officers were elected for the ensuing year: President, Robert Kirkland (I. C.), Chicago; First Vice-President, J. E. Leith (S. L. & S. F.), St. Louis; Second Vice-President, A. B. Thompson (D., L. & W.), New York; Secretary and Treasurer, Warren P. Taylor (R., F. & P.), Richmond, Va. Denver, Colo., was selected as the place for holding the next meeting, on June 19, 1907.

The local entertainment committee entertained the visitors with unbounded hospitality.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Pennsylvania.—Robert Pitcairn, Resident Assistant to the President at Pittsburg, Pa., was retired on a pension on June 1. Mr. Pitcairn was born in Scotland in 1836, and his entire railroad service has been on the Pennsylvania. He began as a telegraph operator in 1853, and later went into the General Superintendent's office at Altoona. In 1861, he was appointed Superintendent of the Middle division, and in 1862, Superintendent of Transportation. During the next three years he was Superintendent of several divisions and in 1865 he was appointed Superintendent of the Pittsburg division. He remained in this office until 1902, when he was appointed Resident Assistant to the President.

C. M. Bunting, Chief Clerk to the First Vice-President, has been appointed to the new office of Assistant to the First Vice-President. A. J. County, Assistant Secretary, has been appointed to the new office of Assistant to the Third Vice-President.

Operating Officers.

Chicago, Indiana & Southern.—H. A. Ziesel, Superintendent at Kankakee, Ill., has been appointed Superintendent at Hammond, Ind., succeeding F. T. Bowles, who is transferred to Kankakee.

Chicago, Milwaukee & St. Paul.—E. D. Sewall, Assistant General Superintendent at Minneapolis, Minn., has been elected Vice-President of the Chicago, Milwaukee & St. Paul of Montana, with office at Chicago, Ill. H. B. Earling, Assistant General Superintendent at Milwaukee, Wis., succeeds Mr. Sewall.

Cleveland, Cincinnati, Chicago & St. Louis.—P. J. Maloney, trainmaster at Riverside, Ohio, has been appointed Superintendent at Mt. Carmel, Ill., succeeding J. S. Sweeney, transferred.

Marcellus & Otisco Lake.—R. L. Scott has been appointed Superintendent, with office at Marcellus, N. Y., succeeding C. Cooper.

Pullman Company.—S. C. Gardner, Assistant District Superintendent at San Antonio, Tex., has been appointed to the new office of District Superintendent at Monterey.

St. Louis Southwestern.—C. W. Nelson, Assistant to the Vice-President and General Manager, has been appointed Assistant General Manager, with office at St. Louis, Mo.

Traffic Officers.

Seaboard Air Line.—S. C. Boyleston, Jr., has been appointed Assistant General Passenger Agent at Jacksonville, Fla., succeeding A. O. MacDonell, transferred.

Engineering and Rolling Stock Officers.

Chicago, Indiana & Southern.—The office of J. F. Flavin, Assistant Master Mechanic, has been removed from Kankakee, Ill., to Hammond, Ind.

Mexican Central.—S. E. Kildoyle, formerly Master Mechanic of the Southern Pacific at Guaymas, Mex., has been appointed Master Mechanic of the Mexican Central at Mexico City, succeeding L. Strom, resigned.

LOCOMOTIVE BUILDING.

The Lorain Steel Co. has ordered one locomotive from the Baldwin Works.

The Atchison, Topeka & Santa Fe, it is reported, has ordered 15 locomotives.

The Macon, Dublin & Savannah has ordered one locomotive from the Baldwin Works.

The West Virginia Northern has ordered one locomotive from the Baldwin Works.

The Norfolk & Southern is in the market for passenger, freight and switching locomotives.

The Virginia & Southwestern has ordered four locomotives from the American Locomotive Co.

The Santa Fe, Prescott & Phoenix has ordered three locomotives from the American Locomotive Co.

The New York, Pennsylvania & Southwestern, formerly the Binghamton & Southern, is considering the purchase of locomotives. Address D. E. Baxter, General Manager, 27 William street, New York.

The Lima Locomotive & Machine Co. reports the following orders for Shay locomotives for the week ending May 26, 1906: G. A. Goodyear Lumber Co., Tomah, Wis., one 45-ton locomotive; Lewisburg & Ronceverte Electric Railway, Lewisburg, W. Va., two 45-ton locomotives; Grantland & Lumber Co., Selma, La., one 37-ton locomotive; Culbreath Logging Co., Huttig, Ark., one 37-ton locomotive; Flint, Erving & Stoner Lumber Co., Dunlevie, W. Va., one 65-ton locomotive, and the Title Guarantee & Trust Co., Tampa, Fla., one 14 x 20 Mogul locomotive.

CAR BUILDING.

The Illinois Central has ordered one private car from the Pullman Co.

The Atlantic Coast Line, it is reported, is asking prices on passenger cars.

The Great Northern is in the market for 3,000 box cars of 80,000 lbs. capacity.

The Kinnan Refrigerator Line is in the market for a number of refrigerator cars.

The Atlantic Coast Line has ordered 500 coal cars from Barney & Smith for December, 1906 delivery.

The Oklahoma Central, it is reported, is in the market for freight cars. Address R. L. McWilliams, Lehigh, I. T.

The Strobel Steel Construction Co., Chicago, has ordered one flat car of 80,000 lbs. capacity from the Bettendorf Axle Co.

The Louisville & Nashville shops at Decatur, Ala., are turning out 75 new box cars every week. The number of men employed at these shops at present is about 2,500.

The New York, Pennsylvania & Southwestern is considering the purchase of a number of coal cars. Address D. E. Baxter, General Manager, 27 William [illegible] New York.

The Tampa Northern is in the market for upwards of 125 box and flat cars of from 50,000 lbs. to 60,000 lbs. capacity. Address Benjamin Thompson, Chief Engineer, Tampa, Fla.

The Barrs Ferry Brocndell & Chester will shortly order a number of flat cars and box cars. Address Joseph A. Turner, General Superintendent and Purchasing Agent, Rockland, Tex.

The Canadian Pacific is building 1,000 box cars of 60,000 lbs. capacity at its Angus shops. These cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment will include the Simplex bolsters and brake-beams, Christie brake-shoes, Westinghouse brakes, Tower couplers, positive door fastenings, Security doors, Miner draft rigging, Harrison dust guards, McCord journal boxes and Chicago-Winslow improved roofs.

The Isthmian Canal Commission opened bids at Washington on May 19 for 1,000 wooden flat cars of 80,000 lbs. capacity. The lowest bidder was the South Atlantic Car & Manufacturing Co., at $1,129.22 each, delivered and erected at Colon, delivery not to commence for 230 days. The next lowest bidder was the American Car & Foundry Co., at $1,145 each, delivered and erected at Colon, delivery to be at the rate of 200 cars a month, commencing in September. Bids were also submitted by the Pullman Company, Mount Vernon Car & Manufacturing Co., Standard Steel Car Co., and J. K. Joice.

The Philadelphia Rapid Transit Co. has ordered 100 Brill semi-convertible passenger cars from the J. G. Brill Co., for August, 1906, delivery. These cars will weigh 36,000 lbs., and will have a seating capacity for 48 passengers. They will measure 28 ft. long by 7 ft. 6 in. by 8 ft. high, all inside measurements. The bodies and underframes will be of wood. The special equipment will include the 4-in. hammered steel axles, Curtis bolsters and brake-beams, National Electric Co.'s air-brakes, Acme curtain fixtures, Pantasote curtain material, Brill door fastenings, double doors and draft rigging, Consolidated Car Heating Co.'s electric heating system, Curtis journal boxes, open platforms, Curtis springs and trucks, Schoen steel wheels, and Philadelphia Rapid Transit Co.'s brasses, couplers, paint, vestibules, and brake-shoes.

BRIDGE BUILDING.

Albany, N. Y.—Under an act passed by the Legislature this year Governor Higgins has appointed a commission consisting of Alexander J. Shamberg, McDougall Hawkes and E. W. Bloomingdale, of New York, to confer with representatives of New Jersey to secure legislation for the appointment of a joint commission to buy land and water rights, and to secure the necessary federal consent for the construction of one or more bridges over the Hudson river from New York to New Jersey, at the joint expense of the two states.

Boston, Mass.—The Cambridge Bridge Commission, consisting of the Mayors of Boston and Cambridge and City Engineer Jackson, it is said, has given the contract for building the four towers on piers five and six of the new Cambridge bridge to Jones & Meehan at their bid of $99,400. The other bids submitted were Holbrook, Cabot & Rollins Corporation, $102,500; L. D. Wilcutt & Sons' Co., $103,000; Austin Ford & Son Co., $106,864, and Antony Cefale, $111,900.

Brantford, Ont.—The city and Grand Trunk is to jointly build a combined railroad and highway bridge over the river. Address City Engineer Barrow.

The Grand Trunk will build a bridge over its tracks at Emerald street. There will be one 56-ft. and two 37-ft. spans. Address Engineer Somerville.

Campbellton, N. B.—Thomas Malcolm has been granted a charter for a combined highway and railroad bridge over the Restigouche river. Surveys and plans are now being made. Estimated cost $600,000.

Lethbridge, Alb.—The Canadian Pacific has plans for a high level bridge to be built here at a cost of $1,000,000. F. F. Busteed is Chief Engineer for lines west, Winnipeg, Man.

Mt. Vernon, Ohio.—The Commissioners of Knox County have transferred $30,000 from the building fund to the bridge fund, to be used for building new bridges and for repairs to others.

New York, N. Y.—The Board of Estimate and Apportionment has voted an appropriation of $50,000 for preliminary work for the Riverside drive improvements. The plans call for a stone viaduct over Inwood Valley to cost $2,500,000.

Pine Bluff, Ark.—Preliminary surveys are being made by the Bridge Commissioners for a combined highway and railroad bridge to be built over the Arkansas river at this place.

St. Anne's, Que.—The Canadian Pacific is to rebuild the large bridge over the Ottawa river at this place.

Wilmington, Del.—Bids are wanted June 11 by the Board of Water Commissioners for building a seven arch reinforced concrete bridge 350 ft. long over Brandywine creek for the Water Department. Theodore A. Leisen is Chief Engineer.

Winnipeg, Man.—H. N. Ruttan, City Engineer, estimates the overhead bridge to be built over the Canadian Pacific tracks will cost $170,000.

Other Structures.

Atlantic City, N. J.—The West Jersey & Seashore, it is said, is to spend about $600,000 for its new terminal station here.

Birmingham, Ala.—The Illinois Central, reports say, will spend $100,000 for a new freight house on land recently bought near First and Second avenues, between Thirteenth and Sixteenth streets. F. T. Oren, Assistant Engineer, will have charge of the work.

Fremont, Neb.—The Chicago, Burlington & Quincy, local reports state, will build here a passenger station to cost $40,000.

Lethbridge, Alb.—The Canadian Pacific will at once commence putting up terminal shops here, including engine shops, coaling station, roundhouses, freight sheds and repair shops. F. F. Busteed is Chief Engineer of the western lines, Winnipeg, Man.

Stockton Springs, Me.—The Bangor & Aroostook, in addition to the three wharves already completed, will build an additional wharf at Speed's Cove, Cape Jellison. An addition of 500 ft. will also be built to the big Cape Jellison wharf, and 500 ft. to the Pole wharf at Mack's Point. The work has been given to Contractor Spellman, of Bangor, Me.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Abilene Northern.—See Colorado & Southern.

Alabama Central.—Incorporated in Alabama with $100,000 capital by W. C. Davis, A. Russell, O. C. Simmons and other Chicago capitalists, with office at Jasper, to build a railroad from Tuscaloosa, Ala., north through Tuscaloosa, Walker, Winston, Lawrence and Morgan Counties to Decatur, about 125 miles.

Atchison, Topeka & Santa Fe.—A blue-print has been submitted to the Texas Railroad Commission by this company showing the location of the cut-off line which is being built through eastern New Mexico and western Texas. Most of the line on the Transcontinental division, from Rio Puerto to Texico on the New Mexico-Texas border, has been completed. Track-laying will be begun in July on the 70 miles from the Pecos river to a connection with the El Paso & North-Eastern at Vaughn Junction. It is expected to have the road ready for operation by January of next year.

A profile of the proposed branch line of the Pecos Valley & Northwestern division from Canyon City, Tex., south to Plainview has also been filed with the Railroad Commission. Grading is to be finished and much of the track laid by July of this year. This branch line will be extended south from Plainview for about 50 miles to connect with the proposed extension of the New Texico line when it is built east to Brownwood, where it will connect with the Gulf division of the A., T. & S. F. The route of the extension from Texico to Brownwood has not yet been definitely located.

Atlantic Coast Line.—This company, it is said, will extend its line from Newberry, Fla., northwest about 75 miles to Perry.

Beaumont & Great Northern.—This company has notified the Railroad Commission of Texas that 12 miles of track have been laid and that by July 1 its line is to be completed to Onalaska, 20 miles from Trinity. The line, about 110 miles long, is being built by the Gould interests to secure a direct entrance into Southwest Texas. It will probably be operated when completed as a part of the International & Great Northern.

Brinson Railway.—Incorporated in Georgia with $1,000,000 capital and office at Savannah to build from Savannah northwest through Chatham, Effingham, Screven, Jenkins, Burke, Jefferson, McDuffie, Wilkes, Oglethorpe and Clarke Counties to Athens, about 180 miles. George M. Brinson, of Emanuel County, is the principal promoter. The incorporators are George M. Brinson, Charles Neville, Y. E. Bargeron, W. A. Beale, W. C. Myers, C. H. Mason, J. H. Dazemore, H. W. DeLoach, E. F. Rogers and W. L. Clarke, all of Emanuel County.

Buffalo, Lake Erie & Niagara.—The State Railroad Commission is considering the question of granting a certificate to this company, which proposes to build a line around Buffalo. A harbor is to be made at Bay View on the lake shore, protected by a breakwater 4,000 ft. long and piers with room for 16 of the largest lake freight steamers; also freight yards and warehouses. The directors include: C. N. Bushnell, J. H. Metcalfe and H. W. Putnam, all of Buffalo. (See Construction Record.

BUFFALO, LOCKPORT & ROCHESTER (ELECTRIC).—Work on this proposed electric road has been begun, and it is planned to have one track completed this fall. The proposed route is from Rochester, N. Y., west to Lockport, 56 miles. From Lockport connection is to be made with Buffalo and Niagara Falls by the International Railway. The line parallels lines of the New York Central for the entire distance. The company has a capital of $4,000,000. It has had its bonds underwritten by the Traction Finance Co., of New York, and by interests allied with the Mackenzie & Mann syndicate of Toronto, Can. The power for operating the road is to be furnished by the Electrical Development Co., of Ontario, and the Niagara Falls Electrical Transmission Co. Charles B. Hill, of Buffalo, is President. The directors are Sir Henry Pellatt, E. R. Wood, Frederick Nicholls and D. E. Thomson, of Toronto, and Edmund Wragge. (May 25, p. 155.)

CENTRAL & SOUTHEASTERN.—This company, incorporated in Kansas last year, has given a mortgage to the Lincoln Trust Co., of New York, to secure funds to take up the outstanding bonds of the Arkansas, Missouri & Kansas, of which this company is a reorganization, and to build the road projected from Chanute, Kan., through Missouri and Arkansas to Memphis, Tenn., 425 miles. Reports say that work is now going on between Chanute and Joplin, Mo. The road will intersect about 20 railroads. Albert N. Hoxie is President; D. W. Spooner, Manager and Chief Engineer, and F. S. Hoxie, Secretary, 273 Fifth avenue, New York.

CENTRAL OF GEORGIA.—This company is locating a line from Albany, Ga., south to Quincy, Fla., by way of Newton and Bainbridge, Ga., to traverse the counties of Dougherty, Baker, Mitchell and Decatur in Georgia, and Gadsden County, Fla., about 60 miles through large mill and turpentine territory.

CHICAGO, MILWAUKEE & ST. PAUL.—The Idaho section of the Pacific extension now under construction will be built under the name of the Chicago, Milwaukee & St. Paul Railway of Idaho, which was incorporated early this year.

CHICAGO, ROCK ISLAND & PACIFIC.—An officer writes that the budget for expenditures to be made in 1906 includes the following: Roadway, $2,060,437; bridges, $706,000; buildings, $1,760,600, and other additions and improvements, $250,000, making a total of $4,777,037.

CHICAGO SUBWAY.—President A. G. Wheeler, of the Illinois Tunnel Co., is quoted as saying that active operation of the tunnel will begin soon. By August 1 connections will be made with 56 buildings that each receive and send 500 tons and upwards every day; and connection will also by that time be made with all the railroads.

CLEVELAND, ASHLAND & MANSFIELD.—Recently incorporated in Ohio with $500,000 capital to build from Ashland southwest to Mansfield, 14 miles. Construction work is under way already. The contract for the grading is held by L. B. Stanley & Co., Collinwood, Ohio. Contracts for the bridges and culverts and other material and equipment will soon be let. The company's office is in the Williamson Building, Cleveland, Ohio. (May 18, p. 149.)

COLORADO & SOUTHERN.—A plan of the proposed extension southwest from Seymour to Stamford of the Wichita Valley to connect the Abilene Northern has been filed in Texas. Both of these roads are owned by Colorado & Southern interests. The plan shows that the extension will be 60 miles long. The Abilene Northern is building from Stamford south to Abilene, 40 miles. The bridge over the Brazos river at Seymour has been completed and track-laying is now in progress. It is proposed to have the road completed to Stamford by Sept. 1, and to Abilene by Nov. 1 of this year.

COLORADO & SOUTHWESTERN.—Incorporated in Colorado, with a capital of $3,500,000, to build a railroad from Grand Junction in Mesa County, Colorado, south through Unaweep canyon to La Sal Mountain, thence through the Sinbad and Paradox valleys, traversing valuable mineral regions in the La Sal Mountains. Grand Junction is the western terminus of the Denver & Rio Grande and the Colorado Midland and the eastern terminus of the Rio Grande Western. D. C. Willerby, of London, England; A. E. Guy and John Nix, of Norwood, Colo., and J. H. Hinkin, of Chicago, are promoters. A contract is reported let for building the first 10 miles.

DELAWARE & HUDSON.—A contract is said to have been let by this company to the Pacific Construction Co., and sublet to Roger & Quirk, for building the first 15 miles of a branch from Rouses Point, N. Y., to Adirondack Junction, Que., on the Canadian Pacific, to enable the D. & H. to reach Montreal over the Canadian Pacific tracks.

FLORIDA RAILWAY.—This company, formerly the Liveoak & Gulf, is planning to extend its road from Liveoak, Fla., northeast to Fernandina, about 150 miles.

GEORGIA & FLORIDA.—A syndicate composed of Middendorf, Williams & Co., and the International Trust Co., of Baltimore, and John L. Williams & Sons, of Richmond, Va., has bought six or seven lines of railroad in Georgia and Florida aggregating 230 miles. The syndicate plans to build connecting links aggregating 100 miles to unite these several lines and form a continuous railroad from Augusta, Ga., to Madison, Fla., with several branches. The question of further extending the consolidated road to Deepwater on the Gulf of Mexico is also under consideration. J. Skelton Williams is President and C. Gabbett, formerly of the Augusta & Florida, is General Manager.

GEORGIA, FLORIDA & ALABAMA.—Routes have been surveyed for the proposed extension of this road from Columbus, Ga., south to Cuthbert. One of the routes is by way of Lumpkin, another by Richland, and a third by way of the Chattahoochee Valley. It is probable that the first mentioned route will be decided upon.

GEORGIA SOUTHEASTERN & GULF.—Recently incorporated in Georgia to build a railroad from Albany, Ga., southwest about 150 miles to St. Andrews, Fla., on the gulf shore. The incorporators include W. M. Legg, former General Manager of the Georgia, Florida & Alabama; H. J. Bruton and M. D. Powell, of Bainbridge; W. W. Gordon, Jr., of Savannah; W. H. Hilton, of Marianna; L. V. Babcock, of Pittsburg, Pa., and G. J. Pope, of Chicago.

GREAT NORTHERN.—This company is building a new line from Aneta, N. Dak., northwest to Devils Lake, approximately 60 miles.

GULF & SHIP ISLAND.—The new electric line which this company is building under the name of the Gulfport & Mississippi Coast Traction is to be completed from Gulfport to Biloxi June 1. The line is now in operation from Biloxi to Beauvoir.

GULFPORT & MISSISSIPPI COAST TRACTION.—See Gulf & Ship Island.

INTEROCEANIC.—At the next meeting of the Board of Directors, plans for converting this road to standard gage will be considered. The cost of the change, with other proposed improvements, will be about $6,000,000, which expenditure has already been approved by the Board of Directors. Surveys under way for over a year for eliminating curves have recently been completed.

LOUISIANA RAILWAY & NAVIGATION CO.—This company expects to have its road extended by September to New Orleans, La. On the completion of this extension the road will extend from Shreveport, La., southeast to New Orleans, 350 miles. At New Orleans the terminal facilities are practically completed. The road is laid with 70-lb. rails throughout. At Water Valley the Mississippi river is crossed by ferry. (See Construction Record.)

MISSOURI PACIFIC.—Preliminary surveys are being made by the St. Louis, Iron Mountain & Southern for its terminal and yard at Monroe, La. The yard, which will be located south of the cotton mills, east of the main line, will be about a mile long.

MORGANTOWN & DUNKARD VALLEY.—An officer writes that the prospects for building this proposed line are good, and that contracts for the work are to be let during the summer. The proposed route is from Morgantown, W. Va., to Mannington via Cassville, Blacksville, Wadestown and Wise. There are to be 12 or more bridges. W. W. Smith is Secretary and Attorney, Morgantown, W. Va. (See Construction Record.)

NATIONAL OF MEXICO.—Surveys are being made by this company for a line from San Felipe on the main line to Guadalajara; also for a line from Salamanca on the Jaral branch to Guadalajara. An option has also been obtained in that city on lands for terminal yards and shops.

NORTHERN PACIFIC.—Work is proceeding rapidly on the extension of the Port Townsend Southern toward Tacoma.

PORT TOWNSEND SOUTHERN.—See Northern Pacific.

SAN SABA VALLEY.—Charter filed in Texas with $200,000 capital and office at San Saba to build from Antelope Gap, Texas, on the Gulf, Colorado & Santa Fe in Mills County, west through Mills, Lampasas, San Saba and McCulloch counties, by way of San Saba to Crothers, on the Fort Worth & Rio Grande, 50 miles. The directors are E. Campbell, John Kelly, T. A. Murray, R. G. Coryell, W. S. Sanderson, J. H. Martin, J. D. Estep, R. M. Ward and E. L. Rector, all of San Saba.

SOUTHERN PACIFIC.—According to western reports work is to be started at once on a new line from Drain on the Mount Shasta route in Oregon southwest to Marshfield on Coos Bay, about 80 miles. The proposed line is to form the northern portion of a new coast line between San Francisco and Portland.

A contract is reported let by this company to Hemingway & Bowles, of Memphis, Tenn., for grading a new railroad to leave the main line at New Iberia, La. The work will cost about $150,000.

Work has been steadily pushed by the contractors on the Bay Shore cut-off, which is to be finished about the end of this year. This cut-off is to be double track, extending from the Fourth and Townsend street yards of the Southern Pacific in San Francisco

through the Potrero district near the shores of the bay to a point on the main line of the coast division near San Bruno. It will be 11 miles long, and will cost about $3,300,000. It is being built to take the place of the single-track line through the Mission district, which has heavy grades. When finished there will be a double-track road between San Jose and San Francisco, with easy grades. The five tunnels on this new line are of the following lengths: 1,700 ft., 1,200 ft., 2,600 ft., 1,100 ft. and 3,500 ft. They are 22 ft. high and 25 ft. wide. They are lined with concrete and brick. Several of the tunnels were almost completed at the time of the earthquake. The longest one had been bored 1,300 ft. at each end while several of the others were bored 500 ft. at each end. None of them sustained any damage, a fact which the Southern Pacific engineers say was due to the character of the concrete work; to the use of cement with brick thoroughly soaked in water before being laid in the cement.

Vandalia.—A contract is reported let by this company to double-track its line from Terre Haute, Ind., to Harmony, at a cost of about $2,000,000.

Wadsworth & Western Traction.—This company has increased its capital from $1,000 to $500,000. The company is owned by the Northern Ohio Traction and is planning to build across Ohio from Cleveland southwest to Cincinnati. A branch is also to be built through Medina, Wayne, Ashland and Richland Counties.

Wichita Valley.—See Colorado & Southern.

RAILROAD CORPORATION NEWS.

Boston & New York Air Line.—A meeting of the stockholders has been called for June 18 to act on a proposition to sell the property to the New York, New Haven & Hartford, which leases it for 99 years from 1882. The Air Line owns 52 miles of road from New Haven, Conn., northeast to Willimantic, and has outstanding $909,468 common stock, $2,998,500 preferred stock, and $500,000 first mortgage 5 per cent. bonds of 1905.

Calumet Electric Street Railway.—Under order of the Court, the $483,500 capital stock and the $2,926,000 of 5 per cent. consolidated mortgage bonds of 1909 are to be sold to a Chicago syndicate. These securities are the holdings of the National Bank of Illinois which recently went out of existence, and constitute nearly the whole of the stocks and bonds outstanding. The company operates 77 miles of track in and around Chicago.

Chicago, Milwaukee & St. Paul.—This company has bought the Montana Railroad, which is 157 miles long, from Lombard, Mont., to Lewistown. (May 4, p. 138.)

Chicago Union Traction.—It is announced that a new company will be formed to take over the holdings of the Chicago Union Traction in the securities of the Chicago Consolidated Traction Co., the North Chicago Street Railroad, and the West Chicago Street Railroad. The two last named companies are leased to the Chicago Union Traction. It is intended to unite the North and West systems into one operating company.

Cincinnati, Bluffton & Chicago.—The Receiver has been discharged and the property turned over to the company. The road was projected to run from Huntington, Ind., to Union City, 70 miles, of which 29 miles is completed. There are outstanding $1,125,000 capital stock and $1,500,000 first mortgage 5 per cent. bonds of 1933. The property was put into the hands of a receiver in 1904.

Columbus, Buck-Eye Lake & Newark Traction.—See Indiana, Columbus & Eastern Traction.

Denver, Northwestern & Pacific.—The Northwestern Terminal Co., a subsidiary of the D., N. & P., incorporated in July, 1904, with $2,500,000 capital stock, has been granted a franchise to build a terminal road and facilities in Denver, Colo. The D., N. & P. now uses the tracks of another road in getting into the city. The new terminal may be used by other roads which now go to the Union Terminal, controlled by the Union Pacific.

Des Moines & Fort Dodge.—The shareholders of this company, which is controlled by the Minneapolis & St. Louis, which leases it for 30 years from 1905, will meet on June 7 to vote on an issue of not more than $1,000,000 5 per cent. second mortgage bonds. The first mortgage 4 per cent. bonds of 1935, of which there are $3,072,000 outstanding, were issued in 1905 to retire the bonds of the older companies of which the Des Moines & Fort Dodge is a consolidation. The M. & St. L. holds $305,200 six per cent. certificates of indebtedness of the D., M. & F. D., and it is presumed that these will be exchanged for a part of the new bonds.

Hocking Valley.—The committee representing the minority stockholders of the Kanawha & Michigan have reached an agreement with the Hocking Valley by which the K. & M. minority stock is to be exchanged for 60 per cent. of its par value in Hocking Valley common stock. There have been deposited with the committee $3,300,000 of the total $9,000,000 K. & M. capital stock, and it is expected that nearly all of this amount will be exchanged on that basis. The price of Kanawha & Michigan stock has risen during the negotiations from 38 to 73. Hocking Valley common is now quoted at about 128. Assurances have been given that if, as is nearly certain, the $15,000,000 preferred stock of the Hocking Valley is retired, the dividend rate on Hocking Valley common will be raised from 3 per cent. to 6 per cent. During the work of the committee, the fact has been made public that the majority of the Kanawha & Michigan stock is no longer held by the Toledo & Ohio Central, which is controlled by the Hocking Valley, but was acquired some time ago and is now held by the Hocking Valley directly. (May 4, 1906.)

Indiana, Columbus & Eastern Traction.—This company, which is a holding company for the Widener-Elkins Lines in Central Ohio, has taken over the Columbus, Buck-Eye Lake & Newark. The last named road operates a line from Columbus, Ohio, to Newark, with a branch to Buck-Eye Lake, 39 miles in all. It has outstanding $1,000,000 common stock, $500,000 6 per cent. first mortgage 5 per cent. bonds of 1921.

Interborough Rapid Transit.—This company has paid to the Controller of New York City $431,429, being the first annual sinking fund payment of 1 per cent. of its indebtedness to the city. (May 4, p. 138.)

Kanawha & Michigan.—See Hocking Valley.

Mexican Consolidated Electric.—This is a new company backed by Canadian capital and organized to acquire all the street railways in and around the city of Mexico. It has acquired the controlling interest in the Mexico Electric Tramways, which operates 160 miles of road, of which 90 miles are worked by electricity, 13 miles by steam, and 57 miles by other power. The new company has applied for authority to change its name to the Mexico Tramway Co., and to obtain further rights.

Minneapolis & St. Louis.—See Des Moines & Fort Dodge.

Montana.—See Chicago, Milwaukee & St. Paul.

New Bedford & Onset (Electric).—This company, which has $500,000 capital stock outstanding and operates 16 miles of road between Fairhaven, Mass., and Onset, has bought the Taunton & Buzzard's Bay, which has 29 miles of track in Middleboro and from there to Buzzard's Bay and Monument Beach, but which has recently suspended operation. The N. B. & O. will assume the $150,000 bonds of the T. & B. B., and will issue $50,000 additional stock to pay for the road.

New York, New Haven & Hartford.—See Boston & New York Air Line.

New York, Philadelphia & Norfolk.—A meeting of the stockholders has been called for June 14 to vote on a plan to issue $500,000 capital stock. This additional stock is to be distributed as a 25 per cent. stock dividend among the stockholders of the $2,000,000 outstanding stock, the total amount authorized being $2,500,000. The company has been paying 8 per cent. annual dividends since 1903.

Northwestern Terminal.—See Denver, Northwestern & Pacific.

Reading Company.—The gross and net earnings for the month of April of both the Philadelphia & Reading Railway and the Philadelphia & Reading Coal & Iron Co., show a great decrease as compared with the corresponding period in 1905, reflecting the effect of the recent strike. The gross earnings of the railroad company were $2,461,844, a decrease of $858,613; net earnings $495,506, a decrease of $880,233. The gross earnings of the Coal & Iron Company were $1,074,565, a decrease of $3,535,970. This leaves a deficit of $287,293 as compared with net earnings last year of $262,905.

Southern Michigan (Electric).—This company, which is a consolidation of the South Bend & Southern Michigan and the Niles & Buchanan, and which operates a road between South Bend, Ind., and St. Joseph, Mich., 35 miles, has filed a mortgage securing $2,000,000 5 per cent. bonds of 1931. Of these bonds $500,000 is outstanding, $750,000 is reserved to refund the bonds of the South Bend & Southern Michigan, and the remainder is reserved for betterments, improvements and extensions.

Taunton & Buzzard's Bay (Electric).—See New Bedford & Onset.

Velasco, Brazos & Northern.—The property of this company has been ordered to be sold under foreclosure, date to be announced later. The company went into the hands of a receiver last February. It operates 20 miles of road from Anchor, Tex., to Velasco. The authorized capital stock is $200,000, and of bonds the same.

GENERAL NEWS SECTION

NOTES.

In July, when the Shoshone Indian Reservation lands are to be opened for settlement, the Union Pacific will run a line of automobiles from Rawlins, Wyo., its nearest station. The line is 100 miles long.

The Brooklyn Rapid Transit Company, operating the street surface railways in Brooklyn, N. Y., has just established 62 transfer posts, at which agents will be on duty night and day to give free transfers to passengers changing cars who are entitled to them.

Two of the robbers who held up a Canadian Pacific express in British Columbia, May 9, have been tried and sentenced to imprisonment for life, and a third has been sentenced for 25 years. One of the culprits has only recently ended a 20-year term of imprisonment in California.

The State Railroad Commission of Texas on May 30th issued an order directing the Houston & Texas Central to reduce its passenger fares to the basis of 2.5 cents a mile. It is said that the road will take all legal means to resist the enforcement of the order. A reduction on this line would force reductions on a number of others.

The "Lincoln party," an independent Republican organization recently formed in Pennsylvania, held a convention May 31 and nominated candidates for Governor and other state officers. A platform was adopted advocating numerous reforms, among which is more complete control of the railroads; and this clause calls for the creation of a state railroad commission, with powers similar to those of the Interstate Commerce Commission.

The Pennsylvania Railroad is now transferring cars by floats regularly between its freight terminal at Greenville, N. J., on the west side of New York harbor, and the Bush terminal at Thirty-ninth street, Brooklyn, on the east side of the harbor. The Bush terminal grounds and docks are extensive, a dozen or more steamship lines making it their freight headquarters, and freight is transferred directly from freight cars to ocean steamers.

In the United States Court in New Mexico, last week, the Grand Jury brought in a number of indictments against the Atchison, Topeka & Santa Fe for violation of the Interstate Commerce law. It is said that the indictments, which are accompanied also by indictments of the Colorado Fuel & Iron Company, have to do with offences similar to and perhaps connected with those which figured in the Interstate Commerce Commission investigation a year or more ago.

Albert Roath, passenger conductor between Worcester, Mass., and Norwich, Conn., on the Norwich & Worcester division of the New York, New Haven & Hartford, has completed 50 years of service in that position on the same road, and his service with the company began eight years earlier, when, as a farmer boy, he helped clear up the wreck of a freight train and concluded that he would like to go into that kind of business. Mr. Roath is only 78 years old and is erect and clear-eyed. He has never had an accident to speak of.

By the explosion of a steam pipe in the 96th street power house, on the morning of June 1, surface street cars of Manhattan, New York city, were brought to a standstill and delayed several hours on the Sixth, Seventh, Eighth, Ninth, Tenth, Second, Third, Lexington and Madison avenue lines, and the Eighth, Fourteenth, Twenty-third, Forty-second, Thirty-fourth, Eighty-sixth and 116th street crosstown lines. These lines, all depending on a single power house, are very extensive, and the number of passengers who were obliged to take passage on the Subway or the elevated lines aggregated many thousands.

The Appellate Term of the Supreme Court of New York has sustained a lower court in declaring illegal a rule of the Nassau Electric Railroad Company that a passenger entitled to a free transfer must, in order to secure the privilege, apply for the transfer at the time he delivers his ticket or his fare to the conductor. A passenger who did not promptly ask for his transfer sued the company for the $50 statutory penalty and he wins his suit. The court says that the railroad may make reasonable regulations, but that this rule does not come within that class; from which it would appear that the court sees no hardship in requiring a street railroad to give identification checks to each passenger--for how otherwise can a conductor, after passengers have mingled with each other, decide which of them are and which are not entitled to transfers?

Illegal Commissions to Refrigerator Car Co.

In the United States Circuit Court at Milwaukee May 31, a decision was rendered, prepared by Judge Baker, holding the Milwaukee Refrigerator Transit Company and six railroads guilty of violating the Interstate Commerce law in giving and receiving unlawful rebates. The Pabst Brewing Company was found not guilty. The railroad companies, the Wisconsin Central, the Pere Marquette, the Erie, the Chicago, Rock Island & Pacific, the St. Louis & San Francisco, and the Chicago & Alton, with the refrigerator company, were charged with manipulating rates so that shipments of beer from the Pabst brewery were carried for 10 per cent. to 12 per cent. less than the regular rates. The facts were admitted; but it was claimed that the discount was not illegal because it was in the nature of a commission which the railroads paid to other freight solicitors on the same basis as to the refrigerator company. The railroads paid the commission to the refrigerator company to secure the business, apparently for years, the evidence showing that roads refusing to pay the commission received none of the traffic in question; and the benefit received by the refrigerator company was partly or wholly made over to the brewing company, for the reason that the refrigerating and the brewing company were controlled by substantially the same persons, although the organizations were distinct. The opinion was concurred in by Judges Grosscup, Seaman and Kohlsaat.

Record of the "Twentieth Century" Express Trains.

In 176 trips made by the Twentieth Century Limited of the New York Central and the Lake Shore, between New York and Chicago, since March 1 the train has arrived at destination on time 151 times. On 16 trips it has arrived less than 30 minutes late; on five trips it was from 30 minutes to one hour late, and on four it was over an hour late. The regular train westbound consists of four cars all of the way, with a fifth, the dining car, part of the way for dinner and breakfast. Eastbound the regular train has five cars, or six with the dining car. In making the 176 trips above mentioned, 53 extra cars were hauled, and at the present time the eastbound train has seven cars every day from Albany to New York.

Eleven Passengers Killed Near Providence.

On Sunday morning last about 1 o'clock the derailment of an electric car at Moore's Corners, East Providence, R. I., resulted in the death of 11 and the injury of about 75 of the 100 passengers in the car. This was a special car carrying a picnic party and was in charge of a motorman who, it is said, was making his second trip over this line. In descending a steep grade which terminated at the bottom in a curve, he allowed the car to go too fast and it was overturned at the curve by reason of the excessive speed. It is said that an arc lamp at the foot of the hill, usually lighting the street at that point, was not burning.

Marley Not Like Rockefeller.

The Interstate Commerce Commission in an opinion by Chairman Knapp, has announced its decision in the case of Marley against the Norfolk & Western and others. There are two routes over which coal may be shipped from the Thacker district in West Virginia to Alexandria, Ind., one by the N. & W. and C., C., C. & St. L., the shorter line, and one by the N. & W., Hocking Valley and Lake Erie & Western. The complainants in 1903 had shipped to them eight carloads over the latter route. By that line the published rate was $1.90 a ton, while over the other route it was $1.65. On Nov. 26, 1903, the rate by the route used was reduced to $1.65, and later the other line lowered its rate to $1.55. The complainants demanded reparation. The evidence related only to the rate itself, and to the fact that a lower rate was in force over a competing short line. The Commission holds that the rate charged is not shown to have been unreasonable, and that in view of their published tariff the carriers in the through line over which the coal was carried could not lawfully apply the lower rate which was in effect over the competing line.

A Psalm of (20th Century) Life.

Lives of railroad men remind us
We are fools to work for pay,
When from the air and all around us
Stocks and bonds may come our way.

—*Minneapolis Journal.*

Violation of Rule 106.

By a strange freak, several cars of a Big Four freight train, which passed through this place at 2 o'clock this morning, left the rails at the Pennsylvania street crossing, ran six blocks off the rails, in places four feet from the rails, and then took the track without the train crew knowing of the accident until they reached

Prescott, five miles east of here. The cars in their wild career tore more than half the station platform off, cutting through it like a knife, knocked down a stand pipe which flooded the town for blocks before it could be turned off and side-wiped a string of box cars which stood on a siding. Brakeman H. C. Wilson leaped from the moving train when the cars left the tracks and remained in Shelbyville. At Prescott the train was stopped to investigate his absence and all cars and trucks of the train were found on the track. Wilson was standing on a car just ahead of the first one that jumped the track. He thought the whole train was going off, and so jumped for his life. One oil box and a car body were slightly damaged.—*Shelbyville (Ind.) Republican.*

The President's Train.

The sundry civil appropriation bill, as reported to the House, carries an item of $25,000 for the traveling expenses of the President of the United States, his attendants, and invited guests that may travel with him. Guardians of republican simplicity who think a President should be allowed no more than half a seat in a smoking car, with an occasional stand-up, such as his fellow countrymen endure, will, of course, throw the customary spasms over this appropriation; but those of more optimistic views are disposed to approve. The President in the discharge of his duties needs to come into contact with his fellow-countrymen. As to the disbursement of this large sum, it is to be presumed that no President will forget propriety—will allow the decoration of the right of way with champagne bottles, as too often has happened when a Senatorial funeral train has gone on its hilarious way.—*Exchange.*

New Interlockings on Union and Southern Pacific.

Following is a list of interlocking signal plants to be installed on the Harriman Lines this year. In some instances the number of levers is approximate, as the plans have not yet been completed.

Union Pacific.

Location.	Character.	No. of levers.
Portal, Neb.	Railroad crossing	10
Lane, Neb.	Double track work	20
Valley, Neb.	Double track work	16
Ellsworth, Kan.	Railroad crossing	20
Topeka, Kan.	Double track work	60
Bonner Springs, Kan.	Railroad crossing	20
Armstrong, Kan.	Junction	18
Buford, Wyo.	Double track work	12
Hermosa, Wyo.	Double track work	12
Lookout, Wyo.	Double track work	12
Hanna, Wyo.	Double track work	12
Point of Rocks, Wyo.	Double track work	12
Rock Springs, Wyo.	Double track work	12
Canceled in 1905, but proposed for 1906, as follows:		
Central City, Neb.	Railroad crossing	16
Wymore, Neb.	Railroad crossing	8
Columbus, Neb.	Railroad crossing	20
Manhattan, Kan.	Railroad crossing	36
Abilene, Kan.	Railroad crossing	16
Omaha Union Depot		
Southern Pacific Co.—Pacific System		
East Oakland, Cal.	Junction	17
Fruitvale, Cal.	Junction	17
Webster St.	Junction	23
Southern Pacific. Atlantic System.		
Englewood, near Houston, Tex.	Junction	25
Oregon Railroad & Navigation Co.		
Spokane, Wash.	Railroad crossing	47
Oregon Short Line.		
Ninth Street, Salt Lake	Railroad crossing	23

Canal Improvement Bonds.

The Controller of the state of New York will receive bids until June 14 for the purchase of $1,000,000 3 per cent. bonds of 1956. No bid will be accepted for less than the par value of the bonds. The proceeds of the sale will be used for canal improvement.

Manufacturing and Business.

The Quincy, Manchester, Sargent Company, Chicago, announces that James L. Pilling is no longer connected with that company.

W. A. Williams, who has been Acting District Manager at St. Louis of the American Car & Foundry Co., has been appointed District Manager. He will have charge of the new steel car plant in St. Louis, as well as the Madison steel car plant and the wood car shops and steel foundry at St. Louis.

The American Blower Co., Detroit, Mich., on May 25th invited the members of the Detroit Engineering Society to visit the plant in the afternoon, after which they were entertained by the company at a "beefsteak" supper at one of the city clubs. Immediately following the supper the regular meeting of the society was held, at which Mr. F. R. Still presented a paper on "Small Vertical High-Speed Self-Oiling Engines." The invitation met with a hearty response from the members of the society. The movement was initiated by the American Blower Co. with the idea that it would be followed by other manufacturers, giving the engineers of the city the benefit of visits to its various manufacturing plants.

Iron and Steel.

The Harriman lines are in the market for rails. These lines last year ordered over 200,000 tons for delivery this year.

The Wheeling & Lake Erie has ordered 10,000 tons of rails for 1907 delivery. Other contracts practically closed include the Baltimore & Ohio, 40,000 tons; Chicago, Burlington & Quincy, 25,000 tons, and the Seaboard Air Line, 25,000 tons. The sale of rails last week aggregated about 150,000 tons for 1906 delivery, and about the same quantity has been ordered for 1907 delivery.

The American Bridge Co. has received several additional orders for bridge material, including 3,000 tons for the Erie and 300 tons for the Baltimore & Ohio. The Florida East Coast, Southern Railway, and the Louisville & Nashville are reported to be negotiating for a heavy tonnage of bridge material to be used in 1907, and the New York Central and Erie to be inquiring for more tonnage to be used this year.

The Chicago, Rock Island & Pacific has ordered 36,000 tons of rails; the Atlantic & North Carolina 4,500 tons, and the Shreveport & Northwestern 2,500 tons, all for 1907 delivery. For delivery this year, the Chicago, Indianapolis & Louisville (Monon) has ordered 1,500 tons; the Shreveport & Northeastern 2,000 tons; the Atlantic & North Carolina 1,000 tons, and the Raleigh & Pamlico Sound 8,000. The United Gas Improvement Co., of Philadelphia, has also contracted for 2,500 tons, and the Union Pacific will, as reported, soon make contracts for 37,000 tons, and the Delaware, Lackawanna & Western for 15,000 tons for 1907 delivery.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Transportation and Car Accounting Officers.

The spring meeting of this association was held at Denver, May 17, with about 100 members present from all over the country. An interesting address was given by Mr. A. D. Parker, Vice-President of the Colorado & Southern, who welcomed the members to Denver. The election for the ensuing year resulted in the choice of T. S. Bell (P. R. R.), Philadelphia, for President, and G. P. Conard, 24 Park Place, New York, Secretary. The fall meeting will be held at New Orleans in November. The report of the committee on office methods, embodying a proposed code of rules for tracing, was adopted. An abstract of this report was given in the *Railroad Gazette*, May 18, page 500. The report on handling railroad mail, also given in the *Railroad Gazette*, was accepted and the Secretary instructed to take a letter ballot as to the use of the letters R.R.B., R.R.S., or R.R.M. The matter of a uniform card waybill was not settled, as it is understood that the association of accounting officers will soon take up the subject. Diversion of cars was discussed at length, but the man with the magic wand to cure the troubles that afflict this department of the railroad service was not present.

Local Freight Agents.

The American Association of Local Freight Agents' Associations will hold its 19th annual convention at the Windsor Hotel, Montreal, June 19, 20, 21 and 22. The President of the association is A. D. Oyer (C. & N.-W.), Chicago, and the Secretary is G. W. Dennison (Pennsylvania and Hocking Valley), Toledo, Ohio. Following are the principal topics to be discussed:

Proper marking of freight; need of special marking for freight billed to shipper's order.

What charge, if any, should be made for car load freight received from industries, to be sorted at freight houses?

The yardmaster and the agent.

Best method of recording foreign cars with a view to the proper preparation of penalty notices.

Weighing carload freight under the rules of the Cincinnati Chamber of Commerce. These rules have stopped friction and complaints, and have given marked satisfaction.

Proposition to compile the results of the discussions in the association for the past 18 years.

Comparison of switching methods at different important cities.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atlantic & Birmingham Air Line.—Alfred Walter, President of the Seaboard Air Line, has been also elected President of the A. & B. A. L., succeeding J. M. Barr.

Brockville, Westport & Northwestern.—E. R. Thomas has been elected President, succeeding John Gerken, who has been elected First Vice-President, succeeding Clarence P. King. Mr. King remains on the Board of Directors. E. R. Thomas, O. F. Thomas and W. I. Burgess have been elected Directors, succeeding H. W. Gennerich, Albert Berngaud and Carston Heilshorn.

Chicago, Rock Island & Pacific.—W. W. Stevenson, Controller, has resigned.

Grand Trunk.—A. A. Tisdale has been appointed Assistant to the Fourth Vice-President, with office at Montreal, Que.

Missouri, Kansas & Texas.—A. H. Joline, Counsel, has been elected Chairman of the Board, succeeding H. C. Rouse, deceased. R. W. McGuire, St. Louis, and Otto Miller, Cleveland, have been elected Directors.

The New York Central Lines.—Q. H. Smith, General Manager of the N. Y. C. & H. R., has been appointed Vice-President in charge of operation and maintenance on all lines east of Buffalo except the Rutland. C. E. Schaff, General Manager of the C., C., C. & St. L., has been appointed Vice-President in charge of operation and maintenance on the lines west.

Frederick Middlebrook, Assistant Treasurer of the Lake Shore & Michigan Southern and other New York Central Lines west, has resigned, on account of ill health. H. G. Snelling, Transfer Agent for Stocks and Bonds, succeeds Mr. Middlebrook.

Traffic Officers.

Great Northern.—F. I. Whitney, Passenger Traffic Manager, has resigned, effective July 1.

Lehigh Valley.—H. B. Crandall, Coal Traffic Manager and Fuel Agent, has resigned. W. T. Grier succeeds Mr. Crandall as Coal Freight Agent, with office at New York, the title of Coal Traffic Manager being abolished.

Southern.—F. H. Behring, Chief Clerk in the office of the Assistant Freight Traffic Manager at Louisville, Ky., has been appointed Assistant General Freight Agent, succeeding R. J. Curran, resigned to go to another company.

Engineering and Rolling Stock Officers.

Chicago, Burlington & Quincy.—F. Newton, road foreman at Sterling, Colo., has been appointed to the new office of Master Mechanic at that place.

Special Officers.

Chicago, Burlington & Quincy.—W. H. Hanss has been appointed Industrial Commissioner, with office at Chicago, Ill.

Operating Officers.

Boston & Albany.—Charles Firth, General Agent at Worcester, has been appointed Superintendent of the Western division (Springfield to Albany and branches), with headquarters at Springfield, Mass., succeeding N. Wales, resigned. Mr. Firth was born at Leicester, Mass., in 1860, and began his railroad service in 1880 on the Boston & Albany at Worcester as a clerk. From that position he was promoted to the position of agent at Rochdale, and from there, in 1887, to Westfield. After serving as agent at Westfield for 10 years he was for a short time city agent at Boston, and from that place was promoted to the agency at Worcester, which he now leaves. Mr. Firth is a nephew of the late Abraham Firth, who was Superintendent of the Boston & Worcester before its consolidation into the Boston and Albany.



Charles Firth.

Philip Morrison, Assistant Superintendent at Boston, has had his title changed to Superintendent, and J. B. Stewart, heretofore Superintendent, in charge of the whole road, is now General Superintendent.

Chicago, Milwaukee & St. Paul. D. C. Cheney, Superintendent of the La Crosse division, has been appointed Assistant General Superintendent at Milwaukee, succeeding H. B. Earling, promoted. P. C. Eldredge, Superintendent of the Prairie du Chien and the Mineral Point division, has been appointed Superintendent of the La Crosse and the Northern divisions, with office at Milwaukee. E. D. Wright, Superintendent of the Northern division, succeeds Mr. Eldredge.

Grand Trunk. L. G. Coleman, Trainmaster at Montreal, Que., has been appointed to the new office of Assistant Superintendent at Ottawa, Ont.

Purchasing Agents.

Lehigh Valley.—F. L. Blendinger, Purchasing Agent, has taken over the duties of Fuel Agent, H. B. Crandall having resigned.

LOCOMOTIVE BUILDING.

The Kansas City Belt Railway has ordered two locomotives from the Baldwin Works for July delivery.

The Delray Connecting has ordered one 4-30 Baldwin type locomotive from the Baldwin Locomotive Works.

The Butte, Anaconda & Pacific, it is reported, has ordered six locomotives from the American Locomotive Co.

The J. A. Roebling's Sons Co. has ordered two 4-20 Baldwin type locomotives from the Baldwin Locomotive Works.

The Western Allegheny has ordered one consolidation locomotive from the American Locomotive Co. for August delivery.

The Seaboard Air Line has ordered 40 locomotives, 20 from the Baldwin Works and 20 from the American Locomotive Co.

The St. Louis & San Francisco, as reported in our issue of May 11, has ordered 20 locomotives from the Baldwin Works, and 20 locomotives from the American Locomotive Co.

CAR BUILDING.

The Texas & Pacific is considering the purchase of 500 box cars.

The Atlantic Coast Line is in the market for from 125 to 150 flat cars.

The Erie has ordered 100 Hart convertible cars from the Rodger Ballast Car Co.

The Standard Steel Co. has ordered four dump cars from the King-Lawson Car Co.

The Tonopah & Goldfield, it is reported, has ordered several cars from the Pullman Co.

The Capital Traction Co., Washington, D. C., has ordered 25 cars from the Cincinnati Car Co.

The Quebec Central is building 15 stock cars and two refrigerator cars at its Sherbrooke shops.

The Southern Pacific has ordered a number of additional baggage cars from Barney & Smith.

The Cincinnati Northern has ordered 20 closed cars for electric service from the Cincinnati Car Co.

The Macon, Dublin & Savannah, it is reported, is in the market for 100 box cars of 60,000 lbs. capacity.

The Washington Railway & Electric Co., Washington, D. C., has ordered from 40 to 50 cars from the St. Louis Car Co.

The Frisco System is reported to have ordered 2,000 box cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The King-Lawson Car Co. is having 15 King-Lawson dump cars built at the Middleton Car Works. These cars will be used for general service.

The H. S. Kerbaugh Co., Philadelphia, Pa., has ordered 20 dump cars from the King-Lawson Car Co. They will be built at the Middleton Car Works.

The Temiskaming & Northern Ontario has purchased four second-hand passenger cars and will probably shortly place an order for four first-class passenger coaches.

The Canadian Pacific has completed a motor car at its Angus shops. The car is now being tested on its lines in the vicinity of Montreal. The company has also placed orders at its Angus shops for one sleeping car, one baggage car, 90 box cars, 85 flat cars and 15 stock cars.

The Solvay Process Co., Syracuse, N. Y., has ordered 15 tank cars of 8,000 gallons capacity and six tank cars of 6,000 gallons capacity from the American Car & Foundry Co., for June 30 and August 1 delivery. All cars will weigh 80,000 lbs., and measure 33 ft. long, over all. The special equipment for all includes American Car & Foundry Co.'s standard bolsters, brake-beams and brake-shoes, Westinghouse brakes, Climax couplers, and Cardwell friction draft rigging.

The Lehigh Valley has ordered 10 express cars of 50,000 lbs. capacity, 10 express horse cars of 50,000 lbs. capacity, and one dining car from Harlan & Hollingsworth, for July and August delivery. The express cars will weigh about 108,000 lbs. and the express horse cars will weigh about 110,380 lbs. The express cars and express horse cars will measure 69 ft. 2½ in. long, over platforms, 10 ft. ¼ in. wide and 14 ft. 5¼ in. high, over all. The dining car will be 80 ft. 11½ in. long, over platform, 10 ft. ¼ in. wide and 14 ft. 5½ in. high, over all. The special equipment for all includes Pullman cast-steel bolsters for dining car, Diamond Special brake-beams; American Brake-Shoe Co.'s brake-shoes, Westinghouse brakes, Mag

nus Metal Co.'s brasses; Gould couplers, National curtain fixtures and Pantasote curtain material for dining car, Gould draft rigging, Soule dust guard for dining car, Gold heating system, Safety Car Heating & Lighting Co.'s light and Protectus paint for express and express horse cars; Gould platform for dining car; Lehigh Valley standard trucks and roofs; Railway Steel Spring Co.'s springs and Paige wheels for express and express horse cars.

BRIDGE BUILDING.

BATTLEFORD, SASK.—The Legislature has included $200,000 in its estimates for a new steel bridge.

BOONE, PA.—A contract is reported let by the Newton & Northwestern to the Marsh Bridge Co., of Chicago, for building a number of bridges along its proposed extension. The largest will be over the Des Moines river at Kato, south of Fort Dodge. It is to be a concrete structure, of three spans 175 ft. long.

CORNWALL, ONT.—Bids are wanted June 18 by Adrian I. Macdonnell, County Clerk, for building two bridges, one over the south branch of river Aux Raisins and the other over Payne river.

FREDERICKSBURG, MO.—A bill has been introduced in the Lower House of Congress authorizing Gasconade County to build a bridge over the Gasconade river.

FREMONT, OHIO.—The Lake Erie & Western has given a contract to the American Bridge Co. for building two steel bridges over both channels of the Sandusky river and the Wheeling & Lake Erie tracks. The proposed structures will be 443 ft. and 702 ft. long respectively, and will cost $100,000.

HELENA, MONT.—Bids are wanted June 18 by Percy R. Witner, County Clerk, of Lewis and Clark County, for building a steel bridge 550 ft. long, 16 ft. wide and 12 ft. above the water, and approximately 61 ft. above the river-bed.

KINGWOOD, W. VA.—The County Court has accepted the offer of the Caddell Lumber Co. to build a bridge over Cheat river at Fairfax Ford, to cost $15,000, in Preston County.

MEMPHIS, TENN.—Engineers estimate the cost of a double deck viaduct for a proposed belt line and the Southern Railway at Pigeons Roost road at approximately $104,000. The question of abolishing the grade crossing at this point has long been under discussion. It is proposed to elevate the tracks of the Southern to allow the tracks of the belt line to pass under them, at the same time maintaining the proper height above the thoroughfare. The Southern had been making plans for a subway at this point, which, it is said, has been abandoned since the belt line has been projected.

MONTANA.—A bill has been introduced in both Houses of Congress authorizing the Chicago, Milwaukee & St. Paul to build a bridge over the Missouri river in Lewis and Clark County.

NEW YORK, N. Y.—Bids are wanted June 14 by the Department of Bridges for building the Manhattan subway station for the Williamsburg bridge.

OHIO.—The Upper House of Congress has passed a bill authorizing the Back River Bridge Co. to build a bridge over the west division of the Ohio river from Wheeling, W. Va., to the Ohio shore.

PINE BLUFF, ARK.—Judge Kerwin has ordered that seven bridges ranging from 80 ft. each to 234 ft. be built in Jefferson County.

PRINCE ALBERT, SASK.—The Legislature has appropriated $50,000 towards the cost of enlarging the Canadian Northern bridge.

REGINA, SASK.—The Saskatchewan government has decided to at once build the following bridges: Battleford, costing $200,000; Saskatoon, $100,000, and Prince Albert, $50,000. Hon. J. H. Lamont, Prince Albert, Saskatchewan, Minister of Public Works, can give particulars.

SASKATOON, SASK.—The Legislature has appropriated $100,000 for a new steel bridge here.

TOLEDO, OHIO.—The Osborne Engineering Co., of Cleveland, has been authorized to make plans for a new bridge to be 1,100 ft. long and 70 ft. or 80 ft. wide, to be built of reinforced concrete arches, with steel bascule spans over the Maumee river at Cherry street. The estimated cost of the bridge is $750,000.

WILMINGTON, N. C.—The Atlantic Coast Line has applied for authority to replace its bridge over Smiths creek by a new structure. The new bridge is to be of steel, double track.

YREKA, CAL.—Bids are wanted July 5 by Robert Rankin, County Clerk, for building four steel bridges over Shasta and Scott rivers in Siskiyou County.

Other Structures.

ATLANTA, GA.—The Louisville & Nashville has let the contract to the Ferro-Concrete Construction Co., of Cincinnati, for making its new freight terminals at Waverly Way, this city. The freight house will be five stories high, 835 ft. long by 50 ft. wide.

CHATTANOOGA, TENN.—Plans for the new union passenger station are said to have been accepted by the various railroads interested. It will be 316 ft. long and 80 ft. or 90 ft. wide.

ENOLA, PA.—The new paint shop recently completed by the Pennsylvania at this place has been found too small and an addition will be built to it to cost $100,000.

EVERETT, WASH.—The petition of the Great Northern asking for the vacation of Bond street for a station site has been granted on condition that the company begin work on a new station to cost $50,000 during the next five months.

HAGERSTOWN, MD.—The Western Maryland is to build three large shops here: a machine and erecting shop 240 ft. long and 161 ft. wide of brick and steel; boiler and engine house 50 ft. long and 30 ft. wide, and blacksmith shop 80 ft. by 50 ft.

LORAIN, OHIO.—P. Farrell, of Cincinnati, who has the contract for the Baltimore & Ohio lake terminal improvements, expects to have them completed within a few weeks. The improvements include a 10-stall brick roundhouse, machine shop, blacksmith shop and boiler room, oil and storehouse, 30 ft. by 50 ft.; gravity coal tipple and sand house, a storage ash pit, 86 ft. long. There will also be a trainmen's building 35 ft. by 50 ft. to contain offices for the general foreman and clerks. Improvements are also being made to the B. & O. ore docks, consisting of the alteration of 10 ore-hoist machines to operate automatic buckets. The machines are also being equipped with a modern scraping device. The cost of this latter work will be about $100,000. The McMyler Manufacturing Co. has the contract for the ore machines, and has about completed the work. The scraping devices are being furnished by M. Andrews, of Cleveland. At Fairport, a new bridge is being built over the Black river, and additional tracks are also being laid at the coal docks at that place.

PASCO, WASH.—Plans have been completed by the Northern Pacific for putting up a machine shop and some other buildings.

PENSACOLA, FLA.—The Louisville & Nashville has rejected all the bids recently received for putting up its new station here, and, it is thought, the company will do the work with its own forces.

PERTH AMBOY, N. J.—The Pennsylvania has been buying land near Fayette and Division streets, and, it is said, has a site for a freight yard to include large freight houses. On the completion of this work, the present passenger station at this street is to be replaced by a new one on the ground opposite the Central station in Smith street.

TULSA, IND. T.—An agreement, it is said, has been reached by the residents and the St. Louis & San Francisco so that the work on a new station here to cost $25,000 can be started at once. Other improvements to be made will bring the total expenditures up to $100,000.

WAYNESBORO, PA.—The Cumberland Valley is to put up a new freight house here. The plans call for a steel and brick structure 130 ft. 6 in. long and about 30 ft. wide.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—This company and the St. Louis & San Francisco are contesting for an outlet through Beaver County, Okla., into New Mexico and Colorado. The Santa Fe is planning to extend from Woodward, Okla., on the Panhandle branch northwest via Fort Supply and Beaver to a connection with the Englewood & Kansas branch, which is to be extended to Raton, N. Mex., and to build a cut-off east of Woodward, crossing the North Canadian river to Waynoka, Okla., which will eliminate the heavy grades and sharp curves near Quinlan. Permanent surveys are being made from Liberal, Kansas, south and west through Beaver County into New Mexico.

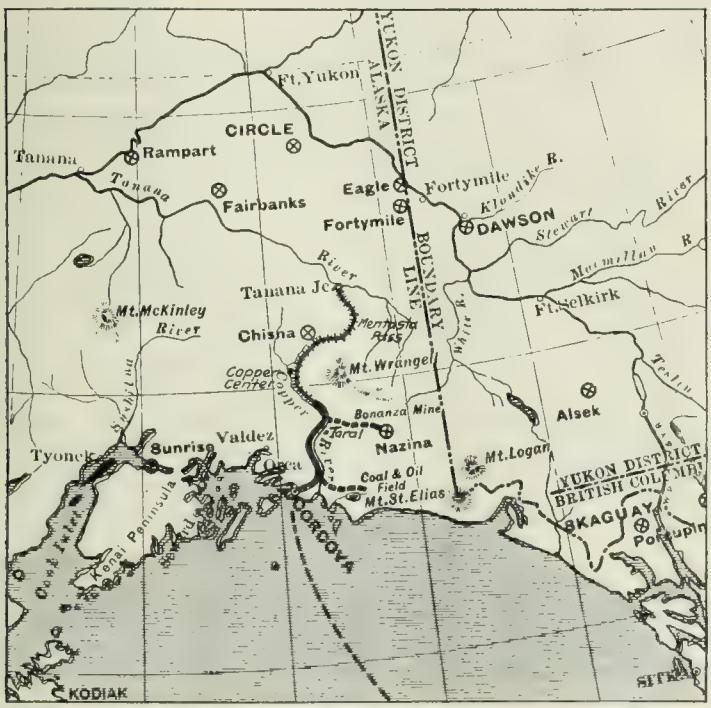
CANADIAN NORTHERN.—Plans have been filed by this company for a line from Sudbury to Batchawaung Bay, Lake Superior, and from Sudbury round the north end of Lake Superior to connect with the Canadian Northern at Kashabowie, west of Port Arthur. See Mackenzie-Mann Roads.

CHICAGO ROADS.—In an ordinance now before the city government provision will be made for the elevation in the city of Chicago of 57½ miles of road, at a cost of about $5,000,000. The roads and the estimated cost of elevation work and subways are as follows: Chicago & Western Indiana, $600,000; Pennsylvania Lines West, $1,600,000; Lake Shore & Michigan Southern, $1,500,000; Chicago, Rock Island & Pacific, $600,000; Baltimore & Ohio, $500,000; South Chicago, $150,000, and Chicago & Eastern Illinois, $20,000.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—A contract has been given by this company to Williams Brothers & Morse for double-track work and reducing the grades from Batesville, Ind.,

on the Chicago division, 49 miles west of Cincinnati, to McCoy, 11 miles.

COPPER RIVER.—Close Brothers & Co., of Chicago and London, in conjunction with American and European capitalists, are building this road to develop the Bering Lake coal fields, the Copper river copper fields and the rich gold districts on the upper Tanana Valley and other sections in the interior of Alaska. The proposed route is from Cordova, Alaska, near a bay of the same name, east to the Copper river, thence north along that stream to a point north of Taral, about 135 miles. An extension is projected north through Copper Center, Chisna and Mentasta Pass to Tanana Junction on the Tanana river. Branches are projected also from a point just north of Taral east along the Chitana river to Bonanza Mine, and from a point near the mouth of the Copper river south and east to a point east of Bering Lake. The work now under way is being done by M. J. Heney, contractor for the White Pass Railway. A considerable amount of grading has been finished, and it is expected to commence track-laying shortly. The work is not very difficult. The line and gradients are favorable, maximum grade being under one-half of 1 per cent. There will be two large steel bridges, both over the Copper river. The permanent organization of the company will not be completed until the contractors turn over the line for operation. The White Pass & Yukon is not interested in this project.



Copper River Railway.

CUBA RAILROADS.—According to Sir William Van Horne, President of this company, about 250 miles of new lines, to develop the resources of the island, and to provide an independent connection to Havana, will be built this summer. About 180 miles of this work will be needed for the Havana line.

The House of Representatives has voted a subsidy of $500,000, which is at the rate of $6,000 per kilometer, for building a number of short railroads. It has been left to the President to decide which lines shall receive the subsidy, but it is said that most of the money will probably go to the Van Horne system. Protests have been filed by other companies who claim they can build these lines without subsidies, and that the amount granted is excessive.

DANBURY & PORT CHESTER.—Incorporated in New York, with $100,000 capital, to build from Salem Center, Westchester County, New York, east to Ridgefield, Conn., about seven and one half miles, thence south through Lewisboro and Poundridge, N. Y., to Highridge, Conn. J. G. Parker, E. G. Buckland, F. E. Hall, William Greenough and others, of New York, are incorporators.

EAST SIDE VIADUCT.—Incorporated in New York, with $50,000 capital, to build an elevated railroad from the terminus of the Harlem River branch of the New York, New Haven & Hartford at Willis avenue in the Borough of the Bronx, New York City, southward across the Harlem river and thence between First avenue and Avenue A to East 34th street in the Borough of Manhattan. It is proposed to build a six-track stone viaduct between Avenue A and First avenue and across Jefferson Park. The directors are: O. W. Barnes, of Fishkill, N. Y.; C. H. Cook, O. B. Nairs and L. C. Twombley, of New York, and F. H. Loomis, of Steubenville, Ohio. The southern terminus of this line is close to the Pennsylvania Railroad's underground line.

GRAND TRUNK PACIFIC.—Hogan & McDonald have sublet to M. P. Davis, of Ottawa, the building of 50 miles of line from the Cap Rouge bridge. Work is to be started at once.

A large contract for rock work on the section of this road east from Winnipeg has been let to Guy Campbell, of Ottawa.

J. D. McArthur, Winnipeg, has sublet work on the Winnipeg-Lake Superior section as follows: A. Herbert, 20 miles of prairie; W. Wardrop, 15 miles, and F. W. Smith, two miles of solid rock work.

During July the National Transcontinental will call for bids for the construction of the Quebec-Moncton section of this road. The commission has not yet decided which of the two routes will be used.

The McDonald-McMillan Co., Winnipeg, has started preliminary work on the Portage la Prairie-Winnipeg section. Construction work will be begun at once at a number of points on the section.

McIntosh Bros., of Petrel, Man., have secured a sub-contract on this road.

Location plans of new branches of the transcontinental system have been submitted to the Minister of Railways by the Grand Trunk Pacific. One of these is to run from Sudbury to Kashabowe, west of Port Arthur, 960 miles, where it will join the Canadian Northern. Another will run from Sudbury to Batchawaung Bay on Lake Superior, 170 miles. A third will run from Rumford on the Canadian Pacific west of Sudbury to the James Bay line. This branch is to take the ore deposits. The ore will be shipped either from Batchawaung Bay or Parry Sound.

GREAT BEND & GULF.—E. L. Peckham, of Denver, Colo., is the promoter of this company, which has applied to the Kansas Railroad Commission for authority to build from Hayes in Ellis County, Kansas, southeast to Arkansas City, 175 miles air line. It is intended to begin construction work next month.

GREAT NORTHERN.—A contract has been let to Campbell & Ferier, of Duluth, Minn., for building 80 miles of the Midland of Manitoba.

John Bradley, of Brandon, Man., has the contract for building the line from Brandon to the international boundary.

INDIANAPOLIS, COLUMBUS & SOUTHERN TRACTION.—W. G. Irwin, General Manager of this road, announces that a contract has been given to Howard Lee for grading work on 20 miles of the proposed extension south to Seymour. This extenson is to form one link in the proposed Indianapolis & Louisville Line. Work is to be started at once.

MACKENZIE-MANN ROADS.—In connection with the execution of their plans for the construction of a transcontinental system, Mackenzie & Mann presented to the Minister of Railways for approval a route map of a 560-mile stretch to the north of Lake Superior. The route they have chosen from Sudbury west is north of the Canadian Pacific main line, keeping at an average distance of about 20 miles all the way. It is to connect at a point called Kashaboine with the Canadian Northern's existing line just west of Port Arthur. The construction of this link around the north of Lake Superior would give Mackenzie & Mann a through line from Toronto to Edmonton. Plans are already before the government of the line that this company intends building through Ottawa to connect with Montreal and Quebec. The plan presented, on Monday, shows that they intend to build a branch line from Sudbury to Batchawaung Bay on Lake Superior. Their main line, north of Lake Superior, will keep to the north of the height of land which comes pretty close to the lake.

MINNEAPOLIS & ST. LOUIS.—An officer writes that the Minnesota, Dakota & Pacific, which is the western extension of this road in South Dakota, is to consist of two lines. The first is from Watertown, in Codington County, northwest via Bradley in Clark County, Conde in Spink County, and Aberdeen in Brown County, to Leola in McPherson County. The second is to be built from Conde in Spink County west via Mellette and Northville in the same county to Scranton in Potter County, thence to Lebeau. Grading is now in progress, but no track has yet been laid. The contractors are Winston Brothers Co., of Minneapolis. The ruling grades will be 0.5 per cent. and maximum curves 3 Deg. There will not be any important bridges or trestles. L. F. Day is President, and C. H. Kelly, Chief Engineer, both of Minneapolis, Minn. (May 25, p. 1555.)

MINNESOTA, DAKOTA & PACIFIC.—See Minneapolis & St. Louis.

MISSISSIPPI EASTERN.—This company, operating 12 miles of road in Mississippi, and now building an extension of five miles, intends to start work at once on an additional 10 miles.

NASHVILLE & HUNTSVILLE.—J. H. Connor, President of this road, denies that the road has been sold to the Atlanta, Birmingham & Atlantic. He says that the road will be built and operated as an independent railroad from Nashville, Tenn., via Birmingham and Montgomery to Pensacola, Fla. The company has been making surveys, and securing franchises, and ground for terminals during the past year, and is now about ready to let contracts for the

work. The new road will not have any connections with the A. B. & A., but will connect with other roads in Birmingham and Montgomery; and at Pine Hill, Ala., it will connect with the Mobile & Ohio, continuing south from Camden to Mobile through the Black Belt cotton section to Pensacola, where it has secured dock and terminal facilities. Entrance will be made into Nashville over the tracks of the Nashville Terminal Co., crossing the old Tennessee Central Belt line near Browns creek. It will use the same tracks and depot facilities as the Illinois Central and the Southern.

New York City Subways.—The Subway in Manhattan is now in operation to the northern terminus at 221st street, and the Broadway expresses run through from South Ferry to that terminus, about 14 miles. The station at 181st street has also been opened. This station is more than 100 ft. below the surface of the ground and has two large elevators. At 181st street connection is made with a new surface street car line running eastward from that station, crossing the Washington bridge and thence through 181st street to Fordham and beyond. This surface line is operated by the New York City Interborough Railway Company. This company is affiliated with the Interborough Rapid Transit Company, operating the Subway, and through tickets are sold over the two lines for eight cents.

The proposed west side subway, known as the Seventh and Eighth avenue route, has been approved by the Commission appointed last January by the appellate division of the Supreme Court, composed of Randolph Guggenheimer, Patrick A. Whitney and R. B. Moffat. The Commission reports that this subway should be built as soon as possible. The work would take about four years, and the cost would be about $41,000,000, and equipment would cost $15,000,000.

Northern Pacific.—A contract is said to have been let to A. Guthrie & Co., of St. Paul, to revise the line and grades, also to build a second track from Wadena Junction, Minn., where the double track at present ends, northwest for a distance of 87 miles to Moorehead, Minn.

Nova Scotia Eastern.—A new syndicate is petitioning the Legislature of Nova Scotia to extend the time for building this line from Halifax to Guysboro, with a branch line to or near New Glasgow to secure an outlet for the coal from the Pitcou collieries. An increase is also asked for raising the subsidy from $5,000 a mile to $12,000.

Oregon & Washington.—This company was recently incorporated in Oregon to build a railroad from Portland, Ore., north to Everett, Wash., 180 miles, air line. E. H. Harriman is President; J. D. Farrell, Vice-President; W. W. Cotton, General Counsel, and G. W. Boschke, Chief Engineer. Definite location surveys have not yet been made.

Organ Mountain.—This company has filed its charter in Texas. The capital is $100,000 and the office is at El Paso. The company is planning to build a railroad from El Paso to a mining district in the Organ Mountains of New Mexico, about 75 miles. The incorporators are: N. D. Streeter, of Philadelphia; Adriens A. Jones, of Las Vegas, N. Mex.; Harris Walthall, D. Y. Hadley, S. A. S. Cox, A. M. Walthall, H. W. Fall, W. S. Crombie, Dan M. Jackson, J. W. Eubank, all of El Paso.

Pan-American.—B. T. Davis, who has the contract for building the division of this road from Tonala, Mex., to the Guatamalan line, says that about 35 miles of the division have been graded and about 50 miles cleared.

Pennsylvania Lines West.—The Hickory branch of this road has been opened. It is from Burgettstown, Pa., on the Pittsburg division of the Pittsburg, Cincinnati, Chicago & St. Louis, to Cherry Valley, four miles. The Burgetts branch, from Burgettstown to Valcar, one mile, has also been opened.

St. Louis & San Francisco.—Surveys are being made by this company for extending the Arkansas Valley & Western from Avard, Okla., west through Beaver County to the New Mexico coal fields, touching Fort Supply and Beaver City. (See Atchison, Topeka & Santa Fe.)

St. Louis, Decatur & Champaign (Electric).—An officer writes that contracts have been let, but that no track has yet been laid on this proposed electric road from Champaign, Ill., southwest via Monticello and Decatur to Litchfield, about 125 miles. W. D. McKinley, of Champaign, is President, and W. H. Tarrant, of the same place, Chief Engineer.

San Francisco, Idaho & Montana.—This company, organized at Boise, Idaho, proposes to build a line from Butte, Mont., to Winnemucca, Nev. The directors, most of whom are eastern capitalists, it is said, have decided to at once begin the construction of the western section of the line. (See Construction Record.)

Schenectady & Southwestern.—Incorporated in New York, with $850,000 capital, to build from Margaretville in Delaware County, New York, on the Ulster & Delaware, northeast to Schenectady, about 60 miles, with a branch from Schenectady through Scotia to a connection with the Boston & Maine and the New York Central roads, and an additional branch from Schenectady to Rotterdam Junction. The directors are George P. Ford, George S. Fulton, Frederick J. Whan, of New York City; A. S. Brown, of Brooklyn, N. Y.; G. S. Hilton, of Paterson, N. J., and others.

Youngstown & Ohio River (Electric).—The proposed route of this road is from Salem, Ohio, east via Washingtonville, thence southeast via Leetonia, Lisbon and West Point to East Liverpool, Ohio, 34 miles. The company has already acquired six miles of track, from Salem to Washingtonville. The general contract for building the road has been given to the Cleveland Construction Co., Citizens' Building, Cleveland. The work will be rather difficult, the line being over a rough country. Maximum grades will be 2½ per cent. The plans for bridges have not yet been made. George A. Stanley, Electric Building, Cleveland, Ohio, is President, and W. E. Davis, Citizens' Building, Cleveland, Ohio, is Chief Engineer. (May 4, p. 138.)

RAILROAD CORPORATION NEWS.

Atlanta, Birmingham & Atlantic.—The Atlantic & Birmingham Construction Co., which is building the extension of the A. B. & A. to Birmingham, Ala., and Atlanta, Ga., has sold $8,000,000 5 per cent. 4 year collateral trust notes through a syndicate consisting of the Trust Company of America; Clark, Dodge & Co., New York, and the Old Colony Trust Co., Boston. The notes are secured by the deposit of $1,000,000 Brunswick Steamship Co. bonds; $1,000,000 Brunswick Steamship Co. capital stock; $1,206,000 A. B. & A. equipment notes; $3,000,000 capital stock of the Coal Company and the Iron Company; $6,000,000 A. B. & C. first mortgage bonds; $4,600,000 A. B. & A. preferred stock, and $10,000,000 A. B. & A. common stock. The sale of the notes will provide funds for the construction mentioned above and also for steamships, equipment, coal and iron purchases, shops and for tidewater terminals at Brunswick, Ga.

Brockville, Westport & Northwestern.—This company has passed into the control of E. R. Thomas and associates through the purchase by these interests of the United National Bank, which controlled the railroad company. The road runs from Brockville, Ont., to Westport, 45 miles, and has authorized $1,000,000 6 per cent. non-cumulative preferred stock and an equal amount of common. The bonded debt consists of 4 per cent. gold bonds of 1923 secured by a mortgage limited to $450,000.

Chesapeake & Ohio.—The Chesapeake & Ohio Railroad of Kentucky, the Kinniconick & Freestone, and the Big Sandy Railway Co., operating in all 349 miles, have been consolidated under the name Chesapeake & Ohio Railway Co. of Kentucky.

Erie.—This company, through its subsidiary, the Pennsylvania Coal Co., has bought the Clarabee Coal Co., whose annual output is about 100,000 tons and the Avoca Coal Co., whose output is 75,000 tons.

Pittsburg, Chartiers & Youghiogheny (P. C. C. & St. L. and P. & L. E.).—A meeting of the stockholders has been called for July 17 to approve an increase in the authorized capital stock from $1,000,000 to $1,500,000. This company owns 19 miles of road between Chartiers, Pa., and Beechmont. The $700,000 stock outstanding is owned jointly by the Pittsburg, Cincinnati, Chicago & St. Louis and the Pittsburg & Lake Erie, and these companies guarantee the $1,000,000 general mortgage 4 per cent bonds of 1932, of which $316,000 are outstanding.

St. Louis & North Arkansas.—This company, which owns 128 miles of road between Seligman, Mo., and Leslie, Ark., has been bought at foreclosure sale by D. R. Francis and associates. The St. L. & N. A. has $1,702,500 capital stock. Interest on the $3,065,500 outstanding 5 per cent. bonds of 1941 was recently defaulted.

Southern.—This company has sold $2,500,000 short term notes in London.

Twin City Rapid Transit.—This company, which operates all the street railways of Minneapolis, Minn., St. Paul and Stillwater, as well as interurban lines between the three cities, has authorized the issue of $2,100,000 additional common stock, making the total amount outstanding $20,100,000, there being $22,000,000 authorized. The holders of both preferred and common stock have the right to subscribe for this stock at par to the extent of 10 per cent. of their holdings.

Union Pacific.—This company has extended, until July 2, 1906, the right to exchange the first lien convertible 4 per cent. bonds into common stock. This right originally expired on May 1, 1906, and there are now $880,000 outstanding. Those that remain unconverted on July 2 will be called for redemption on Nov. 1, 1906, at 102½. (May 4, p. 138.)

GENERAL NEWS SECTION

NOTES.

The Cleveland, Cincinnati, Chicago & St. Louis has announced that it will not burden its conductors with bulletins describing lost or stolen tickets.

In the United States Court in Iowa, the Government has brought suit against the Chicago, Milwaukee & St. Paul for violations of the Safety Appliance law in using defective coupling or uncoupling apparatus on freight cars.

It is said that the Grand Trunk has abandoned its project of consolidating all the fast freight lines which run over its road. It appears that the Erie refused to be thus buried out of sight, and threatened to make a new alliance.

Vice-President W. C. Brown says that the New York Central Lines, meaning presumably all of the roads over which he exercises authority, moved during the month of May a larger number of loaded cars than ever before in one month, the total exceeding by 100,000 the total for the month of May, 1905.

Shipments of peaches have begun in Georgia for Northern cities. A railroad officer in Atlanta, said to be well informed, estimates that 5,700 carloads will be shipped from points in that State this year. The total number of cars sent out last year was 2,700. The largest crop hitherto was that of 1904, which amounted to 4,600 cars.

The State Railroad Commission of Kansas is issuing a new map of the state, and it is said that the number of towns shown on it is 100 less than on the last map published. This is due to the abandonment of small post offices in consequence of the introduction of rural free delivery, and also to the abandonment of some railroad stations, which is said to be due to the same cause.

The Illinois State Railroad Commission has finally issued a definite announcement in pursuance of its notice, promulgated about six months ago, threatening a general reduction in freight rates on the railroads of the state. The sixth class is reduced 10 per cent.; seventh class, 8 per cent.; wheat, grain, lumber, salt, coal and hogs, 10 per cent., and material reductions in the eighth, ninth and tenth classes.

In the United States District Court at Kansas City, June 11, the cases of the Government against the Chicago & Alton and the Chicago, Milwaukee & St. Paul for granting rebates on export shipments were dismissed, the District Attorney saying that he had become convinced that the railroads were not at fault in connection with the shipments on which the indictments were based. On June 12 four shippers—Cudahy & Co., Armour & Co., Swift & Co. and the Nelson Morris Packing Co.—were found guilty of accepting illegal rates. The jury deliberated one hour. On shipments of lard to Germany over the Chicago, Burlington & Quincy one of these shippers accepted a rate of 23 cents to the seaboard when the tariff was 35 cents. The offenses of the others were similar. Sentence was suspended until the completion of the trial of the Burlington road on charges based on the same transactions.

With the adoption of its summer time-table this week the New Haven road has restored the time of the through expresses which were made about 10 minutes slower last fall, and before, on account of the numerous delays at points where bridges were being renewed, and there are now running between New York and Boston every week day, each way, four trains which make the trip in five hours, and three which make it in 5 hrs., 30 min. Two of these last, the 12 o'clock and the 4 o'clock, go over the Boston & Albany, and the third, the 3 o'clock train, is quickened 40 minutes from its old time of 6 hrs., 10 min. This train runs by the Shore Line. Evidently, Mr. Mellen will never be so hardhearted as to compel a Boston passenger from New York to travel over the Boston & Albany unwillingly. The Fitchburg express now leaves New York at 3.53 p.m. and reaches Worcester at 8.24, or practically in the same time as that made by the Boston & Albany train leaving New York seven minutes later. The 9 a.m. train over the Boston & Albany now runs through in 6 hrs. and 1 min. The Mayflower Limited, the new 8 a.m., five-hour train, began business on Monday with three cars.

1,091 Baldwin Locomotives in Five Months.

In the first five months of this year the Baldwin Locomotive Works, Philadelphia, turned out 1,091 locomotives, or at the rate of 218 a month. In the first five months of 1905 the total production was 816 engines.

The Supply Men's Vaudeville.

On Friday evening, June 15, the Entertainment Committee, of which A. L. Whipple, of the Curtain Supply Co., is Chairman, will give an amateur vaudeville performance to members and guests of the convention. The performance will be given in the Music Hall, on the steel pier, at 9 o'clock. All the talent is identified with the railroad supply business, as may be seen from the programme, which follows.

MASTER CAR BUILDERS' CONVENTION, ATLANTIC CITY, N. J.

Supply Men's Amateur Vaudeville Performance.

PROGRAMME.

Overture

Ensemble.....Some of the Railway Supply Men
Mr. Herbert Self, Soloist.
(By courtesy of Crandall Packing Co.)

Monologue.....Miss Margaret Moir Currie
(By courtesy of Nathan Manufacturing Co.)

Illustrated Song.....Mr. John H. Thomas
(By courtesy of Standard Paint Co.)

COLONEL CARTERET, V. C.
A Dramatic Sketch in One Act by Seth Cook Comstock.

CAST.

Col. the Hon. Sir Robt. Carteret, V.C.....Mr. Jacob Wendell, Jr.
Sir John Middleton, M.P.....Mr. Evert Jansen Wendell.
Lieut. Robt. Carteret, 1st Hussars (Bobbie)...Mr. E. O. Power
Billings (Col. Carteret's Butler).....Mr. Howard M. Peck
Scene:—Room in Colonel Carteret's House, London.
Time:—During the Boer War.
(Produced by courtesy of Wendell & MacDuffie.)

A Singer of Popular Songs.....Mr. William Murray
(By courtesy of Jenkins Brothers.)

Character Stories.....Mr. Charles C. Pierce
(By courtesy of General Electric Company.)

The Merry Minstrel.....Mr. John Forsman
(By courtesy of Safety Car Heating & Lighting Co.

The Garlock Wizard.....Mr. E. Clinton Adams
"If you are satisfied with being mystified, you will be mystified until you are satisfied."
(By courtesy of the Garlock Packing Co.)

Informal Dancing.

Reeves American Band Orchestra.
Bowen R. Church, Leader.
Henry Frautzen, Accompanist.

Southern Pacific General Offices.

The Southern Pacific has leased for a term of years nine floors of the 12-story James Flood building at the corner of Market and Powell streets, San Francisco, for its general offices. These floors will be fitted up at once for the accommodation of the departments that were burned out in the Merchants Exchange building. The city ticket office, formerly at 613 Market street, will also be in this building, and the city ticket agencies of a number of the eastern railroads will probably take quarters on the ground floor of the same building.

Tracks in San Francisco.

An officer of the Ocean Shore writes that temporary tracks for removal of the debris from the burned district of San Francisco have been laid by the Ocean Shore, the Southern Pacific, the Atchison, Topeka & Santa Fe, and the United Railroads of San Francisco. These tracks cover the eastern district of the burned section. Storage bunkers will be located at convenient points along these tracks for receiving the discarded material, and to provide a rapid means for unloading cars. The four companies named above have united to carry out this work, and have put the several tracks and all equipment under one management, to be operated under the direction of the United Railroad which also directs the street car traffic. The discarded material is being used to fill in the Islais creek flats, the haul being about four miles. The amount to be moved is approximately 4,000,000 cubic yards. John B Rogers, Chief Engineer of the Ocean Shore, is in charge of the work.

Tinned Channel Pins.

A patent has recently been issued to Mr. E. W. Vogel, Signal Engineer of the Railroad Supply Co., Chicago, on a bonding or channel pin used in electrical signal construction, which is tinned or galvanized. Until recently channel pins, to prevent them from rusting and to insure a good contact, were copper plated. But often after a comparatively short time the bond wires would break off where they were in direct contact with channel pin and rail. The assumption was that this was due to ordinary processes or rusting. However, by careful investigations and tests, covering a long period of time, Mr. Vogel found that it was electrolysis which ate off these wires where they entered the rail. This was due to the fact that the copper plating of the channel pins and the zinc coating or galvanizing of the bond wire formed a combination with the damp atmosphere, making a miniature battery which would slowly and surely eat the bond wire in two. To overcome this it was necessary

to have the channel pin coated with a metal which is approximately of the same contact potential as the bond wire.

Tinned channel pins have now been in use for about two years, during which time it is said no cases of electrolysis have been found. The tinned channel pins have been recommended by the Railway Signal Association.

Accident Record—With Variations.

The locomotive belonging to the Continental Coal Company, of Tulsa, Ind. Ter., was blown into fragments Friday afternoon (May 25) by dynamite, presumably placed on the track by property owners adjoining the railroad tracks, who are opposed to its operation. The mines of the company are located about two miles from Tulsa and are connected with the town by a single track of railroad. Owners of property which is crossed by the track opposed its building and there has been much dissatisfaction over it ever since. Although the engine was blown to fragments the crew was not injured. F. W. Kassner, cashier of the First National Bank of Tulsa, has been placed under arrest under a charge of having participated in the affair. There is great excitement at Tulsa, and the people are all arming themselves.—*Oklahoman, Oklahoma City.*

The Effect of Sea Water on Concrete.

Mr. John Macaulay, General Manager of the Alexandra Docks & Railway, England, writes to the *Railway Gazette*, London, as follows: I have perused with considerable interest the article which apeared in your valuable paper on February 2, entitled "The Effect of Sea-Water on Concrete," and, with your kind permission, I should like to make a few remarks on certain aspects of the case which have not been touched upon.

The same omission occurs in all similar articles on this subject, and that is, the conditions under which the concrete was made prior to, and its condition at, the time it was immersed in the sea, are not stated.

As a rule concrete is used in two forms—either in large blocks moulded beforehand in the shape of artificial stone, or in blocks moulded *in situ* between tides.

With regard to the former, it takes but a short time, even for a layman inspecting a work where artificial stone blocks are made, to discover that the concrete is, generally, made very liquid and dropped into the moulding boxes without any attempt at punning, or solidifying sufficiently by ramming it in layers. The result is that a huge block is obtained in an extremely honeycombed condition, or the resulting state might aptly be described as "spongy."

It is generally known that excess of water has a tendency to kill cement and to prevent its being uniformly distributed in the body of the concrete. We also know that concrete which is not made fairly dry and vigorously rammed always contains cavities detrimental to the quality of the finished piece.

Blocks made as above described are allowed to set more or less rapidly, and in the case of the more voluminous blocks they are frequently used before the heart of the block is set at all. Those who have watched the lowering of such blocks under water will have probably noticed at times that for some hours after immersion bubbles of air were rising to the surface of the water producing that condition which justifies the term of "concrete sponge."

It will easily be perceived that in the case of blocks so moulded the sea-water, instead of being merely in contact with the skin of the concrete, penetrates into the interior of the blocks, where it sets up disintegration.

With regard to concrete blocks made *in situ*, the contractor is usually so preoccupied in getting as much concrete in a given space as he can between two tides, that in most instances the essential feature of punning in thin layers and welding them hard together is omitted, with the result again that sea-water is allowed to penetrate deeply into the concrete and begin its deleterious action before it has had time to crystallize or set hard.

Without doubting that some attention should be paid to the composition of the cement used, and that preference should be given to the quality which does not contain certain elements which have a tendency to be affected unfavorably by sea-water, more attention to the mechanical composition of the concrete is of even greater importance.

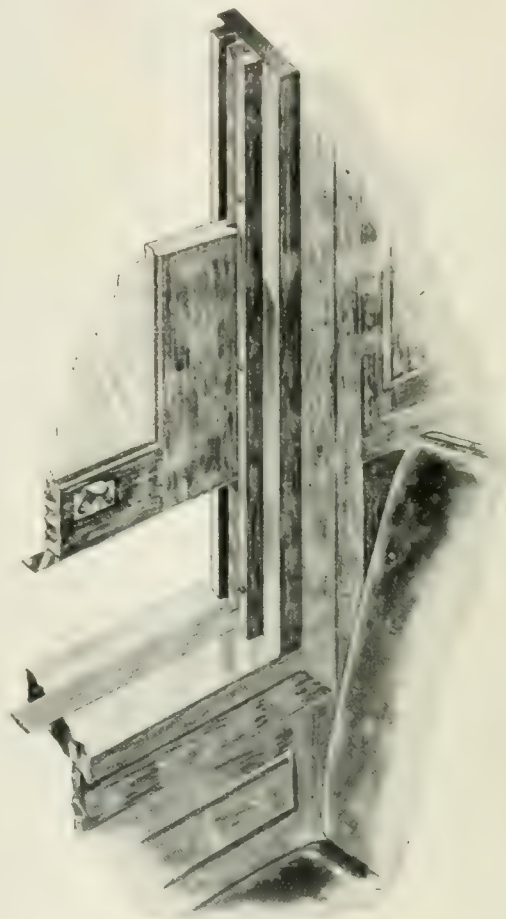
Everything depends upon the density of a block, and its imperviousness to the infiltration of sea-water can only be guaranteed by systematic ramming, which is best performed in thin layers, care being taken to secure a complete contact between successive layers.

In many heavy sea works which have given trouble, natural cement has sometimes been very largely used instead of good Portland cement.

In ferro-concrete work, where the concrete is used in comparatively small volumes, the most important members, namely, those which come in immediate contact with sea-water, such as piles, cylinders, etc., are prepared long before they are used in the works; they are also well punned. They are never used until the concrete has set perfectly, and, so far as experience goes in the particular kind of ferro-concrete work I have in mind—this, unfortunately, does not extend over a longer period than about eight years—it is stated that the works have not been found to be affected by sea-water, nor, in view of the great care taken with the preparation of the concrete, is it expected that they will suffer any deterioration from that cause.

The Acme Metallic Weather-Strip.

The metallic weather-strip for passenger car windows here shown is intended to displace rubber weather-strips. Being practically indestructible, it will last the life of the car. It is simple in form and is invisible when the window is closed. It is easily applied, requiring no special nails or screws; instead, it is slipped under the window casing, its edge being notched around the screws holding same. As appears from the illustration, the weather-strip fits into a groove in the edge of the window sash. It is claimed to be dust and weather proof, does not rattle, and prevents windows



The Acme Metallic Weather-Strip.

from falling in dry weather or sticking in damp weather. The material is brass and the cost of application is no greater than for other good weather-strips. It may be applied to old equipment as cheaply as to new. The Acme Supply Co., Chicago, is the maker.

The Farmer's Delight—The Interurban Railway.

1. He can go to town as easily as his neighbors, no matter how bad the weather.

2. He can have his produce taken to town and left with his grocer, in good weather or in bad, in busy season or in slack, and can have his grocer send back in same basket any groceries needed.

3. By putting in a spur he can load a car of grain, stock or fruit right on his farm without hauling it over long bad roads. He can buy a car of coal and have it delivered at his door.

4. By making arrangements to do so, can have the great metropolitan daily papers at his door, or near it every morning in time to read before breakfast.

5. Can go for the doctor, or take the sick one to the doctor, in comfort, without exposing him or her to the cold or bad weather, or to jolting over the roads.

6. Can visit towns a hundred miles away and return the same day with less trouble than he can now go to town to take the train.

7. Can sell off five or ten acre plats to parties for truck and fruit farms for three to five times as much per acre as his land will now bring.

8. Can turn all his farm into pasture, except 40 acres, and make twice as much producing milk, garden truck and small fruits which the electric car line will take to market every morning.

9. He can keep in close touch with the great world around

him, and enjoy the broadening influence which always accompany a more frequent intercourse. . . .

10. His children can be given the advantages of better schooling with little, if any, added costs; can visit the larger places and there enjoy their libraries and other public institutions, and it does more than all else to reconcile the farmer's children to staying on the farm. He and his family will live longer . . . than those whose only method of getting to town is by hitching up old "Dobbin" and splashing through the mud and rain, and snow, and heat, and dust.

11. In Indiana, Ohio and Michigan, where there are 3,706 miles of interurban road, the land along these lines has increased in value all the way from $10 to $100 per acre. It will do the same in Kansas. Do you want from $1,600 to $16,000 added to the value of your quarter section? If you do write to the representatives of the Southern Kansas Electric Railway, Light & Power Co., Chanute, which is now building 160 miles of interurban road.—*Leavenworth (Kan.) Times.*

TRADE CATALOGUES.

Ventilating Apparatus, Blowers, Etc.—A set of 10 publications has been received from the American Blower Co., Detroit, Mich., devoted to ventilating and blowing apparatus made by that company. Each bears a number. No. 189 is on "Steel Plate Fans." It is a 7 x 8¾, 82-page illustrated sectional catalogue on "A B C" fans for heating, ventilating and drying plants, forced and induced draft apparatus, etc. No. 190, on "Blowers," has 48 pages. No. 192 is a miniature on "A B C" "Dryers." No. 193, on "A B C" double enclosed high-speed self-oiling engines, Type E, is standard size, containing 11 pages. No. 194 on engines for small direct-connected generator sets, supplements Nos. 171 and 193. No. 195 describes the "A B C" "Economy" buffing hood, a new device for grinding and buffing wheels to recover the metal removed in grinding. The pamphlet No. 196, also 3⅝ x 6, describes "A B C" self-oiling engines. No. 200 is a 44-page illustrated sectional catalogue of the company's standard size, 7 x 8¾, on "Disc Ventilating Fans." Nos. 202 and 203 are on "Electric Disc Fans" and "Disc Ventilating Fans" respectively. They are two-leaf folders, 3⅝ x 6. All these publications are of the high standard of excellence characteristic of the advertising literature of this company.

Reinforced Concrete and Fireproof Construction.—The Trussed Concrete Steel Co., Detroit, Mich., is sending out in pamphlet form the advance sheets of Part I. of a volume entitled "Practical Calculation and Application of Reinforced Concrete." This first part is devoted to calculation. It is intended for the accurate and convenient use of practicing engineers and architects in calculating and designing reinforced concrete buildings. It contains formulae, tables, diagrams and drawings, and discusses the design of reinforced concrete beams, floor slabs, columns and footings and arch bridges. There are 31 pages.

Another pamphlet of equal size is on "Fireproof Construction." The contained matter is stated to be based on practical tests as set forth in official reports, including comments on the San Francisco disaster. Extracts from reports on the Baltimore fire are presented with illustrations, also an article on the fire resisting qualities of reinforced concrete. The contents are quite interesting. Both pamphlets are of pleasing design.

The Denver & Rio Grande has issued "A Glimpse of Utah, Where Health and Wealth Abound," an attractive booklet written by Edward F. Colborn. It treats of the early settlement of Utah; the Mormons and Gentiles; the natural wonders of the state; the wonderful climate, and Utah's growing cities and towns. The different resources and industries of the state are described under such heads as Agriculture, Fruit Growing, Stock and Wool Raising, Mining, Smelting and Manufacturing. The new Uintah Reservation, New Railroads and Hunting and Fishing also have short chapters. The book is illustrated by many excellent photographs.

Coal Mining by Machinery. This is the title of a little 16-page pamphlet of the Sullivan Machinery Co., Chicago. It contains a brief summary of the line of equipment made for this special purpose, each device being illustrated by a half-tone engraving. Where the device is more fully described in some bulletin or catalogue the proper reference is given.

Bulletin 48-F of this company now being distributed describes the Sullivan continuous coal cutter. It is fully illustrated and explains in detail the characteristics, merits and advantages of the device.

Mine and Quarry. The Sullivan Machinery Company, Chicago, has begun the publication of a quarterly bulletin or magazine bearing the above title. The object of the publication, as stated on the editorial page, is to familiarize its readers with the different classes of machinery made by the Sullivan Company. The initial number contains articles on "Rock Excavation at Panama," "Modern Methods at an Illinois Mine," "Diamond Drilling," "The Power Extension of the Chicago Drainage Canal," "Low Cost of Compressing Air for Drills," "Cleaving Granite by Compressed Air," and "Suggestions for Operation of Rock Drills." The magazine is 6 x 9, and its general style is excellent. The special front-cover design is printed in two colors, and the engravings and printing are of the best quality. The current number has 28 pages.

The Pioneer Limited.—The name of this famous train of the Chicago, Milwaukee & St. Paul furnishes the caption for an attractive publication by the passenger department of the road on the occasion of the meeting of the Federation of Women's Clubs in St. Paul, May 30 to June 7. Its four 7 x 11 pages contain a number of most artistic colored half-tones, and the letter-press is in brown. The front cover is printed in gold with an oval colored half-tone, in a gold frame, in the center.

Walschaert Valve Gear.—Record of Recent Construction, No. 55, issued by the Baldwin Locomotive Works, is devoted to a full description in detail of the Walschaert valve gear and its application to different types of locomotives. Special instructions for erecting and setting valves with this gear are given as well as a short discussion in regard to the advantages of the Walschaert gear over the Stevenson link motion.

Manufacturing and Business.

Nic Le Grand, formerly Manager Supply Department of the St. Louis Car Co., has resigned, to take effect July 1st. He will go into the railroad supply business.

The Newton Fire Brick Co., Albany, N. Y., makers of locomotive blocks and fire bricks, have just completed a new plant at Albany, near to and operated in conjunction with their old plant. The capacity is from 10 to 12 carloads per week.

The Buda Foundry & Manufacturing Co., Chicago, has opened a branch house in St. Louis, Mo., and also established a warehouse there to expedite shipments of orders originating in that territory. The new branch will be in charge of W. E. Marvel, formerly a traveling representative.

The Bettendorf Axle Co., Davenport, Iowa, has begun work on large improvements to its plants. An additional building, nearly as large as the present shop structure, is to be built and much trackage added in the yard. The work will include the diversion of a creek now running through the site of the new building.

David O. Holbrook, until recently Vice-President of The Pennsylvania Malleable Co. and The Central Car Wheel Co., has been elected Vice-President of The Dayton Pneumatic Tool Company, Pittsburg, Pa., maker of Green chipping and riveting hammers. He has opened an office at 717 Park building, Pittsburg.

Application has been made in Pennsylvania for a charter by the Westinghouse Consolidated Foundries Company, of Pittsburg, Pa. The object is for the various Westinghouse Companies, which now have foundries at Pittsburg, Allegheny City, Cleveland and Attica, N. Y., to have all their castings made in one factory, which is located at Trafford City, near Pittsburg. This plan is to assure greater economy and uniformity in the making of foundry products.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Railroad Detectives' and Special Agents' Association.

This association, with 200 or more members present, held a convention at Washington, D. C., last week, beginning June 5. At this meeting the following officers were elected: W. A. Humphrey (N. Y. C.), Albany, N. Y., President; L. L. Scherer (Chesapeake & Ohio), Vice-President; H. C. Lards (Lake Shore & Michigan Southern), Second Vice President; L. G. Crovier, Montreal, Third Vice-President, and C. H. Dawson, Aurora, Ill., Secretary and Treasurer. The Board of Managers consists of G. A. Ogline, Baltimore & Ohio; G. S. Fitzwater, Seaboard Air Line; W. G. Baldwin, Norfolk & Western; J. W. Connelly, Southern; W. E. Riley, Chicago & North-Western, and C. H. Dawson and W. A. Humphrey.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Baltimore & Ohio. G. H. Pryor, Special Accountant, has been appointed Auditor of Disbursements, succeeding G. B. Howerth, resigned, to go into other business.

Boyne City, Gaylord & Alpena. G. F. Moore has been appointed

Auditor, with office at Boyne City, Mich., succeeding Martin Reeder, transferred.

Chicago, Burlington & Quincy.—H. D. Foster, Auditor of Expenditures, has been appointed Auditor at Omaha, Neb., succeeding H. D. Allee, resigned, to go to another company. H. F. Evans succeeds Mr. Foster, with office at Chicago, Ill.

Chicago, Indianapolis & Louisville.—Byron Cassell has been elected Treasurer and Assistant Secretary, with office at Chicago, Ill., succeeding W. H. Lewis, deceased.

Grand Trunk.—A. A. Tisdale, who was recently appointed Assistant to the Fourth Vice-President, was born in 1874 at Mt. Vernon, Ont. His first railroad service was in 1889 as clerk in a freight office of the Grand Trunk at Hamilton, Ont. He remained in this office for three years, when he was made Secretary to the Chief Engineer of the Great Western, the Northern and Northwestern divisions of the same road. In 1896 he was made Secretary to the Chief Engineer to the whole road, and in 1899, Secretary to the General Superintendent. In 1902, he was appointed Secretary to the Manager, being promoted in a few months to the position as Chief Clerk to the Manager. From 1905 until his recent promotion he was Chief Clerk to the Fourth Vice-President.

Long Island.—David C. Green, Assistant Secretary, has been elected Vice-President, with office at Philadelphia, Pa.

Minneapolis, St. Paul & Sault Ste. Marie.—A. A. Bell has been appointed Auditor of Traffic Receipts.

Ohio River & Western.—G. P. Rogers has been appointed Auditor, with office at Woodsfield, Ohio, succeeding M. J. Howard.

Washington & Columbia River.—Joseph McCabe, Vice-President and General Manager, has resigned.

Operating Officers.

Boyne City, Gaylord & Alpena.—M. E. Hotchkiss has been appointed General Superintendent.

Central Vermont.—W. E. Mullins, Superintendent of Transportation, has resigned, to become General Manager of the Costa Rica Railroad.

Chicago, Rock Island & Pacific.—H. L. Reed has been appointed Superintendent at Eldon, Mo., succeeding J. F. Sugrue, transferred.

Georgia, Florida & Alabama.—D. F. Kirkland, Trainmaster, has been appointed Superintendent of Transportation, with office at Bainbridge, Ga.

Grand Trunk Pacific.—M. C. Sturtevant, formerly Car Service Agent of the Grand Trunk, has been appointed General Assistant on the Grand Trunk Pacific, with office at Winnipeg, Man.

Kansas City, Mexico & Orient.—A. H. Dickinson, Assistant Superintendent, has been appointed Superintendent, with office at Wichita, Kan., succeeding J. A. Foley, deceased.

National of Mexico.—H. H. Allison has been appointed Superintendent of Terminals at the City of Mexico, succeeding D. R. Caffey, transferred.

Pennsylvania.—The office of A. P. Gest, Superintendent of the Belvidere division, has been moved from Lambertville, N. J., to Trenton.

Philadelphia, Baltimore & Washington.—The duties of the Superintendent of the Delaware division, formerly performed by R. L. Holliday, who died recently, have been taken over by E. F. Brooks, General Superintendent.

Wabash.—D. I. Forsyth, Acting Superintendent of Transportation, has been appointed Superintendent of Transportation, with office at St. Louis, Mo.

Traffic Officers.

Beaumont, Sour Lake & Western.—A. V. Holmes, General Freight and Passenger Agent, has been appointed Superintendent and Traffic Manager.

Boston & Albany.—W. M. Skinner has been appointed General Baggage Agent, with office at Albany, N. Y.

Boyne City, Gaylord & Alpena.—G. F. Moore has been appointed Traffic Manager, succeeding H. H. Denison, resigned.

Chicago, Burlington & Quincy.—A. L. West has been appointed Assistant General Freight Agent at St. Joseph, Mo., succeeding William Fitzgerald, Jr., resigned.

Erie.—C. S. Ingersoll has been appointed Suburban Passenger Agent, with office at New York, succeeding E. H. Barto.

Kansas City Southern.—C. E. Perkins, Assistant General Freight Agent at Texarkana, Tex., and General Freight Agent of the Texarkana & Fort Smith, has been appointed Assistant General Freight Agent at Kansas City, Mo. R. R. Mitchell, General Agent at Shreveport, La., succeeds Mr. Perkins.

Texarkana & Fort Smith.—See Kansas City Southern.

Engineering and Rolling Stock Officers.

Beaumont, Sour Lake & Western.—B. B. Gordon has been appointed Chief Engineer, succeeding M. A. Hanson, resigned.

Chicago, Indiana & Southern.—Byron Layton has been appointed Engineer of Maintenance of Way, with office at Hammond, Ind. W. R. Sanborn, Assistant Engineer, has resigned.

Chicago, Rock Island & Pacific.—W. L. Harrison, Master Mechanic at Horton, Kan., has been appointed Acting Superintendent of Motive Power at Chicago, Ill., succeeding J. P. Kilpatrick.

Denver & Rio Grande.—Arthur Ridgeway has been appointed Acting Engineer of Bridges and Buildings, with office at Denver, Colo., succeeding W. A. Morey.

Long Island.—G. C. Bishop has been appointed Superintendent of Motive Power and Equipment, with office at Richmond Hill, N. Y., succeeding Phillip Wallis.

National of Mexico.—C. L. Walker, Master Car Builder, has resigned.

Pere Marquette.—E. K. Woodward, Principal Assistant Engineer of the Wabash, has been appointed Chief Engineer of the Pere Marquette, succeeding J. F. Deimling, resigned, to go to another company.

Wabash.—E. M. Merriwether, Engineer of Maintenance of Way at Moberly, Mo., has been appointed Principal Assistant Engineer, with office at St. Louis, Mo., succeeding E. K. Woodward, resigned. J. T. Sheahan, master carpenter at Moberly, succeeds Mr. Merriwether. (See Pere Marquette.)

Purchasing Agents.

Georgia, Florida & Alabama.—R. L. Uzzell, Assistant to the President, has been appointed Purchasing Agent, with office at Bainbridge, Ga.

Wabash.—C. A. How, Acting Purchasing Agent, has been appointed Purchasing Agent, with office at St. Louis, Mo.

LOCOMOTIVE BUILDING.

The Wisconsin Central, it is reported, has ordered 10 locomotives from the American Locomotive Co.

The Temiskaming & Northern Ontario has ordered two switching locomotives from the Canadian Locomotive Co., for October delivery.

The Lima Locomotive & Machine Co. report the following orders for Shay locomotives for the week ending June 9: Pidgeon River Lumber Co., Pidgeon River, N. C., one 15 x 20 Prairie type locomotive; United States Leather Co., Medford, Wis., one 28-ton locomotive; Germain-Boyd Lumber Co., Atlanta, Ga., one 37-ton locomotive; Tremont Lumber Co., Tremont, La., two 55-ton locomotives; Bering Manufacturing Co., Houston, Tex., one 37-ton locomotive; Thornton & Alexandria Ry. Co., Thornton, Ark., one 14 x 20 ten-wheel locomotive, and Malvern Lumber Co., St. Louis Mo., one 33-ton locomotive.

The Macon, Dublin & Savannah, as reported in our issue of June 1, has ordered one simple switching locomotive from the Baldwin Locomotive Works, for July delivery. This locomotive will weigh 100,000 lbs.; cylinders, 18 in. x 24 in.; diameter of drivers, 50 in.; straight top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,474.6 sq. ft.; 186 tubes, 2 in. in diameter and 14 ft. long; firebox, $71^{11}/_{16}$ in. x $34^{6}/_{16}$ in.; grate area, 17.12 sq. ft., and tank capacity, 2,500 gallons. The special equipment includes: Westinghouse-American air-brakes, magnesia sectional boiler lagging, Tower couplers, Monitor injector, U. S. metallic piston rod packings, Ashton safety valve and steam gages, Watters sanding devices, Nathan sight-feed lubricators, and Baldwin springs.

The Western Allegheny has ordered one consolidation (2-8-0) locomotive from the American Locomotive Co., for August delivery. This locomotive will weigh 202,000 lbs., with 180,000 lbs. on drivers; cylinders, 22 in. by 30 in., and drivers 54 in. in diameter. The boiler will be 80 in. in diameter, with a working steam pressure of 200 lbs. There will be 339 tubes, 2¼ in. in diameter, and 14 ft. 10 in. long; firebox, 120 in. by 40 in.; tank capacity, 7,000 gallons, and coal capacity, 1,300 tons. The special equipment includes: Westinghouse air-brakes, hammered iron or steel axles, Keasbey & Mattison magnesia sectional boiler lagging, Lappin brake-shoes and couplers, two Dressel herculean 5 in. lens headlight, Ohio injector, Chicago bull's-eye sight-feed lubricators, Union springs, and Ashton steam gages.

The Mobile & Ohio, as reported in our issue of May 18, has

ordered 10 simple 10-wheel (4-6-0) locomotives and five simple six-wheel switching (0-6-0) locomotives from the Baldwin Locomotive Works, for October delivery. The 10-wheel locomotives will weigh 170,000 lbs., with 130,000 lbs. on the drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 68 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,944 sq. ft.; 361 Detroit seamless steel tubes, 2 in. in diameter and 15 ft. long; Otis steel firebox, 120$^{3}/_{16}$ in. x 41$^{7}/_{16}$ in.; grate area, 34.3 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 15 tons. The switching locomotives will weigh 138,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; straight top boiler, with a working steam pressure of 200 lbs.; heating surface, 1,919.2 sq. ft.; 325 Detroit seamless steel tubes, 2 in. in diameter and 10 ft. 5 in. long; Otis steel firebox, 108$^{3}/_{16}$ in. x 41$^{7}/_{16}$ in.; grate area, 30.8 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, eight tons. The special equipment for both includes: Westinghouse air-brakes, Otis steel axles, Western bell ringer, Johns asbestos boiler lagging, Damascus brake-beams, Perfecto and Streeter brake-shoes, Gould couplers, Pyle-National headlights, Ohio injector, Ajax journal bearings, U. S. piston rod packings, Richardson valve rod packings, Consolidated safety valve, Leach sanding devices, Railway Steel-Spring Co.'s springs, Ashton steam gages, Safety steam heat equipment, Midvale driving, truck and tender wheel tires for passenger locomotives, and Paige truck wheel tires and Midvale tender wheel tires for switching locomotives.

The Seaboard Air Line, as reported in our issue of June 8, has ordered ten 10-wheel (4-6-0) passenger locomotives, and ten 10-wheel (4-6-0) freight locomotives from the Baldwin Works, and twenty 10-wheel (4-6-0) freight locomotives from the American Locomotive Works. All the locomotives are simple. The freight locomotives will weigh, including the tender, 265,050 lbs., with 125,300 lbs. on the drivers; cylinders, 19 in. by 28 in.; drivers, 60 in. in diameter. The passenger locomotives will weigh, including tender, 269,090 lbs., with 132,610 lbs. on drivers; cylinders, 20 in. by 28 in.; drivers, 67 in. in diameter. Other specifications for all locomotives are: Wagon top boiler, with a working steam pressure of 200 lbs.; 328 steel tubes, 2 in. in diameter and 14 ft. 1⅞ in. long, with a heating surface of 2,645 sq. ft.; firebox, 108 in. by 41¾ in., with a grate area of 31 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, 10 tons. The special equipment for all locomotives includes: Westinghouse high-speed air-brakes, Machinery steel axles, Magnesia Sectional boiler lagging, Monarch Seaboard Air Line brake-beams, cast-iron brake-shoes, Tower steel couplers, Monitor injectors, Bronze journal bearings, U. S. Multi-Angular piston rod packings, Soapstone or Garlock valve rod packing, one open consolidated and one Coale's muffled safety valve, Leach sanding devices, Nathan sight-feed lubricators, Seaboard Air Line standard springs, Ashcroft or Starr steam gages, and steel driving wheel tires. For passenger locomotives, Pyle National Electric headlights, New York Safety steam heating equipment and steel truck and tender wheel tires. For freight locomotives, Seaboard Air Line standard headlights, cast-iron truck and tender wheel tires.

CAR BUILDING.

The Intercolonial is in the market for 200 flat cars.

The Missouri River & Northwestern will soon be in the market for flat and box cars.

The Hocking Valley, it is reported, will shortly place orders for upwards of 3,000 freight cars.

The New York Central & Hudson River has ordered 1,500 gondola cars from the Pullman Co.

The Armour Car Lines are building at their shops the last 400 cars on their total order of 1,000 40-ft. fruit cars.

The Mexican International has ordered 100 stock cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The National R. R. of Mexico has ordered 50 stock cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Knickerbocker Ice Company, Chicago, has ordered 50 gondola cars from the Pullman Co., to be built on New York Central specifications.

The Cincinnati Northern denies having ordered 20 closed cars for electric service from the Cincinnati Car Co., as reported in our issue of June 8th.

The Harriman Lines have ordered for the Southern Pacific 15 baggage cars from Barney & Smith and four observation smoking cars from the Pullman Co. for use on the Golden State Limited. All cars are for October delivery.

The Texas Central has ordered one coach and twenty 60,000 lbs. capacity flat cars from the Hicks Locomotive & Car Works. The flat cars will be 36 ft. long and 8 ft. 9 in. wide, over all. The special equipment includes: Westinghouse air-brakes, Tower couplers and Hinson draft rigging.

The Gulf & Ship Island has ordered 40 Hart convertible ballast cars of 80,000 lbs. capacity from the Rodger Ballast Car Co., for September delivery. The special equipment includes: American Steel Foundries bolsters, Lappin brake-shoes, Westinghouse brakes, R. E. Janney couplers, Miner draft rigging, Republic Railway Appliance Co.'s dust guards, Symington journal boxes, Simplex Railway Appliance Co.'s springs and American Car & Foundry Co.'s wheels.

The Panama Railroad has ordered three first-class passenger cars and 10 second-class passenger and four combination baggage and mail cars from the American Car & Foundry Co. for December delivery. All these cars will be 5 ft. gage, 61 ft. long, 10 ft. 4½ in. wide, and 6 ft. 10 in. high. They will be built of wood. The special equipment will include: M. C. B. steel axles, Streeter steel back brake-shoes, Westinghouse brakes for first-class passenger cars, and Janney-Buhoup couplers.

The Erie, as reported in our issue of June 8, has ordered 100 Hart convertible cars of 100,000 lbs. capacity from the Rodger Ballast Car Co., for January, 1907, delivery. These cars will weigh 43,000 lbs. and will be 40 ft. long, 8 ft. 8 in. wide, and 3 ft. 6 in. high, all inside measurements. They will be of wood, with steel underframes. The special equipment includes: Steel axles, Common-sense bolsters, Climax M. C. B. brasses and journal bearings, Miner tandem draft rigging, and American Car & Foundry Co.'s wheels.

The Spokane & Inland has ordered from the J. G. Brill Co. six combination baggage, smoking and passenger cars 58 ft. 8¾ in. long, 8 ft. 11 in. wide over sills and sheathing, 13 ft. high from rail over trolley board; six passenger motor cars 41 ft. long, 8 ft. 11 in. wide, and 13 ft. high, all outside measurements; six trailers, with observation ends, 41 ft. long by 8 ft. 11 in. wide and 13 ft. high, all outside measurements, and six express cars 50 ft. long and 8 ft. 6 in. wide, outside measurements.

The Brooklyn Rapid Transit has ordered 50 convertible passenger cars from the Jewett Car Co., and the same number from the Laconia Car Co. These cars have a seating capacity for 48 passengers. They will be 30 ft. 7¼ in. long, 7 ft. 7 in. wide, and 7 ft. 8⅜ in. high, all inside measurements. The body will be of wood, with ⅜ in. by 17 in. steel plate sides, and the underframes will be of wood. The special equipment includes: Buffalo Brake-Beam Co.'s brake-beams, Lappin brake-shoes, Curtain Supply Co.'s curtain fixtures, J. L. Howard & Co. door fastenings, double slide doors, Gold heating system, Symington journal boxes, vestibule platforms without side doors, B. R. T. standard monitor roofs, and Schoen solid rolled steel wheels.

The Seaboard Air Line, as reported in our issue of June 8, has ordered 1,000 box cars of 80,000 lbs. and 1,000 gondola cars of 80,000 lbs. capacity. The box cars will weigh 38,600 lbs., and will be 36 ft. long, 8 ft. 6 in. wide and 7 ft. 6 in. high, inside measurements, with wooden body and steel underframes. The gondola cars will weigh 36,600 lbs., and will be 37 ft. 6 in. long, 8 ft. 7 in. wide, and 8 ft. ⅜ in. high, all inside measurements, with wood and metal bodies and underframes. The special equipment up above includes: Open hearth steel axles, Pressed Steel bolsters, Seaboard Air Line standard brake-beams, cast-iron brake-shoes, Westinghouse brakes, Tower steel couplers, Seaboard Air Line standard draft rigging, wood dust guards, Symington journal boxes, Seaboard Air Line standard paint, springs and trucks; Dayton door fastenings, Seaboard Air Line standard doors, and Chicago old steel roofs for box cars.

BRIDGE BUILDING.

COLORADO SPRINGS, COLO. The Canon City & Royal Gorge Interurban Railway Co. has given contracts to the Bullen Bridge Co., of Pueblo, Colo., for putting up 15 iron bridges on its proposed line, now building to the top of Royal Gorge. The 150 ft. suspension bridge over the chasm, 2,800 ft. above the Arkansas river, may be built during the present summer.

EL PASO, TEX. Plans are being made by the Texas & New Orleans for building a viaduct in the east end of the city.

MICHIGAN CITY, IND. The County Commissioners have approved the plans for the proposed bascule bridge for the harbor at Franklin street, and bids are to be asked for shortly. The cost of the work will be about $36,000.

MINERAL WELLS, TEXAS. A contract has been let by the Commissioners' Court to John L. Moore for putting up three steel bridges at a cost of $12,300.

MUSKOGEE, IND. T. Plans are being made for building a new bridge over the Arkansas river at Hyde Park, between Muskogee and Fort Gibson. The bridge is to be 1,300 ft. long, 50 ft. above

low water mark, and is to carry street cars. There will be approaches on each end of 1,000 ft. long.

Norfolk, Va.—The Harbor Board will take applications from the Norfolk & Western to build bridges over the east and south branches of the Elizabeth river to replace the present structure. The War Department has already granted permission to build these bridges.

Roanoke Rapids, N. C.—The stockholders of the Roanoke Rapids Bridge Co. at a recent meeting let a contract to the Roanoke Bridge Co., of Roanoke, Va., for building a steel and concrete toll bridge, with approaches over the Roanoke river. The cost of the work will be about $25,000.

Vicksburg, Miss.—Plans are now under consideration for building a stone arch over the Alabama & Vicksburg tracks at Cherry street.

Other Structures.

Allouez, Wis.—The Great Northern, it is said, will rebuild No. 1 ore dock and make it a duplicate of No. 2. The cost of the improvement is to be about $1,000,000.

Birmingham, Ala.—The Alabama & Western has given a contract to the Leonard-Martin Construction Co., of Chicago, for putting up a new brick and steel skeleton freight house, two stories high, 30 ft. by 342 ft., to cost $30,000, at Second avenue and Sixteenth street.

Hagerstown, Md.—The Western Maryland will start work soon on new brick and steel shops, to include a blacksmith shop 50 ft. by 80 ft., repair shop 100 ft. by 240 ft., and a power plant 40 ft. by 40 ft., to cost, exclusive of the machinery, $75,000. Bids are now being received for the work at the office of the principal Assistant Engineer at Baltimore.

Moncton, N. B.—Bids are wanted June 23 by the Intercolonial, for building the first of its new car and machine shops to replace those destroyed by fire. The first building to be put up is to be a reinforced concrete car repair shop 630 ft. long by 132 ft. wide.

New Orleans, La.—Work is shortly to be started on the New Orleans Terminal Co.'s passenger station at Basin street. It will cost about $175,000.

Portsmouth, O.—J. P. Pettijohn & Co., of Lynchburg, Va., have been given a contract by the Norfolk & Western for putting up a new brick coach shop 66 ft. by 304 ft., to cost $16,500.

San Francisco, Cal.—The Atchison, Topeka & Santa Fe has let contracts and work is now under way on its two large freight sheds at China Basin. The cost of the work will be about $300,000.

Seattle, Wash.—The Northern Pacific will build a modern wharf and warehouse to replace the burned Arlington wharf.

Springfield, Ill.—The C., C., C. & St. L., it is said, will soon put up large car shops on a 24-acre tract of land near Lagonda. It is said that $500,000 has been appropriated for these improvements.

Syracuse, N. Y.—The Delaware, Lackawanna & Western has begun work on West Fayette street on a big coal trestle; estimated cost about $50,000.

Toledo, Ohio.—The Lake Shore & Michigan Southern, it is said, will build a large engine house and some shop buildings at a cost of about $500,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alaska Pacific Railway & Terminal.—Dr. M. W. Bruner, of Alaska, the promoter of this company, incorporated to build from Controller Bay in Alaska through the Copper River country to Eagle City, about 450 miles, states that survey maps have been filed, and that construction work is to be started during the present year.

American Hayti Co.—Incorporated in New Jersey, with a capital of $3,000,000, to build railroads in the republic of Hayti. The incorporators are A. S. Longbottom, William J. Merrill and Robert F. Bonner, all of Philadelphia.

Arizona Midland.—The directors and stockholders of the Lake Superior & Arizona Mining Co., of Arizona, have organized a company under this name, with $500,000 capital, to build a railroad to connect the mine at Superior, Ariz., with the Gila Valley, Globe & Northern, about 28 miles. John T. Reeder, Chief Clerk of the Tamarac & Osceola Mining Co.; J. D. Cuddihy, A. W. Kerr, all of Calumet; H. L. Baer, of Hancock, and others are interested.

Boston Elevated.—There is pending in the Massachusetts Legislature (the House), not having passed the Senate, a bill to permit the Boston Elevated Railway Company to build subways in Cambridge. Under former legislation, the company has a right to build an elevated road in Cambridge. Since that legislation was passed, the people of Cambridge have changed their attitude and have made certain concessions to the company whereby it agrees to build a two track subway instead of an elevated road. The company must begin to build within a year in order to preserve its rights under the act permitting an elevated road. The main route for the proposed subway is for the tracks to cross the new West Boston bridge (not yet open to travel) from the Boston to the Cambridge side of the Charles river, and then become a subway under Main street and Massachusetts avenue to Harvard Square. This is the route of the heaviest travel between Boston and Cambridge and cars would land passengers close by Harvard University. A short travel to Brattle Square is included. There is provision for subsequent construction from Central Square in Cambridgeport, which is about a mile east of Harvard Square, southwesterly under River street toward Brighton. Further provision is made for subsequent construction around the west side of Harvard University grounds and back easterly on Cambridge street to Boston, crossing over the new Charles river dam (which will be built with provision for a driveway on its broad surface and further room for car tracks on its downward slope), thence up Leverett, Brighton, Lowell and Causeway streets, by the north union station, and to a connection with the present elevated structure and the new Washington street subway, now under construction. Provision is also made for an extension of the subway in Cambridge under Webster avenue toward Somerville, so that that city can be included in the system eventually. The lines under Cambridge street, River street and Webster avenue may, under the terms of the bill, be begun at the option of the company any time within four years after the Main street line is put in operation. A referendum is permitted to the company on the acceptance of the act, but none is given to the city of Cambridge. After 20 years the city of Cambridge shall have the right (or before that time by agreement with the company) to buy the property, upon payment of the cost of construction and 7 per cent. simple interest per annum, deducting any dividends paid to the stockholders.

Buffalo, Lake Erie & Niagara.—An officer writes that contracts are to be let as soon as a certificate has been granted by the New York State Board of Railroad Commissioners. The company proposes to build a connecting railroad around and just outside of the city of Buffalo, and to Tonowanda, passing through West Seneca, Hamburg, Cheektowaga, Amherst and Tonawanda; total length about 36 miles. The work will include about 3,000,000 cubic yards of embankment made from borrow pits, and 500,000 cubic yards of cuts; double-track to be laid and ballasted, bridges built on concrete foundations, and the necessary terminals, tracks and buildings. There is also to be a breakwater 4,800 ft. long, and a harbor, docks and slips. The maximum grades will be 1.14 per cent., and maximum curves of 10 per cent., though mostly 6 per cent. The bridge work includes 14 railroad bridges, three for use of electric cars, and 37 highway bridges. There will be five smaller bridges over streams, 18 farm bridges, 13 culverts, two pile trestles and one frame trestle. Edward Michael, 618 Mooney building, is President, and C. C. Conkling, 798 Ellicott avenue, Chief Engineer, both of Buffalo. (June 1, p. 160.)

California & Oregon Coast.—An officer writes that prospects of building this road are very good. The proposed route is from Grant's Pass, Ore., on the Southern Pacific, southwest to Takilma via Loves, Wilderville, Selma and Kerby, 45 miles. Contracts for grading are to be let about the first of next month. The work is fairly light. The maximum grades are 2 per cent. and the maximum curvature is 8 deg. There will be one tunnel 730 ft. long, two bridges and 25 trestles. J. O'B. Gunn, Mechanics Savings Bank, is President, and J. W. M. Draper, Chief Engineer, San Francisco, Cal. (April 13, p. 114.)

Chicago, Burlington & Quincy.—An extension of the Lincoln division has been opened for business from Fremont, Iowa, northward to Hodge, 46.4 miles.

Chicago, Rock Island & Pacific.—The Chicago, Rock Island & Pacific Railway as lessee, effective June 1, operates as the Louisiana division of its Choctaw district that portion of the Rock Island, Arkansas & Louisiana Railroad between Haskell and Fordyce, Ark., and the line formerly known as the Arkansas Southern Railroad, whose northern terminus is at Eldorado, Ark., and which has now been extended southward as far as Grant, La.

Columbus, New Albany & Johnstown Traction.—This company, operating a line from Columbus, Ohio, northeast to Gahanna, about nine miles, proposes to extend its line from the latter place to Johnstown, 17.5 miles additional. W. D. Brickell, Despatch Building, Columbus, is President.

Delaware & Hudson.—An officer writes respecting the connecting line under construction from Rouse's Point, N. Y., to St. Constant, Que., on the Canadian Pacific, that this company is not build-

ing the line, but that it is being built by the Napierville Junction Railway Co., of Rouse's Point, N. Y. (June 1, p. 161.)

DURHAM & CHARLOTTE.—This road, which runs from Gulf, N. C., on the Southern, to Star, 34 miles, has been extended from Star, N. C., to Little River, 3 miles.

DURHAM & SOUTHERN.—This road now runs from Dunn, N. C., west to Durham, 60.7 miles, having been recently extended from Apex, N. C., northwest to Durham, 20.3 miles.

FLINT RIVER & GULF.—This new road has been opened for traffic from Ashburn, Ga., southward to Bridgboro, 32 miles. J. S. Betts, Ashburn, Ga., is President.

GEORGIA, FLORIDA & ALABAMA.—The Quincy extension, which runs from Havana, Fla., westward to Quincy, 11.3 miles, has been opened for business. (May 18, 1906.)

GREAT NORTHERN.—On Tuesday, June 12, the last rail was laid on the Sioux City-Ashland connection with the Burlington. (See Construction Record.)

HILLCREST RAILWAY, COAL & COKE.—The bill to incorporate this company was ordered to be reported by the Railroad Committee. It proposes to incorporate a company with a capital of $500,000, and bonding powers to the extent of $30,000 a mile to build a railroad from Morrisey, B. C., via Crow's Nest Pass to Hillcrest Junction, on the Canadian Pacific, and Cardston, Alberta, with branch lines to Pincher Creek, and to certain local coal and oil fields.

HUDSON RIVER & EASTERN TRACTION.—The New York State Board of Railroad Commissioners on June 11th granted a certificate of public convenience and necessity to this company to build from Ossining (Sing Sing), N. Y., east through Briarcliff Manor and Pleasantville to Sherman Park, nine miles.

JONESBORO, LAKE CITY & EASTERN.—The Osceola branch of this road, running from Dell, Ark., to Osceola, 19.5 miles, together with a two-mile branch from this line to Luxora, have been opened for traffic.

LAS VEGAS & TONOPAH.—This road is now in operation for 73 miles from Las Vegas, Nev., on the San Pedro, Los Angeles & Salt Lake, via Indian Springs to a point called Johnnie.

LEE COUNTY.—Incorporated in Illinois with $10,000 capital to build a line from Nachusa west to Nelson, 13 miles. Both these places are on the Chicago & North-Western, and the new line is to be built to shorten the road between the places named. It is to be known as the Nelson cut-off. The incorporators are C. & N.-W. men, viz.: J. M. Whitman, M. Hughitt and J. B. Redfield, of Chicago; W. A. Gardner, of Evanston, and H. R. McCollough, of Lake Forest, Ill.

LEROY & SOUTHERN.—Incorporated in Illinois, with $2,000 capital and office at Bloomington, to build a line from Leroy in McLean County, southwest to Waynesville in Dewitt County, 25 miles. The incorporators are: A. H. Shelby and J. A. Taylor, of Bloomington; A. Hinton and L. A. Hinton, of Normal, and G. W. Shelby, of Wapella.

LIVE OAK, PERRY & GULF.—The Live Oak, Perry & Gulf Railroad now runs from Live Oak, Fla., to Hampton Springs, 49 miles, an extension having been put in operation from Perry, Fla., to Hampton Springs, 5 miles. Also a branch has been completed and opened for business which runs from Mayo Junction westward to Mayo and Alton, 14.3 miles.

MANILA RAILROAD.—Incorporated in New Jersey with $100,000 capital by R. Schuster, of Speyer & Co.; W. F. Taylor and J. Rattray, of Hasbrouck Heights, N. J. Speyer & Co. have taken a contract to build railroads in the Philippine Islands, and it is believed that this company has been organized to carry out this work.

NAPIERVILLE JUNCTION RAILWAY. See Delaware & Hudson

NEW YORK CITY RAPID TRANSIT ROUTES.—The Commissioners appointed by the Appellate Division of the Supreme Court, composed of James A. Donnelly, Paul L. Kiernan and Julius C. Kreiel have filed a report favoring the construction of the proposed Van Cortlandt Park Rapid Transit route. The proposed route is an extension of the present west side subway system from Broadway, at 230th street, in the Bronx, north along Broadway to a point beyond 242d street and opposite the entrance to the park. This is to be an elevated structure, and will cost about $710,000.

PITTSBURG & LAKE ERIE.—A contract has been given by this company to the Midland Steel Co., of Pittsburg, for the steel to be used on an extension of its road west to Midland, Pa.

PITTSBURG & TUBE CITY.—A franchise has been asked for in Pittsburg, Pa., by this company, which proposes to build a terminal line giving entrance to Pittsburg, to the Erie, the Pittsburg, Shawmut & Northern and other roads. The proposed route is from Try street and Fourth avenue east to the city line. Charles S. Cameron is chief promoter of the line, and former Senator Lee, counsel for the company; the latter says that the new line is to be an independent passenger and freight line, between Pittsburg and McKeesport. The cost of the work will be about $6,000,000. Plans and surveys have all been completed.

PITTSBURG SUBWAY.—Ordinances will be introduced in the Pittsburg Council during the present month authorizing this company to build a tunnel from Oliver avenue and Smithfield street to Center avenue near Luna Park, where connection is to be made with surface lines. The company proposes to spend about $20,000,000.

PITTSBURG, WESTMORELAND & SOMERSET.—This road has been opened from Somerset, Pa., northwest to Ligonier. Connection is made at the latter place with the Ligonier Valley from Ligonier to Latrobe on the Pennsylvania. The new road shortens the distance from Somerset to Pittsburg about 40 miles, and was built to develop a large timber and coal section. It is supposed that it was built in the interests of the Goulds, and that it is to be extended south to Meyersdale, about 20 miles, where connection can be made with the Wheeling short line of the Wabash system.

RIO GRANDE, SIERRA MADRE & PACIFIC.—This company, it is said, will extend through the Sierra Madre Mountains southwest to Topolobampo on the Pacific Coast. Surveys are now being made by Chief Engineer J. P. Halihan. It is said that a route has been found through the Sierra Madre, and that the line will shortly be located. When built, this line will be a competitor of the Kansas City, Mexico & Orient to the west coast of Mexico.

SAN SABA VALLEY.—Contracts are soon to be let by this company for building its line. The proposed route is from Antelope Gap, on the Gulf, Colorado & Santa Fe, west to Crothers, about 50 miles. (June 1, p. 161.)

SOUTH DAKOTA CENTRAL.—This South Dakota road, which runs from Sioux Falls to Wentworth, 36 miles, has been extended from Wentworth to Rutland, 6.2 miles.

SOUTHERN.—A contract is reported let by this company to Edington & Griffith, of Knoxville, to build new yards at Asheville, N. C. The contract calls for removing 250,000 cubic yards of earth. The work is to be started shortly.

SUMTER & CHOCTAW.—The Sumter & Choctaw Railway is now in operation from Bellamy, Ala., on the Southern, to Nix, 7 miles. It reaches mills and logging camps of the Allison Lumber Co., and is operated on irregular schedule for freight and passenger service. E. F. Allison, Bellamy, Ala., is President.

SOUTHERN PACIFIC.—This company has commenced the reconstruction of its South Pacific Coast branch, known as the "Narrow Gage," as far as Watsonville. The entire road through to Santa Cruz will be rebuilt at standard gage. The line will probably be widened as far as Boulder Creek within four months. Several tunnels will have to be widened.

TIDEWATER DEVELOPMENT CO.—Incorporated in Alabama, with $100,000, by J. M. Dewberry, R. H. Little and J. W. Donnelly, with other capitalists of Birmingham and Tuscaloosa. The company proposes to establish and operate steamship lines on the Warrior, Tombigbee, Alabama, Coosa, Mobile and other rivers and to build electric railroads and power stations in Alabama. Franchises have already been secured for building an electric line from Tuscaloosa to Gadsden through Birmingham. The company expects to build numerous other similar lines in the state. J. M. Dewberry is President; Lewis Miller, Vice-President, and J. W. Donnelly, Secretary.

WABASH.—This company after a five years' campaign has secured an entrance into profitable Pittsburg freight territory by completing a connection with the Union Railway. The Wabash Pittsburg terminal is four miles long from the West Side Belt Railway, a local switching road, at a point one mile east of Castle Shannon, to the head waters of Thompson's Run. At this point, the junction of this new line with the Monongahela Southern Railroad, a yard is being built. The M. S. is a subsidiary company of the United States Steel Corporation. It is seven miles long, and extends to a connection on the Monongahela river at Duquesne with the Union Railroad of the United States Steel Corporation. The line just completed gives the Wabash an entry into the mills of the Carnegie Steel Co., and enables it to secure the preference of the company's shipments, which was agreed upon prior to the absorption of the Carnegie Company by the United States Steel Corporation.

WESTERN PACIFIC.—Petition has been made by this company to the San Francisco Board of Supervisors for a 50-year franchise. The company is prepared to begin construction as soon as permission to do so has been granted. The route applied for connects with the line of the franchise asked for three years ago at a point on the water front near Twenty-fifth street and parallels with the latter thoroughfare to Indiana street. It then turns northwesterly through a tunnel in the Potrero hills to the Ninth and Brannan streets terminal. It is said that the change in the plans for that

portion of the line first applied for was on account of the Ocean Shore road having recently secured a franchise on practically the same route. The proposed line begins on the water front at Twenty-fifth street. Other streets to be traversed are: New York, Indiana, Iowa, Pennsylvania avenue, San Bruno avenue, Channel street and Brannan street.

Wisconsin & Northern.—Incorporated with $1,000,000 capital in Wisconsin to build from Menasha, Wis., on the Minneapolis, St. Paul & Sault Ste. Marie north to a point near Crandon Junction through Winnebago, Outagamie, Shawano, Langlade and Forest Counties, approximately 125 miles; much of the right of way has been secured. J. S. Jones and H. C. Adams, of Chicago; M. D. Keith and S. Shore, of Crandon; M. J. Walreck, Shawano; R. H. Edwards, of Oshkosh, and others, are interested.

RAILROAD CORPORATION NEWS.

Chicago & Alton.—This company, which is a reorganization of the Chicago & Alton Railroad and the Chicago & Alton Railway, effected a few months ago, has declared its initial dividend of 2 per cent. on the $899,300 cumulative preferred stock and 2 per cent. on the $19,557,900 4 per cent. non-cumulative preferred stock to stockholders of record June 15, 1906.

Chicago Railways Co.—This company, incorporated several years ago with $10,000 capital stock, has been organized with F. H. Rawson, President of the North Chicago Street R. R. and of the West Chicago Street R. R., as President, and H. H. Blain, receiver of the North and West lines, as Vice-President and C. E. Adams, H. H. Blain, J. H. Eckels, W. N. Eisenbrath, J. W. Gary, F. H. Rawson and one other to be named later, as directors. This company, it is expected, will take over the holdings of the Chicago Union Traction in the securities of the North Chicago Street R. R. and the West Chicago Street R. R., both of which are leased to the Chicago Union Traction. It is to issue $50,000,000 4 per cent. bonds, which will be used to retire $17,000,000 outstanding of the total authorized issue of $30,000,000 Illinois Tunnel Co. first mortgage 5 per cent. bonds of 1928 and to refund other issues.

Chicago Union Traction.—(See Chicago Railways Co.)

Cleveland, Painesville & Ashtabula (Electric).—See Cleveland, Painesville & Eastern.

Cleveland, Painesville & Eastern (Electric).—This company, which has outstanding $1,606,000 capital stock and $1,402,000 bonds, has acquired two-thirds of the $1,000,000 outstanding capital stock of the Cleveland, Painesville & Ashtabula at a price said to be $20 a share. The C., P. & E. has trackage rights over the Cleveland Electric from Cleveland, Ohio, to Euclid. It owns 23 miles of road from the last-named place eastward along the shore of Lake Erie to Painesville, where it connects with the C., P. & A., which operates 30 miles of road from Painesville east to Ashtabula.

Des Moines & Fort Dodge (M. & St. L.).—The shareholders have approved the authorized issue of $1,000,000 5 per cent. second mortgage bonds of 1935. They also voted to increase the common stock from $4,283,100 to $5,335,600 and the preferred from $763,500 to $1,164,400. (June 1, p. 162.)

Interborough Rapid Transit.—A quarterly dividend of 2¼ per cent. has been declared payable to stockholders of record on June 20 on the $35,000,000 common stock. Since July, 1905, the quarterly dividend has been 2 per cent. With this stock on a 9 per cent. annual dividend basis, the shareholders who did not exchange their holdings for the 4½ per cent. Interborough-Metropolitan bonds do not seem to lose by their non-participation.

Minneapolis & St. Louis.—See Des Moines & Fort Dodge.

New Haven & Northampton. This company, which is leased by the New York, New Haven & Hartford, which owns its entire capital stock, has made a mortgage to the Treasurer of the State of Connecticut, trustee, to secure an issue of $10,000,000 4 per cent. bonds of 1956, guaranteed by the N. Y., N. H. & H. The purpose of this issue is as follows: $2,000,000 to reimburse the N. Y., N. H. & H. for the redemption several years ago of that amount of N. H. & N. bonds; $1,900,000 to refund at maturity bonds falling due in 1909 and 1911, and the remainder for double-tracking, elimination of grade crossings and improvements in New Haven and at other places.

New York City Railway.—The report for the quarter ended March 31 shows a distinct improvement over the corresponding quarter of 1905. Gross earnings were $3,960,771, an increase of $321,304. The operating expenses decreased $68,916, leaving net earnings $1,562,313, an increase of $390,220. After interest and other charges, including the 7 per cent. guaranteed dividend on the $52,000,000 capital stock of the Metropolitan Street Railway Co. (the lessor of the road), the deficit amounted to $926,367 as compared with a deficit during the corresponding quarter of 1905 of $1,322,406.

New York, New Haven & Hartford. (See New Haven & Northampton.

Pennsylvania Company.—A semi-annual dividend of 3 per cent. has been declared on the $60,000,000 outstanding stock. The annual dividends paid in December, 1904, and December, 1905, were 5 per cent., and in 1903 and 1902, 4 per cent.

Pere Marquette.—The car ferry lines between Ludington, Mich., Kewaunee, Manitowoc and Milwaukee, Wis., formerly operated by the Pere Marquette Steamship Company, are now operated by the Pere Marquette Railroad.

Philadelphia Co.—A meeting of the shareholders of this company, recently sold to the United Railways & Investment Co. of San Francisco, has been called for August 14 to authorize an increase in the common stock from $30,000,000 to $36,000,000. The proceeds will be used to reimburse the company for the purchase of the capital stock of the Beaver Valley Traction Co. and the Washington & Hammondsburg. The remainder will be used to provide additional power facilities for the Allegheny County Light Co. and the Pittsburg Railways Co., and for other improvements and expenses.

Pittsburg, Cincinnati, Chicago & St. Louis.—A semi-annual dividend of 2½ per cent. has been declared on the $27,456,099 preferred stock. The previous dividend was 2 per cent., the rate paid semi-annually since 1899.

Seaboard Air Line.—It is reported that this company intends to consolidate some of the coal companies controlled by it. The Clinchfield Coal Corporation is being organized with $10,000,000 capital stock to take over the Cranes Nest Coal & Coke Co., the Dawson Coal & Coke Co., and the Clinchfield Coal Co., controlling, it is said, about 350,000 acres of coal land. Another company, the Cumberland Corporation, is to control the Clinchfield Corporation, and also the South & Western Railroad, now in operation from Johnson City, Tenn., to Sprucepine, N. C., and building to connections with the S. A. L. and other roads.

Southern.—Lee, Higginson & Co., Boston, are offering, at a price to yield 4½ per cent., $9,000,000 4½ per cent. equipment trust certificates due in semi-annual instalments from August 1, 1906, to February 1, 1921, inclusive. These certificates are secured by a mortgage to the Fidelity Trust Co., Philadelphia, as trustee, of 100 locomotives and 10,000 freight cars.

Velasco, Brazos & Northern.—The foreclosure sale of this 20-mile Texas road will take place on July 3. (June 1, p. 162.)

Wabash.—The directors have approved of a plan for the redemption of the $26,500,000 outstanding debenture "B" 6 per cent. non-cumulative bonds. No interest has ever been paid on these bonds, and about a year ago a protective committee was formed to determine the rights of the bondholders, since it was understood that the net earnings of the company had been used for improvements so that there was no surplus available to pay the interest on these bonds, which are a prior lien upon the main line from Toledo to Chicago, and from Chicago to St. Louis. Negotiations were entered into with the company, and it has finally agreed, subject to ratification by the shareholders, of a plan, the substance of which is as follows: The Wabash is to issue about $200,000,000 4 per cent. consolidated mortgage bonds; the debenture B's are to be exchanged for 70 per cent. of their face value in these new bonds, 50 per cent. in common stock, and 50 per cent. in preferred stock. The directors have referred the matter to the committee, who will put the plan in shape to present it at a shareholders' meeting to be called later. It is understood that the Gould interests control about $15,000,000 of the outstanding debenture B's. The new bond issue will also be used to retire the $3,500,000 debenture A bonds, and for other purposes. To carry out the above plan, it will be necessary to issue $13,250,000 new preferred stock.

Wisconsin Central.—This company has filed amended articles of incorporation giving it power to take over the Owen & Northern and the Lake Superior & South-Eastern. The first-named company has completed 42½ miles of road from Owen, Wis., northwest to Ladysmith, and the other company has under construction 112 miles of road from Ladysmith to Duluth.

This company has sold to a syndicate of bankers $7,000,000 Superior and Duluth division and terminal first mortgage 30-year 4 per cent. bonds.

Youngstown & Ohio River.—The Pittsburg, Lisbon & Western, a subsidiary company of the Wheeling & Lake Erie, has leased that part of its line extending from Salem, Ohio, to a connection with the Erie Railroad at Washingtonville, Ohio, to the Youngstown & Ohio River Railroad, which now operates this line. A meeting of the stockholders has been called to increase the authorized capital stock from $10,000 to $1,700,000.

GENERAL NEWS SECTION

NOTES.

The Indiana State Railroad Commission, acting on the complaint of Slader, a coal merchant of New Albany, finds that certain rates on coal over the Southern Railway are excessive; and has ordered a reduction of about 40 per cent.

A press despatch from Omaha, June 13, reported the through trains of the Northern Pacific as passing through that city and eastward over the Burlington road for five days, the Northern Pacific having been blocked in North Dakota for that length of time.

A law passed by the last legislature of the State of Virginia and which went into effect on June 15, requires that all the railroads of the State shall sell mileage tickets at 2 cents a mile, but no road has complied with the law, and the newspapers are wondering what is going to be done about it.

In Fort Wayne, Ind., according to the *Journal*, of that city, the number of residents who work on trains is 1,950, and their average monthly earnings is $222,500. It is estimated that there are over 1,200 Pennsylvania employees, 425 of the New York, Chicago & St. Louis and 270 of the Grand Rapids & Indiana.

Vice-President Besler, of the Central of New Jersey, has informed the city officers of Elizabeth, N. J., 11 miles from Jersey City, that the road intends to establish there a large freight yard, to serve as an annex to the facilities of its New York terminals. The Elizabeth yard is to be 500 ft. wide and 4,000 ft. long.

Congressman Sherman, of New York, has reported in the House a bill to require railroads to check baggage through to a passenger's destination even though his ticket be in two parts, as, for example, when the ticket on a road beyond the originating line is in the shape of a mileage ticket with which the originating line has nothing to do.

The *Wheeling* (W. Va.) *Intelligencer* makes out that the 2-cent fare law in the State of Ohio has proved of more advantage to the railroads than to the people. The railroads have run few or none of the cheap excursions which formerly were common, and clergymen, politicians and others who formerly paid half fare or rode for nothing now pay full rates.

In the United States District Court at Kansas City, June 13, the Chicago, Burlington & Quincy was found guilty of granting illegal discounts on shipments for export to Europe. The judge deferred sentence until June 22. These indictments were based on the same facts as those reported in connection with the indictment of certain shippers, the meat packers, reported last week.

It is announced in Omaha that beginning with July 1 fares on the Union Pacific in Colorado, Wyoming and Utah will be reduced from the basis of 4 cents a mile, or higher, to 3 cents a mile, and that the change will make a reduction in through fares between the East and the Pacific Coast. The commercial bodies of the states affected were surprised by the announcement.

The Southern Railway has applied to the court at Raleigh, N. C., for a temporary injunction to restrain the State Corporation Commission from interfering with the schedules of trains to and from Greensboro, N. C. The railroad claims that the action of the Commission in this matter was taken in the interest of a newspaper which desired to have the change made for its own selfish purpose.

The third-rail electric cars of the New York, New Haven & Hartford, which have been run between Hartford and Bristol for several years, are to be taken off the first of August. This announcement appears in a Hartford paper, and is based on a decision of the Superior Court in a suit brought by or on behalf of citizens of New Britain complaining of the third rail. The track used by the electric cars will be restored to its former use as one of the two lines of a double track for steam trains.

In a suit brought by the Mystic Milling Company the Supreme Court of Iowa has decided that a railroad is not compelled to switch cars to or from private sidings. The Mystic Milling Company refused to pay a demurrage bill of $11, claiming that bills amounting to more than this amount were due from the railroad for delays. The road, the Chicago, Milwaukee & St. Paul, thereupon refused to deliver cars to the mill's track, and suit was brought against it for $10,000 damages. The milling company claimed discrimination on the ground that cars were still being switched to the private tracks of other parties, but the court sustained the railroad.

The Ohio Central lines have lately run an excursion from Gauley, W. Va., to Detroit, 420 miles, at a round trip fare of $4, and the two trains carrying the excursion were filled with about 1,300 people. As this excursion traversed the whole length of the State of Ohio from south to north, some of the people of that State, who feel that under the 2-cent fare law the railroads are abusing them by withholding cheap excursions, are said to have been more or less irritated at the sight of the West Virginians. The gall manifested in thus favoring Gauley was warmly resented. Some comfort was found, however, in the fact that the only people who could make use of this excursion were those who were willing to rise at the "weird hour" of 4 o'clock in the morning.

A reporter at Columbus, Ohio, has discovered that a passenger can travel from that city to New York all the way by daylight. Train No. 28 of the Pennsylvania leaves Columbus at 3:50 a. m. and connects at Pittsburg with No. 44, arriving in New York at 7 p. m. There is a wait of 45 minutes at Pittsburg. The distance is about 633 miles. If the reporter could only have arranged this scheme with westbound trains, which can make more or less headway in overtaking the sun, he could have figured a journey from 150 to 200 miles longer, as train No. 44 reaches New York about an hour before dark. Train No. 8 of the Lake Shore & Michigan Southern could travel by daylight about the same distance (Cleveland to New York), if it should leave Cleveland an hour and a half late.

Making and Unmaking Shippers.

Daniel v 19: Whom he would he slew, and whom he would he kept alive.

The nastiest part of the revelations regarding the Pennsylvania is that chapter relating to the treatment of citizens who attempted to open coal mines without the advice or consent of the railroad. The testimony of one of the Vice-Presidents of the road is that he "discouraged new openings," and that he refused applicants sidetracks. If they got past him and secured them from higher officials, the testimony of other Pennsylvania minions is that the shippers were harassed and worried by the lack of cars until they either quit or bribed the understrappers of the road with shares of stock to send them adequate supplies. Despotism could surely go no farther than this. The railroad which held itself out to be a common carrier bound by its charter to treat all alike, undertook either in the pursuance of a policy or merely from caprice—it matters not which—to regulate a private business, to control the supply of an important product and to declare who should be miners and who should not. The more this unblushing testimony is examined, the more irritating does it appear; the more does it raise in the minds of the people a doubt of the efficacy or character of any private management of railroads. . . . The lid has been partially lifted. It must be taken off entirely, though the smell should drive men as high up as Cassatt himself to disgraceful retirement.—*Minneapolis Journal.*

Opening of the Teltow Canal in Germany.

On June 2d the Emperor of Germany inaugurated a new canal system which provides readier communication between the Oder and the Elbe. For six years the undertaking has been under way and it has cost over $10,000,000. The canal is 25 miles long, and only craft which are electrically hauled will be allowed on it. The municipality of Teltow has been responsible for all the cost and has also built a power station from which energy is derived to operate the small hauling locomotives along the tow path, to light the canal from end to end, and to work certain electric railroads which, together with some steam tramroads, have been laid out as a part of the undertaking. The hauling locomotives are equal to a load of 1,500 tons, including the weight of the craft. The monopoly which the municipality has obtained is such that even a steam tug will have to shut down and submit to being hauled by electricity. In depth and width the Teltow canal conforms to other recent German practice, thus helping toward general uniformity throughout the Empire.

New Buildings for the Baltimore & Ohio.

A contract for the erection of a new passenger station for the Baltimore & Ohio, at Defiance, Ohio, has been let to P. A. Baker & Bro., of Defiance, and one to G. W. Doerr back & Bro. of Sandusky for one at Sandusky.

At Chicago Junction the Baltimore & Ohio will erect a round house to accommodate 25 engines, a machine shop, a storehouse, a coal tipple and a sand house. At Washington D. C. two round houses are to be built, each for 25 locomotives, a machine shop, a

power house, oil and storehouse, signal towers and other buildings to be used in connection with the terminal work. A new passenger station is also to be built at Mt. Vernon, Ohio, at a cost of about $20,000. This station will be of pressed brick, with stone trimmings and tile roof. The bids for all of this work must be received by the Engineering Department by June 25.

New Date for Bids for Tunneling Work in New Zealand.

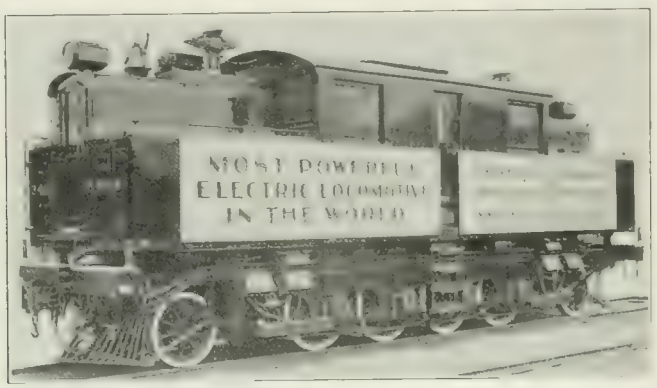
The New Zealand Government has extended the time for receiving bids for piercing the 5¼ mile tunnel through the mountain at Arthur's Pass to July 23, 1906. (See *Railroad Gazette*, June 1, p. 158.)

Manhattan Bridge Contract Let.

The New York City Board of Estimate and Apportionment has instructed Bridge Commissioner James W. Stevenson to let the contract for building the steel towers and the suspended superstructure of the Manhattan bridge to the Parker-Ryan Construction Co. at its bid of $6,493,223. Under the terms of the contract, the bridge is to be ready for traffic Dec. 15, 1909. The work includes the furnishing of about 40,000 tons of steel.

New York Central Electric Locomotive at Atlantic City.

One of the 100-ton electric locomotives which the General Electric Company and the American Locomotive Company are furnishing for the electrification of the New York Central lines in New York City was shown at Atlantic City. Its capacity under ordinary working conditions is 2,200 h.p., and it is said to be the



Electric Locomotive for the New York Central.

most powerful electric locomotive in the world. The locomotive is the same type as the famous "6,000" which has so many times distanced its steam competitor while working out on the test track on the New York Central road near Schenectady, but bears on its side the number 3,404, and the inscription "New York Central Lines." The locomotive attracted much attention at the Pennsylvania side track, where it is in charge of representatives of the two companies which have been co-operating in its manufacture. The electric locomotive is primarily on the ground to serve as an actual example of what the Master Mechanics are likely to encounter in their daily work within a few years.

Manufacturing and Business.

The Philadelphia Rapid Transit has ordered, for August delivery, 1,000 car wheels from the Schoen Steel Wheel Co.

The firm of F. M. Hicks & Co., locomotive builders, has been succeeded by the Hicks Locomotive & Car Works, Chicago, Ill.

The Mitsu Bishi Dock Yard & Engine Works, Japan, have ordered two car loads of Falls Hollow Stay Bolt Co.'s iron bars.

The New York office of the Camel Co., Chicago, makers of railroad specialties and supplies, has been moved from 95 Liberty street to 11 Broadway.

The Dayton Pneumatic Tool Co., Dayton, Ohio, have moved into their new plant at 435 East First street, where additional machinery has been installed.

O. E. Shields has been appointed manager of the Railroad Water Softening Department of the Pittsburg Filter Manufacturing Co., with office at Pittsburg, Pa.

The Board of Public Service of Toledo, Ohio, is having plans made by the Osborne Engineering Co., of Cleveland, Ohio, for a reinforced concrete bridge about 1,100 ft. long over the Maumee river, to cost $750,000.

The Quincy, Manchester, Sargent Co. has sold its pneumatic tool business to the Pittsburg Pneumatic Tool Co., Canton, Ohio. Barrett Ridgley, Controller of Currency, Washington, D. C., is interested.

The specifications for the cars recently ordered by the Philadelphia Rapid Transit Co., and reported in the *Railroad Gazette* of June 1, have been changed, and the Curtain Supply Co.'s ring fixtures, No. 48, with projecting pins and without handles, are to be used instead of Acme curtain fixtures.

A blower built by the B. F. Sturtevant Co., Boston, has been installed at the lower end of the Gallitzin Tunnel on the Pennsylvania. The air is driven into the tunnel through a sheet iron hood, and drives the smoke of the locomotive forward so that the tunnel is free from gas while the train is going through it.

The city of Vancouver, B. C., will ask bids for building a steel bridge over False creek harbor. The structure at Greenville street will be 2,250 ft. long, with an additional 1,000 ft. at Westminster avenue. The cost of the improvements will be about $500,000. Arthur McEvoy, City Clerk, Vancouver, may be addressed.

The Cincinnati, Milford & Loveland Traction Co., Cincinnati, is installing a plant to supply power for its 21-mile extension now under construction from Milford, Ohio, to Blanchestor. The equipment will consist of two Allis-Chalmers horizontal cross compound heavy duty engines, driving two "Bullock" type 500-k.w., 25-cycle, three-phase, 400-volt generators; also exciters, rotary converters and other apparatus made by the Allis-Chalmers Co.

The General Electric Co., which now has an office in the Union Savings Bank Building at Oakland, Cal., has leased rooms in the new Monadnock Building, San Francisco, which, it is expected, will be ready for occupation by June 15, 1907. Land has been leased and a temporary warehouse has been built at Emeryville close to the Atchison, Topeka & Santa Fe and the Southern Pacific tracks. Work has been started on a permanent building at that place.

The Wellman-Street steel hopper car, which was first exhibited at the 1903 M. C. B. convention at Saratoga, was again on exhibition at Atlantic City this year after having been in constant and regular service for three years, it is said, without repairs except to minor parts. The car has been in coal and ore service between Pittsburg and Ashtabula, which is very severe for such equipment. The car is in excellent condition, showing practically no corrosion or other bad results from the service. The claims of Mr. C. F. Street, the patentee, are thus being verified in a gratifying way. This car was described in the *Railroad Gazette*, July 31, 1903.

Iron and Steel.

The Chicago Junction Railway has bought 3,500 tons of rails, to be delivered in 1907.

D. E. Ryan, Secretary of the Temiskaming & Northern Ontario, is asking for bids for 85,000 tons of 80-lb. rails, open-hearth or Bessemer, also for the necessary fastenings, and for 1,545,000 ties.

The Interborough Rapid Transit Co. is in the market for 4,000 tons of 100-lb. rails; the Southern Pacific is inquiring for 15,000 tons of rails; the St. Louis & San Francisco is negotiating for 23,000 tons of rails, and the Mexican Central and the National of Mexico for 10,000 tons each. The Missouri Pacific has bought 26,000 tons; the Florida East Coast 11,000 tons, and the Lehigh & Hudson 15,000 tons for 1907 delivery. The Missouri Pacific, it is said, has also bought 10,000 tons for 1906; the Western Maryland 4,000 tons; the Baton Rouge, Hammond & Eastern 1,600 tons; the Morris County Traction Co. 1,600 tons, and the Chesapeake & Ohio 2,000 tons for 1906 delivery.

OBITUARY NOTICES.

W. J. Cudworth, Engineer of the Southern division of the North-Eastern (England), died on June 5 at the age of 90.

F. W. Webb, the former distinguished Chief Mechanical Engineer of the London & North-Western, who retired four years ago, died at Bournemouth, England, on June 4. A sketch of Mr. Webb's life was published in the *Railroad Gazette* of Dec. 12, 1902, p. 953.

ELECTIONS AND APPOINTMENTS.

Engineering and Rolling Stock Officers.

Grand Rapids & Indiana.—H. M. Large has been appointed Master Car Builder, with office at Grand Rapids, Ind.

Panama.—C. H. Mead, General Car Foreman of the Iowa Central, has been appointed Master Car Builder of the Panama.

Southern.—W. F. Moran has been appointed Master Mechanic at Sheffield, Ala., succeeding C. B. Cramer, resigned.

Operating Officers.

Brookhaven & Pearl River.—A. C. Enochs has been appointed General Manager, with office at Brookhaven, Miss., succeeding J. H. Scott.

Colorado & Wyoming.—C. S. Robinson, General Superintendent, has

resigned. J. B. McKennan has been appointed Superintendent at Pueblo, Colo., succeeding George Van Brimer.

El Oro Mining & Railway Co.—R. E. Agnew has been appointed Superintendent, succeeding F. A. Lattig, resigned. See National of Mexico.

Grand Trunk.—L. G. Coleman, Trainmaster at Montreal, Que., has been appointed Assistant Superintendent at Ottawa, Ont.

National of Mexico.—F. A. Lattig, Superintendent of the El Oro Mining & Railway Co., has been appointed Superintendent of the Hidalgo & Northeastern division of the National of Mexico, succeeding F. Barrera, resigned.

New York Central & Hudson River.—A. H. Smith has been appointed Vice-President of all the lines east of Buffalo except the Boston & Albany. He retains also the title of General Manager.



A. H. Smith.

Mr. Smith has spent his entire railroad service on New York Central lines, beginning in 1878 as a messenger boy on the Lake Shore & Michigan Southern. He had the good quality of being unsatisfied, and in minor service changed whenever he got a chance to learn how other work was done. He learned the art of handling men and was a bridge carpenter when his opportunity came. The Kalamazoo division was in bad shape in 1890 and he put it in order. He had the habit of being out on the line, and learned the art of seeing. He had like chances on other divisions until in 1901 he became Assistant General Superintendent, then General Superintendent, of the Lake Shore; and in 1902, he was appointed General Superintendent of the New York Central & Hudson River. He has been General Manager since July, 1903.

J. P. Bradfield, General Superintendent, has been appointed Assistant General Manager in charge of operation. Mr. Bradfield has also spent the greater part of his railroad service on New York Central lines. In 1882, he came from the Lake Shore & Michigan Southern to the West Shore as train despatcher of the Hudson River division. He was made Superintendent of that division in 1885, and was transferred to the Buffalo division in 1890. Three years later he was appointed General Superintendent of the New York, Ontario & Western, but, in 1895, went to the New York Central and was appointed Superintendent of the Western division. In 1903, he was made Assistant General Superintendent, and General Superintendent six months later.

A. T. Hardin, Assistant to the General Manager, has been appointed Assistant General Manager, and will perform "such duties as may be assigned to him." This may be taken to mean that he will have an increased responsibility for the physical condition of the road, structures and equipment—a duty for which he has shown unusual capacity. Mr. Hardin was born in 1868 and graduated from the University of South Carolina in 1894. He began railroad service as a telegraph operator on the Richmond & Danville, now the Southern. In 1890 he left the road in order to go to college, and after graduation went into the Maintenance of Way Department of the Southern. In 1898 he went to the New York Central as supervisor and Division Engineer of the Eastern division. He was made Engineer of Track the next year and, in 1903, was appointed Engineer of Maintenance of Way. He was made Assistant to the General Manager in July, 1905.



A. T. Hardin.

P. E. Crowley, Assistant General Superintendent, has been appointed General Superintendent of the Western district, which consists of the Mohawk, the Western, the R., W. & O. and the Pennsylvania divisions, with office at Syracuse, N. Y. Mr. Crowley was born in 1864 and began railroad work in 1878 as a telegraph operator on the Erie. He was made train despatcher in 1885 and, in 1889, was appointed to the same position on the N. Y. C. & H. R. He was promoted to be chief train despatcher the next year and, in 1891, was made trainmaster. In 1900, he was appointed chief trainmaster and, in 1901, Superintendent of the Pennsylvania division, being made Assistant General Superintendent in 1904.



P. E. Crowley.

C. F. Smith, Assistant General Superintendent, has been appointed General Superintendent of the Eastern district, having jurisdiction over the Hudson, the River, the Harlem and the Putnam divisions, and being in charge of passenger train service in both districts; his office is in New York City. Mr. Smith was born in 1873, and has been on the New York Central since 1886, when he began work as a messenger in the telegraph office at New York. After serving as clerk to the Superintendent of the Harlem division and, later, as Secretary to the Assistant General Superintendent, he was, in 1890, made clerk and timekeeper of the Hudson division. In 1893, he was appointed Secretary to the General Manager and, two years later, chief clerk to the Superintendent of the Western division. He was appointed chief clerk to the General Superintendent in 1898 and, in 1902, was made Superintendent of Passenger Transportation. He has held his position as Assistant General Superintendent since 1903.



C. F. Smith.

St. Louis & San Francisco.—J. E. Hutchinson, Superintendent of Terminals at Kansas City, Mo., has been also appointed Superintendent at Fort Scott, Kan., H. S. Mitchell having been given leave of absence on account of poor health.

Southern.—C. L. Harris, Assistant Superintendent at Birmingham, Ala., has been appointed Assistant Superintendent at Knoxville, Tenn.

Executive, Financial and Legal Officers.

Atlanta, Birmingham & Atlantic.—P. S. Arkwright has been elected First Vice-President. G. D. Wadley, Vice-President and General Manager, has been elected Second Vice-President and General Manager. R. E. Cullinane has been elected Secretary, succeeding C. F. Redding.

Brookhaven & Pearl River.—G. C. Ligon has been appointed Auditor, with office at Brookhaven, Miss., succeeding Alfred Mead, who remains General Freight and Passenger Agent.

Columbia, Newberry & Laurens.—S. W. Parham has been appointed Auditor, with office at Columbia, S. C., succeeding C. D. Miller, resigned.

Columbus & Southern.—F. C. Rector has been elected President and General Manager, with office at Columbus, Ohio, succeeding J. G. Reeves.

Lorain & West Shore.—Alfred Walter has been elected President, with office at Norfolk, Va., and A. T. Cooper, Vice-President, with office at Jacksonville, Fla. R. L. Nutt, Treasurer, has been elected also Secretary, succeeding T. G. Williams.

Kansas City Southern.—J. F. Lorec, formerly President of the Baltimore & Ohio and later of the Rock Island Company, has been elected a Director and Chairman of the Executive Committee, succeeding, in the last named position, Hermann Sielcken, who has been elected to the new office of Chairman of the Board.

Mexican Central.—F. M. Souther has been appointed Assistant Treasurer.

Texas & Southwestern.—J. S. Williams is President; J. W. Middendorf, Vice-President; C. T. Williams, Secretary, and F. E. Nolting, Treasurer.

Sonora.—W. G. Sherlock has been appointed Assistant Auditor, with office at Guaymas, Mex., succeeding G. L. Bughee.

Wisconsin & Michigan.—W. T. Abbott has been elected Vice President.

Traffic Officers.

Bangor & Aroostook.—R. K. Nickerson has been appointed Assistant General Freight Agent, with office at Bangor, Me.

Columbia, Newberry & Laurens.—W. J. Craig has been appointed General Passenger Traffic Manager, and R. A. Brand, Freight Traffic Manager.

Great Northern.—A. L. Craig, General Passenger Agent of the Oregon Railroad & Navigation Co., has been appointed Passenger Traffic Manager of the Great Northern, succeeding F. I. Whitney, resigned.

Oregon Railroad & Navigation.—See Great Northern.

Purchasing Agents.

Evansville & Terre Haute.—F. P. Jeffries, Purchasing Agent of the C., R. I. & P. and the St. L. & S. F., has been also appointed Purchasing Agent of the E. & T. H., with office at Chicago, Ill., succeeding W. E. Boyden, resigned.

Special Officers.

Cumberland Valley.—S. H. Long has been appointed Real Estate Agent, with office at Chambersburg, Pa.

LOCOMOTIVE BUILDING.

The St. Louis & San Francisco has ordered 20 consolidation (2-8-0) type locomotives; the weight on the drivers will be 160,000 lbs., and 10 switching locomotives weighing 120,000 lbs. on the drivers, from the American Locomotive Co. This company has also ordered 10 ten-wheeler (4-6-0) locomotives from the American Locomotive Company.

The Santa Fe, Prescott & Phoenix, as reported in our issue of June 1, has ordered three simple consolidation (2-8-0) locomotives from the American Locomotive Co., for August delivery. These locomotives will weigh 144,000 lbs., with 128,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 50 in.; extended wagon top boiler, with a working steam pressure of 180 lbs.; 256 tubes, 2 in. in diameter and 13 ft. 1 in. long; Otis firebox, 108 in. x 33 in.; tank capacity, 6,000 gallons, and oil capacity, 2,500 gallons. The special equipment includes: Westinghouse air-brakes, Gollmar bell ringer, Sterlingworth brake-beams, Leeds couplers, Pyle-National electric headlights, Ohio injector, Sullivan piston rod packings, Crosby safety valve, Leach sanding devices, Chicago sight-feed lubricators, A. French springs and Latrobe driving, truck and tender wheel tires.

The Lehigh & New England has ordered five simple consolidation (2-8-0) locomotives from the Baldwin Locomotive Works, for September delivery. These locomotives will weigh 151,000 lbs., with 134,000 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; straight top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,124 sq. ft.; 280 tubes, 2 in. in diameter and 13 ft. 4½ in. long; firebox, 114 in. x 106 in.; grate area, 83 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, eight tons. The special equipment includes: Westinghouse-American air-brakes, Golmar bell ringer, Pennsylvania brake-beams, Gould couplers, Star headlights, Ohio injector, Damascus journal bearings, U. S. metallic piston and valve rod packings, Coale safety valve, Leach sanding devices, Chicago sight feed lubricators, and Crosby steam gages.

The Kansas City Belt has ordered from the Baldwin Locomotive Works two simple six wheel switching locomotives. They will weigh 121,000 lbs., cylinders, 19 in. by 26 in.; drivers, 51 in. in diameter; straight top boiler, with a working steam pressure of 180 lbs., 242 charcoal iron tubes 2 in. in diameter and 11 ft. 1 in. long, with a total heating surface of 1,195 sq. ft. The firebox is 88 in. by 41 in., with 25 sq. ft. grate area; tank capacity, 3,500 gallons, and coal capacity six tons. The special equipment includes: Westinghouse air-brakes, Steel axles, Gollmar bell ringer, Franklin block boiler lagging, iron brake-beams, Perfecto brake-shoes, Climax couplers, Star headlights, Sellar injectors, Bronze journal bearings, U. S. piston and valve rod packings, Crosby safety valves, Leach sanding devices, Nathan sight feed lubricators, Standard springs, Crosby steam gages, Standard tires, Chester Wheel Foundry steel wheel centers and reflex water gages.

CAR BUILDING.

The Arizona & New Mexico is in the market for two steel tank cars.

The Lehigh & New England is in the market for 150 steel gondola cars.

The Chicago City Railway and the Chicago Union Traction have, it is reported, placed orders for new electric cars.

The Columbus, Delaware & Marion, Delaware, Ohio, has ordered two 70-ft. interurban cars from the Niles Car & Manufacturing Co.

The Norfolk & Western is building 50 cabin cars at its Roanoke shops. The special equipment includes Ajax brasses and Norfolk & Western standard paint.

The Chillicothe Electric Railroad, Light & Power Co., Chillicothe, Ohio, has ordered four standard single-truck, grooveless-post, semi-convertible Brill cars from the G. C. Kuhlman Car Co.

The Erie has ordered four passenger motor cars and one combination passenger and baggage motor car from the St. Louis Car Company. These cars will each be equipped with four 75-h.p. Westinghouse a.c. motors.

The Portland & Richmond Falls has ordered five special gondola cars of 110,000 lbs. capacity from the Pressed Steel Car Co., for January, 1907, delivery. These cars will be 42 ft. 9 in. long, 10 ft. 2¼ in. wide, and 9 ft. high over all.

The Anderson Traction Co. has ordered from the J. G. Brill Co., Philadelphia, for October 1 delivery, two passenger cars and one combination freight and passenger car. These cars will have wood bodies and underframes, the body weighing 25,000 lbs. General Electric Co. single-phase equipment will be used.

The Seaboard Air Line has about arranged for 125 to 150 flat cars of 60,000 lbs. capacity. These cars will be 42 ft. 4 in. long, 9 ft. 6 in. wide and 4 ft. 3¼ in. high, over all. The special equipment includes: Seaboard Air Line standard brake-beams, brake-shoes and trucks, Westinghouse brakes, Tower couplers, Miner tandem draft rigging, and Symington journal boxes.

The Washington Railway & Electric Co. has ordered from the St. Louis Car Co., for September 1 delivery, 40 closed passenger cars. They will have a seating capacity for 40 persons, and will be 35 ft. 1 in. long and 8 ft. wide over all, and 8 ft. 1 in. high inside. The bodies and underframes will be of wood. The special equipment includes: Adams & Westlake brakes, Forsyth curtain fixtures, Pantasote curtains, Valentine's paint, and Peckham trucks.

The Rhode Island Co., Providence, R. I., has ordered 70 cars from the Cincinnati Car Co., including 15 bench open cars, 13 bench open cars and closed cars. The 15 bench open cars will be 41 ft. 9 in. long and the 13 bench open cars will be 37 ft. 8¾ in. long, over all (outside to outside of bumpers); both 15 bench and 13 bench open cars will be 8 ft. 3 in. wide, over all (outside to outside of grab handles), and 8 ft. 1 in. high from floor to under side of ceiling. The closed cars will be 35 ft. 7 in. long, over all (outside to outside of bumpers), 8 ft. wide at top of paneling under window, and 8 ft. 1 in. high from floor to under side of ceiling. The special equipment for all includes: J. G. Brill Co.'s axles, brake-beams, brake-shoes, brasses, journal boxes and trucks, Cincinnati Car Co.'s bolsters, couplers, door fastenings, doors, draft rigging, paint, platforms, roofs, seats, springs and vestibules, National Electric Co.'s air-brakes, Curtain Supply Co.'s curtain fixtures and material, Consolidated Car Heating Co.'s heating system, and Griffin Wheel Co.'s wheels.

The Atlantic Coast Line, as reported in our issue of June 1, has ordered 500 composite hopper bottom coal cars of 80,000 lbs. capacity from Barney & Smith, and six express cars, two combination mail and express cars, and two postal cars from the Hicks Locomotive and Car Works. The coal cars will weigh 34,000 lbs. (estimated), and measure 27 ft. 6 in. long, 8 ft. 10½ in. wide and 10 ft. 7 in. high, inside measurements. The special equipment includes: Pennsylvania brake-beams, Christie brake-shoes, Westinghouse brakes, Tower couplers, Atlantic Coast Line door fastenings, paint and springs; Farlow Westinghouse draft rigging, Harrison dust guards, National Malleable Castings Co.'s journal boxes and arch-bar trucks. The express cars will weigh 50,000 lbs., and the combination mail and express cars will weigh 78,000 lbs. (estimated), and both express and combination mail and express cars will measure 60 ft. 11½ in. long, 8 ft. 10½ in. wide, and 9 ft. 6 in.

high, inside measurements. The postal cars will weigh 111,000 lbs. (estimated), and measure 60 ft. 5 in. long, 9 ft. wide and 9 ft. 5⅛ in. high, inside measurements. The special equipment for express, combination mail and express and postal cars includes: Composite bolsters, Diamond special brake-beams, Christie brake-shoes, Westinghouse brakes and draft rigging, Janney-Buhoup couplers, Atlantic Coast Line standard doors, paint, roofs, springs and trucks; Harrison dust guards, Gold heating system, Pintsch light and Pullman dummy vestibules.

RAILROAD STRUCTURES.

CLEVELAND, OHIO.—Plans for the long discussed new union passenger station for Cleveland are said to be finished and an ordinance is to be introduced in the City Council authorizing the work.

DALLAS, TEX.—According to reports a union passenger station is to be built here.

KANSAS CITY, MO.—Application has been made by the Kansas City Terminal Co. for incorporation with a capital of $30,000,000. The company is being organized to build the new union passenger station here.

MACON, GA.—The Central of Georgia, it is reported, has bought land here as a site for car shops to cost approximately $1,000,000.

NEW YORK, N. Y.—The American Bridge Co. has been given an order for 27,000 tons of structural steel for the new Hudson river tunnel station on Church street.

OMAHA, NEB.—The Union Pacific is asking bids for new car shops to cost about $790,000.

RANGELEY, ME.—The Phillips & Rangeley Co. is extending its tracks to the wharves on Rangeley Lake, at which point it will put up a new station. It will also build an additional station on Main street in Rangeley.

SPRINGFIELD, OHIO.—The C., C., C. & St. L. has plans ready for putting up a new passenger station and improving its terminals here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BOSTON & MAINE.—This company has been authorized to issue stock for second main track. (See Railroad Corporation News.)

BROOKLYN RAPID TRANSIT.—The Board of Estimate of New York City has approved the amended plans which were passed by the Rapid Transit Commission some time ago for a four-track extension of the B. R. T. to Bensonhurst, Bath Beach and Coney Island. The proposed extension will be part subway and part surface road, with a loop terminal at Coney Island. No appropriation for the work has yet been made. It has not been decided when work will be started.

BUFFALO & LACKAWANNA TRACTION.—Incorporated in New York, with $1,000,000 capital, to build a line five miles long from the Lackawanna steel plant to the center of the city of Buffalo. J. B. Mayer, C. H. Werner, W. F. Sheehan, of New York; C. V. Nellany and O. F. Georgia, of Buffalo, are interested.

CANADIAN PACIFIC.—A contract has been given to the British Columbia Contract Co., Vancouver (G. H. Webster, Manager), for laying rails on the Kootenay Central from Golden, B. C., on the C. P. main line, southeast along the Columbia and Kootenay rivers 180 miles to Jaffray, on the Crow's Nest Pass line of the C. P. About 10 miles has been completed. (March 30, p. 98.)

A contract has been let to the British Columbia Contract Co. for clearing the right of way and grading 112 miles of this company's line from Strassburg, Sask., northwest to Saskatoon. About 1,000 men are now at work on this section.

CHICAGO & NORTH-WESTERN.—Under the name of the Wolfe River Valley, recently incorporated by this company in Wisconsin, the C. & N. W. will build a line from Shawano, Wis., north to Crandon, in Forest County, approximately 60 miles. It is to be used in connection with the Manitowoc, Green Bay & Northwestern.

Plans have recently been filed by this company showing the route of its proposed extension from Bonesteel, S. Dak., northwest via Herrick and Gregory to Burke, in Gregory County, which is as far as it is proposed to build this year. The line is to be extended next year northwest, crossing the Pierre-Rapid City line at Midland. (May 11, p. 143.)

CLEVELAND, YOUNGSTOWN & EASTERN.—Incorporated in Ohio by A. M. Snyder, H. M. Roberts, E. G. Derr and others, as a successor to the Eastern Ohio Traction Co. The company proposes to build an extension from Chagrin Falls southeast 20 miles to Garrettsville, where connection will be made with the Mahoning & Shenango Railway & Light Co., the two lines forming a through route from Cleveland to Youngstown.

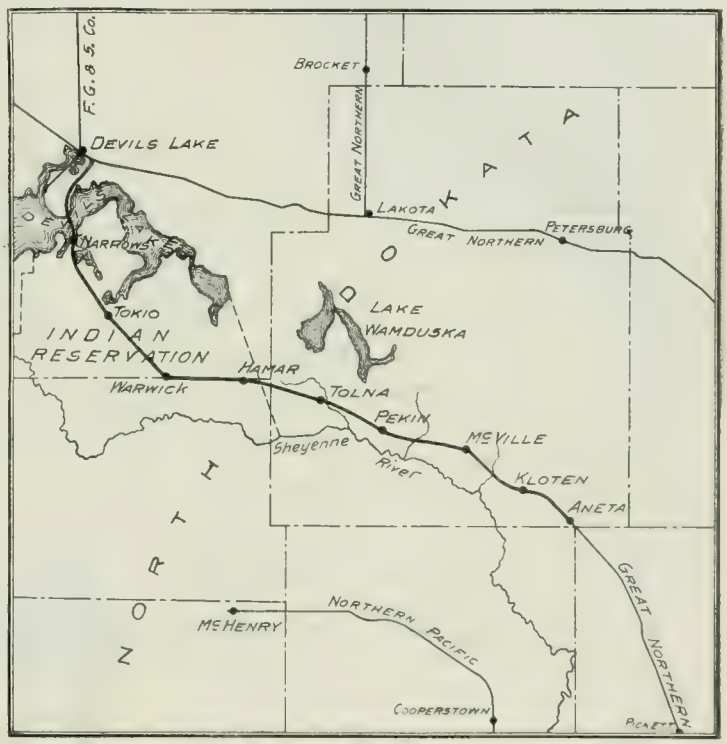
COBALT RANGE.—President L. H. Timmons, of Montreal, is quoted as saying that work is to be started shortly on this proposed line. Surveys have been completed, and rights of way are being secured. The proposed route is from Haileybury, Ont., east to a point on the shore of Lake Temiskaming, about 90 miles, thence south to Ville Marie, thence east and south to a connection with other roads. (April 6, p. 106.)

DENVER & RIO GRANDE.—This company is reported as building a 10-mile spur to the Utah Copper and Boston Consolidated Mines in Utah. The cost of the work will be about $4,000,000.

DETROIT & GRAND RAPIDS.—Organized in Michigan, with $1,600,000, to build a line to be operated by gasolene motor cars from Farmington northwest via Byron to Corunna, and thence north to Saginaw, about 100 miles. E. P. Sherman, of Bancroft, is President, and James S. Smart, of Saginaw, Vice-President.

DETROIT, TOLEDO & IRONTON.—President Eugene Zimmerman it is said denies the reports concerning the sale of the Northern Coal & Coke Co. properties. The Northern Coal & Coke Co. and the Detroit, Toledo & Ironton will be connected by a new line about 100 miles long, for which surveys are being made. This work is to be carried out by the Detroit, Toledo & Ironton and some of those interested in the Cleveland Coal & Coke Co.

GREAT NORTHERN.—An officer writes that grading is under way by A. Guthrie & Co., of St. Paul, Minn., on an extension of the Great Northern's Aneta branch from Aneta, Nelson County, N. Dak.,



Great Northern.

northwest via Kloten, McVille, Pekin, Tolna, Hamar, Warwick, Tokio and Narrows to the main line at Devil's Lake, approximately 60 miles. Part of the route is through the Devil's Lake Reservation and over an arm of Devil's Lake.

EASTERN OHIO TRACTION.—See Cleveland, Youngstown & Eastern.

EAST SIDE VIADUCT.—An official of this road, which was recently incorporated in New York, tells us that both steam and electricity will be used as motive power. The proposed route is from Thirty-fourth street, Manhattan, north between Avenue A and First avenue for a distance of five miles. (June 8, p. 167.)

ERIE.—The contract for electrifying the Rochester division of this road from Mt. Morris to Rochester, 34 miles, has been let to Westinghouse, Church, Kerr & Co. Work is to be started at once. (*Railroad Gazette*, June 15, p. 644.)

ERIE, CAMBRIDGE SPRINGS, UNION & CORRY (ELECTRIC).—A contract is reported let to Charles Van Bibber, of Boston, at $1,000,000 for building this proposed electric road. It is to be about 40 miles long. (See Erie, Cambridge, Union & Corry in Construction Record.)

ILLINOIS CENTRAL.—This company will shortly make preliminary surveys for an extension of the Canton, Aberdeen & Nashville division from Aberdeen, Miss., northeast about 100 miles to Sheffield, Ala. The new line will cross the extension now under construction from Corinth, Miss., southeast to Birmingham.

Lake Bay.—This company has applied for an amendment to its charter, authorizing it to build a branch from its Toronto-Sudbury line in Ontario to Key Inlet, 10 miles. The proposed line is through a rocky country.

Kettle Valley Lines.—A contract is reported let to P. Tierney, of Nelson, B. C., for building a 60-mile extension of this line from Grand Forks, B. C., west. The cost of the work is approximately $1,250,000.

Kootenay Central.—See Canadian Pacific.

Louisville & Nashville.—A contract has been let by this company to Walton, Wilson, Rodes & Co. to build 56 miles of road in Kentucky to connect its St. Louis and Nashville lines. The new line is to be known as the Madisonville, Hartford & Eastern, and will reach coal lands in eastern Kentucky. Under the terms of the contract the work is to be finished in 18 months, and is to cost $1,200,000.

Madisonville, Hartford & Eastern.—See Louisville & Nashville.

Maryland & Pennsylvania.—This company, operating 79 miles of road, has announced through President Brown that that part of the road from Baltimore to Belair, 26 miles, is to be electrified, and also, probably, the entire road.

Milwaukee Southern.—See Milwaukee Junction.

New York, New Haven & Hartford.—Assistant General Superintendent Martin of this company is reported as saying that the Providence division is to be four-tracked from Boston to Providence. At the present time there are four tracks from Boston to Readville. The plans contemplate two additional tracks from East Junction to Seekonk river, and entrance into Providence through the tunnel which was planned for some months since. (See Construction Record.)

New York Subways.—Henry T. Wood, a contractor, announces that application is to be made to the Board of Estimate for a franchise to build a subway across the island of Manhattan at Fourteenth street. The proposed subway will connect with tunnels under both the Hudson and East rivers. The Hudson river tunnel will run from Fourteenth street to Stevens Castle in Hoboken, where connection is to be made with a subway under Bergen Hill to connect with the terminals of the Delaware, Lackawanna & Western and the Erie. The tunnel under the East river is to run from Fourteenth street, Manhattan, to Greenpoint, continuing in a straight line to Varick street and Montrose avenue. In Manhattan there are to be three branches from the main line, one from Fourteenth street to the Grand Central Station, another to the Pennsylvania terminal, and the third south through West Broadway, Hudson and Greenwich streets to the Battery. The plans also include a large underground station at Union Square. Mr. Wood is quoted as saying that of the estimated cost, $45,000,000, about $20,000,000 has been subscribed by French capitalists. Francis H. Leggett, of New York, is president of the company.

Quebec Midland.—It is said that this company will shortly call for bids for building this line from the intersection of the Grand Trunk Pacific and the Ontario boundary near Lake Abittibi northeast to Lake Matagami, about 85 miles. (April 13, p. 115.)

Texas Roads (Electric).—E. M. House, a capitalist of Austin, Tex., is negotiating with Stone & Webster, of Boston, Mass., to build an interurban electric road from Houston to Galveston, about 51 miles.

Toledo Railway & Light Co.—E. W. Moore, director of this company, the Detroit United Railway and the Northern Ohio Traction Co., is quoted as saying that the Toledo Railway & Light Co. is making improvements and extensions at a cost of $700,000. The work includes a new power house, a union electric station, and a new line 15 miles out of Toledo to Ottawa Beach, where the company owns two miles of frontage on the lake.

Twin City Rapid Transit Co.—It is announced that the new common stock issue of $2,100,000 recently offered to the shareholders was issued for the new interurban line between Minneapolis and St. Paul, the extension to South St. Paul, and for the new line to Lake Minnetonka, and for equipping these lines.

Uniontown & Wheeling Short Line.—See Wabash.

Wabash.—Contracts will shortly be let by J. Q. Barlow, Chief Engineer of the Western Maryland, for building the Uniontown & Wheeling Short Line, which was recently bought from J. V. Thompson, of Uniontown, Pa. This line will be about 68 miles long. Local newspapers say that work is to be vigorously prosecuted on the entire line to connect with the western Gould lines from Cumberland west.

Wolf River Valley.—See Chicago & North-Western.

RAILROAD CORPORATION NEWS.

Aurora, Elgin & Chicago (Electric).—The stockholders have authorized the issue of $25,000,000 5 per cent. bonds. (March 30, p. 100.)

Baltimore & Ohio.—A semi-annual dividend of 3 per cent. upon the $152,308,000 common stock, payable Sept. 1. For four years, up to 1905, the annual rate was 4 per cent., and 5 per cent. was paid out of the 1905 earnings.

Boston & Maine.—The State Railroad Commission has authorized this company to issue 42,037 shares of new common stock to be offered at 165 to shareholders at the rate of one share of new stock for each five shares already held. The proceeds, amounting to about $6,930,000, will be used as follows: $5,000,000 for new equipment; $1,000,000 for new shops, for repairs and maintenance of motive power and equipment and the remainder for double tracking.

Cincinnati, Hamilton & Dayton.—J. P. Morgan & Co. have acquired the Kentucky & Ohio Bridge Co. in the interests of the C., H. & D. The bridge is being built over the Ohio river from Ironton, Ohio, to Ashland, Ky.

Delaware & Hudson.—This company has sold $14,000,000 4 per cent. convertible debenture bonds. The proceeds are to be used as follows: For additional equipment, $2,400,000; for the purchase of 50,000 shares of United Traction Co., of Albany, $7,500,000; for half of the capital stock of the Schenectady Railway and for advances to that company, $1,600,000; for an electric railway from Ballston, N. Y., to Saratoga, $500,000, and for the cut-off around Wilkesbarre, Pa., $2,000,000.

Detroit, Toledo & Ironton.—This company has applied to the New York Stock Exchange to list $214,000 additional Detroit Southern Railroad (Ohio Southern division) first mortgage 4 per cent. bonds. According to the income account of the D., T. & I. for nine months ending March 31, the gross earnings were $1,483,120; net earnings, $438,541. The deficit after fixed charges was $161,578. This deficit, however, will be more than covered by the surplus earnings of the Ann Arbor, a subsidiary of the D., T. & I., since the Ann Arbor surplus for 10 months of the current fiscal year was $365,649.

Grand Trunk Pacific.—The shareholders have authorized the issue of $15,000,000 new 4 per cent. debentures, being part of a total authorized issue of $25,000,000. The interest is guaranteed by the Grand Trunk and the debentures will have a lien on the lines under construction west of Winnipeg, and also on the Lake Superior branch. These securities are junior to the first and second mortgage bonds, which amount to $95,873,000. The proceeds are to be used in part payment for the construction of the above mentioned lines.

Kentucky & Ohio Bridge Co.—See Cincinnati, Hamilton & Dayton.

Lehigh Valley.—This company has sold $1,900,000 additional general consolidated mortgage 4 per cent. bonds of 2003, making the total amount outstanding $22,000,000. The proceeds have been used to reimburse the company for the payment of annual installments on equipment trust bonds, and for interest payments on other bonds.

Pennsylvania.—This company has sold to Kuhn, Loeb & Co., New York, 250,000,000 francs (about $48,250,000) Pennsylvania Company 15-year 3¾ per cent. bonds, redeemable at the option of the company at the end of 12 years, and guaranteed principal and interest by the Pennsylvania Railroad Company. Kuhn, Loeb & Co. have placed the entire loan with a French syndicate under the management of the Banque de Paris et des Pays-Bas and the Credit Lyonnais. The French banks will pay all the taxes and other costs of issue. The price at which the railroad company sold the bonds is not known, but it is understood that the loan will cost it about 4½ per cent. per annum. The bonds are in 500 and 1,000 franc denominations, since none of them are to be sold in the United States. They are secured by Pennsylvania securities deposited as collateral, and the proceeds will be used toward meeting payments for 33,000 steel cars and 313 locomotives, and for the completion of the water supply system. The car trust certificates and water company certificates which were to have been issued for the above purposes will, instead, be held in the treasury of the company. (See p. 684 of this issue.)

United Railways Investment Company of San Francisco.—This company has declared a dividend of 2½ per cent. upon the $15,000,000 preferred stock for the six months ending March 31, 1906. This dividend will be payable in scrip, bearing interest at the rate of 5 per cent. per annum. This is a continuation of the policy adopted two months ago when back dividends were paid in this way in order to keep cash on hand for the rebuilding of the United Railway of San Francisco, a subsidiary company. (May 4, p. 138.)

Wabash.—This company has sold to Lee, Higginson & Co., Boston, $6,900,000 4½ per cent. equipment trust notes, maturing in 20 semi-annual installments. They are secured by a mortgage on 80 locomotives and 6,000 freight cars ordered some time ago.

GENERAL NEWS SECTION

NOTES.

The Grand Trunk Railway now checks baggage through from Chicago to Liverpool.

According to the *Fort Wayne* (Ind.) *Journal*, the four interurban electric railroads centering in that city carry out from Fort Wayne 160 tons of freight daily.

The Delaware, Lackawanna & Western has put in service for the summer its "Manhattan Flyer," between Oswego and New York, running through in 8 hrs., 35 min. The train has observation and dining cars.

Officers of the International Machinists' Union say that they have secured for their members on the New York, New Haven & Hartford an increase of pay averaging one cent an hour, or an aggregate of $27,500 a year.

A press despatch from Dallas, Texas, last Monday, says that Judge McCormick, of the United States Circuit Court, has enjoined the State Railroad Commission from reducing passenger fares on the Houston & Texas Central.

The Supreme Court of the state of Wisconsin has reversed a judgment of State Railroad Commissioner Thomas who had assessed fines of $10,000 each against four of the principal railroads of the state for making alleged incorrect reports of earnings.

The Chicago & Alton has taken off its four "interurban" trains which have been running between Springfield, Ill., and Lincoln, 29 miles. This change is said to have been due to the large volume of coal and other freight now moving over that part of the road.

The State Railroad Commission of Georgia has called upon the Atlanta Northern Railway, an electric line from Atlanta to Marietta (20 miles), to file its passenger and freight tariffs. This is the first action taken by the Georgia Commission looking to the supervision of electric railroads.

Slason Thompson, agent of the railroads in Chicago, announces that all of the roads in that city have increased the wages of freight house men, an agreement having been reached to partially meet the demands of the Freight Handlers' Union. The increases is in most cases one cent an hour.

According to a New Jersey local paper the New York & Long Branch Railroad has notified its highway crossing attendants to destroy their flower gardens. It appears that the plants are liable to take so much of the flagman's attention that he will not keep his ears open for approaching trains.

Mayor Dunne, of Chicago, acting on a report of a city official, to the effect that 21 persons have been killed by street cars in that city within 50 days, calls upon the street car companies to explain; and if no satisfactory explanation is received he proposes to ask the Grand Jury to indict the managing officers of the companies.

At Indianapolis, June 20, Ernest and Walter Carruth, brothers, were sentenced to long terms of imprisonment for fraud on a street railroad company. One of the brothers is able to throw his ankle out of joint at will, and with the aid of the other he has been able to collect many claims of damages for alleged injury in falling off street cars.

It is announced, apparently on authority, that the Pennsylvania will in about two months run trains from between New York and Washington in 4 hrs. 30 mins., or 30 minutes less than the present fastest time. The distance is 225 miles. The completion of the elevated roadway through Wilmington and of that across the Susquehanna river will do away with the delays at those places.

The Southern Pacific has announced a reduction in fares on its main line in Arizona to 4 cents a mile; on the Maricopa & Phoenix from 6 cents to 5 cents, and on the Gila Valley, Globe & Northern from 6 cents to 5. Reductions on the Union Pacific in Wyoming were noted last week. It is reported in Arizona that the Atchison, Topeka & Santa Fe will also reduce fares in that territory.

A press despatch from Chicago says that the Government is going to proceed in the courts against the Standard Oil Company and the refrigerator car lines for violation of the railroad freight rate laws. Mr. Marchand, Agent of the Interstate Commerce Commission, and Mr. Morrison, District Attorney, are preparing the cases. The same item says that the Armour Refrigerator Line is trying to sell 8,000 fruit cars to the American Refrigerator Transit Company.

On June 20 the Kentucky State Railroad Commission issued an order directing sweeping reductions in freight rates in that state. Investigation of the subject and consideration of the wishes of shippers have been going on for six months past. It is said that the Louisville & Nashville is ordered to reduce all freight rates 25 per cent. on the main line and the Knoxville and Cumberland Valley divisions. Similar reductions are ordered on other roads, but the exact percentage is not given.

The Senate, at Washington, on motion of Senator LaFollette, of Wisconsin, has passed a resolution calling upon the Interstate Commerce Commission to investigate the relations between the railroads and the grain elevators. Senator LaFollette said that abuses existed in South Dakota, Nebraska and other western states. Senator Nelson, of Minnesota, said that the legislature of his state had cured some of the evils of the elevator situation, but agreed that an investigation would probably disclose conditions needing to be remedied.

President Stickney, of the Chicago Great Western, has announced that rates on grain eastward from Omaha will be reduced 1¼ cents per 100 lbs. to compete with other lines, which he says allow an illegal rebate of this amount to elevators. The newspapers say that the Union Pacific refuses to reduce its elevator allowance of 1¼ cents at the Missouri river on grain originating in its territory, explaining that "we are compelled to allow this charge under our contract with Peavey. We had to make this arrangement with him to protect ourselves. Our line ends at the Missouri river, and if we let our cars go to the yards of competing lines they would steal them and we would have to go out of the grain business. Four years ago the Burlington and the Santa Fe began an attack on our contract, but the Interstate Commerce Commission decided in our favor. Then the other Missouri river lines began to allow the same elevator charge as we did, which in their case amounted to a rebate. Omaha is not a grain center like Minneapolis, where 100 cars of wheat a day are ground into flour. We do not pay Peavey something for nothing. He gives us service easily worth what we pay. The worst thing that would happen to our line would be for the elevators to burn down. We propose to protect ourselves, no matter what the other lines think about it. The whole trouble is that they suspect something mysterious or suspicious below the surface, while there is nothing they cannot see."

The Buffalo Forged Steel Fulcrum.

The accompanying illustration shows the Buffalo Brake Beam Company's one-piece forged steel fulcrum for application to the Vanderbilt special brake beam. While under former conditions the malleable iron fulcrum was sufficiently strong to perform the service required, the introduction of high capacity cars, higher speed and quick action brakes, has made necessary the use of a stronger and more reliable fulcrum. The forged steel fulcrums meet these requirements. All Vanderbilt brake beams are equipped with the forged fulcrum and both the beams and the fulcrum are guaranteed to last the life of the car. Many railroads are using these fulcrums to replace the malleable iron fulcrums now in service as they fail. They are made by the Buffalo Brake Beam Co., 30 Pine street, New York.



From the Statistical Department.

A Pittsburg paper reports that in warm weather the amount of drinking water consumed in the waiting room of the Union Station, in that city, is 3,600 gallons a day. The same statistician estimates that 3,200 persons drink once each hour. The size of the drink he does not tell us. He neglects to take into account the fact that between 11 p.m. and 5 a.m. there is a slight falling off in the volume of traffic passing through the station and so it is impossible to estimate just what portion of the 75 or 100 barrels of water is consumed by the "average" person.

Medals to Enginemen.

President Roosevelt has awarded medals of honor to two locomotive engineers for heroism, Charles W. Haight of the Delaware, Lackawanna & Western, Utica, and George H. Williams, of Braintree, Mass., on the New York, New Haven & Hartford. At West Winfield, N. Y., on April 26 1905, Mr. Haight climbed out on the pilot of his engine and picked a little child from between the rails while his train was running at a good speed. Mr. Williams dashed in front of an approaching train at Quincy, Mass., for the purpose of saving a woman from being [illegible]. This was on Dec. 21 1904.

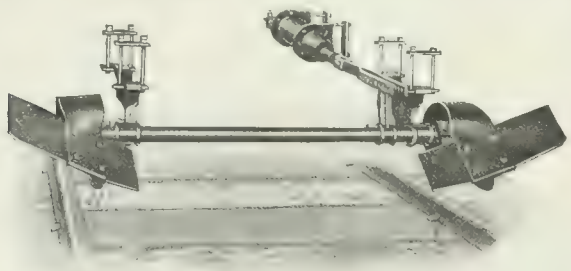
He was struck by [illegible] as the approaching train and sustained injuries which kept him in the hospital for nearly four months. Only one medal has heretofore been awarded under this law, and it will still become time before Messrs. Haight and Williams receive their medals, as the dies from which the medal is struck are not yet completed. They are being made at the mint in Philadelphia from a design made by Mr. Adolph Weinman, a New York sculptor.

Imprisonment for Rate Cutters.

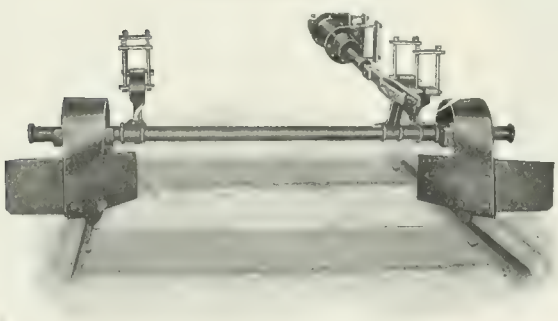
In the United States District Court at Kansas City June 22 four packing companies were fined $15,000 each, the Chicago, Burlington & Quincy Railway the same and, George L. Thomas, of New York, $6,000 and four months in the penitentiary, and L. B. Taggart, of New York, $1,000 and three months in the penitentiary; all for participating in illegal rates. The packing companies—Swift, Cudahy, Armour and Morris—had accepted a rate of 23 cents to New York when the tariff was 35 cents, the 27 cent rate being given on a contract which had been made before the advance to 35 cents was decided on. Thomas is a freight broker and Taggart is his assistant. They had secured rebates on shipments from New York west to Kansas City and other cities, mostly dry goods, and had divided the spoils with the consignees, for whom they had acted as agent. The judge in his summing up said that he assumed that these consignees were to be proceeded against later. He named six firms who had received various sums of money from the railroads through Thomas, aggregating, in four years, $82,459; and the evidence showed that there were still other sums, the exact amount of which was not discovered. Under the decision of the Supreme Court of the United States March 12, 1906, in the case of Hale vs. Henkle, a corporation can no longer plead immunity when testifying.

Root Locomotive Snow Scraper.

The accompanying illustrations show the Root locomotive spring scraper for removing snow and ice from the rails in front of a locomotive. It consists of two scrapers made of spring steel, carried by a broad spring which is attached to a shaft carried in hangers from the front fork of the locomotive frame. A lever arm is mounted on the shaft just inside the frames, and to the end of this lever arm is fastened an air cylinder, also bolted to the frame. When not in use the air is released from the cylinder and the blades are drawn up by a spring coiled around the piston rod and held in



Rear View—Raised.



Rear View—Lowered on Track.

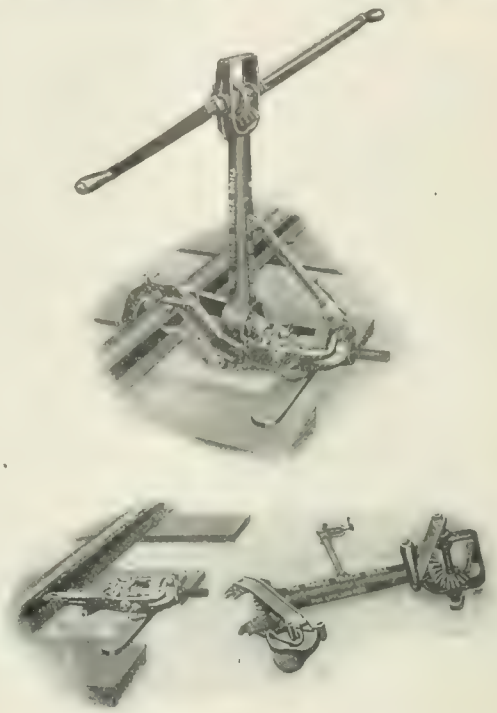
Root Locomotive Spring Snow Scraper.

a position 8 in. above the rail. When it is desired to clean the rails of snow or ice, air pressure is admitted to the cylinder from a valve in the cab and the scrapers are forced down on top of the rail. Being carried by springs, and being dragged rather than pushed over the rail, this device does not require raising for switches, crossings, or similar breaks in the track, and it is claimed that it is absolutely safe to use at any rate of speed. Any pressure can be applied to the spring and scrapers according to the conditions of snow, whether dry, wet or packed. The blades clear the snow from the rail 8 in. on each side, even with the top, and also clean out a groove 1½ in. x 1½ in. below the top of the rail on the inside, thus forming a clear space for the wheel flanges. The device is sold complete, including the air cylinder. It is made by the Kalamazoo Railway Supply Company.

The Moore Track Drill.

A new rail drill designed for heavy and severe work is shown herewith. It is intended especially for use in yards and on busy lines without interruption to traffic. The upright and cranks are readily detachable from the lower parts, which are left in position below the top of the rail while a train is allowed to pass.

The drill has a variable feed, adjustable from zero to full capacity, and therefore capable of meeting varying requirements such as the use of a large or small drill, drilling hard or soft rail, reaming for electric bond work, etc. By throwing the feed mechanism out of gear the drill bit can be quickly fed up to or returned from

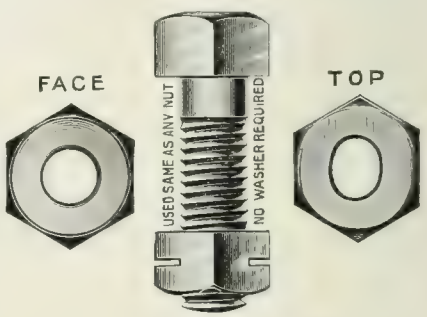


The Moore Track Drill.

the work. Under-clutch and over-clutch patterns are made, the former enabling quick attachment to the rail without digging beneath. Both patterns are shown in the illustrations, the over-clutch, which hooks over the rail top, having the upper parts detached for passing trains. The drill can be equipped with either or both clutch arrangements as desired. Ball thrust bearings are used on the spindle to minimize friction. The drills are made in two sizes. No. 1 weighs 60 lbs. and is intended for 1 in. holes and smaller, but has power to drill holes up to 1¼ in. No. 2, weighing 100 lbs., is intended for continuous heavy work and readily drills 1⅛ and 1¼ in. holes. They are known as the "Moore" drills and are made by the Kalamazoo Railway Supply Co., Kalamazoo, Mich.

The "Bull-Dog" Lock-Nut.

A new design of lock-nut is shown in the illustrations herewith. In general appearance it resembles an ordinary nut except that the opposite sides are slotted as shown. After slotting, the upper part, or portion above the slots, is pressed parallel to the slots so as slightly to elongate the hole. The appearance of the hole from the top is therefore slightly elliptical while from the face it has the appearance of an ordinary nut. The nut is made of steel and has sufficient spring so that it conforms to the bolt when wrenched on, and resumes its shape upon removal.



The "Bull-Dog" Lock-Nut.

It is claimed that it does not loosen under the most severe tests of jar or vibration. In one such test it was placed on two main line railroad crossings where heavy trains are constantly passing. It is said that before trying this nut the nuts formerly used on this crossing had to be tightened several times a week. The present nuts have been on the crossing for nearly a year and have only been tightened once, shortly after placing, to take up the slack. They have been in use in other severe service such as on a trip hammer without loosening, on engines, automobiles, cars, locomotives, trucks, etc., and are claimed to have given most satisfactory results.

They may be given any tension desired in manufacture, fitting

them for use on the most delicate machinery or in the roughest railroad service. They are furnished finished, semi-finished or plain; hexagon or square, and with V, U. S. standard, or any special size of thread. They are made by The Railway Lock-Nut Co., Chicago.

A School for Section-Bosses.

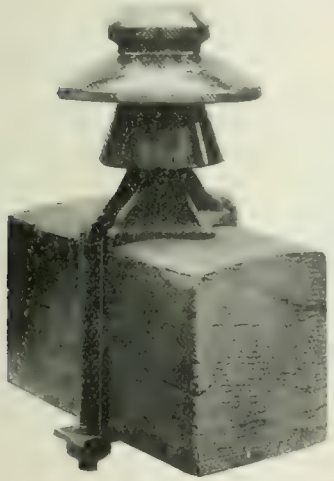
According to a California paper the Southern Pacific is planning to make a determined effort to raise up a tribe of competent track foremen, by the establishment of an "educational gang." The road-master at San Bernardino has issued a circular explaining the purposes of the company as follows:

"As soon as twenty applications are to be had an educational gang will be started from Bakersfield under one of the best foremen on the division. The young men in this party will receive the best possible teaching, and we expect to soon turn out some good extra gang and section foremen. The rate of pay will be $2 per day and $15 per month for board. The company has fitted up some coaches in first class shape, with library, bathroom, with hot and cold water, dining car, and everything for comfort. Let it be known that the company wishes to receive applications from young men of strong physique, good moral habits, energetic, with common school education, and who are not cigarette fiends. Young men off farms are preferred."

A New Insulator Pin.

The transmission line and third rail system of the Long Island Railroad was described in our issue of June 8, 1906. A new type of iron insulator pin has been employed in this work, which is a radical departure from previous practice in pin design. It is the invention of Mr. W. N. Smith, of Westinghouse, Church, Kerr & Co., who has applied for a patent on the device. The design has been further improved and arrangements are now being made for manufacturing and placing it on the market, under the name of "Smith-Grip" insulator pin.

It combines several advantages. It does away with the necessity of boring holes in the crossarms, thereby increasing the strength of the arm and lengthening its life; the metal composing it is distributed in an effective manner, as its cross-section is greatest next to the arm where the greatest resistance to bending is required; and the shrinkage of the arm can be taken care of more effectively by the U-bolt and strap than by other forms of pin fastening in common use, as there is no tendency to distort the bolt, and consequently the pin will not stand crooked upon the arm after the shrinkage has been taken up. It is claimed to be practically indestructible, and instead of being one of the weakest factors in line construction, this pin is expected to be the strongest.



The "Smith-Grip" Insulator Pin.

More than 8,000 of the pins as originally designed and shown in the accompanying illustration, were used in the transmission line construction of the Long Island Railroad, carrying 250,000 c.m. cables in spans averaging 150 ft. in length, and no failures have yet been reported after over a year of service. A dozen or more standard sizes of the improved design are being worked up to fit several sizes of crossarms and pole tops, and to carry insulators of varying sizes up to the highest voltages in practical use. The pins will be made of either cast or malleable iron to suit the purchaser's conditions.

While it is designed particularly for use with wooden crossarms, it can be adapted to steel crossarms, and to such special fixtures as are often necessary in heavy transmission line construction. It can also be used in heavy catenary trolley construction for the electrification of railways by the single-phase system.

Intellectual Resources.

Much talk of excessive and discriminating railroad rates has made the advocates of canal transportation more eager than ever. It was Senator Knox who, in calling up an ancient committee-room measure for building a waterway from Lake Erie to the Ohio river on Tuesday, dwelt upon this method of "regulating" our rail carriers. Theoretically, canals are of the greatest value; the promoters of the Lake Erie-Ohio river project declare that by securing a 12 ft. waterway from Ashtabula to Pittsburg, ore boats can be run from the fields of the Northwest directly to the mills without reloading, and at a fraction of the cost of rail transportation. In the same way the promoters of the Cape Cod ship canal have proved the economic feasibility of their plan; and, logically, it has been shown that a ship canal across Westchester County from the Hudson River to Long Island Sound would be a paying investment. The waterway from Minnesota and the wheat fields of the Northwest to the Gulf is only slightly less practicable, while everybody knows that a De Witt Clinton in Louisiana or Texas would see the advantage of paralleling the coast from New Orleans to Galveston with a canal to accommodate river craft that could not live in the waters of the Gulf. Such projects appeal to the imagination, and serve to remind us that the intellectual resources of the country are as great as those of a material nature.—*Evening Post, New York.*

Canadian Railroad Subsidies.

Hon. Mr. Emmerson, Minister of Railways, has asked the Dominion Parliament to appropriate $9,399,900 for railroad subsidies to be divided among 43 lines. They are all renewals of bonuses formerly voted, which had lapsed, no new subsidies being asked for. By provinces the amounts to be voted are as follows: Ontario, $2,925,000; Quebec, $3,574,100; Maritime Provinces, $1,697,600; Western Provinces, $1,203,200.

TRADE CATALOGUES.

Coaling Chutes.—The Gravity Measuring Coal Chute Co., Richmond, Va., is distributing a pamphlet, well illustrated with half-tones and line drawings, descriptive of coal chutes for locomotives. The delivery pockets are in pairs, each pair containing four or two tons of coal. Pneumatic vertical gates control the filling of the pockets from the storage pocket above. It is claimed that this method lowers the cost of coaling locomotives and allows of a reliable record being kept of the amount delivered to each engine, as the pockets measure the coal as accurately as it can be measured by volume.

General Contractors.—Westinghouse, Church, Kerr & Company, Engineers, New York City, have published a second volume of a small book, entitled "Work Done," which includes a brief description, with illustrations, of 45 large pieces of contract work which this company has undertaken during the last three or four years. The book shows the varied nature of the contracts for the entire completion of large engineering enterprises which this company has recently finished.

Denver & Rio Grande.—This company is distributing a folder listing various places on its lines near which good fishing and hunting are to be found. Another folder gives the names of hotels at these places, with schedule of prices and distances from the railroad. The company has put on a new train, the "Scenic Limited," between Denver, Colo., and Ogden, Utah, which, it is announced, will leave the terminals on time each day regardless of connections.

Hayes Derails.—The Hayes Track Appliance Co., Geneva, N. Y., has issued a revised descriptive catalogue of its well-known lifting and pivot derails. In addition to the complete descriptions heretofore published, numerous illustrated examples are given of the use of derails in all sorts of situations, and there are very complete instructions for putting the derails in track.

Highway Crossing Bells.—The Union Switch & Signal Company, Swissvale, Pa., has issued Bulletin 24 describing its apparatus for the protection of highway crossings by automatic bells. The pamphlet gives not only full descriptions of the apparatus but a page of suggestions to buyers and a dozen rules for maintenance and inspection.

Pneumatic Hammers.—Bulletin No. 2,006 of the Ingersoll-Rand Co., New York, is devoted to "Imperial" pneumatic hammers. Chipping, calking and riveting hammers are illustrated and weights and dimensions given. There is also an illustrated list of parts with code words for ordering them.

Gages.—The Standard Gage Manufacturing Co., Syracuse, N. Y., sends a pamphlet illustrating and giving prices of its steam, water, and other gages. The company also makes speed indicators and counters for recording the strokes of pumps and other machines.

Pneumatic Tools.—A small pamphlet, 6 A, just issued by the Ingersoll Rand Co., New York, contains tables of sizes and capacities of Haeseler and Imperial pneumatic tools, including hammers, motors, drills and hoists.

Track Gages and Levels.—A seven-page bulletin of the Buda Foundry & Mfg. Co., Chicago, describes and illustrates both the new and old styles of track gages and levels, with and without insulation, made by this company.

Ventilators.—The Globe Ventilator Co., Troy, N. Y., sends an illustrated folder describing its car ventilators. There is a copy of

an inch thick, testimonial written by the Master Car Builder of a railroad in 1878.

Manufacturing and Business.

The installation of the block and interlocking signals for the lines of the New York Central which are to be electrified has been entrusted to the General Railway Signal Company of Buffalo and Rochester and in view of the novelty and magnitude of the undertaking, the reader will be interested in some account of the men who are carrying out the work. As will be seen by the description of the signaling, which is published in another part of this paper, the most prominent characteristic feature of this signaling is the reactance bond, designed by Mr. S. Marsh Young. This and other features are so essential that the engineering department of the New York Central in describing the signaling speaks of it as the "Young system." The designing of the different new machines and new apparatus required has been done under the direction of Mr. W. K. Howe and the Signal Company's Superintendent in charge of the work in the field is Mr. W. G. Hovey. Mr. Salmon, the well-known President of the company, has been in immediate charge of this undertaking, and continues so. The preliminary studies and estimates have taken many weeks.



W. W. Salmon.



S. M. Young.

W. W. Salmon was born in Delaware in 1866, and graduated from Dickinson College, with the degree of A. M., in 1886. He immediately went into the railroad service and was in it for six years, first on the Philadelphia, Wilmington & Baltimore in the engineering corps, and subsequently on the Philadelphia & Reading and the Chicago & North-Western. On the latter road he was assistant engineer for three years. In 1892 he left the railroad service and became engineer of the Hall Signal Company. With this company he remained nine years, being successively western agent, general agent, vice-president and European representative. In 1901, on establishment of the Taylor Signal Company, he became its vice-president. The Taylor Signal Company was merged in the present organization, the General Railway Signal Company, in 1904.



W. K. Howe.



W. G. Hovey.

W. K. Howe, Chief Engineer of the General Railway Signal Company, was born at Clifton, Ill., in 1869, and is a graduate of Purdue University. After a post graduate course at Purdue in electrical engineering, Mr. Howe entered the employ of the Western Electric Company at Chicago (1890), and was with that company ten years, engaged in the design, testing and erection of electric power and telephone apparatus. He began with the Taylor Signal Company as principal assistant engineer in charge of electrical manufacture and testing, but soon was put in charge also of designing and of the management of the factory. He is now chief engineer.



H. M. Sperry.

S. Marsh Young was born in New York City in 1867. He entered the College of the City of New York at the age of 17, but owing to financial necessities left the college in the middle of his second year and went into the dry goods business, but after two years he went to the Julien Electric Company, the first company to use storage batteries for propulsion of cars. He was Vice-President of the Hall Signal Company at its organization and represented the company at Chicago for four years. During this time the Hall automatic block signals were introduced on the Chicago & North Western, the Illinois Central, and other western roads. In 1894 Mr Young made important improvements in the enclosed arc lamp, which were a marked success, but in 1898 this interest was sold to Mr. Westinghouse. Three years later Mr Young dissolved his connection with the business, and in 1902 he brought out his arrangement for working track-circuit automatic signals on electric railroads where both of the traffic rails are required for the return of the propulsion current. He at once made a contract with the Pneumatic Signal Company, and it is this system, somewhat modified, which is now to be used on the New York Central. Mr. Young holds ten patents on the reactance bond.

W. G. Hovey, Construction Manager of the General Railway Signal Company, has already been introduced to the readers of the *Railroad Gazette*. Mr. Hovey was born in Maine in 1850, and his first railroad service was on the New York, New Haven & Hartford. He then went to the Hall Signal Company and from there to the Chicago & North-Western. He left the North-Western in 1900 and went to the Taylor Signal Company. He has been with that company and its successor ever since, being for some time superintendent of the shops and subsequently New York representative.

The New York manager of the General Railway Signal Company is Mr. H. M. Sperry, already well known to the readers of the *Railroad Gazette* as the former signal engineer of the New York division of the Pennsylvania and later engineer and commercial representative of the Union Switch & Signal Company. Mr. Sperry not only has the management of the business end of the New York Central enterprise, but may be said to have had a hand in the engineering features of the work; for it was at his suggestion that the overlap was adopted for use on the New York Central terminal line in the Park avenue tunnel. The overlap is now to be used throughout the electric zone.

Iron and Steel.

The Norfolk & Western has given a contract for 11,500 tons of rails for 1907 shipment, and the Erie has placed a supplementary order for 2,200 tons.

The Kansas City Southern has ordered 400 tons of fabricated bridge material, the Chicago, Burlington & Quincy 800 tons, and 100 tons for bridges to be built over the Illinois and Mississippi Canal. The New York Central is in the market for some bridge material. The Chicago & North-Western; Illinois Central; Chicago, Milwaukee & St. Paul; Ontario & Western; Missouri, Kansas & Texas, and the C., C., C. & St. Louis have ordered bridge material amounting to 5,000 tons.

Profit-Sharing Trolley Line.

It is reported from Lyons, France, that a profit-sharing system has been adopted by the street railways of that city. The amount distributed will be $500 for each franc (19.3 cents) of dividend earned by the company over 35 francs ($6.75) per share. The shares are 500 francs. This year the company earned 40 francs per share. As a consequence $2,500 will go to the employees, two-thirds of the sum to the general relief fund, and one-third to personal relief for sickness. The company also makes other stipulated contributions to the relief funds, the full details of the agreement being on file at the Bureau of Manufactures. The employees bind themselves not to ask for increase in wages for three years. Heretofore there have been frequent strikes.—*Consular Report.*

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Canadian Pacific.—L. J. Forget has been elected to the Board of Directors, succeeding G. R. Harris, deceased.

Flint River & Gulf.—The officers of this company are: J. S. Betts, President, with office at Ashburn, Ga.; C. A. Alford, Vice-President, with office at Sylvester, Ga.; J. L. Evans, Secretary and Treasurer; J. H. Hillhouse, General Freight and Passenger Agent; C. S. Roe, Car Accountant; all with offices at Ashburn, Ga.

Flint River & Northeastern.—The officers of this company are: J. L. Hand, President, with office at Pelham, Ga.; W. W. Ashburn, Vice-President; C. W. Pidcock, General Manager; X. H. Clark, Treasurer; B. H. Groover, Secretary and Auditor; F. R. Pidcock, General Superintendent and Assistant Secretary; G. E. Smith, Traffic Manager; all with offices at Moultrie, Ga. J. W. Walters, General Counsel, with office at Albany, Ga.; J. H. Owen, Car Accountant; C. B. Patterson, Master Mechanic; all with offices at Moultrie, Ga.

Gulf, Colorado & Santa Fe.—D. F. Shuckhart, Acting Auditor, has been appointed Auditor.

Operating Officers.

Chesapeake & Ohio.—E. W. Grice, Superintendent of the Huntington division, has been appointed General Superintendent in charge of Operation and Maintenance of the West Virginia Grand division, consisting of the Huntington and the Greenbrier divisions, with office at Hinton, W. Va. J. W. Haynes, Assistant Superintendent, has been appointed Superintendent of the Greenbrier division, with office at Ronceverte, W. Va. J. R. Carey, Assistant Superintendent, has been appointed Superintendent of the Hinton division, which consists of that portion of the Huntington division east of Handley, with office at Hinton, W. Va., and C. P. Snow, Assistant Superintendent, has been appointed Superintendent of the Huntington division, which consists of the portion of the old Huntington division west of Handley, with office at Huntington, W. Va. All appointments are effective July 1.

Chicago, Milwaukee & St. Paul.—P. C. Eldredge, who was recently appointed Superintendent of the La Crosse and the Northern divisions, began railroad service in 1878 as a night operator on the Delaware & Hudson. After serving on the Kansas Pacific and the Chicago, Milwaukee & St. Paul in various positions, he went, in 1883, to the Iowa Central as chief despatcher and Superintendent of Telegraph. Three years later he went to the Minneapolis & Pacific and, in 1887, was made despatcher on the Norfolk & Western. Later in the same year he returned to the Chicago, Milwaukee & St. Paul as chief despatcher at Ottumwa, Iowa. He was made trainmaster on the Kansas City division in 1892, and was transferred to the Superior division in 1894. Four years later he was appointed Superintendent of the Wisconsin Valley division. In 1900, he was transferred to the Prairie du Chien division, where he remained until his recent promotion.

Engineering and Rolling Stock Officers.

Chicago, Indiana & Southern.—Byron Layton, who was recently appointed Engineer of Maintenance, began railroad work in 1901 on preliminary surveys in Oregon. Before that time, he had been, for nine years, a junior engineer in the United States Engineering Corps. In 1902 and 1903, he was in the Maintenance Department of the Merchants' Bridge & Terminal at St. Louis, and, after that, spent some time studying the belt railroad facilities in Chicago. He was later made Engineer of Maintenance of the Indiana Harbor Belt.

Lake Shore & Michigan Southern.—H. F. Ball, Superintendent of Motive Power, has resigned to go to the American Locomotive Co., in charge of the manufacture of automobiles.

Pittsburg & Lake Erie.—D. P. Morrison has been appointed Electrical Engineer, succeeding G. M. Campbell, resigned.

LOCOMOTIVE BUILDING.

The Quebec Central has ordered two locomotives from the Canadian Locomotive Co.

The Oklahoma Central has ordered three eight-wheel locomotives and five Mogul locomotives from the Baldwin Works for October and November delivery.

The Newburg & South Shore, as reported in our issue of May 11, has ordered one Mogul and one six-wheel switching locomotive from the American Locomotive Co.

The Midland Valley has ordered five simple consolidation locomotives and one simple 10-wheel (4-6-0) type locomotive from the Baldwin Locomotive Works. The consolidation locomotives will weigh 138,000 lbs., with 122,000 lbs. on the drivers; cylinders, 20 in. x 24 in.; driving wheels, 50 in. in diameter. Four of the five consolidation locomotives will have wagon top boilers, fitted with 241 tubes, and the remaining one will have a Wooten type boiler, fitted with 280 tubes, with a working steam pressure of 180 lbs. Four of the locomotives will have a heating surface of 1,995 sq. ft. and the remaining one will have a heating surface of 2,100 sq. ft.; the tubes will be 13 ft. 3¾ in. long by 2¼ in. in diameter; the fireboxes of four of the locomotives will measure 103 3/16 in. long by 42 in. wide, with a grate area of 30 sq. ft.; the remaining one consolidation locomotive will have a firebox 96 in. long by 84 in. wide, with a grate area of 72 sq. ft. The tender will have a capacity for 10 tons of coal and 5,000 gal. of water. The 10-wheel locomotive will weigh 117,000 lbs., with 90,000 lbs. on drivers. Cylinders, 18 in. by 24 in.; diameter of drivers, 57 in.; wagon top boiler, with a working steam pressure of 190 lbs.; total heating surface, 1,796 sq. ft.; 254 tubes, 2 in. in diameter by 12 ft. 6 in. long; firebox, 96 in. long by 33⅜ in. wide; grate area, 22.2 sq. ft.; tank capacity, 3,000 gals., and coal capacity, 10 tons. The special equipment for all will include: Westinghouse air-brakes, hammered steel axles, Western bell ringers, Magnesia boiler lagging, Tower couplers, Pyle electric headlights, Monitor injectors, bronze journal bearings, U. S. metallic piston and valve rod packing, Crosby safety valves and steam gages, Houston sanding devices, Nathan sight-feed lubricators, Safety Car Heating & Lighting Co.'s steam heat equipment, cast-steel wheel centers and Ewald staybolts.

CAR BUILDING.

The Intercolonial is in the market for 200 hopper cars.

The Chesapeake & Ohio is considering ordering 50 cabooses.

The Boston & Maine is building three mail cars in its own shops.

The Lehigh Valley, it is reported, is in the market for a number of steel gondola cars.

The Northern Pacific has ordered 10 dining cars from the Barney & Smith Car Company.

The National of Mexico, it is reported, has ordered 100 dump cars from the National Dump Car Co.

The Richmond, Fredericksburg & Potomac is considering the purchase of one combination dining and parlor car.

The Macon, Dublin & Savannah, as reported in our issue of June 8, has ordered 100 box cars from the American Car & Foundry Co.

The Wabash, it is reported, has placed orders for 2,000 box cars of 80,000 lbs. capacity, 4,000 steel coal cars of 100,000 lbs. capacity, and 500 stock cars, all of which are to be delivered before the end of the current year.

The Isthmian Canal Commission has placed orders for the 1,000 flat cars for which it was in the market. Three hundred of the cars were ordered from the South Atlantic Car & Mfg. Co., and the remaining 700 were ordered from the American Car & Foundry Co.

The Chicago, Burlington & Quincy has ordered 100 steel underframe box cars of 80,000 lbs. capacity from the Standard Steel Car Co., for August delivery, in addition to the 1,900 cars ordered from the Pullman Co. reported in our issue of May 25. These cars will measure 40 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements.

The O. F. Jordan Co., Chicago, has ordered three special flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works. These cars will weigh 22,000 lbs. and measure 36 ft. long, over all; 6 ft. wide and 4 ft. high, inside measurements. The special equipment includes: Westinghouse air-brakes, Tower couplers, Hinson draft rigging and Griffin wheels.

The Zanesville Railway, Light & Power Co. has ordered five semi-convertible cars from the Cincinnati Car Co., for October delivery. These cars will weigh 19,000 lbs., and measure 39 ft. long, 8 ft. 5 in. wide and 8 ft. 11 in. high, over all. The special equipment includes: Cincinnati Car Co.'s brakes, paint and vestibules, Forsyth curtain fixtures, Pantasote curtain material and Brill journal boxes and trucks.

RAILROAD STRUCTURES.

ATLANTA, GA. A permit has been issued to the Louisville & Nashville for the construction of five-story freight terminals to cost $230,000.

ATTLEBORO, MASS. The new railroad station which is to be erected at Attlebero in the near future by the N. Y., N. H. & H. is to be of red brick and will be much larger than the present station. The location will be about 800 ft. south of the old station and it will be above grade, thereby abolishing about 12 grade crossings. There will be two buildings, one on the east and the other on the west side of the tracks.

CHATHAM, ONT. The Chatham, Wallaceburg & Lake Erie is

plaintiff, to build a steel bridge over the Thames river at a cost of $40,000.

CHATTANOOGA, TENN.—Both Houses of Congress have passed a bill authorizing the Chattanooga Northern to build a bridge over the Tennessee river.

EDMONTON, ALB.—The Canadian Pacific, it is said, has decided to build a combined railroad and highway bridge at a cost of $2,000,000 to shorten the line into this city.

FOSTORIA, OHIO.—The Baltimore & Ohio has given a contract to P. A. Baker & Bro., of Defiance, Ohio, for building a new stone passenger station here. It will contain a general waiting room 24 ft. by 26 ft., women's waiting room and smoking room each 12 ft. by 15 ft.

LETHBRIDGE, ALB.—The Canadian Pacific Railway is about to build a steel bridge across the Belly river at Lethbridge, Alberta, one mile long and 300 ft. high at the highest points. The object is to straighten the line between Lethbridge and Macleod. It is proposed to make a double bridge, railway on top and for wagons below. As the iron mills are extremely busy it is not likely that the steel work can be delivered this season, but the masonry will be proceeded with at once.

MACON, GA.—The Central of Georgia Railroad has bought from the City of Macon 27 acres in the city reserve with the intention of erecting shops on the site to cost $1,000,000. It is said that a new union passenger station is assured.

MONTREAL, QUE.—The Grand Trunk Pacific Railway Terminal Elevator Co. has been formed with $5,000,000 capital, and announces that an elevator will be erected at Fort William and another at Tiffin, near Midland, each with a capacity of 2,500,000 bushels. The elevators are to be finished in time for the crop of 1907. The two elevators will cost $1,500,000.

NIAGARA FALLS, N. Y.—The Trans-Niagara Bridge Company has been incorporated at Ottawa, Ont., with a capital of $1,000,000, to build a bridge over the Niagara river north of the upper steel arch bridge at Niagara Falls. Among the incorporators are Frederic Nicholls, Sir Henry Pellatt, H. G. Nicholls, E. R. Wood and Allan H. Boyce, of Toronto. It is to be a combined railroad and highway bridge. (April 6, p. 105.)

PITTSBURG, PA.—The Wabash Railroad will soon have an additional entrance into the Pittsburg district. The bill just passed by the lower House of Congress, authorizing the Jones & Laughlins Steel Company to erect a bridge over the Monongahela river from Hazelwood to Baldwin Township, will give the Wabash an entrance to the mills of the company and permit it to reach its South Side mills, above the Smithfield street bridge, from which it is now blocked by the Pittsburg & Lake Erie.

ST. LOUIS, MO.—Both Houses of Congress have passed a bill authorizing the city of St. Louis to build a combined railroad and highway bridge over the Mississippi river. The city voted to issue bonds for $3,500,000 to build a municipal bridge.

SALISBURY, N. C.—The Southern has started work on a new passenger station here to cost $65,000.

THOMAS, OKLA.—One of the largest railroad bridges in the entire southwest is that recently completed by the Kansas City, Mexico & Orient near Thomas over the Canadian river. The bridge has 21 spans, and cost more than $800,000. About 100 men have been employed on the huge structure for the past year, working every day.

TORONTO, ONT.—The Grand Trunk of Canada has retained Westinghouse, Church, Kerr & Co. as engineers to construct a terminal in Toronto. There is to be a new station which is to cost more than $2,000,000. Westinghouse, Church, Kerr & Co. have retained Carrere & Hastings as architects to prepare the plans for the buildings.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALASKA CENTRAL.—At the recent annual meeting of this company, the stockholders arranged to secure funds to finance the line. An agreement was made with the Tanana Construction Co. to complete the road as far as the Chicalon Fields, 150 miles north to the southern terminus at Seward, the work to be finished by Jan. 1, 1907. (April 6, p. 105.)

APALACHICOLA NORTHERN.—This company, it is said, has given its general contract for construction to the Morey Engineering & Construction Co., of St. Louis, Mo., and the contractor has already completed grading on 19 miles of the line. The proposed route is from River Junction, Fla., on the Atlantic Coast Line, the Louisville & Nashville, and the Seaboard Air Line south to Apalachicola; and thence west to St. Joseph Bay, approximately 100 miles. W. A. Hunnicke, Apalachicola, Fla., is Chief Engineer.

ATCHISON, TOPEKA & SANTA FE.—This company is double-tracking its line from Nixon, Iowa, southwest to Wyaconda, Mo., about 30 miles. A large force is now doing grading work between Dumas and Wyaconda. Between Dumas and Medill, the line will be straightened, requiring some new trestles and bridges.

ATLANTA & ST. ANDREW'S BAY.—An officer writes that this road, which is capitalized at $1,000,000, has been authorized to issue $10,000 per mile first mortgage bonds, none of which the company has found it necessary to sell up to the present time. The company is chartered in the states of Alabama and Florida, and is now building from Dothan, Ala., south via Cottondale, to Panama City, with terminals on St. Andrew's Bay, approximately 85 miles. Grading between Dothan and Cottondale has been finished and track has been laid to a point within eight miles of Cottondale. The company expects to have trains running between these two places by the middle of July. Surveys are being made between Cottondale and Panama City, and work will be started shortly on this section and completed by March, 1907. All the rails for the entire road are on the ground. Maximum grades are 1 per cent. On the section between Dothan and Cottondale, 31 miles, there will be nine curves, two of which are 4 per cent. and the balance 2½ to 3 per cent. When the road is completed to Panama City, the company is planning to extend from its northern terminus at Dothan to Opelika, Ala., an additional 90 miles. On the completion of this section, it is proposed to build to Atlanta, Ga., if traffic arrangements cannot be made with existing lines to that place. A. B. Steele is President and General Manager; G. H. Purvis, First Vice-President and Secretary; Ben W. Steele, Second Vice-President and Assistant Manager, and P. J. Dormer, Superintendent, Atlanta, Ga. The company is not connected in any way with the Birmingham, Columbus & St. Andrew's Bay, which is building from Chipley, Fla., to St. Andrew's Bay.

ATLANTA, BIRMINGHAM & ATLANTIC.—This company, according to local reports, will be running trains into Birmingham and the Birmingham district next spring. The road is now in operation from Brunswick, Ga., on the Atlantic seaboard, west to Montezuma, 194 miles. Recently the Eastern of Alabama, 25 miles long, operated by the Louisville & Nashville between Talladega and Pyriton, Ala., was bought and will be used as part of the main line of the new system. Construction work on terminals is being pushed at Talladega, and surveys have been made for a line from Talladega to Bessemer, 12 miles south of Birmingham. The new road will enter Birmingham via Pelham and Helena, avoiding the Irondale hills, northeast of the city. The contract for construction from Warm Springs, Ga., to Atlanta, 70 miles, has been let to the Callahan Construction Co., of Knoxville, Tenn. According to the information given out, H. M. Atkinson, of Atlanta, and the Old Colony Trust Company of Boston, are behind the financing of the new road. A branch is to be built from Wedowee, Ala., to Atlanta, providing a third direct line from Birmingham to Atlanta. (See Atlantic & Birmingham in Construction Record.)

AUGUSTA & NORTHWESTERN.—Incorporation reported in Georgia to build a line from Augusta northwest to Athens, approximately 100 miles. W. W. Ramsey, T. Fargo, B. Lawrence, B. D. Langdon and others, of Augusta, are incorporators.

BIG HORN.—See Chicago, Burlington & Quincy.

BOSTON ELEVATED.—The bill recently passed by the Legislature which provided for the construction of two subways in Cambridge, one through Massachusetts avenue to Harvard Square, and the other through Cambridge street, East Cambridge, to Harvard Square, was signed by Governor Guild on June 23. (June 15, p. 174.)

CAIRO & KANAWHA VALLEY.—At a recent meeting of the directors of this company, it was voted to extend the road south, 10 miles, to the Little Kanawha river. The present line is 17 miles long from Cairo, W. Va., on the B. & O., south to Macfarlan.

CALIFORNIA ROADS.—The Great Western Gold Co. is said to be planning to build a line from Redding, Cal., to the Ingot Smelter, 26 miles, at a cost of $200,000.

CALUMET, HAMMOND & SOUTHEASTERN. Incorporation in Illinois with $100,000 capital to build a line from Chicago, east of Lake Calumet, to the Illinois-Indiana state line, with a branch to Lake Michigan. Talbot E. Pierce, of Chicago, is an incorporator.

CARSON & COLORADO.—See Southern Pacific.

CHATTANOOGA NORTHERN.—Incorporated in Tennessee to build a line 20 miles long from Chattanooga, Tenn., to Walden's Ridge to develop mineral lands. The Chattanooga Company, Ltd., of which W. G. M. Thomas, of Chattanooga, is General Manager, is said to be largely interested in the project. The incorporators are: W. G. M. Thomas, T. MacClellan, L. H. Thomas and J. H. Thomas. Thomas Crewdson, of London, England, is a large stockholder, it is said.

CHICAGO & NORTH-WESTERN.—This company has almost completed the extension of the Wyoming & Northwestern from Casper,

Wyo., to Lander. An announcement is made that trains are to be running on this division by the first of next month from Casper to Shoshone, 100 miles, so that it will be in operation to the Shoshone Reservation, which is to be opened by the Government on July 15. The remaining 50 miles from Shoshone to Lander is to be opened a month later.

An officer writes that the Lee County Railway, recently incorporated in Illinois, is to be a low grade freight cut-off. The line is to be built by the Chicago & North-Western from Nechusa to Nelson, south of the present main line, and is to be used for eastbound freight trains. Work will be started about the first of next year. (June 15, p. 175.)

CHICAGO, BURLINGTON & QUINCY.—Construction of the new line building under the name of the Big Horn Railroad through the heart of the Big Horn Basin is so near completion that plans have been made for train service beginning July 14. The new line extends from Frannie, in the northern part of Big Horn County, Wyo., southeast to Basin, thence south to Worland, Wyo., on the upper Big Horn river. Worland is to be a registration point for the Shoshone Indian Reservation opening. Trains will be run to carry the homeseekers, connection being made at Toluca with eastern trains. Registration for the Shoshone Indian land begins July 14 and ends July 31. (See Construction Record.)

CHICAGO, ROCK ISLAND & PACIFIC.—A contract is reported let to the Delhoff Construction Co., of Little Rock, Ark., for building a branch from Alexandria on the Rock Island, Arkansas & Louisiana south to Eunice, about 60 miles.

COLUMBUS, NEW ALBANY & JOHNSTOWN TRACTION.—An officer writes that the work of extending this line from Gahanna, Ohio, northeast to New Albany and Johnstown, 17½ miles, will not be difficult. The work includes two steel bridges and one 1,400 ft. trestle, with a maximum height of 65 ft. The date for asking bids for the work has not yet been decided. W. D. Brickell, Despatch Building, Columbus, Ohio, is President. (June 15, p. 174.)

DUBLIN & SOUTHWESTERN.—This company, operating a line 31 miles long in Georgia, from Dublin south to Eastman, is to be extended from its present southern terminus about 35 miles southwest to Cordele, which is on the Albany & Northern, the Atlanta, Birmingham & Atlantic, the Georgia, Southern & Florida, and the Seaboard Air Line.

ERIE.—This company has applied in New Jersey for a right of way across the Hackensack Meadows from a point 425 ft. north of the present Newark branch. The new road will cross the Greenwood Lake branch of the Erie. It is said the purpose of the company is to connect with its main line at Rutherford.

FRISCO, OKLAHOMA & TEXAS.—See St. Louis & San Francisco.

GEORGIAN BAY & SEABOARD.—Bids are wanted July 7 by J. W. Leonard, President of this road, at Toronto, Ont., for the grading, bridging, fencing, track laying, ballasting and other work required from Victoria Harbor to a point connecting with the Canadian Pacific between Peterborough and Havelock. Plans and specifications can be examined at the office of the Division Engineer of Construction, 118 King street west, Toronto.

KAMLOOPS & YELLOW HEAD PASS.—The Dominion Government has granted a charter to this company in addition to the charter already secured from the Province of British Columbia. Bids will shortly be asked for building 250 miles of the line from Kamloops north to Tete Jaune Cache, B. C., over the valley of the North Thompson river, Canoe river and McLenna creek, B. C.

KETTLE VALLEY LINES.—A contract is reported let by this company to Lewis Woodred, of Grand Forks, B. C., for building 16 miles of its line, including culverts.

LEE COUNTY.—See Chicago & North-Western.

LEROY & SOUTHWESTERN.—An officer writes that this road, recently incorporated in Illinois, with office at Wilmington, is to be operated either by steam, gasolene or electric power. Contracts for the work, which will be easy, will be let soon. The proposed route is from Leroy, in McLean County, southwest to Waynesville, in Dewitt County, 25 miles. A. H. Shelby, Wilmington, Ill., is President.

LOUISVILLE & ATLANTIC.—This company, which operates a line from Versailles, Ky., on the Southern, southeast to Beattyville, 101 miles, is making surveys for building an extension east from its present eastern terminus at Beattyville, through Lee, Wolfe, Breathitt, Magoffin and Floyd Counties, about 50 miles.

MARIANNA, BRINCKLEY & WESTERN.—This company, it is reported, has been incorporated in Arkansas with $200,000 capital by J. Lesser, J. B. Grove, W. P. Wells and others to build a line from Marianna, Ark., northwest about 30 miles to Brinckley.

MARION RAILROAD.—Incorporated in West Virginia with $500,000 capital to build a line from Fairmont, W. Va., on the Baltimore & Ohio north to Fairview, about 100 miles, and thence to Blockville. The incorporators include: J. Y. Hamilton, J. Gregory and J. R. Thomas, Jr., of Fairview; James R. Lynn, F. H. Bailey and A. S. Fleming, of Fairmont.

MICHIGAN ROADS.—Frank C. Andrews announces that a number of New York capitalists and George L. Maltz, former Banking Commissioner, are back of a project to build a line from Detroit, Mich., northwest to Lansing, 86 miles. Entrance is to be made into Detroit over the Detroit United Railway. It is proposed to operate the road with gasolene engines. The proposed route parallels the Pere Marquette for 40 miles between Brighton and Lansing.

MILWAUKEE JUNCTION.—Incorporated in Wisconsin by the promoters of the Milwaukee Southern to build terminal lines for that road at Milwaukee. The capital stock is $25,000, and the incorporators are: H. C. Wood, Chicago; F. W. Rogers, L. Kitauf, E. N. Spaulding and S. E. Hall, all of Milwaukee.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—After about two years consideration, this company has begun work on a line giving it an entrance into St. Paul. The preliminary work will be completed by November of this year. The company at present enters the city over the Northern Pacific tracks. The cost of the proposed line will be about $2,000,000. The plans call for the building of a double-track 2½ miles from the Soo Junction west of the Cortlandt street bridge to the terminal property, which has been bought at Seventh and Kittson streets. Near the Westminster bridge it will be necessary to build a tunnel 1,500 ft. long under the Great Northern and Northern Pacific tracks. There will be a number of bridges over important thoroughfares.

MIONA SPRINGS.—Incorporated in Georgia to build a line from Fort Valley, Ga., on the Central of Geogia and the Southern southwest to Southland on the Atlanta, Birmingham & Atlantic, about 27 miles. The incorporators include: J. R. Lane, C. B. Culpepper and A. O. Brewton, of Fort Valley, and J. R. Lane is General Manager.

MORGANTOWN & PITTSBURG.—Incorporated in Pennsylvania with $120,000 capital to build 12 miles of line in Green County. W. P. Rainbow, of Pittsburg, is President and also a director. The other directors are: P. G. McClelland, J. S. Weller, J. B. Chalfant, R. W. Martin and J. E. Sampson, all of Pittsburg.

MUNCIE & PORTLAND TRACTION.—This new line has been formally opened from Muncie, Ind., northeast via De Soto, Albany, Redkey and Dunkirk to Portland, 32 miles. George F. McCulloch, Muncie, is President.

NEW ORLEANS & BATON ROUGE (ELECTRIC).—Incorporated in Louisiana, with $2,500,000 capital, to build an electric line from New Orleans northwest to Baton Rouge, about 100 miles. The incorporators are W. O. Orton, C. S. Young, Edward Goodchaux, R. H. Himel and F. E. Lowe.

NEW ORLEANS, CROWLEY & WESTERN.—Location surveys are reported finished and construction work soon to be started on this line which was incorporated recently to build from New Orleans to a point in Texas, connecting with the Missouri, Kansas & Texas. (March 30, p. 99.)

NEWTON & NORTHWESTERN.—J. G. White & Co., of New York, have the contract for electrifying this road. The line is 102 miles long, from Newton, Iowa, northwest to Rockwell City. Work is to be started shortly.

NEW YORK, NEW HAVEN & HARTFORD.—This company has applied to the Rapid Transit Commission of New York City for authority to build a line from the present southern terminus of its main line at Woodlawn, 12 miles north of New York, south along the east bank of the Bronx river, about four miles, to a connection with its Harlem River & Portchester branch near West Farms, four miles north of the New York terminus of the branch. West Farms is also the present northern terminus of the eastern branch of the Interborough Subway line.

NORFOLK & JAMESTOWN EXPOSITION RAILWAY (ELECTRIC).—Incorporated with $300,000 capital by Baltimore capitalists to build electric lines from points on the Norfolk & Atlantic Terminal in Norfolk, Va., to the Jamestown Exposition grounds, and to points in the neighborhood of Sewall's Point and Norfolk. The officers are: President, Alexander Brown; Vice-President, B. Howell Griswold, Jr.; Secretary and Treasurer, Austin McLanahan. These officers with John L. Rowe, Irving E. Campbell, William L. Royall and John J. Blake, of Richmond, Va., are the incorporators.

OREGON SHORT LINE.—This company will build a branch from Cokeville, Wyo., which is 83 miles west of its present eastern terminus at Granger, north to the southern border of the Yellowstone National Park, about 150 miles.

PEACH RIVER & GULF.—It is said that this company, operating 11 miles of road from Oaklawn, Tex., southeast to Battle, contemplates

...the Gulf, Colorado & Santa Fe at Timber, and with the Houston, East & West Texas at Midline, is to be extended from Midline southeast to Beaumont, about 65 miles; and also from Timber northwest to a point on the International & Great Northern between Conroe (where that road crosses the Gulf, Colorado & Santa Fe) and Willis, approximately 12 miles.

Randolph & Cumberland.—Incorporated in North Carolina with $1,000,000 capital by E. V. Shedd and M. E. Caldwell, of Aberdeen, N. C., and I. J. Edwards, of Providence, R. I., to build a line from Fayette, N. C., on the Atlantic Coast Line, northwest about 117 miles, along Deep river, through Cumberland, Moore, Randolph and Guilford Counties.

Roanoke & Salem Traction.—Incorporated in Virginia with $25,000 capital to build an electric line from Roanoke, Va., west to Salem, 10 miles. The officers are: O. L. Stearnes, President; Chas. D. Denit, Vice-President; W. B. Dillard, Treasurer; W. H. Tinsley, Secretary; R. W. Kime, General Manager, all of Salem.

Rock Island, Arkansas & Louisiana.—See Chicago, Rock Island & Pacific.

Sacramento Belt.—Incorporation asked for to build a belt line along the crest of the river levee on the city front of Sacramento, Cal. The Jobbers' Association is said to be back of this enterprise.

St. Louis & San Francisco.—According to local reports this company is planning to at once let contracts for building an extension from Oklahoma City south. The work is being done under the name of the Frisco, Oklahoma & Texas, a company which was chartered some time ago. The proposed route is from a point near Oklahoma City south to Hewitt, Ind. T., thence east to a connection with the Frisco line at Ardmore, approximately 100 miles.

Shreveport, Houston & Gulf.—Incorporated in Texas with $100,000 capital to build a line from a point on the St. Louis Southwestern, in Angelina County, Texas, south to Houston, 120 miles. The proposed route is through the Counties of Angelina, Polk, Tyler, Liberty, Montgomery and Harris. The board of directors are: G. A. Kelley, R. D. Collins, of Lufkin, Texas; J. J. Carroll, Jack Thomas, E. A. Carter, of Camden, Texas; W. T. Carter and C. L. Carter, of Houston.

Southern Pacific.—Surveys, it is reported, are being made to extend the Carson & Colorado from Wabuska south 15 miles to Yerrington. The grading is very easy. Perhaps one small cut may have to be made, but for the most part the company will need only to lay its tracks upon the ground, without bridges or fills.

Trinity Valley & Northern.—Incorporated in Texas with $25,000 capital to build a line from Dayton, Liberty County, north to a point near Cleveland in the same county, about 25 miles. Connection is to be made with the Texas & New Orleans, and with the Houston, East & West Texas. The incorporators are: L. Fouts, A. L. Rutt and J. B. Sterling, of Dayton; C. B. Wood, C. Ross and W. B. Cottingham, of Houston; J. C. Johnson, of Richmond; C. L. Rutt, of Beaumont, and W. H. McGregor, of Carson.

Wyoming & North-Western.—See Chicago & North-Western.

RAILROAD CORPORATION NEWS.

Boston & New York Air Line.—The shareholders have approved of the sale of this 52-mile road, running from New Haven to Willimantic, Conn., to the N. Y., N. H. & H., which has leased the line since 1882. (June 1, p. 162.)

Canastota Northern.—See Lehigh Valley.

Chicago, Milwaukee & St. Paul.—This company has asked to have listed on the New York Stock Exchange $6,450,000 3½ per cent. general mortgage bonds, making the total listed $8,950,000. Of the additional amount, $5,000,000 has been outstanding for a year.

Consolidated (N. Y., N. H. & H. Electric).—It is reported that this company has acquired three-quarters of the $200,000 outstanding common stock of the Torrington & Winchester Street Railway, which runs from Torrington, Conn., to Winsted, 13 miles.

Eastern Pennsylvania (Electric).—Under this name a company is being organized to acquire the electric railroad and lighting companies in and around Schuylkill County. The roads to be acquired are: the Pottsville Union Traction; the Pottsville & Reading; the Schuylkill, New Haven & Orwigsburg; the Schuylkill Electric; the Tamaqua & Lansford; the Tamaqua & Pottsville; the Coal Castle Electric and the Port Carbon & Middleport Electric. These roads operate an aggregate of 57 miles, and it is intended to build about 20 miles more. The new company will also control eight electric light and gas companies. There have been issued $974,900 5 per cent. cumulative preferred, the total authorized amount being $1,000,000; $4,000,000 common stock, total authorized $5,000,000, and $3,186,000 first mortgage 5 per cent. bonds of 1936, total authorized $6,000,000. Of the authorized bonds, $1,252,000 are to be sold in part payment for the property of the subsidiary companies, $938,000 are to be exchanged or reserved to retire the securities of the subsidiary company, and $3,390,000 are to be issued during the next two years for additions and improvements. The remainder is reserved for future extensions and improvements.

Indiana, Columbus & Eastern Traction.—This company, which is a holding company for the Widener-Elkins Lines in Ohio, has authorized an increase in its capital stock from $1,000,000 to $12,000,000; $1,000,000 will be 5 per cent. preferred stock. (Apr. 27, p. 130.)

Interborough Rapid Transit.—See New York & Queens County.

Key West (Electric).—This company, which operates five miles of street railway and controls the entire lighting property in Key West, Fla., has been bought by Stone & Webster, Boston. It is to be reorganized with $500,000 common stock, $230,000 6 per cent. non-cumulative preferred and $1,000,000 first mortgage 50-year 5 per cent. bonds, of which $450,000 are to be issued to retire $300,000 outstanding bonds and for other purposes.

Lehigh Valley.—The $300,000 first mortgage 6 per cent. bonds of the Canastota Northern, a subsidiary of the Lehigh Valley, will be redeemed at the office of Drexel & Co., Philadelphia, or J. P. Morgan & Co., New York, after their maturity on July 1, 1906. Up to and including June 30, 1906, they may be exchanged for Lehigh Valley general consolidated mortgage 4 per cent. bonds of 2003 at the office of Drexel & Co., or Brown Brothers & Co., Philadelphia.

Mexican Central.—This company has sold to a syndicate managed by Ladenburg, Thalmann & Co., and Hallgarten & Co., of New York, and including two German banking firms, $33,000,000 5 per cent. notes of 1910, being part of an authorized issue of $35,000,000. These notes are secured by: $1,200,000 Mex. Cent. 5 per cent. priority bonds; $5,000,000 Mexican Pacific first mortgage 5 per cent guaranteed bonds; $2,500,000 Tampico Harbor Company first mortgage 5 per cent. guaranteed bonds; $41,000,000 consolidated mortgage 4 per cent. bonds of the railway; and $5,000,000 Mex. Cent. first consolidated income bonds. They were sold to redeem $29,000,000 short term notes, and it is announced that the new notes will be exchanged for old ones as follows: The 6 per cent. notes of 1907 may be exchanged for their par value in new notes and 2½ per cent. additional in cash. The 4½ per cent. collateral trust bonds of 1907 may be exchanged for par value and 1⅛ per cent. additional in cash and the 5 per cent. notes of 1908 may be exchanged for par value and 2⅛ per cent. cash.

Mobile & Ohio.—This company has declared a dividend of 3 per cent., payable to stockholders of record on June 22. In December, 1905, 2 per cent. was paid, and in June, 1905, 4 per cent. on the $6,070,600 outstanding capital stock.

Naugatuck.—See New York, New Haven & Hartford.

New York & Queens County (Electric).—This company, which operates 40 miles of road in Long Island City, N. Y., and between towns in the western part of Long Island, has applied to the New York State Railroad Commission for permission to issue $10,000,000 first and refunding mortgage bonds. The proceeds are to refund present indebtedness and provide new cars and power equipment. The company is controlled by the Interborough Rapid Transit.

New York, New Haven & Hartford.—The entire property of the Naugatuck Railroad has been transferred to the New York, New Haven & Hartford. The Naugatuck runs from Naugatuck Junction, Conn., to Winsted, 57 miles, and has long been operated by the New Haven.

See Boston & New York Air Line.

New York, Ontario & Western.—A dividend of 2 per cent has been declared on the $58,117,982 common stock. Previous dividends were: Jan., 1905, 3 per cent., and July, 1905, 1½ per cent.

New York, Philadelphia & Norfolk.—The Philadelphia Stock Exchange has listed $500,000 additional trustee certificates representing that amount of capital stock which has been issued as a 25 per cent. stock dividend to the holders of the $2,000,000 stock outstanding on June 14.

Pittsburg & Allegheny Valley Street Railway.—The entire property of this company, consisting of eight miles of completed road from Apollo, Pa., to Leechburg, the franchises, rights of way, all rights of the additional 25 miles now under construction to New Kensington and Parnassus, and power houses, have been sold to M. K. McMullen, and others, for $2,000,000.

St. Louis & North Arkansas.—This company, which was recently sold to D. R. Francis and associates, is to issue $6,000,000 5-year 5 per cent. notes. It is understood that over half of this amount will be exchanged for the $3,065,500 5 per cent. bonds of 1941 on which interest was defaulted early this year.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
AT 83 FULTON STREET, NEW YORK, AND AT QUEEN ANNE'S CHAMBERS, LONDON, S. W.
$5.00 per Year to North America.
$8.00 per Year to Foreign Countries.

CONTENTS OF PART TWO.

Railroads Building and Proposed:
United States 87
Canada 132
Mexico 134
Bridge Work Proposed:
United States 137
Canada 152
Mexico 154
Index to Advertisements 154

Part Two of the *Railroad Gazette* is intended to include:

Every new line, extension or important improvement proposed or building in the United States, Canada and Mexico.

Correct corporate names of companies.

Names and addresses of officers of the newer companies, including Chief Engineer.

Complete list of companies incorporated within the past few months, with names and addresses of incorporators.

Alphabetical arrangement of companies, with cross references to subordinate lines, by which projects of one company under a different corporate name may be located without difficulty.

Separation by paragraphs of different projects of the same company.

Route, length, terminals and important railroad connections of projected lines.

Present state of surveys, financial aid, right of way, grading, track laying, etc.

Names and addresses of contractors, both general and special, so far as obtainable.

The date (March 17, 1905) following an item indicates that nothing has been heard either officially or through press reports since the last issue of this Construction Record. Should nothing more be heard for another six months these items will be dropped from the list.

Complete list of important bridges in the United States, Canada and Mexico for which contracts are yet to be let.

NEW RAILROAD AND BRIDGE WORK.

In the accompanying pages will be found the twelfth regular Construction Record of the *Railroad Gazette*, which was compiled semi-annually from the spring of 1898 until March, 1902, when it was made an annual report. This Construction Record contains a list of railroad companies incorporated and railroads projected or building in the United States, Canada and Mexico. There are 1,382 definite projects reported, representing 1,079 companies in different stages of advancement. Of this number 1,223 are the projects of 965 companies in the United States, 90 represent 53 companies in Canada and 69 represent 61 companies in Mexico. The following table gives a comparison of the number of projects and companies in the United States, as recorded in the last six Construction Records:

	United States.	
	Projects.	Companies.
March, 1901	1,700	1,290
October, 1901	1,689	1,038
March, 1902	1,308	995
March, 1903	1,797	1,490
March, 1904	1,600	1,336
March, 1905	1,230	1,080
March, 1906	1,223	965

The asterisk (*) is used to denote that contracts have been let, or that work has actually been begun on new railroads, extensions and improvements. It is our policy to be as conservative as possible in marking projects, and in the very large majority of cases where the asterisk appears, definite news has been received that work has actually been begun, or that contracts have been let. Also in many cases where work is not yet under way, the information given has been received direct from officers or incorporators. The number of lines, extensions or improvements actually building in Canada and Mexico at the present time is presumably greater than the estimate given, owing to the difficulty experienced in getting information from remote distances. The projects marked with the date (March 17, 1905) indicate that nothing has been heard either officially or through press reports, since the last Construction Record was issued. These items are retained without change, as they were reported a year ago. New lines and extensions completed during the past year have been omitted, notice of their completion having been given in the regular weekly issues of the *Railroad Gazette*.

The total number of projects under contract or building is considerably larger than it was last year. This is, of course, primarily due to very general prosperity. It is a striking fact that not only are there throughout all parts of the country very many small lines under construction, but the amount of new work planned by established systems is larger than for many years. The past year has seen the beginning of work on the Western Pacific and in Canada on the Grand Trunk Pacific, a reaching further westward into Wyoming by the Chicago & North-Western and the letting of contracts for a Chicago, Milwaukee & St. Paul line to the Pacific coast. At the same time a large campaign of branch line development, both in the United States and Mexico, has been actively undertaken by the Harriman group of roads. Both by large and by small companies, the coming summer should see an exceptionally large amount of new railroad building.

The following is a comparative estimate of the number of projects on which work has been reported in progress in each Construction Record from February, 1899, through the present issue:

	United States.	Canada.	Mexico.	Total.
February, 1899	255	22	13	290
March, 1900	295	33	19	347
July, 1900	407	36	22	465
March, 1901	352	35	21	408
October, 1901	352	37	15	404
March, 1902	399	42	12	453
March, 1903	569	38	19	626
March, 1904	465	38	23	526
March, 1905	253	35	17	305
March, 1906	390	32	12	434

In addition to the railroad projects, we also give a very full list of bridges under consideration, for which contracts are, so far as we can learn, yet to be let. This list is intended to include the larger steel and stone structures, whether for railroads or not, and we have aimed to record only those which seem likely to be built. Bridges which are needed on new railroads, mentioned under Railroads Building and Proposed, are only included in this list where specific information was obtained. As a rule, they are not mentioned. There are approximately 915 entries, under about 600 cities and towns of the United States and Canada. This list includes about 1,000 new projects. Proposed bridge work of which nothing has been heard since our last Record has been omitted from this issue. It is interesting to note that there are on the North American continent more than 95 bridges proposed, the cost of which will reach over $100,000 each, almost every one of which appears to have a good prospect of being built. There are about 17 structures, the cost of which will reach more than $1,000,000 each, and 16, which are estimated to cost between $500,000 and $1,000,000. But the majority of the bridges included in the Record are structures costing from $20,000 to perhaps $60,000 each.

In cases where bids are wanted on any work we have endeavored to get the date on which bids will be received; also the name and address of the person who will receive the bids, or the engineer in charge who may possibly be able to give information. Up to June 1, dates are already set for the awarding of 26 different bridge contracts.

RAILROADS BUILDING AND PROPOSED.

United States.

ABILENE RAILROAD.—Chartered in Texas to build from Hamlin, in Jones County, to Brady, about 100 miles; also to build a branch line from Anson to Stamford, 15 miles. The office of the company will be at Abilene. The incorporators include E. S. Hughes, W. G. Swenson, H. James, of Abilene; B. W. Fonts and C. C. Sanford, of Fort Worth.

ALABAMA & MISSISSIPPI.—This company, which operates 18 miles of railroad from Vinegar Bend, Ala., southwest to Leaksville, Miss., has projected a 20-mile extension into Greene County, Miss.

ALABAMA ROADS.—W. R. Sweeney and others, of Hopewell, Ala., and Tallapoosa, Ga., who own extensive sawmills in that section, plan to build a railroad from Hopewell northwest to Edwardsville, in Cleburne County, thence south through Clay County to Montgomery, about 110 miles.

ALABAMA WESTERN (ILLINOIS CENTRAL.)—Incorporated in Alabama to build a railroad from a point near Birmingham west to the Alabama-Mississippi State line. Entrance into the new union station at Birmingham is to be made over the Southern's tracks. The officers of the new company are all Illinois Central officials. Contract reported let by the Illinois Central for building from Corinth, Miss., to Haleyville, Ala., 80 miles, at a cost of $5,000,000, the work to be finished by 1907.

ALASKA & PACIFIC RAILWAY & TELEGRAPH CO.—Incorporated in the State of Washington, with a capital of $2,000,000, to build from a point opposite the northern end of Martin's Island into the interior of Alaska. The incorporators include James Buzzard, J. C. Jeffrey and William Wray. Offices at Seattle, Wash.

*ALASKA CENTRAL.—Contracts reported let by this company to P. Welch & Co., of Spokane, for building 30 miles of its proposed road along the north shore of the Turnagain Arm at a cost of about $1,200,000; also to Rich & Harris, of Prosser, Wash., for the construction of 2,500 ft. of tunnel at Placer river canyon, 50 miles from the Seward terminus of the road, to cost $300,000. With the completion of this grading contract, all the heavy work will be finished on the proposed line from the coast to the Tanana district. The proposed route is from Seward, on Resurrection Bay, Alaska, north to Lake Kenai, and thence through Cariboo and Tanana passes to Fairbanks, 463 miles, with a 30-mile branch to the Metamuska coal fields.

ALASKA MIDLAND.—Incorporated in the State of Washington, with a capital of $5,000,000, to build from Valdez, Alaska, to Eagle City. W. D. Hofius, Seattle, Wash., is president.

ALASKA RAILROAD. Andrew F. Burleigh, of New York, who represents a syndicate, is interested in a projected railroad from Cordova, Alaska, into the interior of Alaska.

ALASKA SHORT LINE. Under this name a company will ask for incorporation in Washington, through J. T. Cornforth, formerly of Denver, to build a railroad from Hianna, on Cook Inlet, northwest to Anvik. The proposed line will be 380 miles long, and its highest elevation 960 ft. above sea level, where it is to cross the mountains.

ALBANY & NORTHERN. This company, which operates a 35 mile road from Cordele, Ga., southwest to Albany, has decided to build an extension from the latter place southwest through Dougherty, Baker and Decatur counties in Georgia, passing through Colquitt, in Miller County, and thence through Marianna, in Jackson County, Fla., west to Pensacola, a total distance of about 225 miles.

ALBUQUERQUE EASTERN (SANTA FE CENTRAL). Proposed line from Moriarty, N. Mex., on the Santa Fe Central, to Albuquerque, 46 miles. Grading completed for 20 miles.

ALEXANDRIA, BAYOU MACON & GREENVILLE. Chartered in Louisiana to build from Alexandria, La., to Greenville, Miss., 150 miles. Preliminary work under way for past year and construction is soon to be begun. Headquarters at Delhi, La. J. D. Garrison is Chief Engineer.

ALLEGHENY & WESTERN. Surveys completed for a line from a point on Gauley river, near Belva, W. Va., up the valley of the Meadow river, through Nicholas and Fayette Counties into Greenbrier County, thence down Muddy creek valley to its mouth near Alderson up the north bank of Greenbrier river to a point above Fort Spring, across the river and the Chesapeake & Ohio tracks, thence through Monroe County via Gap Mills and via Sweet Springs, through Peter's Mountain by a tunnel into Potts Creek valley, in Alleghany County, Va. The project is backed by Charleston capitalists. Wm. A. McCorkle, of Charleston, is President and C. P. Peyton is Chief Engineer. The Kanawha & West Virginia, under construction from Charleston to Belva, 44 miles, and which is projected to run from the latter place to the Meadow river, 100 miles, will, it is said, be a part of this road.

ALLENTOWN, LAMAQUA & ASHLAND. (Electric.) Organized at Harrisburg, Pa., with capital of $500,000, with William Laidlaw, of Pittsburg, as President. Surveys being made near Mahanoy City for the proposed road to run from Slatington, Pa., west via Lehighton and Tamaqua to Mahanoy City, about 30 miles.

ALTON, JACKSONVILLE & PEORIA. Incorporated in Illinois to build a railroad from Alton to Peoria, with branch lines to Gratton and Jerseyville. A franchise for 50 years through Alton has been granted. Work is soon to be started. Robert Cordie, Alton, Ill., and J. W. Rooker, Jerseyville, Ill., are incorporators.

*AMADOR RAILROAD.—Contract reported let by the Amador Mining Co. to Ross & Co., Chicago, Ill., to build a railroad from the new town of Amador, Mono, near Iron Mountain on the Nevada Pacific up Cedar creek to the ore beds of the company. Several contracts which were previously let and on which work was under way have been taken over by Ross & Co. Erasmus B. Wiggins of Wilmington, Del., and William Sachse of Carbonville, Ill., are interested.

AMARILLO & SOUTHERN.—Surveys are reported under way for this proposed road from Abilene, Tex., on the Texas & Pacific, southeast via Coleman to Brownwood, at a junction of the Gulf, Colorado & Santa Fe and the Fort Worth & Rio Grande, 75 miles.

*AMERICAN-MEXICAN PACIFIC.—Contract reported let for building the first 250 miles of this proposed road in Mexico. This company is planning to build over 2,000 miles of road in Mexico and Arizona, the first division to be from Naco, Ariz., to Riverside, Cal. Lyman Bridges is President and Chief Engineer; S. W. Purcell, General Attorney; D. M. M. Shorb, Purchasing Agent, and P. B. Ziegler, Master Mechanic.

*AMERICAN OF PORTO RICO.—This company is building a new line to connect its two main lines, to furnish a through route from San Juan to Ponce, which are 170 miles apart. The line is being built between Cumuy and Aguadilla. The work is very heavy. The line crosses a number of small streams and deep canyons, over which many small and a few large bridges will be built, the largest about 500 ft. long. There will also be two tunnels. About 14 miles is completed and the remaining 13 will be finished this fall. The new line passes through the towns of Isabella and Quebradillas, through a fertile section. The work is being done by the company's men. George Servanigan, Isabella, is the Engineer in charge of construction.

ANDERSON & SALINE RIVER.—This company, incorporated in Arkansas, has increased its capital from $20,000 to $56,000. It is to build a railroad from Clio, in Cleveland County, Ark., southwest 18 miles. G. W. Richie of Pine Bluff, Ark., is an incorporator.

APALACHIAN INTERURBAN.—Under this name a new electric road is projected to run from Asheville, N. C., southeast through Hendersonville, Chimney Rock, Mill Spring, Columbus and Tyron, and thence to Gaffney, S. C., about 100 miles. W. A. Smith is President, F. M. Stearns, Vice-President; J. W. Wafford, Secretary, and J. M. Williams, Treasurer, all of Hendersonville.

*APALACHICOLA & NORTHERN.—A contract has been given by this company to the Morey Engineering Company, of St. Louis, for building its proposed railroad from Apalachicola north to Quincy, Fla., about 65 miles. The proposed route is 80 miles long from Apalachicola to Quincy, Fla., where it will cross the Seaboard Air Line, and thence to Bainbridge, Ga., which will be the northern terminus for the present. R. B. Coleman, of Bainbridge, is Superintendent of Construction.

APPOMATTOX & CHARLOTTE.—Chartered in Virginia to build a railroad from Appomattox to Drake's Branch, Va., about 30 miles. The incorporators include: B. P. Eggleston, President, of Drake's Branch, and S. L. Ferguson, Vice-President and Secretary, of West Appomattox.

*ARIZONA & CALIFORNIA (A., T. & S. F.).—New line from Arizona and California Junction near Wickenburg, north of Phoenix, on the Santa Fe, Prescott & Phoenix, west to the Colorado river and into Southern California. About 50 miles of track is laid and grading is in progress from mile post 50.47 to mile post 60, 90½ miles. The Grant Bros. Construction Co., of Los Angeles, Cal., has the contract for grading. Surveys are also being made for an additional 40 miles to Barker, Ariz.

ARIZONA & COLORADO (SOUTHERN PACIFIC).—This company, operating 17 miles of road in Arizona, has projected a line to run from Durango, Colo., southwest to Clifton, Ariz., about 350 miles, with a branch line from Durango, north to Silverton, 40 miles, and another branch west to Dolores, 40 miles; also a branch from Farmington, N. Mex., south to Manuelito, 150 miles. Surveys reported in progress. It has not as yet been definitely decided which of these lines will be built.

ARKANSAS CENTRAL.—This company, which operates a line between Fort Smith and Paris, Ark., 45 miles, is making surveys to extend its line from Paris to Dardanelle, about 60 miles.

ARKANSAS, LOUISIANA & GULF.—This company, which is planning to build a road from Pine Bluff, Ark., about 125 miles southward, to some point in Louisiana, will, it is said, at once begin construction work. P. B. Stewart, President of the Colorado Title & Trust Co.; E. A. Sunderlin, J. M. Parker and W. A. Otis are interested.

ARKANSAS ROADS.—A company has been organized in Arkansas to build from West Point through Kensett to Searcy, in White County, 9 miles. H. G. Smith and W. H. Foster, of West Point, Ark., are interested. (Mar. 17, 1905.)

ARKANSAS VALLEY.—Recently incorporated in Colorado by officers of the American Beet Sugar Company, to build through the Arkansas Valley in the same section through which the Holly & Swink is projected. The same company has a capital of $1,000,000, and the directors include F. Weitzer and C. M. Ward, of Colorado; Robert Oxnard, of San Francisco, and H. R. Duval, of New York.

ARLINGTON & PACIFIC COAST.—Incorporated to build from Arlington, Ore., to The Dalles, 110 miles, passing through Condon, Fossil and Rock Creek. Surveys made between Condon and Fossil, 20 miles, and between Rock Creek and The Dalles, 50 miles. J. E. Simmons is President; M. M. Shilluck, Secretary, and J. J. Finley, Treasurer, all of Portland, Ore. (Mar. 17, 1905.)

ASHLAND & WESTERN.—Incorporated in Ohio to build from Ashland southeast to Custaloga, Wayne County, 20 miles. C. P. Hine, Ashland, Ohio is interested. (Mar. 17, 1905.)

ASHLAND, ODANAH & MARENGO.—Incorporated in Wisconsin, with a capital of $100,000, to build a railroad from Odanah, in Ashland County, south to Sedgwick, about 15 miles, where connection will be made with the Duluth, South Shore & Atlantic. The incorporators include: J. S. Stearns, of Luddington; L. K. Baker, of Ashland, Wis.; John P. Gary, of Chicago; G. F. Merrill, of Ashland, and E. B. Hill and F. J. Darke of Odanah.

*ASHEVILLE & CRAGGY MOUNTAIN.—President R. S. Howland, of this company, is quoted as saying that this road is now under construction from Craggy Mountain, N. C., to Democrat, 17 miles, 3 miles of which are completed. The R. H. Tingley Co., of New York, are the engineers.

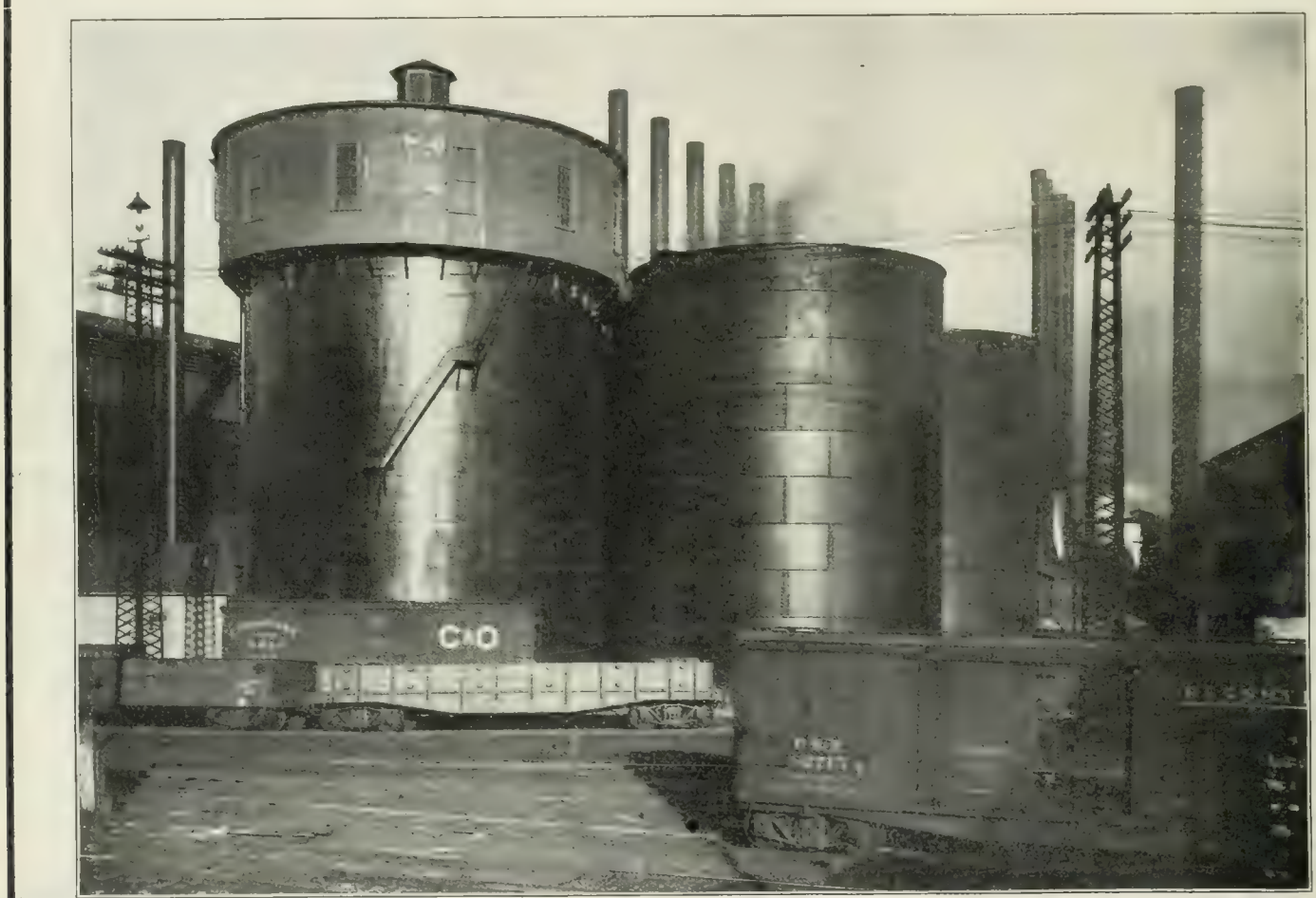
ASHEVILLE & RUTHERFORDTON.—Rights of way have been secured from Asheville, N. C., to Rutherfordton, 40 miles, and surveys made. R. H. Howland, Asheville, N. C., is President. (Mar. 17, 1905.)

ASHEVILLE SOUTHERN (SOUTHERN RAILWAY).—This company, recently chartered in North Carolina, has been formed for the purpose of local development in the interest of the Southern Railway. A. B. Andrews is president and W. H. Wells, Engineer of Construction, Washington, D. C.

*ATCHISON, TOPEKA & SANTA FE.—The Belen cut-off, which this company is building, at a cost of $10,000,000, will enable the road to avoid heavy mountain grades and reduce running time of trains seven to ten hours. It will extend from Belen, N. Mex., to Texico, on the line between Texas and Mexico, 250 miles. Construction was commenced two years ago, but discontinued after 22 miles of track were laid. Work was resumed last spring. At Texico the line will connect with the Pecos Valley line of the Atchison system. It will cross the Santa Fe Central at Willard and connect with the El Paso & Northeastern at Llano. The mountains will be crossed at Abo Pass at an altitude at summit of 6,491 ft. The heaviest grade westbound in crossing the mountains will be 0.6 per cent., while eastbound the heaviest grade will be 1.25 per cent. for 30 miles. The present route of the Atchison over the Sierra Nevada mountains has grades of 3.50 per cent. The Lantry-Sharpe Contracting Co., of Kansas City, has the contract for the work. This cut off is being built under the name of the Eastern Railway of Oklahoma.

— The Eastern Railway of Oklahoma also is permitted by a recent amendment to its charter to build a line from Pauls Valley, Ind. T., southeast to Sulphur Springs, 20 miles.

— *Contracts were let last year by this company for about 130 miles out of the total of 152 miles of the double tracking along the line of the road from Chicago to Kansas City as follows: Between Kernan and Streator, Ill., to Haines & Co., of Shorey, Kan.; between Florence



150,000 Gallons per Hour Kennicott Water Softener Erected at Carnegie Steel Company's Works, Duquesne, Pa.

and Peabody, Kan., to Likes & Hatfield, of Wichita, Kan.; between Bucklin and Marceline, Mo., to Pettibone, Sentry & Co., of Chicago. Three contracts were given to Cameron, McManus & Joyce, of Keokuk, Ia., which includes the grading between Streator and Macuta, Ia., and Hardin and Lexington, Mo. The Lantry-Sharpe Contracting Co. will do the work on the line between Macuta and Nixon, Mo.; Zarah and Olathe, Kan., and "H U" Tower and Malvern, Kan., and Olivet and Lebo, Kan. Work under way. They are on that section of the road between Peabody and Leaman, and Malvern and Olivet, Kan., where the line is to be straightened.

——The Denver, Enid & Gulf, which was recently bought by this company, is to be extended from its northern terminus at Kiowa, Kan., north through Barber County, for about 35 miles, to a connection with the existing line of the A., T. & S. F.

——Bids have been asked by this company for a change of the line between Malvern and Olivet, Kan., and from Canadian to Glazier, on the Pecos Valley line in Texas. Also for second track work between Peabody and Braddock, Kan., between Walton and Lehman, Kan., between Jansen and Morley, Colo., and between Lynn and Hillside, N. Mex. Also for grade reduction between Florence, Kan., and Newkirk, Okla., and between Newton and Dodge City, Kan., and for a raise of grade and levee at the Canadian river crossing near Purcell, Ind. T.

144 ft. below the existing tunnel, and will be 5,000 ft. long.

— -Application made by this company to the courts of Muskogee, Ind. T., to appoint an appraising board to condemn a right of way from that point to Shawnee, Okla. T., 120 miles. The proposed line will connect the branch between Independence, Kan., and Tulsa and the Oklahoma lines at Shawnee.

——Reported that rights of way are being secured for a branch line from a point on the main line in the southern part of San Joaquin County, Cal., to Oakdale, where connection will be made with the Sierra Railroad.

——Reported that work will soon be begun on a new line from Canyon City, Tex., to Plainview, 100 miles, in consequence of the large increase in immigration to the Southwest.

— -See Arizona & California.

——See Gulf, Colorado & Santa Fe.

——See Gulf, Santa Fe & Northwestern.

——See Jasper & Eastern.

——See San Francisco & Northwestern.

——See Santa Fe, Prescott & Phoenix.

ATHENS & NORTHERN.—Incorporated in Ohio, with headquarters at Columbus, to build from Mineral, in Athens County, through Perry, Morgan and Muskingum counties to Zanesville, 45 miles. C. C. Guthrie, M. T. Reed and M. V. Burnside, of Columbus, are incorporators. (Mar. 17, 1905.)

ATHENS, FLORAL PARK & NEWNAN AIR LINES. Charter granted this company about a year ago in Georgia to build from Athens southwest through Monroe, Floral Park and Fayetteville to Newnan, 70 miles. Nothing being done. Ranson Rogers, 828 Empire building, Atlanta, Ga., is said to be interested.

*ATLANTA & CAROLINA (Electric). This company which proposes to build an electric railroad from Atlanta southeast via East Atlanta, Panthersville, Aranaia Mountain and Lithonia to Conyers, Ga., 25 miles, has given the general contract to the Atlanta & Carolina Power Co., of which Dr. H. S. Wilson is President, and M. T. Edgarton, Secretary and General Manager. Contracts for grading and tracklaying are soon to be let. The maximum grade will be 2 per cent. and the maximum curvature 8 degrees. The work includes building two steel bridges and one cut under an existing steam road. John R. Hatch is President, M. T. Edgerton, Secretary and Manager, and M. Mason, Chief Engineer, Atlanta, Ga.

ATLANTA & GULF. This company has given notice that it will apply for a charter in Georgia to build a line from Atlanta to the Gulf of Mexico, 400 miles. The proposed route is through Campbell, Douglas and Heard counties in Georgia. The southern terminus has not been decided upon. F. A. Kuhn, Kennon Dearing and R. B. Beedles, of Atlanta, Ga., are interested. (Mar. 17, 1905.)

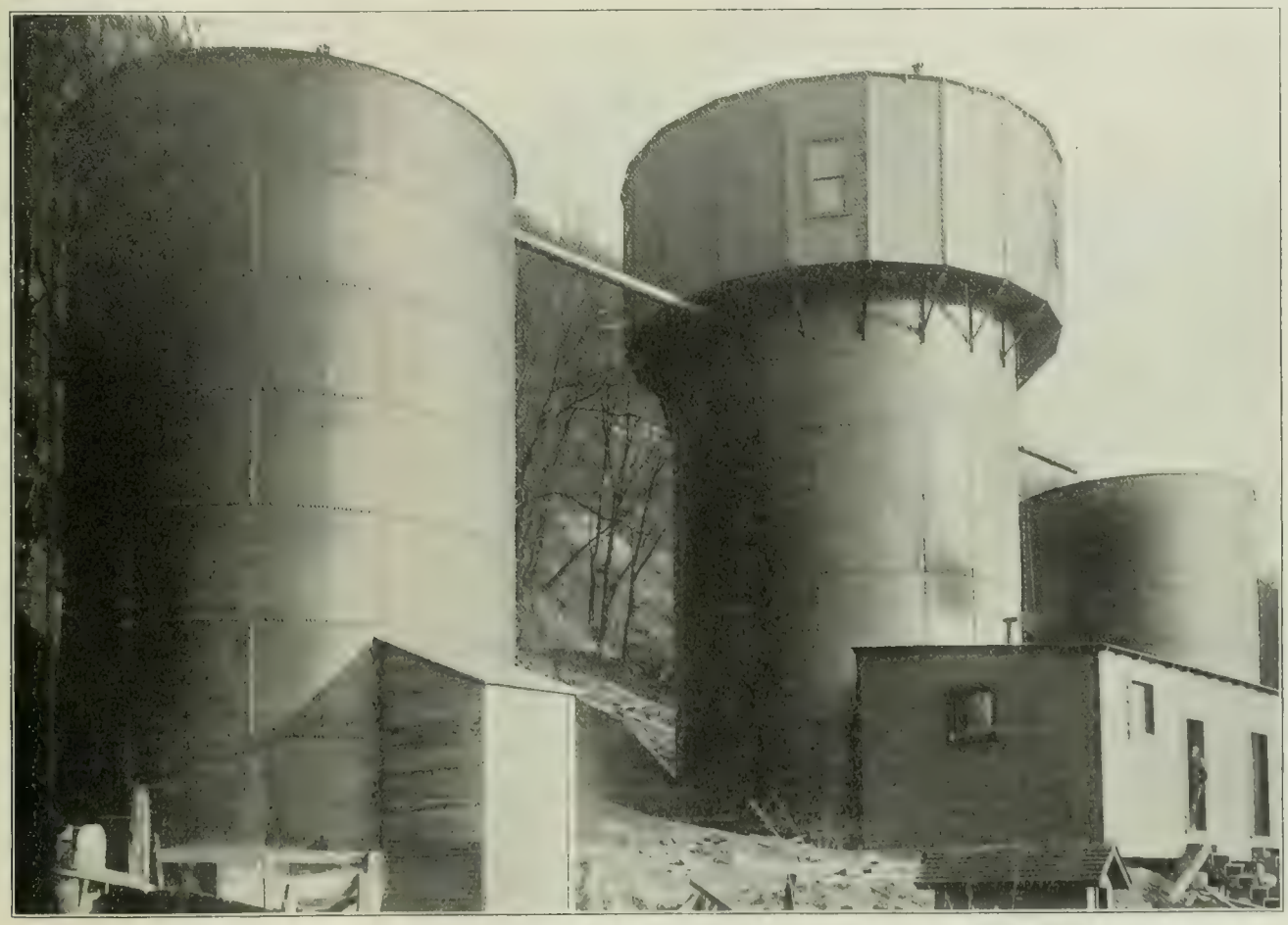
ATLANTA, KNOXVILLE & NORTHERN. See Louisville & Nashville.

ATLANTA MACON INTERURBAN. A company under this name in Georgia, with a capital of $2,000,000, plans to build an electric road from Atlanta to Macon, passing through East Point, Hapeville, Jonesboro, Hampton, Griffin, Barnesville and Forsyth, all of which are on the line of the Central of Georgia. Charles W. Swigert, of Manistee, Mich., is interested in the company.

*ATLANTIC & BIRMINGHAM.—Under the name of the Atlanta, Birmingham & Atlantic, this company is building a line from Montezuma, Ga., northwest to Birmingham, Ala., about 225 miles, with a branch from Talladega, Ala., east to Atlanta, Ga., an additional 125 miles. Contracts for building the road have been let to the Callahan Construction Company, of Warmsprings Station, Bullockville, Ga., and Knoxville, Tenn., for 20 miles of heavy work in Georgia; also to Wright, Williams & Co., on the section from La Grange, Ga., to Talladega, Ala., and for concrete work to John Kries & Co., of Knoxville, Tenn., between Montezuma and the Chattahoochee river. Track has been laid for a distance of about 40 miles from Montezuma west.

ATLANTIC & NORTH CAROLINA.—This company, which operates 95 miles of road in North Carolina, will, it is said, extend its line from Beaufort, N. C., southeast to Cape Lookout, about 15 miles. (Mar. 17, 1905.)

ATLANTIC & WESTERN (NORTH CAROLINA). —This road is now in operation from Sanford to Broadway, 10 miles. An extension of 15 miles east of Broadway has been surveyed. W. J. Edwards, of Sanford, N. C., is President and General Manager.



30,000 GALLONS PER HOUR KENNICOTT WATER SOFTENER ERECTED AT EMBLEM, PA., BALTIMORE & OHIO RAILROAD.

——Reported that this company will rebuild seven miles of track and a new bridge over the Rio Moro, near Watrous, N. Mex. This work is to be done for protection from floods, and will involve the removal of the present roadbed from the valley in the canyon to a higher level along the edge of the canyon walls. The new bridge will be 510 ft. long at an elevation of 45 ft. above high water.

——*Construction work, it is said, has been begun by this company on a branch from Glen Flora, Tex., south to El Campo, 12 miles.

——Surveys, it is reported, are being made by this company for a branch from Woodward, Okla. T., westward through Beaver City to a connection with the Rock Island at Guymon, Okla. T.

——Announcement has been made that this company has definitely decided the proposed route of its trunk line from Galveston to the Pacific coast. The surveys, which have been completed, run from Weatherford, Tex. (which is already connected with Galveston), to Texico through a level country for 250 miles, and thence by the Belgian cut-off now under construction and over the El Paso line to Silver City, where connection will be made with the Santa Fe, Prescott & Phoenix, now under construction, in an easterly direction. The work will not be started for two or three years.

——*Contract is reported let to Corrigan & McDonald, of Pueblo, Colo., for building a new double track tunnel through Raton Hill, near Raton, N. Mex. It will be through solid rock,

*ATLANTIC CITY & SHORE (Electric). This company has been formed to operate with electric power the line of the West Jersey & Seashore (P. R. R.) between Camden, N. J., and Atlantic City by way of Newfield. The line from Newfield to Atlantic City, which is single track, is to be double tracked at once. The incorporators include J. F. Cotter, of Philadelphia; G. H. B. Martin, G. C. Duval and others of Camden, N. J. (See *Railroad Gazette*, December 22, 1905.)

*ATLANTIC COAST LINE. Contract let to W. T. Carter for building a freight yard about two miles long between the large transfer sheds at Jacksonville, Fla., and Grand Crossing. The work calls for the removal of 60,000 cu. ft. of soil, laying of 12 miles of tracks in the yard and building a roundhouse.

——*Contract reported let to Phillips & Allport, of Richmond, Va., to build new freight yards at South Rocky Mount, N. C., to contain 20 tracks with a capacity of 3,000 cars. The work includes the laying of 32 miles of track.

——Plans are being made to build a large freight yard, 1½ miles long and 500 ft. wide at Waycross, Ga.

——Branch from Washington, N. C., south to Newbern, 40 miles. Proposed.

——Extension from Suffolk, Va., southeast to Elizabeth City, N. C., 35 miles. Proposed. (Mar. 17, 1905.)

——*Contract let to A. E. Lingleton, of Valdosta, Ga., to build an extension from Newbern

to Perry, Fla., 30 miles. The work includes a bridge over the Suwanee river. Surveys have also been made from Perry toward River Junction in West Florida.

See Conway, Coast & Western.

AUGUSTA & COLUMBIA.—Application made in South Carolina for a charter to take over the Augusta Allen Electric Railroad, operating 23 miles of road connecting Augusta, Ga., and Aiken, S. C., and to build 52 miles of road to Columbia, also for permission to operate the entire line with steam or electric motive power. It is proposed to enter Columbia over the Seaboard Air Line Ledge.

AUGUSTA & ELBERTON.—This company, which has projected a line from Augusta to Elberton, Ga., 60 miles, will, it is reported, resume construction work, and expects to have the first 15 miles completed this spring. F. L. Verdery, of Augusta, Ga., is President.

AUGUSTA & FLORIDA.—This company, which is building a railroad from Midville, Ga., north through Burke and Richmond counties via Keysville to Augusta, 60 miles, having been unable to secure trackage rights over the Southern Road Keysville to Augusta, proposes to extend its road from that point north to Augusta, 20 miles. Work to begin this month.

AUGUSTA, WATERVILLE & OAKLAND (Electric).—Incorporation asked in Maine, with a capital of $75,000, to build a street railroad through Oakland and Sydney to Augusta, about 18 miles. The directors include E. G. Lawrence, A. B. Gerald, S. A. Nye of Fairfield, Me., and C. W. Davis and R. M. Gilmore, of Waterville.

B

BALTIMORE & OHIO.—This company is planning to make improvements as follows:

——Terminal facilities at Philadelphia, at a cost of $650,000.

Improvements at McKeesport, Pa., $2,000,000.

——Extensions of third or passing tracks from Great Cacapon to Orleans road, and from Hansrode to Baird, on the Cumberland Division, at a cost of $260,000.

——Reduction of the line and the building of an entirely new one between Fairmont and Rivesville, and building a new bridge over the Monongahela River, at a cost of $350,000, and other improvements on the Connellsville Division, to cost $70,000.

Improvements at Pittsburg and on the Pittsburg Division, to cost about $600,000.

West of Pittsburg, $1,750,000 will be spent in lifting the Newcastle Division to handle heavy locomotives. Instead of double tracking the old line between Lodi and Sullivan, a new low grade line is to be built between these points and a second track built from the latter place to Nova. When completed, these improvements will give a continuous double track between Pittsburg and Hamler, on the Chicago Division.

On the Cleveland Division, extensive improvements will be made, $150,000 will be spent for a new engine house, increased power plant and car repair yard at Lorain, and $180,000 will be spent for the new bridge at the mouth of the Cuyahoga River at Cleveland. The present bridge, which is not long enough to accommodate the river traffic, will be replaced with a bascule bridge. This bridge will give 210 ft. clearance between fenders, complying with the United States navigation regulation.

Contract has been let to Thomas A. Shearmaker & Co., of Pittsburg, Pa., for building about three miles of new track on the main line, in Hollofields to Alberton, a short distance west of Ellicott City, Md. This is a continuance of the work which has been carried on for several years in straightening the alignment and reducing a low grade height line from Relay to Washington Junction, upon which over $2,000,000 has already been spent.

——*Contracts, let to the Chesapeake Construction Co., Baltimore, for double tracking the Metropolitan branch from Gaithersburg to Germantown, Md., 4 miles, and from Barnesville to Dickerson, Md., 2 miles, to E. H. Clement & Co., Philadelphia. The line between these points will be relocated and several heavy grades and curves will be eliminated. Work is estimated to cost $600,000.

This company, through the Schuylkill East Side Railroad, has bought 30 acres of land in Philadelphia, Pa., which will be used to increase the company's freight facilities.

——Extensive improvements planned in Wheeling, W. Va., to cost about $2,000,000. The work includes the eliminating of grade crossings and the building of a new station.

——*Enlargement of yards, rebuilding of the line and extension of second, third and fourth track at various points on the Pittsburg and Wheeling divisions. Work under way.

*Terminal improvements at Washington, D. C. Contract let to McMullen & Mellermott, and the Hoffman Engineering & Constructing Co., Philadelphia. The work consists mainly in building the new railroad, from Montello, about 4 miles from Washington, on the Baltimore & Washington line, to the new terminal station at Massachusetts Avenue, Washington. On the viaduct, from New York avenue to the terminal station, there will be 10 tracks. The contract includes, not only the roadbed and bridges, but the freight terminal buildings, roundhouses and yard.

*BALTIMORE & OHIO SOUTHWESTERN.—Extension of present second track, which terminates at Madeira, to O'Bannon, 8.61 miles. The total curvature at present is 455½ deg., and on the reconstructed line will be only 334 deg., a saving of 121½ deg. The present maximum grade is 1.012 per cent., but it is not uniform. On the new line the maximum grade will be the same, but it will be uniform over the given distance, and will practically all be on tangent. There are no important towns between Madeira and Loveland, and the work will be done on the present right of way. The only important bridge work will be that over the Miami River, which will have to be converted from a single to a double-track bridge and will be completed early this summer. Contract let to the Chesapeake Construction Co.

BALTIMORE & SOUTHWESTERN.—Application made to the Maryland Legislature for a charter to build from Baltimore along the western shore of Chesapeake Bay to a point south of Annapolis, where connection is to be made with the eastern shore by means of a ferry; also to extend the road to the Virginia State line and eventually to Norfolk, Va. F. E. Waters, R. B. Dixon and A. P. Gorman, Jr., are incorporators. (Mar. 17, 1905.)

BALTIMORE BELT LINE TERMINAL (P. R. R.).—Proposed belt line, about 10 miles, to be built by the Philadelphia, Baltimore & Washington around Baltimore, Md. It has not as yet been decided whether the line will be built partly through the city or further out.

BALTIMORE TERMINAL. See Washington, Baltimore & Annapolis (Electric).

BANGOR TERMINAL (BANGOR & AROOSTOOK).—Application made in Maine for a charter to build a railroad from some point on the Northern Maine Seaport in the town of Hermon, in Penobscot County, east to some point in Bangor, in the same county, at a point near Maplewood Park, about six miles. The entire line will lie in the town of Hermon and the city of Bangor. The Chief Engineer is P. H. Coombs, of Bangor.

BARBERTON, WADSWORTH & WESTERN.—Arrangements being made to build a railroad from Barberton, in Summit County, O., west to the Medina County line, 5 miles.

BATESVILLE & JACKSONPORT.—Projected road from Batesville, Ark., to Jacksonport, 22 miles. The new road will follow the line of the old Batesville & Brinckley Railroad for the greater part of the distance. H. Devereux, Little Rock, Ark., is President. (Mar. 17, 1905.)

BATTLE CREEK & SOUTHEASTERN.—Incorporated in Michigan, with capital stock of $500,000, to build from Battle Creek, Mich., south to Coldwater, 30 miles, to be operated by any motive power other than steam. General offices at Battle Creek. Directors: William E. Ware, Edward F. Pangburn, of Battle Creek, and Howard E. Murphy and Charles E. Miles, of Columbus.

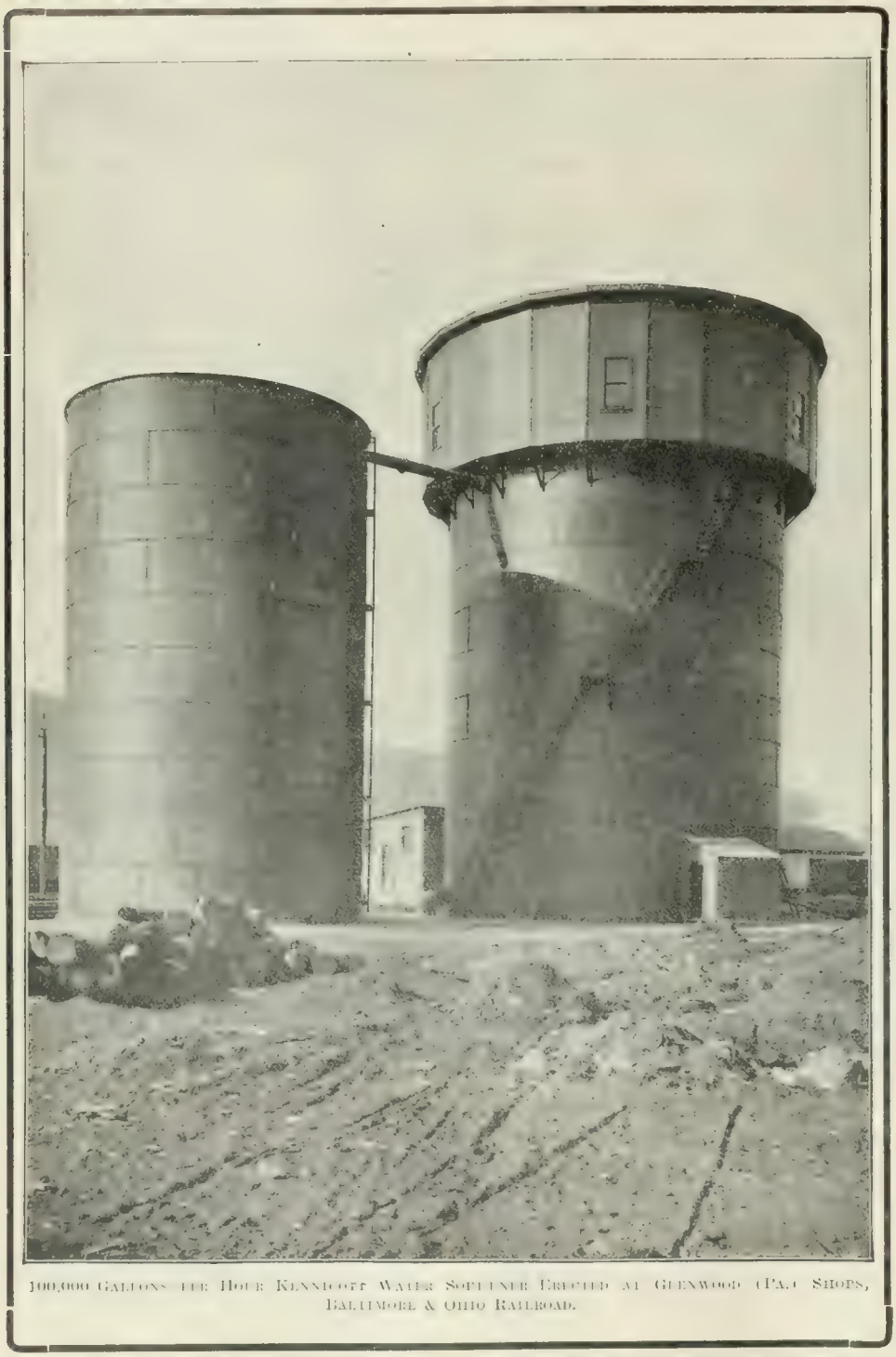
BAY CITY & PORT HURON.—Proposed line from Bay City, Mich., to Port Huron, 105 miles; 20 miles of grade completed from Port Huron to Lexington. The work includes building two steel bridges and a number of small bridges. W. C. Penoyar, of Bay City, is President. The project will be financed by George B. Jenkins, 35 Nassau street, New York. Final surveys to be completed at once. Contract to be given to a construction company, of which Mr. Jenkinson will be President.

*BAYFIELD, LAKE SHORE & WESTERN.—Contract let to W. H. Johnson, of Superior, Wis., for building 7 miles of this road to connect Bayfield, Wis., with Cornucopia on Siskiwit Bay, on the south shore of Lake Superior. The road is projected to Superior, 75 miles from Bayfield.

BAY MINETTE & FORT MORGAN (L. & N.).—The first section of this road has been completed from Bay Minette south to Foley, 37 miles. The road will eventually be extended to Fort Morgan, 45 miles from Bay Minette. W. W. Olney, Bay Minette, Ala., is Chief Engineer.

*BAY SHORE & PACIFIC.—Incorporated in California, with capital of $2,000,000, to build from a point near the southern boundary of San Diego to Pacific Beach and La Jolla. This line is to be the first portion of a proposed railroad to Imperial (about 60 miles east of San Diego). The directors include: H. T. Richards, C. R. Hammond, William Crouse, S. Connell, I. D. Stewart and H. C. Oatman, of San Diego, and N. H. Rodgers, of Denver.

BEAUFORT & WESTERN.—This company has given a contract to the General Contracting & Engineering Co., 15 Whitehall street, New York,



100,000 Gallons per Hour Kennicott Water Softener Erected at Glenwood (Pa.) Shops, Baltimore & Ohio Railroad.

for building its proposed line from Morehead City, N. C., east to Beaufort, 3 miles.

*BEAUMONT & GREAT NORTHERN.—Contract given by this company to Lamb & Hansen, of San Antonio and Houston, for building the first 20 miles of its proposed road, which is to run from Trinity, Tex., via Lexington to Beaumont. Said to be a Gould project.

*BEAUMONT, SOUR LAKE & WESTERN.—Surveys completed by this company for proposed extension from Sour Lake west to Houston, Tex., about 65 miles. Contract for the first 55 miles from Sour Lake to Humble let to Kenefick, Hammond & Quigley, Beaumont, Tex. The work includes the building of bridges over the Trinity and San Jacinto rivers. This road was reported sold to the St. Louis & San Francisco, and later to the Colorado Southern, New Orleans tional facilities for the Beaumont, Sour Lake & & Pacific, formed to operate the several Hawley-Yoakum roads.

BEAUMONT TERMINAL.—Organized in Texas, with a capital of $20,000, to build a belt line around the city of Beaumont, to provide addi- Western. The directors include: R. C. Duff, W. F. Keith, G. A. Clark and others of Beaumont.

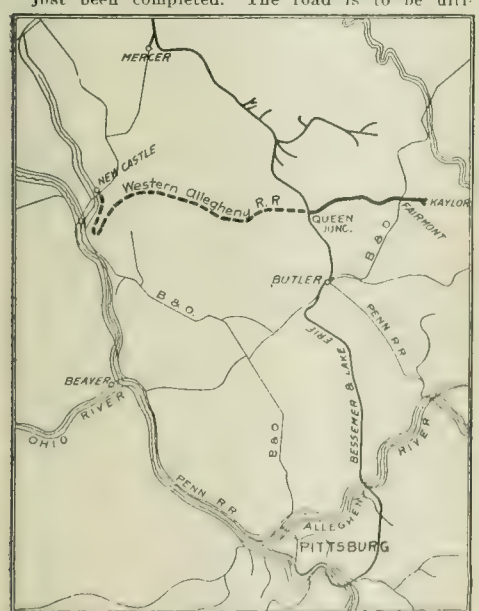
BEAVER MEADOW, TRESCKOW & NEW BOSTON.—In operation from Beaver Meadow, Pa., to Tresckow, three miles. Chartered to extend from Tresckow to New Boston on the Pennsylvania, 21 miles. J. P. Pardee, of Hazleton, Pa., is President. (Mar. 17, 1905.)

*BEE TREE.—Contract for building this proposed road from Swannanoa, N. C., to Craggy Mountain, eight miles, let to J. H. Hemphill & Co., of Marion. S. F. Chapman, Asheville, N. C., is said to be interested. (Mar. 17, 1905.)

BELLINGHAM BAY & BRITISH COLUMBIA.—Reported that this road, which now runs from Bellingham Bay, Wash., north to Sumas, 22 miles, and from Sumas east to Glacier, 22 miles, will build from Sumas west to Blaine, in the northwest corner of Washington, 20 miles, at which point the company has recently purchased six blocks of tidewater lands at the mouth of Dakota Creek. (Mar. 17, 1905.)

BELT LINE RAILROAD.—Projected line 29 miles long from North Bend, on Coos Bay, Coos County, Ore., through Empire and Marshfield to Glasgo. Surveys to be made this year. L. D. Kinney, Marshfield, Ore., is President. (Mar. 17, 1905.)

*BESSEMER & LAKE ERIE.—The Western Allegheny branch, which runs from Kaylor, Pa., west to Queen Junction, Pa., on the Bessemer & Lake Erie, is being extended from Rosepoint, near Queen Junction, west toward Newcastle, Pa., 10.7 miles. Work under way by F. A. Maselli & Co., of Pittsburg, contractors. At Rosepoint a large steel viaduct 900 ft. long and 100 ft. high over Slippery Rock creek has just been completed. The road is to be ulti-



Bessemer & Lake Erie.

mately extended from Newcastle to Youngstown and Girard, O. H. T. Porter, of Greenville, Pa., is Chief Engineer of the Western Allegheny.

——An extension of the Western Allegheny is also projected east from Kaylor to East Brady, where connection is to be made with the Buffalo & Allegheny Valley division of the Pennsylvania.

——Branch of the B. & L. E. from Cranesville to Elk Harbor, about five miles. Projected. At Elk Harbor large shops are to be built.

*BIG HORN.—See Chicago, Burlington & Quincy.

*BIRMINGHAM & LINEVILLE.—Grading has been completed on 6 miles of this proposed road from Lineville, Ala., west to Pyriton, on the Talladega branch of the Louisville & Nashville. In Clay County, 10 miles, and tracklaying is to be begun this month. Contract for the remaining four miles let to J. M. Memler, of Tennessee. R. L. Ivey, Alabama, may be addressed.

BIRMINGHAM & SOUTHWESTERN.—Application made for a charter, in Mississippi, with capital of $5,000,000, to build from Birmingham, Ala., via Hattiesburg, Miss., to Baton Rouge, La. Incorporators include: Former Governor A. H. Longino, former Secretary of State J. J. Coleman, A. J. Hackett, of Jackson, Miss.; G. G. Gibson, of Birmingham; J. C. Dunlap, of Chicago, R. C. Oliver, of Hattiesburg, E. F. Ballard, of Waynesboro, Miss., and others.

BIRMINGHAM, COLUMBUS & ST. ANDREWS BAY.—This company, which is building a line from Columbus, Ga., southwest to St. Andrews Bay, Fla., 185 miles, has grading completed for 45 miles on the section between Chipley, Fla., and St. Andrews Bay and track laid for a distance of 6 miles. The project is said to be backed by the Enterprise Lumber Co., of Atlanta, Ga., of which H. M. Steele is President.

BLACK BAYOU.—Charter granted this company in Texas to build from Myrtis, La., to Stanley, in Cass County, Tex., 25 miles. C. B. Crawford, Atlanta, Tex., and R. McMichael, Jefferson, Tex., are incorporators. (Mar. 17, 1905.)

BLACK HILLS & WYOMING.—Location surveys completed for this line from Rapid City, S. Dak., to Mystic, 35 miles. Reported that grading will be begun at once. This company has bought the Dakota, Wyoming & Missouri River, which had eight miles graded between Rapid City and Mystic. C. D. Crouch, Akron, O., is President, and F. C. Tucker, Deadwood, S. Dak., is Chief Engineer. (Mar. 17, 1905.)

BLACK HILLS TRACTION.—Incorporated in South Dakota, with capital of $100,000, to build an electric road from Deadwood and Lead via Spearfish to Belle Fourche, a distance of 32 miles. The headquarters of the company are to be at Spearfish. The incorporators include: Richard B. Hughes, Henry Keets, J. P. Stimmer, M. L. Brenn and Robert Crawford, all of Spearfish.

BLACK LICK & YELLOW CREEK.—Incorporated in Pennsylvania to build from Revis, in Indiana County, to Burns Summit, 10 miles. Practically completed. A. W. Lee, Clearfield, Pa., is President.

*BLACK MOUNTAIN.—Contract reported let to the Callahan Construction Co., of Knoxville, Tenn., for a 12-mile line in Lee County, Va.

BLACKSTONE & LUNENBURG.—Incorporated in Virginia to build from Blackstone, Nottoway County, southwest into Lunenburg County. Freeman Epes is President, and F. M. Bedford, Secretary, Blackstone, Va. (Mar. 17, 1905.)

BLUFFTON & FORT WAYNE (Electric).—Bonds issued to extend the Muncie, Hartford & Fort Wayne under the name of this company, from Bluffton north to Fort Wayne, Ind., 25 miles.

BOBCAT VALLEY.—Incorporated in Louisiana to build from Alden Bridge, on the St. Louis Southwestern, Bossier County, east to Ivan, 10 miles. H. H. Wells, Benton, La., is President. (Mar. 17, 1905.)

*BONNERVILLE & SOUTHWESTERN (ST. LOUIS & SAN FRANCISCO).—This company, which was incorporated in Arkansas, has secured the necessary capital, completed surveys and obtained the right of way for its proposed road from Bonnerville, Ark., to Jelks, a distance of 65 miles. Contracts for building have been let to the Frisco Construction Co. The directors include A. J. Davidson, C. R. Gray, L. F. Parker, W. B. Drake, of St. Louis; Gordon Frierson, of Jonesboro, and E. Ritter, of Marked Tree.



15,000 GALLONS PER HOUR KENNICOTT WATER SOFTENER ERECTED AT INDIANAPOLIS, IND., VANDALIA RAILROAD COMPANY. ONE OF SIX PLANTS RECENTLY INSTALLED UPON THIS ROAD.

BOSQUE VALLEY RAILROAD.—Surveys reported for this new line from Waco, Tex., via Bosque ville and Meridian to Stephenville, 50 miles. P. A. Moriarty, Dallas, Tex., is interested. (Mar. 17, 1905.)

BOSTON & RHODE ISLAND (Electric).—An officer writes that the company which was recently incorporated in Massachusetts is to build an electric line from Boston through Hyde Park, Foxboro, Mansfield, North Attleboro and Attleboro to Providence. Charles H. Allen of Fitchburg, is interested.

BOSTON ELEVATED.—[illegible] reached an agreement with [illegible] of Boston, agreed to the [illegible] for a Council for building two two-track subways between Harvard Square, Cambridge, and Park[illegible] One [illegible] Massachusetts [illegible] and Main [illegible] the new Cambridge [illegible] and the other through Cambridge [illegible] the new [illegible] tunnel.

[illegible] Pile Bridge Works, Pittsburg, [illegible] for [illegible] ing work [illegible] proposed extension from Chelsea to Forest Hills, about 2 miles. G. A. Kelly, 101 Milk street, Boston, Mass., Engineer.

BOSTON ELEVATED.—The work on the Washington street elevated, Boston, how nearly completed, is expected. The fifth section, to Wellington, has been let, is to be finished by July 1, 1906. Bids for other sections will be called for shortly, although it has not yet been definitely decided how long the new [illegible] will be. On the completion of this subway the Boston Elevated, which now operates [illegible] of elevated structure and 13.5 miles of subway, including the East Boston tunnel, will operate the additional lines.

The report submitted to the Massachusetts Legislature by the Boston Rapid Transit Commission on the future development of the subway favors an extension to Copley Square, and suggests that a new line be built under Commonwealth avenue. A plan has been submitted for an east side subway, and two methods are suggested of reaching South Boston. The city authorities of Cambridge recently passed an order favorable to the company, authorizing negotiations for the building of a two-track subway from Craigie bridge, Cambridge, through Cambridge to Harvard Square, and from Cambridge street at Webster avenue to the Somerville line.

BOSTON TRANSPORTATION COMPANY. This company has applied to the Legislature of Massachusetts for permission to build freight tunnels deep under the city of Boston. The plans outlined involve the building of more than 10 miles of tunnels in the business district. These tunnels would run to the North and the South stations, the Hoosac tunnel docks, the domestic and foreign steamers and through the principal wholesale sections of the city. By the provisions of the proposed charter, the company must build this 10 miles of tunnels within three years or forfeit $200,000. The cost of the tunnels is estimated at $1,000,000 per mile.

*BOYNE CITY, GAYLORD & ALPENA.—This company, incorporated in Michigan, with a capital of $1,000,000, will build a steam road from Boyne City, east through Boyne Falls, Gaylord and Atlanta to Alpena, Mich., about 100 miles. The first 28 miles is already completed and in operation. Part of the road is being built by the company's forces and contracts for the rest will be let. The road will cross the Grand Rapids & Indiana north of Elmira and the Michigan Central at Gaylord, the former by an overhead crossing and the latter at grade. William H. White is President and N. J. Tubbs, Chief Engineer, both of Boyne City, Mich.

BREMEN & SOUTHWESTERN.—Incorporated in Alabama to build a line from Bremen, Ga., on the Central of Georgia and the Southern to Wedowee, in Randolph County, Ala. Incorporators include H. W. Gardner, L. B. Parker and A. A. Hurst.

*BRONX, YONKERS & WHITE PLAINS (Electric).—Incorporated in New York, with a capital of $110,000, to build an electric railroad 11 miles long, from the Borough of the Bronx, New York City, to White Plains, and to Yonkers. John H. Matthews, C. H. West, George Matthews and M. H. Wood, all of New York City, are directors.

BROOKHAVEN & PEARL RIVER.—Proposed line in Mississippi from Brookhaven, Miss., southeast to a point on Pearl River, 20 miles. S. E. Morton, S. J. Carpenter and D. J. Batchelder, Jr., of Brookhaven, are incorporators. (Mar. 17, 1905.)

BROOKLYN GRADE CROSSING COMMISSION.—The lowest bid for the work on section No. 2 of the Brighton Beach improvements, which calls for the depression of about 6,800 feet of roadbed and elevating rails from Avenue G to Church avenue, Flatbush, is said to be that of Charles Crawford, whose bid was $509,000. It is the intention to have the work completed by May 1, 1907. At one point in section No. 2 the Brighton Beach tracks will be raised to go over the Long Island tracks near Vandeveer Park, the former's tracks being depressed at that Point.

——See Brooklyn Rapid Transit.

BROOKLYN RAPID TRANSIT (Brooklyn, N. Y.). This company will at once begin extending its Myrtle avenue elevated line from Ridgewood to Middle Village, two miles. The company has bought about 30 acres of land known as St. James Park, which will be filled in and used for a yard, to have a capacity of 300 cars.

Plans for changing the tracks of the Long Island Railroad and of the Brighton Beach branch of the Brooklyn Rapid Transit Co., in the Borough of Brooklyn, N. Y., have been approved by the Department of Public Works and the Brooklyn Grade Crossing Commission, which has the improvements in charge, under a special law, has let the contracts. It will cost in the neighborhood of $7,000,000, and is to be completed by May, 1907. The plans call for a cut from 18 ft. to 20 ft. deep on the Manhattan Division of the Long Island from Manhattan Junction to Bay Ridge, where there will be a large depressed freight terminal.

*BROOKVILLE & MAHONING (PITTSBURG, SHAWMUT & NORTHERN).—Contracts were to be let for extending from its southern terminus for a distance of 21 miles. The work includes the excavation of about 500,000 cu. yards, and building 200,000 cu. yards of embankment, 20,000 cu. yards of bridge, culvert and masonry work, and 1,000 tons of steel bridges and viaducts. The road is to connect as an extension of the Pittsburg, Shawmut & Northern toward Pittsburg, south from Hydes, in Elk County, Pa., to Freeport, in Armstrong County, 103 miles. Some of the grading work has been under way since last spring. About 15 miles on the west end of the Allegheny, between Freeport and East Brady are graded, and work is in progress at this end.

BROWNSVILLE, HIDALGO & NORTHERN. Incorporated in Texas, with a capital of $600,000 to build a railroad from Brownsville, Tex., to Houston, a distance of 350 miles, also a branch from a point on the main land about ten miles from the southern corner of Lavaca County, to San Antonio, an additional 90 miles; also a branch from a point six miles from Brownsville, through Hidalgo County for a distance of 50 miles, and a branch from a point three miles from Brownsville in an easterly direction to the northern side of the Brazos river, 25 miles, making a total distance of about 500 miles. The offices of the company will be at Brownsville. Uriah Lott is President, James A. Browne, Vice President, and John D. Hill, Secretary.

BROWNWOOD, WACO & NORTHERN.—Proposed road from Rising Star in Eastland County, Tex., south via May, to Brownwood, 30 miles, thence east through Hamilton, Clifton and Valley Mills, to Waco, 125 miles. Contracts for grading will be let in the early part of this year. The country to be traversed is level. Address Brooke, Smith & Co., of Brownwood.

BRONTON, HAZELHURST & SAVANNAH. Application made in Georgia for authority to build a railroad from Osterfield, Irwin County, on the Atlantic & Birmingham, east through Coffee, Appaling, Tattnell, Liberty, Bryan and Chatham Counties to Savannah, about 130 miles. The incorporators include J. A. J. Henderson, W. N. Smith, J. A. Pruitt and J. D. Faulk, all of Ocilla.

BUCHANAN & TAZEWELL.—Chartered in Virginia to build a railroad in that State. Headquarters will be at Whitewood, Buchanan County. Incorporators include John F. Hager, G. F. Hager and M. F. Fleming, all of Ashland, Ky.

BUCK CREEK & CATAWBA RIVER.—Chartered in North Carolina, with capital of $500,000, to build from a point in McDowell County, N. C., near the mouth of Buck Creek, down the valley of the Catawba river to the North Toe river to a point where it crosses the State line of Tennessee, passing through McDowell, Mitchell and Yancey counties, a distance of about 100 miles. C. Bolce, of Abbington, Va.; G. W. Edwards, of Winston-Salem; J. Crawford Biggs, of Durham; L. D. Heart, W. B. Jones and S. J. Hinsdale, of Raleigh, are interested. The line described quite nearly coincides with that of the Johnson City Southern, the chartering of which was reported in the *Railroad Gazette* of June 30 last.

BUCKHANNON & NORTHERN.—New line from Bellington, W. Va., north to New Brownsville, Monongahela County, 60 miles. About 30 miles have been graded, but work has been suspended. S. D. Brady, Parkersburg, W. Va., is Chief Engineer.

*BUFFALO & SUSQUEHANNA.—This company, which is extending its road from Wellsville, via Belmont, Belfast, Arcade, Springville and Hamburg to Buffalo, 87 miles, last year laid track from Wellsville, N. Y., to Canaedea, 26 miles, and about 10 miles north and south of Arcade. Grading is being done by Frank Greco, of Gaston, Pa.; tracklaying is also in progress; bridges are being built; the one over Caneadea Gorge is to be 750 ft. long and 185 ft. high. It is expected that the road will be completed and in operation early this summer.

——*Preliminary work, it is said, has been commenced by this road on a tunnel through Hogback Mountain near Galeton, Pa., to eliminate heavy grades. The work will cost $1,000,000 or more.

BUFFALO, BATAVIA & ROCHESTER (BUFFALO & WILLIAMSVILLE) (Electric).—Permission granted by the Railroad Commission to this company, which has a capital of $3,000,000, to build an electric railroad from Williamsville, Erie County, N. Y., via Batavia to Rochester, a distance of about 65 miles. E. E. Lewis, Jr., W. N. Evarts and G. E. Pierce, of Buffalo are interested.

BUFFALO CREEK & GAULEY.—Proposed line to West Virginia from Clay Court-house southeast to Camden-on-Gauley, 30 miles. J. M. Cameron and J. Y. Boyd are incorporators.

BUFFALO, LAKE ERIE & NIAGARA.—Chartered in New York, with a capital of $4,000,000, to build a railroad around Buffalo, from a point on the shore of Lake Erie southwest of Buffalo through the towns of Hamburg, West Seneca and Amherst to the Niagara river at Tonawanda, and thence to the International bridge at Buffalo. The directors include C. N. Bushnell, J. H. Metcalf and H. W. Putnam, of Buffalo.

*BUFFALO, ROCHESTER & PITTSBURG.—Contract reported let to S. A. Rinn, of Punxsutawney, Pa., for building five miles of second track which, when completed, will give a double track all the way from that place to Buffalo.

BUFFALO, TAYLORSVILLE & STATE LINE.—Chartered in Pennsylvania to build a railroad along Buffalo creek from Taylorstown, Washington County, to the West Virginia State line, near Broom's station, where connection will be made with the railroad which is partially built from Wellsburg to Tate's Run. The company is being financed by Pittsburg and Claysville capitalists. At Taylorstown connection will be made with the Baltimore & Ohio. The promoters of the proposed road control large coal fields along Buffalo creek.

BUFFALO UNION TERMINAL. Incorporated in New York, to build a steam railroad seven miles long in Buffalo. F. C. Mosedale, C. A. Collins and Bernard Marron, all of Buffalo, are directors.

BURRS FERRY, BROWNDEL & CHESTER.—H. G. King and associates of Austin, Tex., have applied for a charter under this name to build a railroad from a point near Burrs Ferry, on the Sabine river, in Newton County, northwest through Newton, Jasper, Sabine, San Augustine and Taylor Counties to a point near Peachtree Village, in Tyler County, and to a junction with the Missouri, Kansas & Texas, a distance of about 80 miles. The incorporators include J. S. Bonner, John H. Kirby, K. H. Cawthorn and J. R. Burns, of Houston; A. C. Averill and W. Weiss, of Beaumont; J. L. Kirby, of Kountze; J. W. Link, of Orange; E. I. Kellie and James Irvine, of New York City.

*BUTTE COUNTY.—This company, which recently completed an extension of its road from Stirling City, Cal., to Gallagher, 17 miles, is building an additional 15 miles from Gallagher to North Valley.

C

*CACHE VALLEY.—This company, which operates a freight line from Sedgwick, Ark., to Light, 15 miles, is building an extension from Light northeast to Stonewall, 15 miles. Work is being done by the company's forces. When this is completed, the company plans to build a further extension of 20 miles to Chalk Bluff. E. W. Culver, Sedgwick, Ark., is President. (Mar. 17, 1905.)

CAIRO & TENNESSEE.—See Powell's Mountain Mineral.

CAIRO & THEBES.—Incorporated in Illinois to build a railroad from Cairo, at the southern end of Alexander County, Ill., northwest to Thebes, about 25 miles. The incorporators include: E. A. Smith, W. J. Johnson, D. Hartman, G. J. Becker and J. H. Galligan, all of Cairo.

CALIFORNIA MIDLAND.—Contracts were to be let in January for building this proposed railroad, which is to be equipped for both steam and electricity, from Marysville, Yuba County, Cal., through Grass Valley to Auburn. Maximum grade to be 2.5 per cent. The work includes the building of three bridges. John Martin is President, and C. A. Trow, Chief Engineer, of Sacramento, Cal.

CALIFORNIA & NORTHEASTERN.—Charter granted this company in California with a capital of $5,400,000 to build a railroad from the Southern Pacific at Weed, in Siskiyou County, Cal., north to Klamath Falls, in Oregon, with branches to Rhett Lake and the Lake of the Woods. The main line to be 100 miles long and the branch 70 miles. The directors are A. H. Naftzger, G. X. Wendling, H. Naething, C. M. Cross and G. E. Bettinger.

CALIFORNIA & OREGON COAST.—Proposed line from Grant's Pass, Ore., southwest through Wilderville and Kerby to Crescent City, Cal., 91 miles. The work will be heavy, with maximum grade of 2 per cent. and maximum curvature of 12 degrees, and will include five tunnels from 250 ft. to 3,200 ft. long. Two branches from the main line are projected. One via Smith river to Chetco, Ore., and the other via Requa to Redwood. James B. Gunn is President, and T. W. M. Dreyer, 230 Montgomery Street, San Francisco, Cal., Chief Engineer. (Mar. 17, 1905.)

CALIFORNIA INLAND EMPIRE.—A number of St. Louis capitalists have organized this company to build a railroad from Boise City, Idaho, into California, with branches touching the principal mineral, agricultural and grain belts of Washington and Oregon, with a terminus at Sausalito and ferry connection thence to San Francisco. The St. Louis Trust Co. is said to be interested.

CALIFORNIA ROADS.—The Pacific Steel Co., with offices at San Diego, Cal., is interested in a projected railroad from San Diego, Cal., to La Paz, Mexico, traversing the whole southern part of the peninsula of Lower California. No further particulars given. C. W. French is Chairman of the Board.

——F. L. Evans, a Civil Engineer of Eureka, Cal., is said to represent an eastern railroad capitalist who plans to build a railroad from Eureka, Cal., east into Wyoming. The proposed line runs east via Delta, Trinity river and along Pitt river through the Sierra Nevada mountains, touching Alturs, thence through Lakeview and Vale in Oregon, and through southern Idaho to Casper, Wyo.

——*The Western Lumber Co., of Jenner, Cal., reported to have awarded a contract to the Hutchinson Construction Co. for building a road three miles long from Jenner to the Pacific Ocean.

——According to Western papers, E. H. Harriman, A. W. Foster and E. P. Ripley, of the Santa Fe, have agreed upon a general plan for railroad extension into the northern territory of California. A new company is being organized, which is to take over the San Francisco & Northwestern (A., T. & S. F.), with its valuable Eureka terminals, also to take over Harriman and Foster's California & Northwestern line between Willits and Tiburn and San Francisco, and probably the North Shore road, and also to build 100 miles of road from a point north of Willits to the southern end of the San Francisco & Northwestern road, 31 miles south of Eureka.

CALIFORNIA-WESTERN RAILROAD & NAVIGATION COMPANY.—Incorporated in California with $1,000,000 capital, to build a railroad in Mendocino County from Ft. Bragg to Alpine and Willets, about 41 miles. The road is to connect with the Union Lumber Co.'s railroad, and with branches is to have a length of 65 miles. The directors include Duncan McNee, Miles W. McIntosh, Charles H. Weller, H. M. Cochran and Max Goldberg, all of San Francisco.

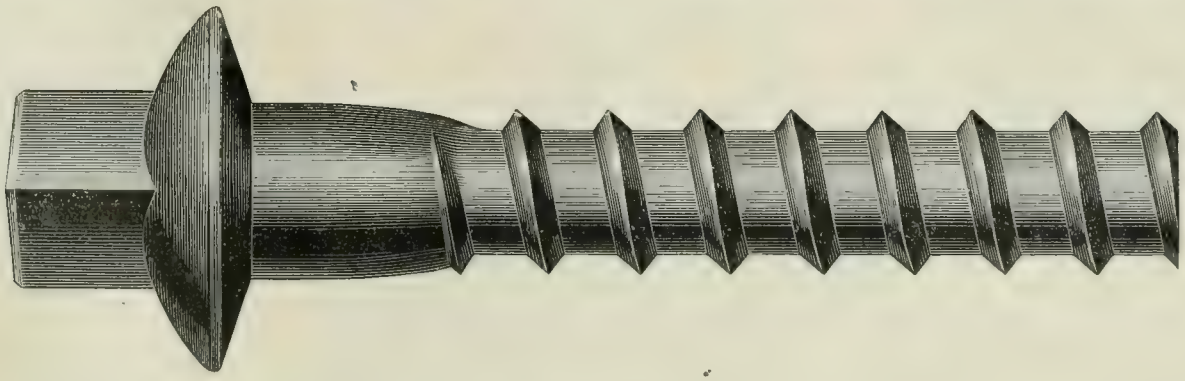
CAMBRIA SOUTHERN.—Chartered in Tennessee with headquarters at Knoxville, to build from Cave Creek, on the Atlanta, Knoxville & Northern Division of the Louisville & Nashville, to a point in Polk County, Ga., near the Conesauga river. H. W. Oliver and J. H. Frantz are incorporators. (Mar. 17, 1905.)

CAMDEN SOUTHERN.—Proposed line in Michigan, from a point in Amboy Township, Hillsdale County, on the Ohio and Michigan state line, to Coldwater, Branch County, about 32 miles. John Reck, of Hillsdale, Mich., is President. Nothing done.

CANADIAN MIDLAND.—Incorporated in Oklahoma with a capital of $40,000,000, to build a railroad from Kansas City to El Paso, Tex., passing through the counties of Pottawatomie, Cleveland, Comanche, Kiowa and Greer, in Oklahoma. Office at Lawton, Okla. Incorporators include G. R. Robertson, C. F. H. Barber, G. McPaschal, all of Lawton; Milfred Steele, of Chicago; I. B. Hampton, of Hampton, Ind. T.; A. S. McKennon, of Wekoka, Ind. T.; and E. A. Hill, of Muskogee.

CANEY & WEST LIBERTY.—Incorporated in Kentucky, to build from Cannel City, in Morgan

SCREW SPIKES



OBJECTIONS TO COMMON SPIKE

"The more important **objections** to the **spike,** and the reasons why it contributes to wearing out the tie prematurely, are:

1st. In the softwood tie the spike does not hold with sufficient firmness to prevent undulations and creeping of the rail, which result in a more or less rapid wearing out of the tie.

2nd. In driving the spike into the softer woods the fibers are broken to an unusual extent. As a result they do not withstand the lateral pressure of the rail, and consequently the spike hole is rapidly increased to such an extent that the spike no longer holds. Water collects in the enlarged hole, and decay sets in.

3rd. Whenever a spike becomes so loose that it no longer holds, it is pulled out and driven in at another point. This constant respiking rapidly ruins the tie."

ADVANTAGES OF SCREW SPIKE

The chief **advantage** which the **Screw Spike** has over the ordinary spike is that, to a large extent, it is put in under circumstances which prevent the mechanical injury to the tie at the time, and when it is once put n it holds the rail to the tie so firmly that a large part of the wear is done away with. The swelled neck prevents the water from entering the spike hole.

European countries have long since abandoned the use of ordinary railroad spikes.

According to Bulletin No. 50 of the Bureau of Forestry, United States Department of Agriculture, the force, in pounds, required to pull the **screw spike** and the ordinary **railway spike** from wooden ties of various sorts was found to be as follows:

Kind of wood	Force required to pull spike	
	Screw spike	Common spike
Chestnut:	*Pounds*	*Pounds*
No. 1	11,150	2,600
	10,950	3,220
	8,620	....
No. 2	7,470	3,250
	8,900	3,080
Average	9,418	2,980
Oak:		
No. 1	11,550	3,760
	11,100	5,300
	8,900	4,860
	8,940	3,490
	13,530	4,300
No. 2	12,300	....
	12,600	..
No. 3	11,000	.
Average	11,240	4,342
Longleaf pine	8,500	2,500
	11,440	2,000
	11,330	2,610
	8,820	2,790
	12,700	1,580
Average	10,558	2,296
White oak	11,050	6,160
	13,700	7,000
	13,670	6,780
	14,940	7,870
	11,770	6,940
Average	13,026	6,950
Loblolly pine	8,850	3,700
	6,500	3,320
	8,930	2,940
	9,100	3,690
	9,140	3,720
Average	8,504	3,474

Write our general office or any of our branch sales offices for further information on this subject, even though you are not ready to purchase Screw Spikes at present.

Some of our Specialties:—Stay Bolt Iron, Stay Bolts, Boiler Rivets, Brake Pins, Spring Pockets, etc.

AMERICAN IRON AND STEEL MANUFACTURING COMPANY

Sales Offices

141 Milk Street, . . . Boston, Mass.
Postal Telegraph Building, New York, N. Y.
Harrison Building, . . Philadelphia, Pa.
Fourth National Bank Building, . Atlanta, Ga.
The Rookery, ... Chicago, Ill.
Crocker Building, ... San Francisco, Cal.

General Office, LEBANON U. S. A. Mills and Factories, LEBANON, PA., and READING, PA.

County, [illegible] to West Liberty, S miles. W. S. Reed, C. M. Martin, and W. B. Smith, of [illegible], are the incorporators. (Mar. 17, 1905.)

*TEXAS, OKLAHOMA & TEXAS.—Contract given by the [illegible] W. R. Stubbs for building its road from Caney, Kan., to Ivanhoe, Tex., 110 miles. The road is controlled by Pittsburg, Pa., interests. The Missouri Pacific or the Atchison, Topeka & Santa Fe may be interested.

CANYON & YOUNGSTOWN.—Officers of the company organized last year to build an electric railroad from Canton to Youngstown, has applied to the [illegible] for rights of way. The officers are: William B. Clark, President; J. R. Snyder, Vice-President; L. D. Barnhard, Secretary, and C. H. Schumach, Treasurer, all of Canton, O.

CANYON CITY & GREAT NORTHERN.—Officers of this company, incorporated about a year ago, express the intention of soon beginning construction. The proposed line is from the Cuckoo coal mine near Lorence, Colo., to El Paso, Tex., 760 miles. (Mar. 17, 1905.)

CANYON CITY & GREAT WESTERN.—Incorporated in Colorado, with $1,000,000 capital. Frank D. Heath, J. P. Fleishel, A. G. Forney, C. F. Willis and A. C. Griffin, Canon City, are interested.

*CANYON CITY, FLORENCE & ROYAL GORGE INTERURBAN.—Organized at Canyon City, Colo., with $1,500,000 capital stock. Bond issue of $500,000 authorized. To be in operation through the Royal Gorge by July 1. An electric line. Officers are as follows: F. R. Street, New York City, President; T. S. Granger, Vice President and General Manager; Former Governor James H. Peabody, Treasurer, and Richard Houle, Secretary.

CANYON CITY, PLAINVIEW & SOUTHEASTERN.—Preliminary surveys made and rights of way secured by this company as far as Lubbock on its proposed railroad to be built from Canyon City, Randolph County, Tex., south to Plainview, 6 miles. The road will eventually be extended south through Lubbock, Gail, Big Springs, Garden City, Sherwood, Eldorado, Sonora, Rocksprings and Brackettsville to Eagle Pass, an additional 400 miles. C. L. Tallmadge, of Chicago; D. C. Benton, of Nashville, Tenn., and E. C. Gordon, of Decatur, Ala., are interested. Offices in Chicago and also in Nashville, Tenn.

CAPE FEAR & NORTHERN.—Arrangements reported made for beginning work on an extension of this road. The road now runs from Apex, on the Seaboard Air Line, to Dunn, on the Atlantic Coast Line and from Apex to Durham, about 21 miles, giving a connection with the Southern Ry. and the Norfolk & Western. It is also said that the road will be extended southeast from Dunn to Southport, at the mouth of the Cape Fear river.

*CARDENAS & JUCARO.—An additional 38 miles is being built on this road, which the United of Havana recently took over.

CARLINVILLE, ALTON & ST. LOUIS.—Incorporation asked for in Illinois to build a railroad from Carlinville southwest to Jerseyville, and thence south to Alton, about 50 miles. Headquarters in Jerseyville. Incorporators and first board of directors include: Andrew J. Gross, J. M. Page, J. W. Becker, J. C. McGrath, all of Jerseyville; A. L. Austen, of Chicago; Robert Curdie and J. M. Rhoades, of Alton, Ill.

CAROLINA & VIRGINIA.—This company, which has an authorized capital of $2,500,000, has applied in South Carolina for permission to build a railroad from Charleston, S. C., north to Monroe, N. C., about 175 miles.

CAROLINA NORTHERN.—This company, which operates a line from Lumberton, N. C., to Marion, S. C., 41 miles, is planning to extend the road north from Lumberton to Fayetteville, 30 miles; also to build an extension south from Marion.

CARROLLTON & WORTHVILLE.—Surveys completed and rights of way secured for building a railroad 9½ miles from Carrollton to Worthville, for which contracts were to be let last year. H. E. Randall, Carrollton, Ky., is President.

CARUTHERSVILLE & WESTERN.—Chartered in Missouri to build from Caruthersville to Derring, in Pemiscot County, 12 miles. The offices of the company will be at Caruthersville, and the incorporators include J. M. Blower, of Chicago, and H. C. Schultz and S. F. Reynolds, of Caruthersville.

CASPAR, SOUTH FORK & EASTERN.—Proposed line from Caspar, Cal., east to Willits, 35 miles. To be built by the company's forces. Surveyed and about three miles of track out of Caspar has been laid. A. E. Kreis, San Francisco, is President, and R. S. Andrews, Caspar, Cal., Chief Engineer. (Mar. 17, 1905.)

CATLIN & NORTHERN.—Incorporated in Illinois to build from Catlin, on the Wabash, northwest to Oakwood, on the Cleveland, Cincinnati, Chicago & St. Louis, 6 miles. L. E. Fisher, G. T. Buckingham and W. V. Dysert, all of Danville, Ill., are incorporators. (Mar. 17, 1905.)

CATOCTIN & PEN MAR (Electric).—This company was granted a charter last year in Maryland to build from Wolfsville to Highfield, on the Western Maryland, and thence to Pen-Mar, about 21 miles. Surveys completed show that the road can be built without any grades in excess of 4 per cent. Nearly all right of way secured.

CATSKILL MOUNTAIN & MOHAWK VALLEY (Electric).—Incorporated in New York with $2,000,000 capital to build from Cairo, in Greene County, N. Y., west to a point near Oneonta, with a branch from Jefferson, in Schoharie County, south to Stamford, in Delaware County, a total length of about 78 miles. The directors include: E. C. White, E. T. Holdridge, C. V. D. Peck, William B. Reed, Jr., and James W. McCabe, of New York; H. S. Lounsberry, of Portchester; N. Herschfield, of Rochester; G. W. Kendall, of Stamford, and E. E. Billings, of Gilboa.

CAYUGA LAKE & ITHACA.—Incorporated in New York, to build from Ithaca to Ludlowville, 7½ miles. J. W. Wright, Dryden, N. Y., and E. A. Beebe, Ithaca, N. Y., are interested. (Mar. 17, 1905.)

CECIL & ASTOR.—Proposed line in West Virginia between those two points, 8 miles. C. A. Young, Robson, W. Va.; W. T. Gates, Astor, W. Va., and W. J. Egan, Kanawha Falls, W. Va., are incorporators. (Mar. 17, 1905.)

CEDAR CREEK.—Charter granted at Harrisburg, Pa., to this company, with $60,000 capital, to build six miles of railroad in Fayette and Westmoreland Counties. Charles Marshall Johnston, of Pittsburg, is President.

CEDAR RAPIDS, WATERLOO & NORTHERN.—Proposed line in Iowa, from Cedar Rapids, Iowa, northwest to Waterloo, 40 miles. L. M. Rupert is President; T. A. Berkebile, Vice President, and E. A. Crocker, Secretary, all of Cedar Rapids, Iowa. (Mar. 17, 1905.)

CENTRAL ARKANSAS.—Chartered in Arkansas, with a capital of $2,600,000, to build in Yell, Perry and Scott Counties, about 130 miles. The incorporators include T. W. McLoud, of the Midland Valley, and W. R. Abbott, of Fort Smith.

CENTRAL BRANCH & ST. JOSEPH.—See Missouri Pacific.

CENTRAL CALIFORNIA.—Incorporated in California, to build from Newark, in Alameda County, west to San Francisco Bay at Portraro Point, and thence across the bay to San Mateo, 15 miles. M. T. Smith, William Hood and J. E. Foulds are interested. Said to be a Southern Pacific project. (Mar. 17, 1905.)

CENTRAL CALIFORNIA TRACTION.—Bonds issued to secure funds to build its proposed road from Stockton, Cal., to Lodi and Woodbridge. Eight and one-half miles of track has been laid in Stockton.

CENTRAL FLORIDA & INDIAN RIVER.—Location surveys in progress for this railroad from Melbourne, Fla., northwest to Orlando and west to Barton, 125 miles. W. T. Wells, Melbourne, and E. O. Painter, Jacksonville, are interested. (Mar. 17, 1905.)

CENTRAL ILLINOIS.—Chartered in Illinois with $50,000 capital to build from Woodhouse, Ill., east to Paris, about 145 miles. Incorporators include A. S. Schneevale and J. Devine, of Chicago. The road is being built chiefly to accommodate the coal traffic from the Peabody mines.

*CENTRAL OF GEORGIA.—This company has let contracts to W. J. Oliver & Co., of Greenville, Ga., to Redmond & Gabbett, of Henry Ellen, Ala., to extend the Columbus & Greenville line from Greenville, in Meriwether County, to Newnan, in Coweta County, about 24 miles. This extension will give a short line to Atlanta, through the C. of G. connection with the Atlanta & West Point at Newnan and direct connection with Chattanooga, through Cedartown and Rome. The distance between Atlanta and Columbus by this route is only 107 miles, as against the Southern Railway mileage of 127 miles by way of McDonough and Griffin, and 117 miles via the Fort Valley line to Williamson. The present line from Columbus to Greenville, 50 miles, is narrow gage. This will be made standard, and about 5 miles saved by relocation.

——The Henry Ellen branch of this company is to be extended for a distance of 10½ miles to the Tunnel Coal Co.'s workings.

*CENTRAL OF NEW JERSEY.—Contract let by this company to C. R. Kingsley, of Scranton, for extending its tracks from Truesdale City, in Luzerne County, Pa., to the West End Coal Co.'s colliery at Mocanaqua, and to connect with its own tracks over its River branch to Shickshinny, a distance of about four miles. The work includes several deep rock cuts.

CENTRAL OHIO & NORTHWESTERN.—Proposed line in Ohio from Marion, Ohio, on the Cleveland, Cincinnati, Chicago & St. Louis and the Erie, southeast to Zanesville, on the Baltimore & Ohio, 100 miles. F. W. Jones, President, Mount Vernon, Ohio.

CENTRAL RAILWAY (Electric).—Organized in Iowa with $25,000 capital stock and headquarters at Des Moines, to build an electric line from Des Moines to Ames, Iowa, 37 miles paralleling the line of the Chicago & North-Western between these two points. T. J. Wilcox, of Clinton, Ia., is President; L. E. Miley, of Chicago, Vice President; B. S. McCully, of Princeton, Ia., Treasurer; D. L. Wilcox, of Des Moines, Secretary, and George H. Carr, of Des Moines, Attorney. Surveys have been made. It is understood that arrangements have been made with the Interurban and the Des Moines City Railway Company for entrance into Des Moines over the tracks of the two companies.

CENTRAL RAILWAY OF OREGON.—Incorporated last June in Oregon, with $2,000,000 capital. Has recently issued bonds to build a belt line in the Grande Ronde valley, Union County, Oregon. The proposed line will connect Elgin, Cove, Union, Hot Lake and La Grande, and will be a feeder for the O. R. R. & N.

*CHARLESTON & SUMMERVILLE (Electric).—Incorporated in South Carolina to build an electric line from Charleston northwest to Summerville, 24 miles, paralleling the Southern Railway. Will, it is reported, be built by the Southern Electric Construction Co., of Gainesville, Ga. Ogden Edwards, of Troy, Ohio, is President, and George Tupper, of Summerville, is Secretary and Treasurer of the railroad company.

CHARLESTON, PARKERSBURG & WESTERN.—Chartered in West Virginia to build a railroad from Charleston, W. Va., north via Sissonville, Spencer and Elizabeth to Parkersburg, 60 miles. The line has been located for eight miles, and contracts are to be let this year. A. S. Alexander is President and C. P. Peyton, Chief Engineer, both of Charleston, W. Va.

CHARLESTON, VIRGINIA & OHIO RIVER.—Chartered in North Carolina to build from Charleston, S. C., through Charleston, Berkeley, Clarendon, Sumter, Kershaw, Chester, York and possibly Lancaster Counties in South Carolina; Gaston, Cleveland, Burke, Caldwell, Mitchell and Watauga Counties, N. C., and Johnson and Carter Counties, Tenn., to Norton, Va., approximately 350 miles. The company is authorized to have a capital of $2,200,000. Headquarters at Morganton, N. C. The incorporators include: W. C. Ervin, H. L. Millner, E. P. Tate, of Morganton, and W. T. Hunter, Joseph F. Gowan and Robert N. Regney, of New York City.

CHATTAHOOCHEE VALLEY.—This company has applied for a charter in Georgia to build a railroad from West Point to a point in Carroll County, about 50 miles. E. F. Lander, J. F. McKemis, N. L. Atkinson and E. J. Collins are among the incorporators.

*CHATTANOOGA & MONTLAKE.—This company is building a line in Tennessee from the mines of the Montlake Coal Co., in Chickamauga Gulch, near Daisy, to Chattanooga, 20 miles, and will also build a branch from a point on its main line to the Tennessee river, about 7 miles. G. W. Nixon, President of the Montlake Coal Co., is interested.

CHATTANOOGA, ANDERSON & ATLANTIC.—Charters have been granted this company, in Georgia and South Carolina, to build a railroad from Chattanooga, Tenn., east via Clayton, Ga., and Westminster and Anderson, S. C., to the seaboard at Charleston. Offices of the company will be opened in Chicago, Ill., and at Anderson, S. C. Albert R. Morton, Chicago, Ill., is President; Capt. P. K. McCully, Treasurer; J. E. Breazeale, Secretary; Mayor M. F. Whitner, of Anderson, S. C., General Counsel.

*CHERRY TREE & DIXONVILLE (PENNSYLVANIA NEW YORK CENTRAL).—This road, which is being built by the Pennsylvania and the New York Central jointly, has been opened for traffic between Cherry Tree, Pa., and Clymer, 25 miles. It will be operated as a part of the Susquehanna extension of the Cambria & Clearfield Division of the Pennsylvania, and will open up extensive coal lands in Indiana County. Work now in progress on an extension from Clymer to Dixonville. (Mar. 17, 1905.)

*CHERRYVALE, OKLAHOMA, GULF & TEXAS.—Contract let to W. R. Stubbs to grade the first 16 miles of this road. The proposed route is from Caney, Kan., southwest through the Osage reservation via Pawhuska and Perry to Kingfisher, Okla. T., about 160 miles. Senator S. M. Porter, of Caney, is President.

CHESAPEAKE & OHIO.—This company is said to be planning to build a branch line at Main Shelby creek, in Kentucky, for about 20 miles into a rich coal and timber section. Surveys have been made and rights of way are being secured.

——This company planned to start work last year aggregating $1,500,000 on maintenance of way improvements, particularly double tracking and increase of yard facilities. Ten miles of the Peninsula Division, 25 miles between Winifrede, W. Va., and Huntington, and about 13 miles near Cincinnati, on the Cincinnati Division, will probably be double tracked; and new yards will be made at Thurmond, W. Va., and Russell, Ky.

——*Work in progress on three extensions. One of these is from the Guyandotte River to Logan, and the other two leave the main line between Hinton and Charleston, and extend to the head waters of the Coal and Guyandotte Rivers, respectively. (Mar. 17, 1905.)

*CHESTERFIELD & LANCASTER.—Contract let by this company to A. H. Page & Son for extending its road from Ruby, S. C., via Hornsboro and Dudley to Lynches river, 18 miles. A. H. Page, Cheraw, S. C., is President, and C. H. Scott, Ruby, Chief Engineer.

*CHICAGO & ALTON.—Contract let for the grading of a new line from Springfield to Murrayville. The line will be known as the "Air Line," and will extend from the junction of the Wabash at Iles, just south of Springfield, for 35 miles toward Murrayville, shortening the distance to Kansas City about five miles. The ruling grade is 0.3 per cent.

——*Work under way on construction of 50.66 miles of second main track from Sherman, Ill., northwest to Bloomington. This will, when completed, give the Chicago & Alton a double track from Chicago to Iles, 187.2 miles, counting the Coal City branch as part of the double track. Contract for $750,000 worth of the work let to Patton & Gibson Construction Co., of Pittsburg, Pa. In this connection, the grades between Carlinville and Bloomington are being reduced to 0.3 per cent. northbound, thereby securing this low grade all the way from the Illinois coal fields to Chicago.

CHICAGO & CENTRAL ILLINOIS.—Proposed new line in Illinois from Chicago through Harvey, Homewood and Mattison to Kankakee. W. R. Reed, C. F. Davies, W. H. Borris and M. W. Hamford, all of Chicago, are named as incorporators. (Mar. 17, 1905.)

*CHICAGO & EASTERN ILLINOIS.—This company has begun to make improvements for which $1,500,000 was recently appropriated. Nearly all parts of the line from Chicago and Terre Haute will be laid with new and heavier rails, new passing tracks and switches and a modern block system will be installed.

——Surveys made for proposed extension from Salem, Ill., northwest to Springfield, about 90 miles.

CHICAGO & ILLINOIS WESTERN.—This company, which recently completed 15 miles of road between Hawthorne and Willow Springs, is making surveys to extend its road southwest through Joliet and thence west across Illinois to the Mississippi river, aggregating about 225 miles of new road.

CHICAGO & MILWAUKEE (Electric).—The Chief Engineer of this company, which operates 70 miles of electric road connecting 16 suburban towns with Evanston, and thence Chicago, is quoted as saying that the company's double track line will be extended on private right of way from Waukegan, Ill., north to Milwaukee, Wis., 45 miles, paralleling the Chicago & North-Western and the Chicago, Milwaukee & St. Paul.

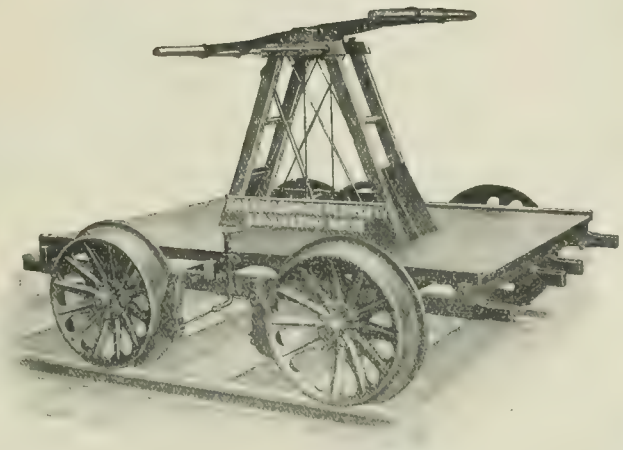
CHICAGO & NORTHERN INDIANA (Electric).—Proposed electric line from Logansport, Ind., through Sheridan, Kempton and Russiaville. The work will be light, with a maximum grade of 0.5 per cent, and a maximum curvature of 3 deg. There will be four bridges. The line will be built under standard steam specifications, and will carry freight as well as passengers. The Company hopes to let contracts early this summer. Lester Soule, Indianapolis, Ind., is President.

*CHICAGO & NORTH-WESTERN.—Under the name of the Manitowoc, Green Bay & North-Western this company is building a line from the north end of the Calumet yard, in Manito-

"KALAMAZOOS"



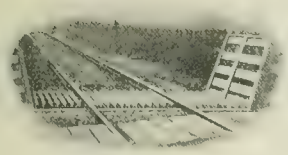
NEW PRESSED STEEL WHEEL.



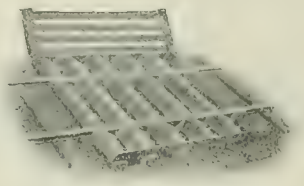
No. 1 STANDARD HAND CAR.



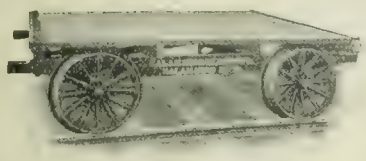
FOR HAND AND PUSH CARS.



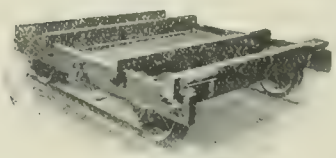
WOOD CATTLE GUARD.



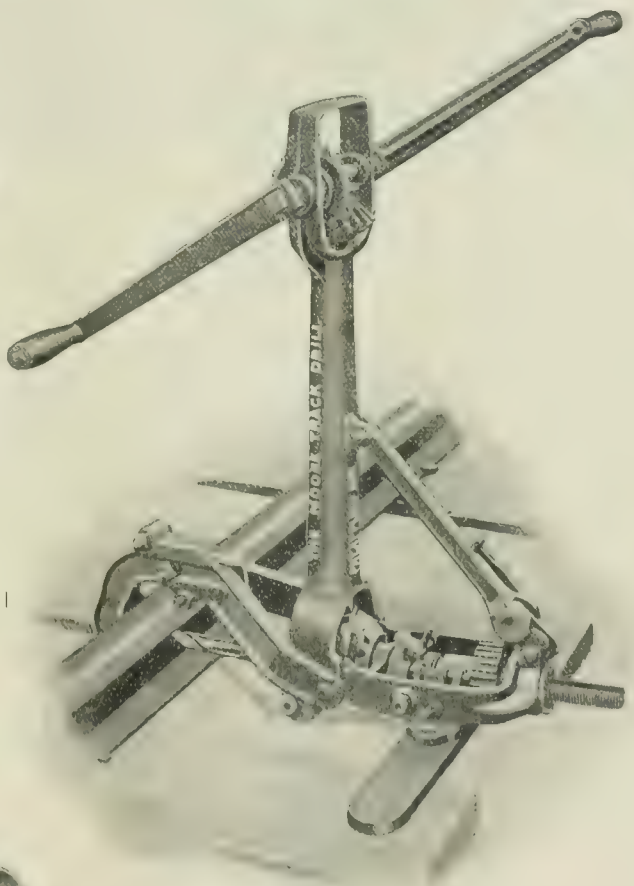
"PERFECT" CATTLE GUARD.

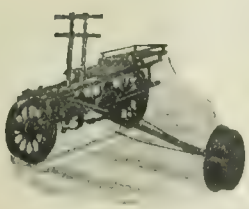


No. 16 PUSH CAR.

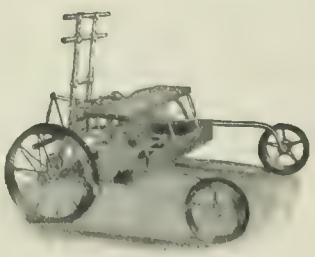


RAIL CAR.





No. 12 VELOCIPEDE.



No. 7 VELOCIPEDE.



KALAMAZOO JACK.

MOORE TRACK DRILL.

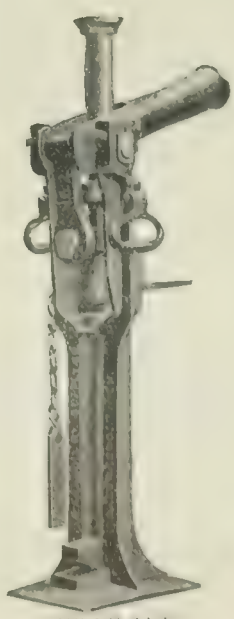
KALAMAZOO RAILWAY SUPPLY CO.

MANUFACTURERS

Kalamazoo, Michigan

A New Catalog Just Issued. Ask for It.

Reorganized Now Equipment New Policy



JENNY JACK.

[illegible] Northern Wisconsin division [illegible] & North Western, at a point 1.36 [illegible] Green Bay, Wis., 55.49 miles, and [illegible] section with the Peninsula division [illegible] & North Western at Duck Creek, Wis., 4 miles on the Ashland division 1.24 miles north of Gillett, 29.88 miles also from Duck Creek on the same road between Duck Creek and Crivitz to the Ashland division at Lilland Junction, Wis., 18.8 miles, making a total of 117.05 miles. About 22 miles of this has been completed. Stiles & Lusk, Shawano, Wis., are contractors.

*Under the name of the Wyoming & North-Western, this company is building an extension from Casper, Wyo., northwest via Welton and Shoshoni, a new town, thence southwest to Lander, 148 miles. The work is being done by the Kilpatrick Bros. & Collins Contracting Co., of Beatrice, Neb., who have the contract for all the construction, except the buildings. About 58 miles of track have been laid. E. C. Carter, Chief Engineer, Chicago, Ill.

Under the name of the Milwaukee & State Line this company is building a line from the city of Milwaukee through Milwaukee, Racine and Kenosha counties to the state line, 50.34 miles. Charles L. Lowe and John M. Mariga, of Chicago, are incorporators. There were 6.25 miles completed last year.

Application filed for permission to build an extension from Lakewood northeast in Oconto County, Wis., six miles.

Right of way secured for building a new road from Pulaski, Wis., to Shawane, 20 miles, through a rich agricultural district.

Cut off projected from Tekamah, Neb., to Dakota City, on the Omaha line, which will shorten the line about 30 miles between Omaha and Sioux City, and will practically parallel the new Great Northern line.

——Surveys being made for proposed cut-off to reduce the heavy grades both east and west of Dixon, Ill. Two routes are under consideration; one from Nachusa to Dixon, and the other from Dixon to Nelson.

—See Pierre & Fort Pierre Bridge & Railway Company.

—See Pierre, Rapid City & North Western.

See Wyoming & North-Western.

CHICAGO & PACIFIC.—Incorporated in Wyoming to build from Casper, Wyo., southwest to Ogden, Utah, about 400 miles. J. B. Bradley and W. B. Rhodes, of Casper, are interested. Said to be a project of the Chicago & North Western.

CHICAGO & RIVER FOREST.—Incorporated in Illinois to build a railroad from Oak Park, in Cook County, to a point in Dupage County, near Wheaton, about 15 miles. F. W. McLean, G. W. Bryson, W. K. Kenley, E. T. Ross and E. J. Carter, of Chicago, are interested.

*CHICAGO, ANAMOSA & NORTHERN.—This company has completed the first 20 miles of its proposed road from Anamosa, Iowa, to Coggon. The proposed route is from Anamosa via Prairieburg, Coggan, Quasqueton and Independence to Waterloo, 73 miles. Contracts are being let. Henry Kiene, Dubuque, Iowa, is President, and J. F. Lacord, Anamosa, Iowa, is Chief Engineer.

CHICAGO, BLOOMINGTON & DECATUR.—Incorporation asked for in Illinois to build a railroad through Will, Grundy, Livingston, McLean, DeWitt and Macon Counties, about 120 miles. D. R. Stephens, Charles Zilly, H. J. Jepper, S. A. Power and W. B. McKinley are interested.

CHICAGO, BURLINGTON & QUINCY.—Proposed improvements to cost about $350,000, including a new track from Foresa City, Mo., to Parkville; a cut off from Beverly to Waldron, in Platt County, and taking out three curves between Waldron and Parkville; also a cut-off at Nodaway and Forest City. The most important work is the cut off from Beverly to Waldron. Twelve miles of track will be laid and the distance between the two places shortened 1½ miles. The work also includes a new bridge over Bush creek.

——*Contracts let to Guthrie & Co., of St. Paul, Minn., for building an extension from Frannie, in the northern part of Big Horn County, Wyo., southeast through Lovell and Basin to Wellington, and thence south to Worland, 91.05 miles. The work includes three steel bridges and the excavation of about 22,000 cu. yds to the mile, 16 per cent. of which will be rock. The maximum grades will be 16 ft. to the mile. Seven miles of track laid. This is being built under the name of the Big Horn Railroad.

——Proposed extension from Valier, north of Christopher, in Franklin County, northwest to St. Louis. The survey from Valier runs in a northwesterly direction through the counties of Franklin, Perry, Washington and St. Clair, about 70 miles.

——Rights of way being secured for a projected line from Sterling, Ill., northwest to Savannah, about 35 miles.

——This company has filed amended articles of incorporation in Wyoming. It is understood that the Burlington will not use its Alliance-Guernsey branch as a main line through Wyoming, but will extend its Holdrege-Cheyenne line west through Southern Wyoming to Salt Lake City. Branches from a point on this line near Laramie, south to connect with the Denver-Lyons line, and north to a connection with the Frannie-Thermopolis now under construction south toward the Wind River Indian Reservation, would fill out this general scheme of development. The Guernsey line could then be extended to a connection with the Denver Frannie north and south line in Wyoming at a point in the coal and iron fields about 50 miles north of Laramie, and eventually southwest to a connection with the main line running from Holdrege through Cheyenne and southern Wyoming. With the completion of this work the Burlington would have direct connection from Denver to the Pacific northwest, and also from the east to Salt Lake City.

——See Custer County Narrow Gage.

CHICAGO, DES PLAINES & FOX RIVER.—Incorporated in Illinois with $1,000,000 capital to build a railroad from Chicago north and northwest through the counties of Cook and Lake to McHenry County, Ill., about 50 miles. The incorporators include: George W. Bryson, William S. Reed, Ernest T. Ross, Walter C. Gunn and William K. Kenly, all of Chicago. Office in Chicago.

CHICAGO GREAT WESTERN.—Appropriation reported made for extension from Arispe, Iowa, northwest 15 miles to Creston.

Preliminary surveys made for an extension from Carroll, Iowa, to Sioux City, Iowa, about 80 miles.

Extension of the De Kalb & Great Western branch from a point on the main line in Ogle County, Ill., through the counties of Ogle, Lee, Bureau, Putnam, Marshall and Tazewell to Peoria, 120 miles. Proposed. (Mar. 17, 1905.)

This company, through the Mason City & Fort Dodge, will, it is reported, take over the properties of the Mason City & Clear Lake Traction Co., operating 18 miles of electric road in Cerro Gordo County, Iowa, and the Waterloo, Cedar Falls & Northern Railway, operating 89 miles of steam and electric lines in Black Hawk and Bremer Counties, and to build a road 50 miles long to connect these properties.

Connecting line to be built from Arispe, in Union County, Iowa, on the Kansas City, line of the Chicago, Great Western, to Carroll, Iowa, on the Omaha Fort Dodge division of the Mason City & Fort Dodge line, about 90 miles.

CHICAGO, INDIANAPOLIS & EVANSVILLE.—This company has been formed in Indiana by L. Wallace, O. B. Jamieson, I. N. Ritchie, S. M. Smith and others, of Indianapolis, with $325,000 capital to build a railroad from Evansville to Indianapolis and thence to Indiana Harbor, Ind.

*CHICAGO, INDIANAPOLIS & LOUISVILLE.—Contract reported let to the Dickerson Construction Co., of Chicago, Ill. Double tracking work is to be commenced at a point on the main line near Quincy, Ind., southwest for a distance of 50 miles, to a connection with the Illinois Central.

See Indianapolis & Louisville.

CHICAGO, JOLIET & KANSAS CITY.—Incorporated in Illinois, with headquarters at Chicago, to build from Chicago through Cook, Will, Kendall, Grundy, Bureau, Lasalle, Stark, Henry, Knox, Mercer and Rock Island Counties, via Joliet, to a point on the western boundary of the state. Millard S. Denslow, Elkworth J. Walton, Charles W. Stevens and Joseph Huhn, of Chicago, are directors.

CHICAGO, KALAMAZOO & EASTERN (Electric).—Incorporated in Michigan with $250,000 capital stock to build an electric line from Kalamazoo to Paw Paw and Marcellus, about 30 miles. The incorporators are Fred F. Bennet, M. H. Lane, Frank H. Melham, Glenn L. Shipman, Victor L. Palmer, Frank B. Lay, of Kalamazoo, and George W. Greenway, of Grand Rapids.

CHICAGO, KANKAKEE & CHAMPAIGN (Electric).—Incorporated in Illinois, with a capital of $100,000, to build an electric road from Champaign, Ill., in a northerly direction through the counties of Champaign, Iroquois and Kankakee to Kankakee, and thence northeasterly through the counties of Will and Cook to Chicago. The incorporators and first board of directors are: E. D. Risser, R. A. McCracken, of Paxon, Ill.; Upton Schaub, of Watseka, Ill., and C. V. Donovon, C. C. Patton and W. J. Boot, of Chicago.

*CHICAGO, LAKE SHORE & SOUTH BEND (Electric).—Contracts let by this company to the John R. Lee Construction Co., of New York, for building an electric railroad from South Bend west through Laporte and Porter Counties, Ind., to connect with the portion of the road between Indiana Harbor and South Chicago, now in operation. The company has increased its capital stock to $6,000,000 and authorized a bond issue of $3,000,000 to secure funds to carry out the work.

*CHICAGO, MILWAUKEE & ST. PAUL.—Extension of this road to the Pacific Coast at Tacoma and Seattle. The Pacific Railway, now the Chicago, Milwaukee & St. Paul, of Washington, was incorporated in the State of Washington in October to build from Seattle southeast to Wallula on the Columbia river, just south of Pasco, Wash. Evarts, in the northern part of South Dakota, on the Missouri river and the westernmost terminus of any existing St. Paul line, is the starting point of the new line to the Pacific. From Evarts the new line is to run west by northwest, probably to Butte and Helena, thence west across the Bitter Root mountains through Lolo Pass an dthe Clearwater country in Idaho to Lewiston; thence west through the southeastern corner of the state of Washington to the Columbia river near Wallula. There is also to be a chanch line from some point on this projected main line south to a connection with the Chamberlain Rapid City line. Contracts let to McIntosh Bros., Milawukee, for building about 800 miles of the extension from Evarts. A contract is reported let to H. C. Henry for building the section from Puget Sound to the eastern boundary line of the state of Washington. Contracts for the rails are said to have been given to the United States Steel Corporation.

*Contracts for extending this road from Saranac, S. Dak., southeast to Colton, eight miles, and the White River Valley Railroad from Presho westward 80 miles let to McIntosh Bros., of Milwaukee, Wis.

*This company, it is said, is double tracking its line from Milwaukee to La Crosse, and within a few months work will be commenced on double tracking from the latter point northward. Grades will also be reduced and the lines straightened.

Surveys reported being made by this company for a line from Albert Lea, Minn., to Mankato. The proposed route follows the Southern Minnesota division as far west as Armstrong, a distance of about six miles, thence northwest through Freeborn, Waseca and Blue Earth Counties to Mankato, about 50 miles.

*Announcement made that this company is operating 40 miles of its extension now under construction from Chamberlain, S. Dak., west to Rapid City, 200 miles. This new line parallels the Chicago & North Western extension now building from Pierre to Rapid City.

——See Pacific Railway.

See White River Valley.

CHICAGO, MILWAUKEE & ST. PAUL OF WASHINGTON.—This is now the name of the Pacific Railway, incorporated to build the western end of the St. Paul's Pacific extension.

CHICAGO, ROCK ISLAND & PACIFIC.—Reported that the Colorado line is to be double tracked from McFarland, Kan., northwest to Belleville, 105 miles, and from Goodland, Kan., west to Colorado Springs, Colo., 186 miles; total, 291 miles. At the same time the laying of 85 lb. rails on the Colorado division is to be finished.

——Surveyors of this company are in the field running three lines from Iowa City west to Des Moines with the object of obtaining a more direct route for the main line. The surveyors have completed one line between these points, several miles south of the present road. Two other routes lying between the present line and the one just surveyed will be laid out.

*Contracts have been let and work begun on building a road from Amarillo, Tex., west to the Texas-New Mexico state line, 70 miles.

Surveys made for an extension from Dallas, Tex., southeast to Houston, 228 miles.

——This company, it is said is planning to build a cut off from Fairbury, Neb., on the Omaha-Denver line south to Herington, Kan., on the Kansas City-El Paso line. The proposed route is from Fairbury to Clifton, using the present main line south from Clifton to Broughton, and a new line from Broughton to some point near Enterprise on the Salina branch, and using this branch the remainder of the way to Herington. The work requires the building of about 75 miles of new road.

——It is reported that a bonus of $20,000 has been voted by the town of Granite, Okla. T., and rights of way granted for 10 miles to secure an extension of this road from Chattanooga westward through Snyder and Granite to Eric, 90 miles, running through the Wichita Mountain mineral fields.

—See Little Rock & Southern.

—See New Orleans Terminal.

—See Rock Island, Arkansas & Louisiana.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA (C. & N.-W.).—This company is planning to improve its road from Le Mars, Iowa, north to Alton. The present line, which is 16 miles long, is to be straightened and grades reduced.

CHICAGO SOUTHERN. Chicago Extension of the Southern Indiana from Terre Haute, Ind., north to Chicago, 170 miles. Most of this is graded and track laid on 85 miles. Involved in failure of John R. Walsh banks in Chicago and status not yet determined.

*CHICAGO, WEATHERSFORD & BRAZOS VALLEY. Contract let by this company to the McCarthy-Miller Construction Co., of Lufkin, Tex., to build a road from Weathersford, Tex., via Springtown and Pooleville to Bridgeport, 35 miles. The road may eventually be extended farther south to Granbury or Glen Rose. The road is supposed to be an independent project, but will make connections with the Rock Island. The city of Weathersford has contributed $65,000 towards the construction of the line. Names of incorporators not given.

CHICAGO, WISCONSIN & SOUTH DAKOTA.—Incorporation asked for in South Dakota by this company, with a capital of $1,000,000 to build a railroad from Viroqua, Wis., to Pierre, S. Dak., 767 miles. The incorporators include A. S. Hendricks, of Chicago, and L. L. Stephens and F. A. Stephens, of Pierre, S. Dak.

CINCINNATI BELT (Electric).—Incorporation asked for by a company under this name, to build a railroad from Winton Place east through the suburbs of Cincinnati and terminating at Redbank. To be a belt line connecting several steam and electric roads. The incorporators include: J. G. Jacobs, J. W. Peurrung, O. C. Evans, K. F. Beckhardt and V. Q. Price. The road was originally planned by Peter Elchels and others, of Redbank.

CINCINNATI, BLUFFTON & CHICAGO.—This company is planning to build extensions from Huntington, Ind., southeast to Bluffton, and from Portland southeast to Union City. The aggregate length of the new lines will be 45 miles.

*CINCINNATI, GEORGETOWN & PORTSMOUTH.—This company, which recently extended its line to Russellville, Ohio, has given a contract to Thomas Daulton for building four miles additional from that place east to Eagle Creek. Surveys also completed for an additional 12 miles east from Eagle Creek.

CINCINNATI, MILFORD & LOVELAND (Electric). Bonds are to be issued to raise funds for an extension from Loveland east to Blanchester, about 18 miles. B. H. Kroger, of Cincinnati, is President.

*CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—New double track from Oakdale, Tenn., north to Somerset, Ky., about 93 miles. This is on the mountain section. About one-third of this work will be carried out this year, after which the remainder will be double tracked as soon as practicable. Contracts let to W. J. Oliver & Co., of Knoxville, for double tracking 12 miles from Pine Knot north to Flat Rock; also from Pine Knot south to Helenwood, Tenn., an additional 18 miles. The cost of the entire work from Oakdale to Somerset will be about $1,000,000.

Surveys being made for a line from Kis-

Cook's Railway Appliance Co.

SUCCESSORS TO

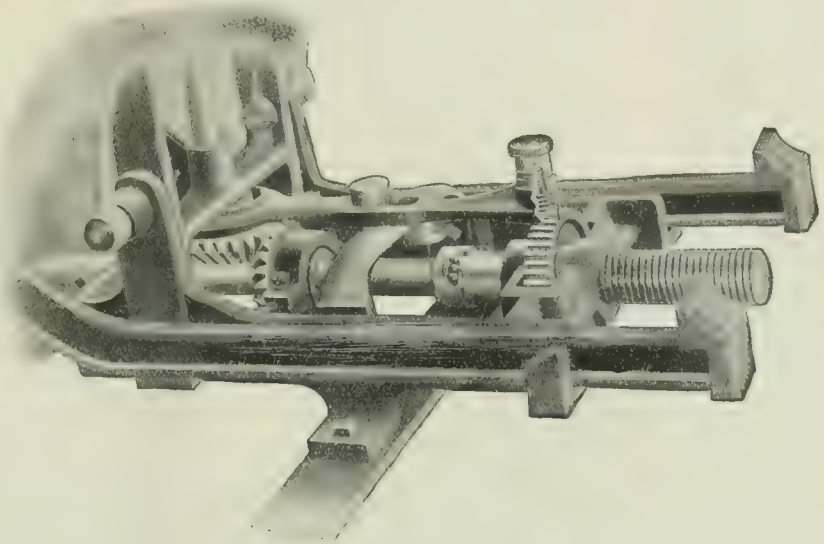
MERRILL-STEVENS MFG. CO.

KALAMAZOO, MICH.

No Change in Ownership or Management

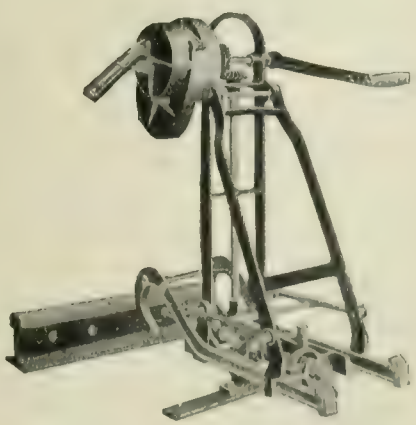
COOK'S PREMIER RAIL DRILL BALL BEARINGS

Variable and reversible Feed.



Detailed View of Feeding Device of Premier Drill

Actual test: Drilled a $\frac{7}{8}$-in. hole through an 80-lb. rail in 2 minutes and 4 seconds. In its construction we have aimed to reduce friction to a minimum. The thrust of the drill-bit holder has BALL-BEARINGS and the bushings are of brass. The feed is variable, and may be increased or diminished without stopping the drill. **Feed** is also **reversible** so that **drill may be extricated** and **saved from breakage.** This Drill is adapted to the HEAVIEST drilling purposes up to $1\frac{1}{4}$ in. hole. Great Speed, Strength and Range of Capacity are Prominent Features.

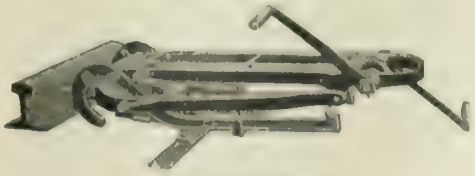


Drill With Tool Grinder Attached

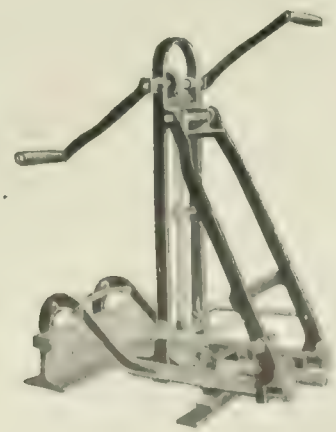


Standard Jack

We make a complete line of these track and automatic Lowering Jacks. All sizes.



Drill Collapsed



Cook's Drill in Working Position

SEND FOR OUR NEW CATALOG

[illegible] County, Tenn., southwest to [illegible], about 133 miles, passing [illegible] coal and coal district.

CLEVELAND, BEREA & SOUTHERN (Elec[illegible]).—Incorporated in Ohio, has secured rights of [illegible] and will soon begin construction. The proposed line is about 50 miles long. The contracts will begin in South Brooklyn and work toward a point northwest of Berea, entering that place over the Cleveland & Southwestern electric line. From the place, a branch is to be built south to Medina. C. H. Hubbell, of Cleveland, is interested.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Bids were recently asked for grading and masonry work in connection with the double-tracking and relocation of the Cincinnati division. The work calls for the removal of two million cubic yards of earth, divided into sections, ranging from 200,000 to 800,000 cubic yards, and for about 20,000 cubic yards of masonry work. The section from Middletown, Ohio, to Miamisburg, 12.3 miles, requires 600,000 cu. yds. of earth excavation.

——*Grading under way on the St. Louis division of this road between Indianapolis, Ind., and Lena. The work includes the excavation of 4,000,000 cu. yds. of earth.

——*Grading work under way on relocation of single track on the Cairo division. The work calls for the excavation of 665,000 cu. yds. Heavy grades near Swango will be reduced. Contracts let for work on the Cairo Division as follows: Tilton-Danville Extension—District A: MacArthur Bros. Co., Chicago, Ill., earthwork, 500,000 yds.; masonry, 3,000 yds.; Bates & Rogers Cons. Co., masonry, 9,000 yds. Tilton to Allendale—District B: W. J. Oliver, Knoxville, Tenn., earthwork, 1,400,000 yds.; Widell-Finley Co., Chicago, Ill., masonry, 15,000 yds. Allendale to Harrisburg—District C: Walsh & Johnson, Davenport, Ia., earthwork, 1,600,000 yds.; Collier Bridge Co., Indianapolis, masonry, 17,000 yds. Lawrenceville Relocation—District D: Wells Bros. & Brown, St. Louis, Mo., earthwork, 250,000 yds.; Moore-Mansfield Construction Co., Indianapolis, masonry, 10,000 yds.

——*The work being carried out by this company from Haughville, Ind., to Augusta, is a relocation of five miles of the Chicago division. The present line is very crooked, following Crooked creek and the White river, and has six large bridges and a great deal of curvature. The line from Haughville to Augusta is intended to take the place of this crooked portion. The relocation is a tangent, and will reduce the line considerably. The work was decided upon when it became necessary to double-track the existing line.

——*Contract reported let by this company to O. D. Guilfoil, of Terre Haute, Ind., for grading and filling on its road from Burnett, Ind., to Carbon, and for laying a second track for a distance of about 10 miles on this section of the road. The double track work from Markles Station to Burnett has been completed by Contractor Wells, of St. Louis.

——*The first track elevation resolution, under the law passed by the last session of the Legislature, has been adopted by the Board of Public Works of Indianapolis, Ind., and has been agreed to by representatives of the Cleveland, Cincinnati, Chicago & St. Louis and the Vandalia roads. Provision has been made for the elevation of tracks and the depression of the streets at Kentucky avenue and Missouri and West street crossings, and for the erection of a new bridge over White river for the Vandalia. The latter company will elevate the tracks for a considerable distance west of White river and the Indianapolis & Vincennes trains will reach the elevation by a new route. The work will cost about $300,000, the railroads paying about 75 per cent. and the city the balance. Work is to be completed by December, 1906.

——Proposed five-mile cut-off near Lebanon, Ind., to reduce grades.

——Proposed improvements to freight terminals at Cincinnati, Columbus and Indianapolis; also new passenger station at Springfield, Ohio. Much of the line from Cincinnati to Dayton will be double-tracked.

CLEVELAND SHORT LINE.—Incorporated in Ohio to build a belt line from Fairport, on the east side of Cleveland, to Lorain, on the west, to cost approximately $10,000,000. It is said that New York and local bankers are back of the project.

CLEVELAND, WOOSTER, MOUNT VERNON & COLUMBUS (Electric).—Rights of way being secured for building an electric railroad from Wooster, in Wayne County, Ohio, through Wayne, Holmes, Ashland, Richland, Knox, Licking and Franklin Counties, about 105 miles; also to build a line to Mansfield, 12 miles. Entrance will be made into Columbus over the tracks of the Columbus City Railway, and traffic arrangements have also been made with the Cleveland & Southwestern.

CLEVELAND, YOUNGSTOWN & EASTERN.—Projected froad from Moran, Ohio, 20 miles from Cleveland, on the Wheeling & Lake Erie, to Youngstown, 40 miles, and thence to a connection with the Buffalo, Rochester & Pittsburg near Newcastle, Pa. (Mar. 17, 1905.)

CLEVELAND, YOUNGSTOWN & OHIO.—Proposed line in Ohio from Cleveland through Cuyahoga, Summit, Portage, Trumbull and Mahoning counties, southeast to Lowellville, 65 miles. Thomas E. Connell and F. B. Hamilton are incorporators. (Mar. 17, 1905.)

COAL BELT.—Surveys completed by this company, which was incorporated in Utah to build a railroad from Spanish Fork, Utah, through Utah, Wasatch and Carbon Counties to the coal fields, 89 miles. The maximum grade will be 2 per cent. and the maximum curvature 10 deg. S. B. Milner is President, and F. P. Jacobs, Chief Engineer, Salt Lake City, Utah. (May 26, 1905.)

COAST LINE (SOUTHERN PACIFIC).—Incorporated in California to build a road from San Francisco to Santa Cruz via Pescadero, for which surveys are now being made. N. T. Smith is President and William Hood, Chief Engineer, San Francisco, Cal.

COEUR D'ALENE & SPOKANE.—This company which operates a road from Coeur d'Alene to Spokane, 33 miles, is making surveys for an extension to Liberty Lake. (Mar. 17, 1905.)

COLORADO & SOUTHERN.—An extension of this road is planned to complete a through line from Denver to Galveston in connection with the Fort Worth & Denver City and the Trinity & Brazos Valley, 80 miles long, recently bought, and the construction of 160 miles of new road.

*Contracts reported let by this company for widening all of the embankments on the Wyoming District, between Cheyenne and Orin Junction, 154 miles. This work is to be carried out this spring.

——Preliminary surveys reported finished for a branch line from Belleville, Colo., to quarries near Owl Canyon, 18 miles northwest of Fort Collins. (Mar. 17, 1905.)

See Trinity & Brazos Valley.

See Colorado Southern, New Orleans & Pacific.

See Wichita Valley Railroad.

COLORADO, COLUMBUS & MEXICAN.—This company, incorporated in New Mexico, plans to build a road from Columbus, N. Mex., via Deming, Gallup and Durango to Salt Lake City, Utah, 700 miles. The maximum grade is to be 1 per cent., and maximum curvature 4 degrees. There will be one steel bridge. A. O. Bailey, Columbus, N. Mex., is President.

COLORADO, OKLAHOMA & SOUTHEASTERN.—The proposed route of this road is from Weatherford, Okla. T., through Independence, Putnam, Lenora, Mutual, Hackberry and Detroit to Woodward, 90 miles, with a branch line from Hackberry to Gage, Okla. T., 35 miles. Location surveys completed and contracts for grading to be let shortly. The maximum grade is 0.8 per cent. P. A. McCarthy, Weatherford, Okla. T., is Chief Engineer. (Mar. 17, 1905.)

COLORADO, OKLAHOMA CENTRAL & NEW ORLEANS.—See Guthrie, Fairview & Western below.

COLORADO ROADS.—Franchise granted for an electric line 100 miles long through Delta County, Colo. W. B. Stockham and C. L. Pike, of Delta, are interested. (Mar. 17, 1905.)

——Reported that the Great Western Coal Co., of Florence, Colo., will build a road from its coal lands in Fremont County to Colorado Springs, 50 miles. F. D. Keith, of Canyon City, is interested. (Mar. 17, 1905.)

*COLORADO SOUTHERN, NEW ORLEANS & PACIFIC.—L. S. Berg, President of the New Orleans Terminal Co., is reported to be interested in this company, which proposed to build a New Orleans connection for the Colorado & Southern and Forth Worth & Denver City. The new line, in which the St. Louis & San Francisco is also interested, is to connect New Orleans, La., and Houston, Tex., paralleling the Southern Pacific. Connection is to be made at Houston with the line which the Fort Worth & Denver City is to build southeast from Fort Worth, its present terminus, to Houston and Galveston. The C. S., N. O. & P. proposes to run from New Orleans to Baton Rouge over the Yazoo & Mississippi Valley tracks. From Baton Rouge, construction work is soon to be begun on a line due west to De Quincy, La., on the Kansas City Southern, 47 miles from Beaumont. From that point, the new company expects to have trackage rights over the Kansas City Southern into Beaumont, and from Beaumont the plan is to run west to Houston, perhaps using the Beaumont, Sour Lake & Western, which now runs from Beaumont west to Sour Lake, 22 miles. Between Houston & Fort Worth, the Trinity & Brazos Valley will form part of the Fort Worth & Denver City extension. On completion of these plans the Yoakum interests will have a line from New Orleans to Denver. Contract reported let to the Kenefick, Hammond & Quigley Construction Co., of Kansas City, Mo., and Beaumont, Tex., for building from De Quincy, La., on the Kansas City Southern, east to Baton Rouge, 250 miles, together with a 50-mile branch.

——See Beaumont, Sour Lake & Western.

COLORADO, TEXAS & MEXICO.—This company, which was organized some time ago, and which graded about 25 miles of road, plans, by vote of its stockholders, to complete the road. The projected route is from Washburn, in Armstrong County, Tex., southeast to Comfort, Tex., on the San Antonio & Arkansas Pass, about 400 miles. The office of the company is at Abilene, Tex. The Chicago, Rock Island & Pacific is said to be largely interested in this project.

——See Denver, Yellowstone & Pacific.

COLUMBIA & NORTHWESTERN.—Chartered in Arkansas to build from Old Lumber, between Waldo and Buckner, in Columbia County, south to Macedonia, 18 miles. J. J. Cochran, G. W. McKay and J. S. Jones are interested. (Mar. 17, 1905.)

COLUMBIA, CHICAGO & NORTHWESTERN.—Rights of way are being secured by this company for its proposed road from Columbia, Mo., north to Clark, about 30 miles.

*COLUMBIA RIVER & OREGON CENTRAL.—Contract let to the Pacific Coast Construction Co., of Portland, Ore., for building this road from Arlington south to Condon, 45 miles. Branch lines are eventually to be built from Ione southwest to Condon, 25 miles, and from Arlington west to Rock Creek, 10 miles. W. H. Kennedy, Portland, Ore., is Chief Engineer. (Mar. 17, 1905.)

COLUMBIA SOUTHERN.—This company, which operates 70 miles of railroad in Oregon, is planning to build an extension from Shaniko, Ore., its southern terminus, south 50 or 60 miles further.

COLUMBUS & ANNISTON.—Incorporation asked for in Alabama, with a capital stock of $100,000, to build from Columbus, Ga., to Attalla, Ala. The incorporators include Frank G. Lumpkin, E. H. Hardaway, Howell Hollis and E. K. Cargill, all of Columbus, Ga.

COLUMBUS & ERIE.—See Erie.

COLUMBUS & LAKE MICHIGAN.—This company will build an extension from Lima, Ohio, southeast to Columbus, about 80 miles, for which the right of way has been secured.

COLUMBUS CITY & OCONEE.—Incorporated in Georgia, with $100,000 capital, to build a railroad from Columbus, Ga., to the Oconee river 12 miles. The incorporators include L. F. Henson and others, of Felher County, and Urlah & Sears, of Montgomery County.

COLUMBUS, MARION & BUCYRUS (ELECTRIC).—Incorporated with $500,000 capital to build an electric railroad from Marion, Ohio, through the counties of Marion and Crawford to Bucyrus, 17 miles. John G. Webb, of Springfield, Ohio, is President.

COLUMBUS NORTHERN.—Chartered in Georgia, with $100,000 capital, to build from Columbus to Lagrange, through Muscogee, Harris, Meriwether and Troup Counties, 60 miles. The incorporators include Charles L. Davis, of Warm Springs, Meriwether County; O. C. Bullock, T. W. Bates and R. O. Howard, of Columbus.

*CONWAY COAST & WESTERN (ATLANTIC COAST LINE).—This company, which was projected to run from Sumter, S. C., east to Conway, S. C., with a branch line from Briton's Neck north to Marion, about 20 miles, and eventually to be extended east to Southport, 50 miles, is now operating from Conway to Myrtle, 14 miles, and has just completed the section from Conway to Cool Springs, 12 miles. The company is building, with its own forces, a branch from the latter place to Ayner, about four miles. On the completion of the work to Cool Springs the company was sold to the Atlantic Coast Line, and although location surveys have been completed to Marion, it is doubtful if these proposed extensions will be built. F. A. Burrows, Conway, S. C., is President, and R. E. Beatty, Chief Engineer.

COOK COUNTY & SOUTHERN.—Incorporated in Illinois, with $50,000 capital, to build a railroad from Franklin Park south to Cary, in Cook County. Office at Chicago. The incorporators include: James S. Hopkins, Royal Wright and E. M. McKinney, all of Chicago; John M. Peffers of Aurora, and George W. Child of Hinsdale, Ill.

COPPER RIVER & NORTHWESTERN.—Surveys are now in progress for this road, projected from Valdez, Alaska, northeast to the Copper river, about 40 miles, and thence to Eagle City on the Yukon river, about 270 miles additional. John Rosene, J. D. Trenholme, of Seattle, Wash., and William T. Perkins, of Nome, are interested. The headquarters of the company are at Carson City, Nev.

CORDELE, HAWKINSVILLE & NORTHEASTERN.—Incorporation asked for in Georgia, with $250,000 capital, to build a railroad in that state 35 miles long. Surveys have not yet been made. The road is projected to run from Cordele northeast to Hawkinsville, in Pulaski County. Hon. J. Polk Brown, former member of the Railroad Commission of Georgia; P. H. Lovejoy, H. N. Parsons, J. J. Harvard, C. W. Jordan, Jr., and E. J. Henry, of Gainesville, are interested.

CORNING, KEUKA LAKE & ONTARIO.—Incorporated to build from Corning, N. Y., north to Sodus Bay on Lake Ontario, 96 miles. This is a revival of the Sodus Bay, Corning & New York, organized long ago, but killed by litigation which lasted more than 30 years. Thirty-five miles of the roadbed was graded by the former company. The new company is capitalized at $1,500,000. Contracts will be let soon for building from Corning, via Savonia, on the Erie, north through Bradford and Wayne to Penn Yan, on the New York Central, about 46 miles. Daniel Danehy, 25 Broad street, New York, is Secretary.

CORRY, FINDLEY LAKE & NORTHEASTERN TRACTION.—Application made in Pennsylvania for a charter to build an electric line from Corry, about 30 miles long, with a branch to Lake Columbus. The project is being backed by Boston capitalists.

*COUNCIL CITY & SOLOMON RIVER.—New line from Dickson (Solomon), Alaska, to Council City, 53 miles. About 18 miles has been completed to mouth of John's Creek. Surveys are being made for balance of the road to Council City, 35 miles. The Western Alaska Construction Co., 5 Nassau street, New York, is building the road.

CRAWFORD COUNTY MIDLAND.—Chartered in Missouri to build a railroad six miles long in Crawford County from a point on the St. Louis & San Francisco, near Steelville. W. K. Bixby and H. J. Hannibal are incorporators. (Mar. 17, 1905.)

CRAWFORDSVILLE & NORTHWESTERN.—Incorporation asked for in Indiana by this company, with a capital of $100,000, to build railroads. The directors are: S. J. Hunt and John F. McFarland, of Crawsfordsville, and Augustus L. Mason, of Indianapolis.

CRESTON & WESTERN.—Incorporation asked for in Iowa, with $250,000 capital, to build a railroad from a point on the Chicago Great Western near Carroll, Iowa, south to Creston, about 80 miles. The officers are: T. Dufer, President, of Des Moines; Thomas A. Way and Irving W. Keerl, Vice-President and Treasurer, of Mason City, and E. E. Sampson, Treasurer, of Des Moines.

CROOKED CREEK.—This road, formerly the Webster City & Southwestern, has been sold to a syndicate represented by a Mr. Seaman, of Milwaukee. The road is now in operation from Webster City, Iowa, southwest to Lehigh, 18 miles, and to the coal mines along the Des Moines river south of Lehigh. The new owners have arranged for the early construction of two extensions; one, southwest from Lehigh to Gowrie, 15 miles, where connection can be made with the North-Western, the Rock Island, Newton & Northwestern and Minneapolis & St. Louis; and

Quincy, Manchester, Sargent Co.

SUCCEEDING

Railway Appliances Co., Q & C Company, Pedrick & Ayer Co.

SOLE SALE AGENTS

Elastic Nut & Bolt Co.

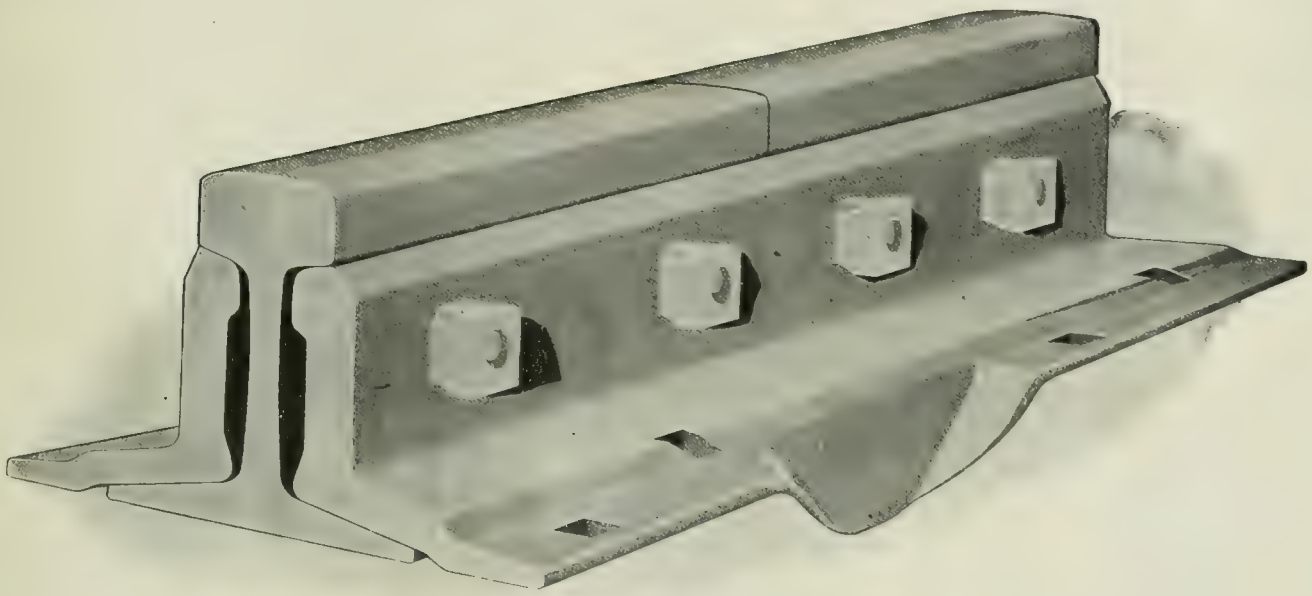
OFFICES:

OLD COLONY BLDG. CHICAGO

114 LIBERTY ST. NEW YORK

FACTORIES:

PLAINFIELD, N. J. CHICAGO HEIGHTS, ILL. MILWAUKEE, WIS.



THE Q & C BONZANO RAIL JOINT

The Bonzano Joint is an economical appliance that will add to the life of your rails by preventing the ends of the rail being damaged.

The track maintenance labor, usually devoted to picking up low joints, can be saved by using Bonzano Joints.

The Bonzano Joint will save in track labor alone, an amount sufficient to defray the cost of renewals of rails and splice-joints.

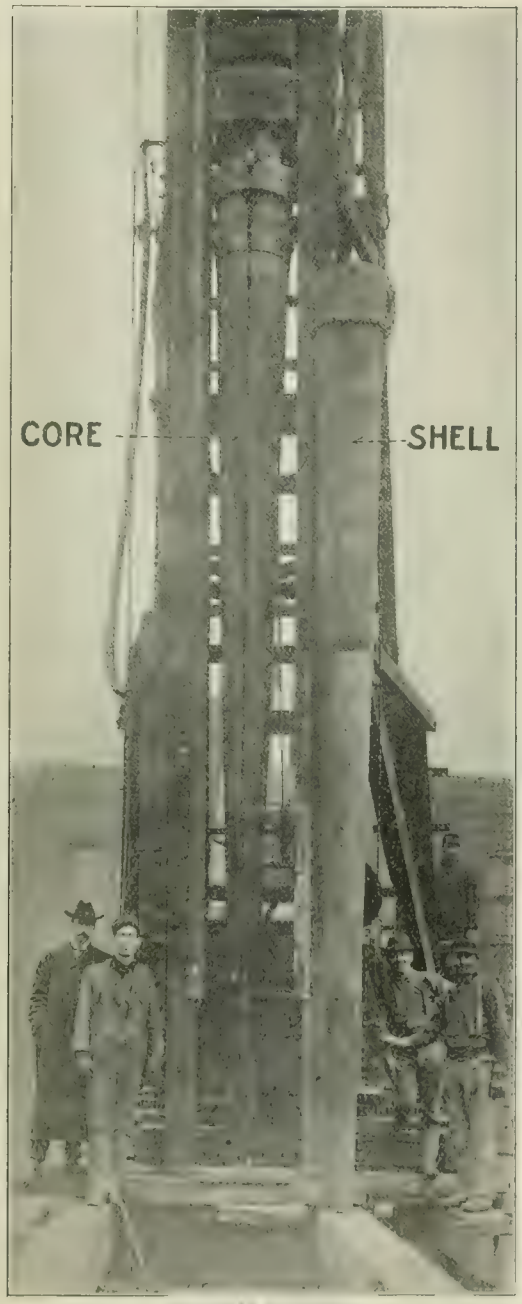
The following devices are of great value in track work :

Elastic Nuts and Track Bolts
American Guard Rail Fastener
Graham Combined Guard Rail & Frog Brace
Q & C Anti Rail Creeper
Q & C Portable Rail Saw
Q & C Samson Rail Bender

SEND FOR CATALOGS

[illegible] to be [illegible] Dover [illegible] [illegible] [illegible]

Raymond Concrete Piles



PILE, CORE AND SHELL.

Every pile absolutely monolithic. Our method of placing concrete piles assures PERFECTION in every pile. No failures. No working in the dark. Carefully prepared Book of Facts Free upon application.



Raymond Concrete Pile Company

GENERAL OFFICE
135 Adams St., Chicago

DES MOINES, WINTERSET & CRESTON (Electric).—Incorporated in Iowa to build an electric railroad from Creston to connect with the Des Moines City Railway Co. and the interurban railway [illegible] Valley Junction southwest via Winterset and Macksburg to Creston, Iowa, 41 miles. The officers are: W. D. Skinner, President, and Mrs. Ward, Secretary, both of Des Moines; S. S. Alexander, of Winterset, Treasurer; A. E. Park, General Manager, and N. E. Coffin, General Counsel, both of Des Moines.

*DETROIT BAY CITY TRACTION.—This company has filed a mortgage for $3,000,000 to cover a bond issue of that amount to be used in building an electric line between Detroit and Bay City, Mich., 112 miles. The contract for the construction of the road has been let to the Ross Construction Co., of Chicago, and a subsidiary company, the Wayne Construction Co., of Detroit, has been organized to carry on the work in Michigan. The contract calls for the completion of the road by Oct. 1, 1906. Construction work will begin at Bay City, run east to Akron and then south to Caro. The officers of the company are: President, E. H. Whitcomb, Davenport, Ia.; Secretary, L. A. Rockwell, Detroit; Treasurer, C. H. Christian, Detroit.

*DETROIT RIVER TUNNEL COMPANY.—This company, which was formed by the merging of the Michigan & Canada Bridge & Construction Co. and the Canada & Michigan Bridge & Tunnel Co., has commenced work on the Michigan Central's new railroad tunnel under the Detroit river between Windsor, Ont., and Detroit, Mich. The approach on the Detroit side will start midway between Fifteenth and Sixteenth streets on the present line of the Michigan Central. The length of the underground portion of the tunnel will be 2.6 miles, and the distance from surface to surface about three miles. Bids were opened this month. It will take between two and three years to complete the work.

*DETROIT TERMINAL.—This company is building with its own forces a belt line around the city of Detroit, about 25 miles. Grading has been completed for four miles, and contracts will be let early in August for some of the grading and track laying, also for building a bridge. P. M. Jacobson, 901 Union Trust Building, Detroit, Mich., is interested.

DETROIT, TOLEDO & IRONTON.—The owners of this road have projected a 125 mile railroad south from the Ashland end of the Ironton-Ashland bridge across the Ohio river, into the Elkhorn and Round Gap coal districts of Kentucky, where they own some 350,000 acres of coal lands. The bridge is being built by the Ironton & Ashland Bridge Company, controlled by the D., T. & I., and is nearly completed.

DIXON FALLS & SOUTHWESTERN (Electric).—Rights of way reported nearly all secured for building an electric road from Dixon, Ill., to Rock Island, 60 miles. O. E. Mason, John Pippert and R. L. Leitch, of Rock Island, are interested.

DONALDSONVILLE & NAPOLEONVILLE.—Location surveys completed for building from Johnson, La., to Houma, 40 miles; and from Thibodaux to Gibson, 16 miles. M. D. Bringier, Donaldsonville, La., is General Manager. (Mar. 17, 1905.)

DOUGLAS, AUGUSTA & GULF.—This road, formerly the Wadley & Mt. Vernon Extension, and the Ocilla, Pinebloom & Valdosta, is now in operation from Nashville, Ga., northeast to Barrows Bluff. An extension is planned from Barrows Bluff north via McRae and Helena to Rockledge, on the Wadley & Mt. Vernon, which runs from Rockledge northeast to Wadley, 40 miles. B. F. Holzendorff, Douglas, Ga., is General Superintendent.

*DOVER & SOUTH BOUND. Extension of charter granted in North Carolina by which this road, running from Dover to Richlands, 25 miles, may be extended to Swansboro, 30 miles. The company plans to build this extension with its own forces. Rails reported ready to be laid.

DUBLIN & SOUTHWESTERN.—Extension projected from Eastman, Ga., south to Fitzgerald, 35 miles. The present line extends from Dublin southwest to Eastman, 31 miles. E. P. Rentz, Dublin, Ga., is President. (Mar. 17, 1905.)

DUBUQUE, IOWA & WISCONSIN.—Organized in Iowa to build from Dubuque through the states of Iowa, Illinois and Wisconsin to points not yet decided upon. Directors include: J. M. McFadden, A. W. Tredway, F. J. Piekenbrock, H. H. Blish and J. E. Hedley.

*DULUTH, MISSABE & NORTHERN.—Contracts let to the Drake & Stratton Co. and to John Runquist, both of Duluth, and also to Winston Bros. Co., of Minneapolis, for building a branch from Alborn, Minn., to Bovey, 55 miles. Grading completed for 75 per cent. of the distance. —Surveys reported for an extension from the western terminus of this road at Hibbing, Minn., to the Mississippi river, 25 miles. (Mar. 17, 1905.)

DULUTH, RAINY LAKE & WINNIPEG.—This company, which was formerly the Duluth, Virginia & Rainy Lake, is now operating 46 miles of road from Rainy Lake Junction north to Pelican Lake, in St. Louis County, Minnesota. President Cook announces that an extension will be built from the northern terminus at Pelican Lake northwest to Fort Francis, Ont., an additional 50 miles.

*DULUTH, ST. CLOUD, GLENCOE & MANKATO.—Contract let to E. L. Tobie & Co., with offices at New York, and at Freeborn, Minn., for building this road from Albert Lea, Minn. northward to Mankato, 52 miles. The company is also making surveys for extending the line from Albert Lea to Duluth, a total distance of 287 miles.

DULUTH, SOUTH SHORE & ATLANTIC.—This company, it is said is planning to extend its Mineral Range line northeast to Keweenaw Point, about 30 miles.

DULUTH, VIRGINIA & RAINY LAKE.—See Duluth, Rainy Lake & Winnipeg.

DUNLAP & REDSTONE.—Charter granted this company in Pennsylvania, with $200,000 capital, to build a railroad about 10 miles long to open up coke fields controlled by W. J. Rainey in Menallen and Redstone Townships, Fayette County.

DYERSBURG NORTHERN.—Incorporated in Tennessee to build from Dyersburg north to Tiptonville, in Lake County, 30 miles. Connection to be made with the Illinois Central at Dyersburg. George T. Weakley, J. C. Doyle and W. H. Kupe, all of Dyersburg, Tenn., are incorporators. (Mar. 17, 1905.)

*DYERSVILLE & NORTHERN.—This company, which is building a line from Dyersville, O., to New Vienna, five miles, has given the contract to E. L. Tobie, of St. Paul, Minn. Grading completed for the entire distance, but no track has yet been laid. Jacob Herper; G. H. Hessleman and E. C. Peaslee, of Dubuque, Ia., are interested.

E

EAGLE VALLEY.—Incorporated in Oregon to build from Baker City east to Richland, in Baker County, 50 miles. W. L. Vinson, John Waterman and P. Basche, all of Baker City, Ore., are named as incorporators. (Mar. 17, 1905.)

EASTERN IOWA (Electric).—Surveys have been completed for this proposed electric road from Muscatine, Iowa, via West Liberty to Iowa City, 34 miles. Contracts have not yet been let, as there has been delay in getting a franchise in Muscatine. The work includes building a number of bridges. A. F. Groeltz, of Cedar Rapids, Ia., is President, and W. W. Chamberlain, Secretary.

EASTERN RAILWAY OF OKLAHOMA.—See Atchison, Topeka & Santa Fe.

EASTERN TEXAS.—Proposed extension from Kennard, Tex., to Crockett, on the International & Great Northern, 30 miles. Surveyed two years ago. Road now runs from Lufkin to Kennard, 30.3 miles, with two branches. (Mar. 17, 1905.)

EASTERN WASHINGTON.—Rights of way being secured by this company for a railroad, projected to run from Fletcher, in Adams County, Wash., southwest to Connell, about 30 miles. E. W. Swanson, Spokane, Wash., and W. S. Foster, Cheney, Wash., are interested. Surveys completed and grading to be begun early this spring.

EAST LIVERPOOL TRACTION.—Plans completed by this company to build an electric railroad from Chester, W. Va., to Wellsburg, W. Va., opposite Brilliant, O., about 60 miles.

EAST WATERFORD & KANSAS VALLEY.—This road, it is reported, is to be built from East Waterford, Pa., to Sulphur Springs and into the Kansas Valley. The road is projected to reach the timber properties of Hockenberry & Breck, recently purchased from the Perry Lumber Co.

EDDY & NORTHERN.—Incorporated in South Carolina, with $100,000 capital to build from Marion south to Eddy Lake, about 35 miles. The incorporators are W. M. Burgan and Norman Jones, of Baltimore; George Officer and J. W. Little, of Eddy Lake, and R. B. Scarborough, of Conway.

EDMONDS & EASTERN.—Incorporated in the state of Washington to build from a point near Edmonds, in Snohomish County, to Monroe, 20 miles, also a branch from Monroe through Snoqualmie Valley, 60 miles. Rights of way secured and contracts for building 36 miles were to have been let last year. H. J. Hughes and F. M. Stanley, of Seattle, Wash., are interested.

EGYPTIAN COAL RAILROAD.—Organized at Carbondale, Ill., to build a railroad from the Mississippi river northeast through the counties of Jackson, Williamson, Franklin and Jefferson to Mount Vernon, Ill., on the Louisville & Nashville, the Wabash, Chester & Western, and Chicago & Eastern Illinois, about 50 miles. C. E. Hamilton, R. E. Refrow, J. B. Bundy and E. S. Patten are incorporators. (Mar. 17, 1905.)

ELDORADO & WESSON.—Chartered in Arkansas, with $50,000 capital, to build from Eldorado, Union County, southwest to Wesson, about 10 miles. Incorporators include C. V. Edgar, A. B. Banks and J. R. Eakin.

ELKTON & BEAVER VALLEY.—Incorporated in Kentucky to build 60 miles of railroad through Floyd and Boyd Counties. (Mar. 17, 1905.)

ELMGROVE, EASTERN & MAJORSVILLE.—Organized in West Virginia to build a railroad from Elmgrove southeast to Majorsville, 10 miles. G. W. Hand, Elmgrove, W. Va., may be addressed. (Mar. 17, 1905.)

ELMIRA, CORNING & WAVERLY (ELECTRIC).—This company, which was recently granted a charter in New York State to build 37 miles of road, will connect the Corning & Painted Post Street Railway with the Elmira Water, Light & Railroad Company's line, and will also connect the latter road with the Waverly, Sayre & Athens Traction Co. All these properties, with the exception of the Elmira concern, are to be consolidated under the name of the Southern Tier Railway Co. Joseph A. Powers, of Troy, N. Y., is President.

EL PASO & DURANGO.—Incorporated in New Mexico to build from Mastodon, in Donna Ana County, on the El Paso & Southwestern, north across the territory of New Mexico to La Plata, San Juan County, N. Mex., and a branch from Putnam, San Juan County, 120 miles southeast to Albuquerque. The main line will be about 400 miles long. The incorporators are said to represent the Phelps Dodge interests and include S. W. French, of Douglas, Ariz., and Charles E. Mills, of Morenci, Ariz. (Mar. 17, 1905.)

EL PASO & SOUTHWESTERN.—Surveys in progress for a proposed extension from Nacozari west to Topolobampo, on the Pacific coast of Mexico, about 200 miles. (Mar. 17, 1905.)

EL PASO, MOUNTAIN PARK & ST. LOUIS.—Successor to the El Paso, Mountain Park & Oklahoma Central, with offices at Mountain Park, Okla., and Kansas City, Mo. The proposed line is from St. Louis, Mo., southwest through Springfield and Joplin, Mo., Wagoner and Okmulgee, Ind. T., and Oklahoma City and Mountain Park, Okla., crossing the Red River into Texas at Quanah, and thence through northwestern Texas to Roswell, N. Mex., and on to El Paso, Tex. Then it is proposed to continue on across the States of Chihuahua and Sonora to the mouth of the Sonora river, on the Gulf of California, 1,600 miles. Locating surveys have been made for 110 miles of the line, on which the maximum grade will be 0.8 per cent. and the maximum curvature 3 deg. Work to be begun this spring. R. K. Kelley is President, and Mark Roberts, Secretary. (Mar. 17, 1905.)

ENID, BEAVER, GUYMON & WESTERN.—Chartered in Oklahoma Territory to build a railroad from Enid through Garfield, Woods, Woodward and Beaver Counties to Guymon, thence west to coal fields at Dorsey, N. Mex., a total of about 400 miles. R. B. Quinn and T. O. James, of Beaver City; W. L. Drummond, of Enid; J. E. George, of Liberal, Kan., and J. C. Gleicester, of New York, are incorporators. (Mar. 17, 1905.)

ERIE.—This company's plans for improvement of its Jersey City terminal have been approved by the city officials, and work is to be started at once. The plans provide for 550 ft. of tunnel and an open cut through the Bergen Heights for passenger trains. At the westerly end trains will, as at present, run under the tracks of the Lackawanna. There will be four passenger tracks. The tracks will run on an elevation in the city east of the tunnel to the new station and ferry house, to be erected at 11th street, three blocks above the present station. A round house is provided for at 12th and Brunswick streets. The present tunnel will be used for freight trains. The company has bought a large tract of land, and asks the city to vacate north of its line 11th and 12th streets for two blocks, from Monmouth street to Division street, at the western mouth of the tunnel, and three blocks between Monmouth and Brunswick streets, from 13th street north to 16th street, all on the meadows; also for the vacation of tracts at Barnum street and at Ninth street. In exchange for these vacations it will give the city certain privileges, and will widen Hoboken avenue on the Heights.

Bids were recently asked for building a four-track road through Bergen Hill, Jersey City, N. J., to parallel the present two-track tunnel. An open cut is to be made through the rock of Bergen Hill, with an average depth of 70 ft. and about 4,500 ft. long. The material excavated is to be moved to the west end to form embankments for passenger connections to existing lines operated by the Erie. There will be about 120,000 cu. yds. of earth and 480,000 cu. yds. of rock to be excavated, and 15,000 cu. yds. of concrete masonry to be built. A company to be known as the Penhorn Creek has been incorporated to build this short line.

——*Contracts let for building a new location of the main line from Lakewood, N. Y., at the south end of Chautauqua lake, west to Columbus, Pa., 20 miles. The first section, from Lakewood to Niobe, Pa., will be built by Burke Bros., of Scranton, Pa., and the remainder of the road from Niobe to Columbus, by R. C. Hunt, of New York. The sections are each about 10 miles long. The new line will be double track and will furnish a low-grade line for main line trains. It is being built under the name of the Columbus & Erie. The cost of the work will be about $500,000.

——Announcement made that this company will double-track its lines from Carrollton, N. Y., to Cuba, 25 miles. This work will be done in connection with the low-grade line being built from Cuba to Hunts, N. Y., on the Buffalo division.

——*Contract let to Bennett & Talbot, of Greensburg, Pa., for building the first section of 12 miles of the Guymard cut-off (Erie & Jersey) extending from Howells to Guymard, N. Y. This includes a 5,300-ft. double track tunnel through the Shawangunk mountains.

——*Contracts amounting to $1,000,000 have been let to the Ferguson Contracting Co., of Pittsburg, by this company for rebuilding part of its road from Port Jervis to Hunter on the New York division. About $3,000,000 will be spent on this division. The work includes the rebuilding of 33 miles of road and abolishing several tunnels. The line east of Jamestown will be rebuilt. Work is to be started immediately, and additional contracts are to be let shortly.

——*Contract let to the McGinty Contracting Co., of Minerva, Ohio, at about $50,000, to build a concrete subway at the eastern end of its yards at Randall, Ohio.

——New ferry slips and passenger station at Twenty-third street and North river, New York, proposed.

——See Genesee River.

——See New York, Susquehanna & Western.

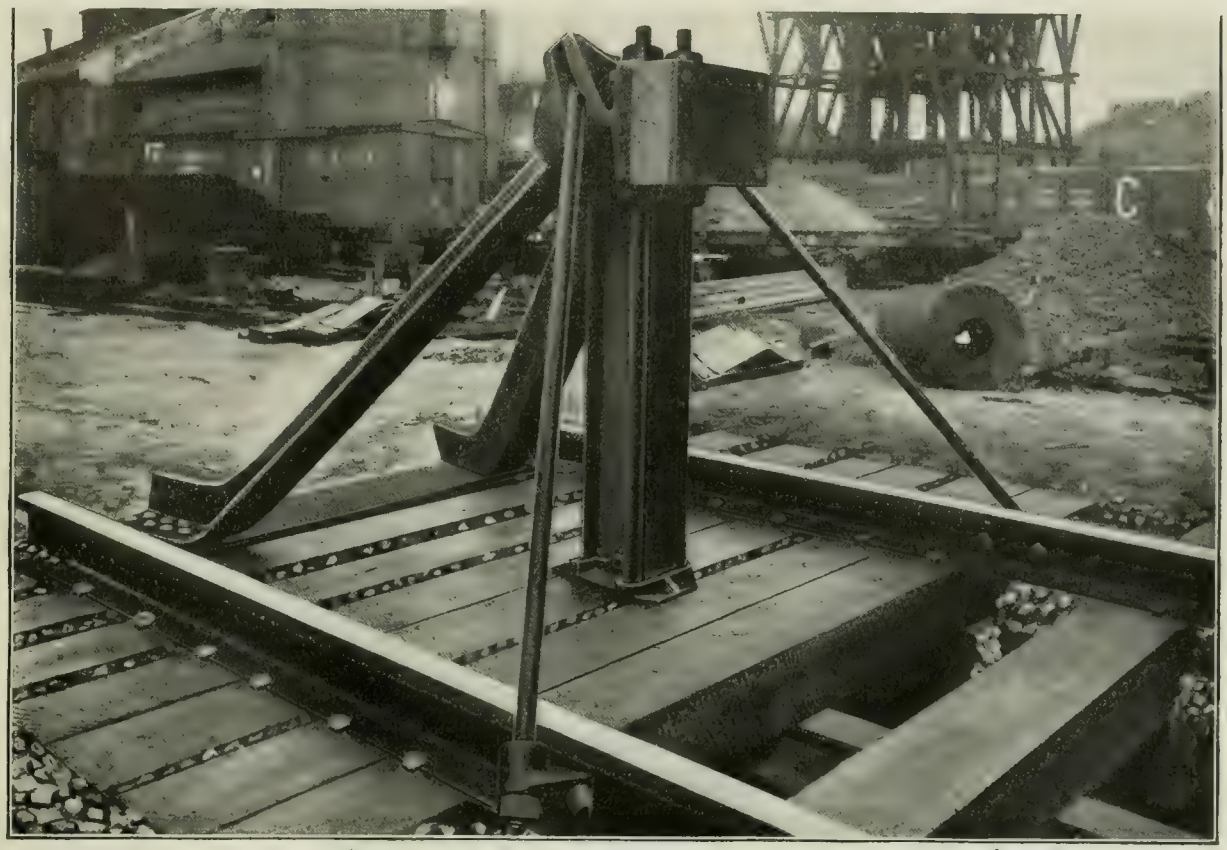
ERIE, CAMBRIDGE, UNION & CORRY (Electric).—This Pennsylvania company proposes to build a railroad from Erie to Corry, Pa., with a branch to Cambridge Springs, 42 miles in all. It is proposed to have private right of way throughout the line, except in cities and towns. The capital stock of the company is $1,000,000, and an issue of $1,000,000 in first mortgage 5 per cent. 30-year gold bonds has been authorized. The bond issue is being underwritten by H. P. Taylor & Co., of Pittsburg. It is estimated that the cost of building the road, including the right of way, will be $900,500.

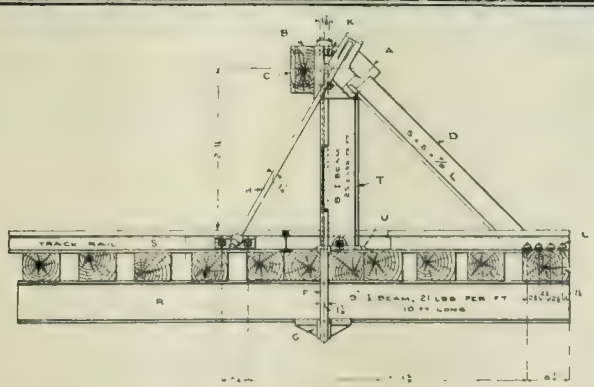
EVANSVILLE & EASTERN (Electric).—This company is building with its own forces an electric railroad from Evansville, Ind., via Newburg, Yankeetown and Hatfield, to Rockport, 31 miles. Grading has been completed between Yankeetown and Rockport, 16 miles. All the work is to be done by the company's forces. Contracts were to be let about March 1 for the rolling stock. H. A. Genung is Chief Engineer.

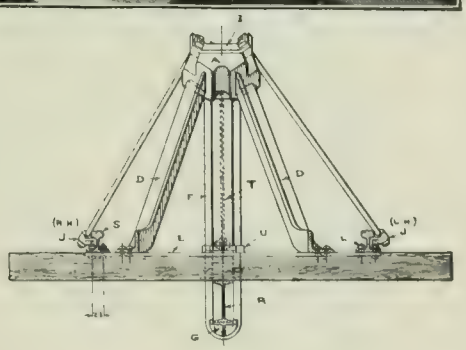
*EVANSVILLE, SUBURBAN & NEWBURG.—This company is building an extension from Evansville, Ind., via the branch from Newburg, now in operation, to Boonville, 15 miles. Grading has been completed by the company's forces and track has been laid for a distance of five

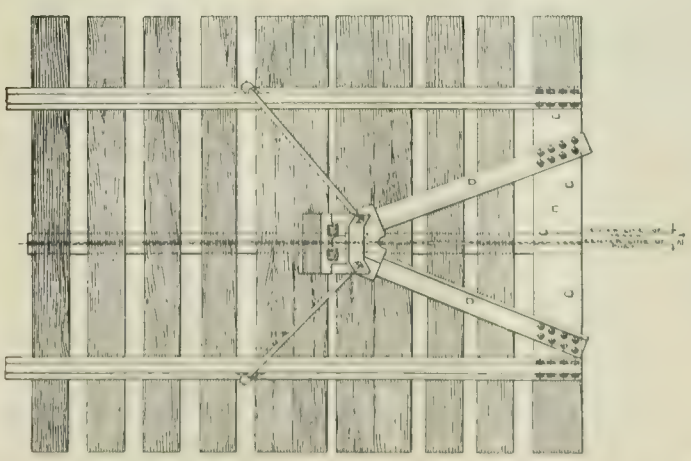
NEW STRUCTURAL STEEL

Gibraltar Bumping Post









Freight Passenger Trestle

THE BEST POST AND COSTS THE LEAST

We have recently published an attractive Booklet on Bumping Posts, which with prices and blue prints will be gladly sent on request.

NEW YORK **McCord & Company** CHICAGO

[illegible] capacity 2 engines to start, 1 coach [illegible] Coal from Newark [illegible] Knoxville to Bristol [illegible] Jacob Dolson.

F

FAIRFIELD RAILROAD.—Proposed new line in Fairfield County, from Rockton, in Lattimer County, southwest to Arcola, 20 miles. B. R. Hayward, Rion, S. C., interested. (March 17, 1905.)

FALCON RAILWAY.—Articles of incorporation filed in Carlin, Nev., to build railroad from Hazen, Nev., to Comstock, in Churchill County, Nev., 22 miles. Capital, $500,000. The directors include William Hood, of San Francisco, N. L. Smith, of San Carlos; J. L. Wilmott, of Oakland, J. L. Loules, of Berkeley, and Frank Shay, of Oakland, Cal.

FALLS CITY, SYCAMORE SPRINGS, SABETHA & SOUTHWESTERN.—Incorporated in Kansas, with $100,000 capital, to build a railroad from Falls City, Neb., south through Nemaha, Pottawatomie, Jackson and Shawnee Counties, Kan., to Topeka, about 100 miles, with a western line from a point near Sabetha, in Nemaha County, Kan., west through the counties of Marshall, Washington, Cloud, Republic, Jewell, Mitchell, Smith, Osborne, Phillips, Rooks, Norton, Graham, Sheridan, Decatur, Rawlins and Thomas to the western boundary of the state, 320 miles air line. The directors and incorporators include: Samuel Kimmel, E. S. Towle, W. H. Crook, W. E. Dorrington, Albert Maust, J. H. Mines and Edwin A. Towle, all of Falls City, Neb.; E. V. Kauffman and H. Reding, of Sabetha; W. A. S. Bird, of Topeka; J. F. Shusnet and Roy Hesseltine, of Sabetha, George Boone, Jr., of St. Joseph, Mo., and George L. Campen, of Lincoln, Neb.

FAYETTE & FAYETTEVILLE.—Incorporated in West Virginia to build from Fayette southwest, crossing the New river, to Fayetteville, about five miles.

FINDLEY LAKE & STATE LINE (Electric).—Incorporated with a capital of $130,000 in New York State to build an electric railroad, 14 miles long in Chautauqua County. F. R. Nichols, Titusville, Pa.; L. A. Austin, Cutting, N. Y., and F. E. Mulkie and G. A. Elston, Corry, Pa., are incorporators.

*FLINT RIVER & GULF.—New line from Carlisle, Ga., northeast via Sylvester to Ashburn, 20 miles. Twelve miles are graded and rails laid on seven miles. C. A. Alford, of Wilmington, Ga., is General Manager. (March 17, 1905.)

*FLORIDA EAST COAST.—Extension from Homestead, 28 miles south of Miami, southwest along Florida Keys to Key West, 126 miles. Work under way. Plan involves 5.78 miles of concrete viaduct. See description and plans in *Railroad Gazette* of October 6, 1905.

FLORIDA GRAND TRUNK.—Projected line from Dothan, Ala., through Tallahassee, Fla., and along the west coast of Florida, with a branch to St. Andrew's Bay. Dr. J. A. McLeay, 516 Fourth National Bank Building, Atlanta, Ga., is interested. (March 17, 1905.)

FLORIDA ROADS.—A syndicate of Chicago and St. Louis capitalists has bought 193,000 acres of land in Liberty and Franklin Counties, Fla., and will build a railroad from St. Joseph to Apalachicola, 40 miles, which it is proposed eventually to extend 100 miles to Quincy and finally to Atlanta, Ga. G. W. Hayne, of Chicago, and R. H. Hemphill, of St. Louis, are said to be interested.

FOND DU LAC & NORTHWESTERN.—This company proposes to build from Madison, Wis., to Fond du Lac. W. H. Phillips, Fond du Lac, Wis., is President. (March 17, 1905.)

FORT SMITH, INDIAN TERRITORY & TEXAS.—Final surveys being made for this proposed road from a point near Fort Smith, Ark., southwest through Sebastian County to Cedars, Ind. T., and eventually to Denison, Tex. J. F. Nelson, Fort Smith, Ark., may be addressed. (March 17, 1905.)

FORT WAYNE & CLEVELAND (Electric).—Incorporated to build an electric road from Fort Wayne, Ind., north, to Fremont, Steuben County, 45 miles. Construction abandoned for the present. F. H. Cutshall and J. W. Wessel, of Fort Wayne, are directors.

*FORT WAYNE & SPRINGFIELD.—Proposed line from Fort Wayne, Ind., south to Portland via Decatur, Monroe, Berne, Geneva, Bryant, Selond, Middleton and Monmouth, 48 miles. Grading completed from Fort Wayne to Decatur, 21 miles, and track laid for two miles.

FORT WORTH & MINERAL WELLS (Electric).—Chartered in Texas with $250,000 capital, to build an interurban electric road from Fort Worth, Tex., west to Mineral Wells, about 60 miles. The offices of the company will be at Fort Worth, and the directors include: Cicero Smith, D. M. Howard, H. N. Frost, E. J. Waldrow and A. Stevenson, all of Mineral Wells.

FOUNTAIN CITY.—Chartered in Tennessee to build a railroad in Knox County from Knoxville to Fountain City, about eight miles.

FOURCHE RIVER VALLEY & INDIAN TERRITORY.—The company, which has nine miles of track laid from Esau, Ark., southeast, is planning to build an extension to the Perry County line south of Jennings Falls, about 35 miles. It has not been decided whether the company will do the work with its own force or give the work out on contract. F. H. Hartshorn, Esau, Ark., is President.

FOX RIVER VALLEY (ELECTRIC).—Chartered in Wisconsin, with $25,000 capital, to build an electric road from Sheboygan to Manitowoc. Work was to be begun last year. The incorporators are: O. H. Behnke, Manitowoc, Wis.; Henry Beyerdorf and Fred Beyersdorf, Milwaukee; and L. A. Bazlen, Calumet County.

Asked as building a line in the interest of the New York Central from Franklin, Pa., to Brookville, 35½ miles, has let contracts to the Miller Construction Co., of Lock Haven, Pa.; Crary Construction Co., of Binghamton, N. Y.; Thomas McNally Co., of Pittsburg, Pa., and the Ferguson Construction Co., of New York. The work includes three tunnels and a number of bridges.

FREDERICKSBURG & RAPPAHANNOCK.—Projected line from Fredericksburg, Va., through Culpeper and Spotsylvania to Washington, Va., 55 miles. The Eastern Virginia Construction Co., of which John S. Barbour, of Culpeper, is President, is financing the road. (March 17, 1905.)

FREELO VALLEY.—Grading reported in progress on this proposed railroad from Eagle Mills, Ouachita County, Ark., northeast to Princeton, Dallas County, 25 miles. Two miles of track laid. Polk Bros., Camden, Ark., are the contractors. D. S. Gates, Eagle Mills, Ark., is President. (March 17, 1905.)

FREIGHT TERMINAL CO. (Pittsburg).—This company has applied for a charter to build a freight tunnel under the principal streets of Pittsburg to connect the railroad freight houses with the principal warehouses and stores. R. E. Flinn and J. S. Weller are interested. (March 17, 1905.)

FRISCO, OKLAHOMA CITY & TEXAS.—Chartered in Guthrie, Okla., with $2,000,000 capital. It proposes to build an extension to the St. Louis & San Francisco, south from Oklahoma City, through Oklahoma and Cleveland counties and west to Ardmore, where connection will be made with both the St. L. & S. F. and the Rock Island.

FULTON COUNTY NARROW GAGE.—This company, now the property of the Chicago, Burlington & Quincy, has changed its road from narrow to standard gage from Galesburg to Lewiston, Ill., 40 miles. The rest of the road, from the latter point to Havana, on the Illinois River, will be widened this spring.

G

*GAINESVILLE MIDLAND.—Contracts let to the Gainesville & Athens Construction Co., of Savannah, Ga., for building extension of its Jefferson branch from Jefferson, Ga., to Athens, 18 miles, and for changing the gage from three feet to standard from Gainesville to Jefferson, 23 miles.

GAINESVILLE, WHITESBORO & SHERMAN.—Chartered in Texas, with $500,000 capital, to build a railroad from Sherman, Tex., east via Whitesboro to Gainesville, 32 miles. The incorporators include: G. A. Hassinger, H. H. Lazarus, of New Orleans; H. G. Stinnett, of Sherman; S. B. Cowell, of Whitesboro, and John King, of Gainesville. The offices of the company are at Gainesville.

*GALVESTON, HARRISBURG & SAN ANTONIO (S. P.).—Contract let to W. O. Robertson, of San Antonio, Tex., for building extension from Stockdale, in Wilson County, Tex., southeast through Smiley, in Gonzales County, to Cuero, in De Witt County, 47 miles. Grading has been completed for 18 miles and track laid for three miles. Maximum grade to be 1 per cent., and maximum curvature 4 degrees; there will be two steel bridges, one 150 ft. long, the other 190 ft.

GALVESTON-HOUSTON INTERURBAN.—Organized to build an electric railroad between these two cities, with branch lines east to Laporte, Tex., and Seabrook. Franchises granted both in Houston and Galveston, and rights of way being secured. The officers include: J. O. Ross, President; Henry House, Vice President; F. L. Dana, of Colorado Springs, Secretary, and J. S. Rice, Treasurer. W. J. Moore and Lyman Levy, of San Antonio, are directors.

GALVESTON TERMINAL COMPANY.—Organized in Texas to build a terminal railroad for the St. Louis & San Francisco in Galveston, from the eastern shore of Galveston bay over the island to the western limits of the city. The incorporators include: S. Lazarus, of St. Louis, Mo.; M. Marx, B. Adone, I. H. Kempner, A. Blum, E. R. Chessbrough, R. Markwell, John Sealy, Charles Fowler and Leon Blum, all of Galveston.

GARLAND WESTERN.—Extension of three years granted by the Arkansas State Board of Incorporators in which to build the first five miles of line. The road is projected to run from Hot Springs, Ark., west to Mena, 80 miles. S. W. Fordyce, Hot Springs, Ark., is President. (Mar. 17, 1905.)

GENESEE RIVER (ERIE).—This company incorporated in New York, with $350,000 capital, by officers of the Erie Railroad, is planning to build a low grade freight line from Portage, in Livingston County, N. Y., on the Buffalo division south to Cuba, in Allegheny County, on the Allegheny division, about 30 miles.

*GEORGIA, FLORIDA & ALABAMA.—Contract let to Hardaway, Wright & Co., and work under way on an extension from Havana, Fla., southwest to Quincy, on the Seaboard Air Line, about 12 miles.

Projected extension from Cuthbert, Ga., north to Columbus, 50 miles. Location surveys in progress. (Mar. 17, 1905.)

GEORGIA NORTHERN OF GEORGIA.—Reported that this company has filed a petition to increase its capital stock to $500,000, the proceeds to be used to build a branch from a point between Moultrie, Ga., and Pavo, southeast to Valdosta, 35 miles. (Mar. 17, 1905.)

GEORGIA ROADS.—Incorporation asked for by a company to build a railroad from Sparta to Sandersville, 15 miles. Those interested are Seaborn Reese, R. E. Baxter, E. A. Rosier and J. D. Walker, of Sparta; W. B. Bennett and C. V. Smith, of Sandersville.

*GILA VALLEY, GLOBE & NORTHERN (Southern Pacific).—Contract let to Shenz & Co., Los Angeles, Cal., for rebuilding the line from San Carlos to Fort Thomas, 31 miles. The line will leave the river at San Carlos and follow higher ground above the flood level for the entire distance, and will be straightened and leveled.

GILPIN & CLEAR CREEK DISTRICT.—Certificate filed by this company in Colorado amending its incorporation papers, changing the capital stock from $50,000 to $1,250,000. The proposed road will be about 17 miles long to mines in Gilpin County. It will be a competitor of the Colorado & Southern. John C. McShane is President, Bennett E. Seymour, Secretary, and R. H. Carpenter, Central City, Chief Engineer.

GOTHENBERG & NORTHERN.—Incorporated in Nebraska, with $50,000 capital, to build from Gothenberg, Neb., on the Union Pacific, north west to Gandy, about 40 miles. Incorporators include: W. D. Griffith, H. L. Williams and J. H. Isely.

*GRAND FORKS & EASTERN (GREAT NORTHERN).—Contract let to Porter Bros., Duluth, for building a 25-mile extension of this road. The Grand Forks & Eastern is a branch of the Great Northern, and connects with the main line at Markus.

*GRAND RAPIDS & KALAMAZOO VALLEY (Electric).—Contracts let for building and equipping this line from Kalamazoo, Mich., to Grand Rapids. It is to be 60 miles long and to cost about $1,500,000. The Westinghouse Company has contract for the electrical equipment.

GRAND RAPIDS, BELDING & GREENVILLE (Electric).—Incorporated in Michigan, with $600,000 capital stock, to build an electric line from Sarona to Greenville, about 19 miles. The board of directors is made up of John T. Rich, J. L. Rich, J. L. Hudson, Edward Holmes, John P. Hopkins and L. M. Hopkins, of Detroit; C. H. Pomeroy, Saginaw; Frank Wescott, Vernon, and M. D. Sly, Romeo.

GRAND RAPIDS TERMINAL BELT.—Articles of association, filed with the Secretary of State at Lansing, Mich., with a capital of $100,000, to build a belt line around Grand Rapids, connecting five of the railroads. Rights of way have practically been secured. The following names appear in the articles: James A. Hamler, St. Louis; Edward A. Wescher, St. Louis; Thomas A. Whitmore, Chicago; Edward H. Christ, Grand Rapids, Mich., and Jacob Kleinhans, Grand Rapids, Mich.

GRAND VALLEY, COLORADO RIVER & SOUTH PACIFIC.—Incorporated to build from Grand Junction, Colo., to the head of the Colorado River, 180 miles. Contracts for grading will be let as soon as surveys are completed. The road is projected for 1,200 miles, through the states of Colorado, Arizona and Utah. Section out of Grand Junction to be built first. G. R. Propper, Basin, Utah, is President, and C. W. Hassell, Grand Junction, Colo., Chief Engineer. (Mar. 17, 1905.)

GRANGER, GEORGETOWN, AUSTIN & SAN ANTONIO (M., K. & T.).—This road was completed between Georgetown and Austin, 30 miles, last year. It will be extended to a connection with the San Antonio & Aransas Pass at San Marcos, Tex., about 50 miles. S. P. Fisher, St. Louis, Mo., is in charge of the work.

GRASSY CREEK.—Incorporated in West Virginia to build from Pickens to a point on the water shed between the Elk and Holly rivers. J. H. P. Smith, of Parkersburg, W. Va.; J. H. Fisher and Fred L. Fox, of Sutton, W. Va., are incorporators. (Mar. 17, 1905.)

GRAY'S PEAK.—Incorporated in Colorado to build three lines from Silver Plume, one around Leavenworth to the base of Gray's Peak, another to Keystone and a third to Minturn, Eagle County. C. J. Morley, Thomas Fielding and Natnan Gregg, Jr., of Denver, Colo., are incorporators. (Mar. 17, 1905.)

GREAT BEND & GULF.—Chartered in Kansas, with $1,500,000 capital, to build from Great Bend, south to Medicine Lodge, 80 miles. It is intended to eventually extend the line to a Gulf port. The incorporators include: R. C. Otis, B. C. Sammons, H. S. Duncombe, R. Pringle, of Chicago; F. V. Russell and G. L. Chapman, of Great Bend, Kan.

*GREAT NORTHERN.—No welevated railroad structure along Third street, commencing at Howard street and ending at the combination bridge, and for the construction and operation of a surface spur track by the Great Northern along Third street, from Jones street west to Perry Creek, with spurs into intersecting cross streets. Work on the improvements under way.

Work on the improvements under way.

*Connection with the Chicago, Burlington & Quincy from Sioux City, Ia., south to Omaha, Neb., 112 miles. Fifty-five miles already completed. This plan involves large additions to terminal facilities in Sioux City.

*The work being carried out by this company and subsidiary lines includes the building by the Washington & Great Northern and the Vancouver, Victoria & Eastern, together of a line from the international boundary at Midway via Molson and Oroville to Keremeos, B. C., 96 miles. The 49 miles in the United States are being built by the Washington & Great Northern, and the 47 miles in British Columbia by the V., V. & E., which already operates 30 miles of line in British Columbia. The latter company has also located an extension from Keremeos to Princeton, 40 miles, on which work will soon be started. The Minnesota & Great Northern has begun work on an extension of its line from Greenbush to Roseau, Minn., 22 miles, practically completed.

Surveys being made for a line from Rugby, N. Dak., to Balfour, on the Minneapolis, St. Paul & Sault Ste. Marie, and from there southwesterly to coal lands.

Surveys being made for a line from St. John, N. Dak., to Brandon, Man. In addition, a spur is to be built from the former place to Fish Lake.

Proposed connecting line from Armington southeast to Billings, Mont., 200 miles. This would connect the Great Northern with the Burlington and Northern Pacific.

Proposed branch from Grand Forks, N. Dak., north on the east side of the Red River to Drayton, passing between Olson and Alvarado, Minn.

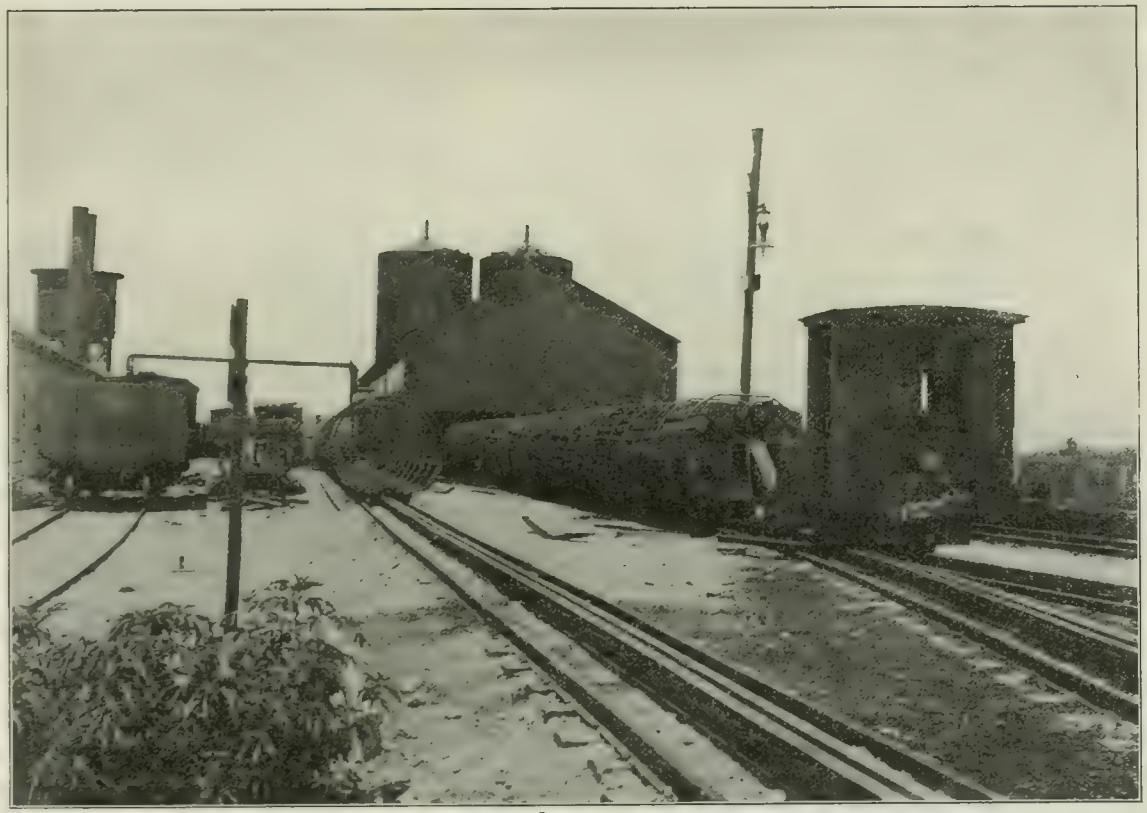
*Work to be commenced at once by the contractors, Grant, Smith & Co., on double tracking the line from Seattle, Wash., to Everett, about 27 miles. For 22 miles of the distance a retaining wall will have to be built. The cost of the work is approximately $1,250,000.

Maps showing filed location of the line of proposed extension from Summers, in Flathead County, Mont., east to Holt, thence along the

A. T. HERT, President L. T. DICKASON, Vice-President M. L. GOULD, Secretary-Treasurer C. B. LOWRY, General Manager

COLUMBIA CREOSOTING CO.

PLANT AT SHIRLEY, INDIANA.



TRAIN LOAD OF TREATED TIES COMING OUT OF RETORT.

DAILY CAPACITY, SEVEN THOUSAND TIES

cas, side of Pinehead lake to the northern side of Sullivan's excavation, about 60 miles.
See Grand Forks & Eastern.
See Iowa & Great Northern.
See Minnesota & Great Northern.
See Portland & Seattle.
See Vancouver, Victoria & Eastern.
See Vancouver, Westminster & Yukon.
See Washington & Great Northern.

•GREAT SOUTHERN.—Chartered in Washington to build 6 miles of road from The Dalles, which will eventually be extended into California. An extension as far as Bend, Ore., will be made. Grading has been finished for 30 miles, and rails are ready to be laid. Work is under way at The Dalles for terminals. The proposed route from The Dalles runs west of the Deschutes river to Durkin. The maximum grade will be 1.5 per cent.

GREAT WESTERN CONSTRUCTION & DEVELOPMENT COMPANY.—Under this name a number of Colorado capitalists have organized a company to build a railroad from the coal fields in Archuleta County to the Denver & Rio Grande main line, about 40 miles. Rights of way now being secured.

GREENBACK RAILROAD.—Chartered by the Secretary of State of Tennessee to build from Greenback, Loudon County, to a connection with the Atlanta, Knoxville & Northern. J. H. Ellis, J. H. Ringgold and J. H. Frantz are incorporators. (Mar. 17, 1905.)

•GREEN BAY, OSHKOSH, MADISON & SOUTHWESTERN.—Projected extension from Madison, Wis., to North Crandon, on the Minneapolis, St. Paul & Sault Ste. Marie, 220 miles. Contracts have been let to McDonell, O'Connor & Co., Grand Rapids, Mich., for building 15 miles of the line from Shawano, Wis., in a northwesterly direction. Contracts have also been let for the ties and for the rails. Other contracts will be let prior to April 15 for building an additional 100 miles of road. W. K. Rideau is President, Leander Choate, Vice-President; R. H. Edwards, Secretary and Treasurer, and C. H. Hartley, General Manager, all of Oshkosh, Wis.

GREENFIELD & SOUTHEASTERN.—Incorporated in Arkansas, with $50,000 capital, to build from Greenfield, Poinsett County, southeast to Marked Tree, about 20 miles. The directors include: W. H. Howe, of Greenfield; S. E. Howe, of Logansport, Ind., and J. J. Mardic, of Harrisburg.

GREENRIVER VALLEY (L. & N.).—Surveys under way, and bids, it is said, will be asked April 1 for building from Stamford, Lincoln County, Ky., on the Louisville & Nashville, southwest to Scottsville, Allen County, on the Chesapeake & Nashville, 100 miles. This project has been under consideration for several years. When completed the road will form part of the L. & N. system.

GREENVILLE & KNOXVILLE.—Authorized in South Carolina to amend its charter and change its name to the Greenville, Greenwood & Knoxville. The projected road is to run from Greenville, S. C., to Greenwood, 50 miles. H. H. Prince, of Greenville, S. C., is interested.

GREENVILLE & NEWNAN.—Chartered in Georgia to build a road from Greenville, in Meriwether County, to Newnan, in Coweta County, about 25 miles. Supposed to be a project of the Central of Georgia.

GUANTANAMO.—This company is building 40 miles of railroad in Cuba. E. A. Brooks, of Santiago de Cuba, is President, and Richard Brooks, of Guantanamo, Chief Engineer.

GULF & CHICAGO.—See Mobile, Jackson & Kansas City.

GULF & NORTHWESTERN.—This company, which is building a line from Waco, Tex., northwest via Meridian and Stevenville to Thurber, 110 miles, is making surveys from Waco to Strawn and securing rights of way. No contracts have yet been let, but as soon as this survey is completed contracts for the first 40 miles from Waco to Meridian are to be let. The work includes building seven bridges, one 400 ft. long, the others ranging from 50 to 100 ft. each. N. R. Morgan, Meridian, Tex., is Secretary.

GULF & PACIFIC.—Chartered in Texas to build from Velasco to Paris, 345 miles, with branch line from a point in Anderson County to Dallas, 115 miles. Completed from Clinesburg, on the Gulf, Colorado & Santa Fe, in Montgomery County, Texas, north to point in San Jacinto County. T. J. Thornhill, R. S. Waldron, W. H. Steele and J. R. England, of Dallas, Texas, are incorporators. (Mar. 17, 1905.)

•GULF & SHIP ISLAND.—This company, which is operating its Columbia branch from Mendenhall, Miss., south to Silvercreek, has given a contract to Bowles & Hennigury, of Jackson, Miss., for extending the line from Silvercreek to Columbia, 27.6 miles. Grading has been completed from Silvercreek to Oakvale, 13 miles, and from Columbia to Hutborne, 11.5 miles, and track laid from Silvercreek to Armes, nine miles, and from Columbia to Twithly, 5.5 miles.

GULF, CALCASIEU & NORTHERN.—Projected line from Lake Charles, La., north to Natchitoches, 100 miles. Surveys completed and contracts for grading to be let in the spring. The work will be light, with maximum grades of 0.8 per cent., and maximum curvature of 4 deg. H. B. Milligan, Lake Charles, is President and J. T. Shutts, Chief Engineer. (Mar. 17, 1905.)

GULF, COLORADO & SANTA FE (A., T. & S. F.).—Preliminary surveys made for building a line from Davis, in the Chickasaw Nation, Ind. T., east to the coal fields, at Sulphur, about eight miles.

GULF, HUTCHINSON & NORTHWESTERN.—New surveys reported made by this company for building from La Crosse, Kan., to the Smoky Hill river, about 12 miles.

GULFPORT & MISSISSIPPI COAST (Electric).—Application made in Mississippi for a charter capital $1,000,000, to build an electric road. J. T. Jones, E. A. Durham and Robert McCormick are interested. Headquarters at Gulfport, Miss.

GULF, SANTA FE & NORTHWESTERN (A., T. & S. F.).—Organized in Texas, with $1,000,000 capital, as part of the Santa Fe system, to build a railroad from Stamford to Dexter, 350 miles, and a branch from Lubbock County to Canyon, Tex., 125 miles. The board of directors include: F. A. Ripley, of Chicago, President of the Santa Fe; J. E. Hurley, of Topeka, Kan., General Manager of the same road, and Avery Turner, T. J. Sweet, J. C. Hall, and others, of Amarillo, Tex.

GULF TERMINAL COMPANY.—Incorporated in Alabama to lease and operate a union passenger station in the city of Mobile and to construct and operate a terminal railroad through and around that city. Incorporators include: E. L. Russell, of the Mobile & Ohio, and F. G. Winsor, of Washington, D. C.

GULF, TEXAS & NORTHERN.—The proposed route of this road which was organized in Texas, is from Sabine Pass, Tex., to Oklahoma City, Okla. T., 300 miles. W. L. Martin, W. C. Pierce, Jr., L. W. Lloyd, A. B. Blocker and others, of Marshall, Tex., are incorporators. (Mar. 17, 1905.)

•GURDON & FORT SMITH (MISSOURI PACIFIC).—New line from Antoine, Ark., northwest to Greenwood, 100 miles. First 40 miles located and under construction by the Dalhoff Construction Co. About ten miles graded, but no track laid. E. F. Mitchell, St. Louis, Mo., is Engineer of Construction.

•GUTHRIE, FAIRVIEW & WESTERN (K. C., M. & O.).—Persons said to be interested in this company, which is building a line from Fairview, Okla. T., southeast via Kingfisher to Guthrie, a distance of about 100 miles, have recently incorporated two railroad companies in Oklahoma Territory; one, under the name of the Colorado, Oklahoma Central & New Orleans, with capital of $20,000,000, to build from Denver, Colo., south to Trinidad, thence southeast, crossing a corner of New Mexico, through Beaver, Woodward, Day, Dewey and Blaine Counties to Fairview, Woods County, on the Kansas City, Mexico & Orient, about 520 miles, connecting at the latter point with the Guthrie, Fairview & Western. The other company, under the name of the Guthrie, Shawnee & Shreveport, has been incorporated, with a capital of $9,000,000, to build from the eastern terminus of the Guthrie, Fairview & Western at Guthrie, southeast through Logan, Lincoln, Oklahoma and Pottawatomie Counties, in Oklahoma Territory, and the Creek, Seminole, Chickasha and Choctaw nations, in Indian Territory, through the eastern part of Texas to Shreveport, La., approximately 350 miles. All of these new lines, it is said, are being built for the Kansas City, Mexico & Orient, and when completed will give that road a through connection from Denver to Shreveport. Incorporators of the new roads are: W. S. McCaull, of Joliet, Ill.; G. E. Smith, J. G. Trimble, L. Underwood and G. F. Riehl, of Kansas City; G. C. Cowles, of Darrow; Don Carlos Smith and F. L. Williams, of Guthrie. The headquarters of the G., F. & W. will be at Guthrie.

GUTHRIE, SHAWNEE & SHREVEPORT.—See Guthrie, Fairview & Western.

H

HAMMOND & SOUTHERN.—Incorporated in Arkansas, with a capital of $25,000, to build a railroad from Hammond, in Miller County, east to Hervey, on the Red river, a distance of about 10 miles. L. Evers, of Hammond; J. W. Stayton and J. Volkner, of Newport, and others are interested.

HANNIBAL & KIRKVILLE.—This company proposes to build a railroad, to be operated either by steam or electric power, from Hannibal, Mo., northwest to Kirkville, approximately 75 miles.

HARRIMAN & OLIVER SPRINGS.—Chartered in Tennessee to build from Harriman in an easterly direction through Webster and thence northerly through Poplar Creek Valley to Oliver Springs, 15 miles. J. E. Rhodes, S. P. Sparks and S. C. Brown are incorporators. (Mar. 17, 1905.)

HARRISBURG & OHIO RIVER.—Local capitalists are organizing a company under this name to build a railroad from Galatia, Ill., southeast via Harrisburg to a point on the Ohio river at or near Rosiclare, traversing coal fields in southern Illinois. F. M. Pickett is President; T. E. Bell, Vice-President; George Ledford, Secretary, and A. P. Dorris, Treasurer. Rights-of-way secured, and construction work to be begun early this spring.

HAVANA CENTRAL.—Incorporated in New Jersey with $5,000,000 capital to build and operate railroads in Cuba. Incorporators include Frank J. Hammer and John J. Cleary, of Brooklyn, N. Y.; Henry M. Traphagen, of Jersey City; Benson S. Currier and Chauncey Blair Spears, of New York.

HAYNEVILLE & MONTGOMERY.—Incorporated in Alabama with $50,000 capital to build from Hayneville, Ala., to Tyson, on the Louisville & Nashville, thence to Montgomery; also from Hayneville to Big Swamp, Lowndes County. Incorporators include: G. E. McGehee, Charles Schuessler and W. G. Davis, all of Lafayette, Ala.

HELM & NORTHWESTERN.—Incorporated in Mississippi to build from Helm to Arnold, 22 miles. M. Gilleas, Memphis, Tenn., is President. (Mar. 17, 1905.)

HICKS RUN.—Chartered in Pennsylvania with $100,000 capital, to build 10 miles long in Elk and Cameron Counties. W. C. Arnold, Dubois, Pa., is President.

HIGHPOINT & WINSTON-SALEM (ELECTRIC).—Chartered in North Carolina with $150,000 capital to build an electric railroad from Highpoint northwest to Winston-Salem, with extensions 50 miles long. The incorporators include: C. C. Yeller, J. H. Mills and R. H. Wheeler, of Highpoint.

HILLSBORO & NORTHEASTERN.—This company, which operates five miles of line in Wisconsin, is planning to build an extension south through Hub City and Rockbridge to Richland Center, about 30 miles. Line has been located and rights of way are being secured.

HILLSBORO & SOUTHWESTERN.—Incorporated in Illinois to build from Hillsboro, Ill., to Alton, 40 miles. The incorporators include: Frank P. Blair and F. A. Chapman, of St. Paul, Minn., and A. W. Crawford, of Hillsboro, Ill. (Mar. 17, 1905.)

•HOLLY & SWINK.—Work has been started by Mischan & Whitescarver, contractors, on this proposed road, from Holly, Colo., west to Swink, about 90 miles. J. Weidell, of La Junta, is Chief Engineer.

HOLLY RIVER & ADDISON.—Reported that this road, which is now in operation from Holly Junction, W. Va., on the Baltimore & Ohio southeast to Webster Springs, 30 miles, is to be extended from Webster Springs to Bergoo, W. Va., eight miles. J. T. McGraw, Grafton, W. Va., is President, and George A. Hechmer, Palmer, W. Va., Secretary and General Manager. (Mar. 17, 1905.)

HOLSTON RIVER.—Incorporated in Tennessee with $100,000 capital to build from Rogersville, Tenn., northeast to Bristol, on the Tennessee-Virginia state line, 45 miles. The officers are: James B. Wright, President; J. H. Frantz, Vice-President, and Howard Cormick, Secretary and Treasurer, all of Knoxville.

HOMAN & SOUTHERN.—Incorporated in Arkansas, with $25,000 capital, to build from Homan, in Miller County, northeast to Harvey, 10 miles. C. B. Kelley, H. G. McBurney, of Homan, and J. M. Stayton are interested.

•HOOD RIVER.—Contract reported let to Archie Mason and Giebisch & Joplin, general contractors, for grading 16 miles of road and laying track. Route of the projected road is along the east bank of Hood river in Oregon, passing through a rich timber region. Work includes one tunnel 300 ft. long, several trestles and some rock work.

HOPKINSVILLE BELT LINE.—Incorporation asked for in Kentucky, with $100,000 capital, to build a belt line around the city of Hopkinsville, Ky., connecting all the railroads centering there. The incorporators are: H. M. Dalton, W. R. Wicks, L. H. Cravens, M. O. Mason, J. B. Jackson, J. M. Renshaw and J. B. Russell.

•HOUSTON & PORT ARTHUR SHORT LINE.—This road is projected from Port Arthur, Tex., west to Houston, 80 miles. Franchise reported to have been granted at a special meeting of the City Council of Port Arthur, which provides that the road mut be completed within two year. Contracts reported let for 20 miles of grading.

•HOUSTON & TEXAS CENTRAL (SOUTHERN PACIFIC).—This company has given a contract to W. S. Hipp, of Houston, for grading the whole of a new line from Mexia, Tex., south to Navasota, one mile of which was completed last year. This new line is to be built to overcome the heavy grades of the present line. Between these two points on the present line the distance is 110 miles.

•HOUSTON, BEAUMONT & RED RIVER.—This company, which was incorporated last year in Texas, has plans ready for its proposed road. The route runs for about 204 miles north from Houston to Humble, thence east across the Trinity river 16 miles north of Liberty and 15 miles south of the Santa Fe road; thence through Batson and Sour Lake to the Sabine river and to Leesville, La., and thence to Alexandria. Contract reported let to P. R. Turney, of Houston, Tex., for building the first 40 miles of this road.

HOUSTON EAST & WEST TEXAS (SOUTHERN PACIFIC).—Surveys reported completed from Shreveport as far as Hope, on the proposed line to be built to Hot Springs. This road has been under consideration for some time and the preliminary surveys are said to indicate a successful carrying out of the project.

HOUSTON GALVESTON (Electric).—Incorporated in Texas, with $1,350,000 capital, to build an electric road from Houston to Galveston, about 50 miles. F. P. Read, R. M. Johnson, G. L. Horton and A. D. Trotter are incorporators.

HOXIE, STRAWBERRY RIVER VALLEY & WESTERN.—Surveys completed for this proposed road from Hoxie, Ark., northwest through Lawrence, Shark and Izard Counties to Franklin, 50 miles. Grading to be begun is soon as rights of way have been secured. R. S. Thomas, Hoxie, Ark., is President. (Mar. 17, 1905.)

HUDSON & MANHATTAN (Electric).—This company, incorporated to build a tunnel between Manhaatan (Cortlandt street) and Jersey City (Montgomery street) has filed a revised certificate submitting surveys for a route from Jersey City to Newark. The purpose is said to be to provide a fast passenger line from Newark to New York, and the Pennsylvania Railroad is said to be friendly to the scheme. From the Jersey City terminus of the Pennsylvania Railroad, which is the western terminus of the river tunnel, the new route is by a subway west to Brunswick street; thence on the surface to a point in Harrison (about six miles), at which place it will again run under ground and beneath the Passaic river, then continuing in a subway to a terminus in Market street, Newark. The certificate was signed by W. G. McAdoo as President of the company.

HUDSON COMPANIES.—Incorporated in New York to merge control of the two tunnels now building under the Hudson river and the new subways in Manhattan which have been approved by the Rapid Transit Commission. By its control of the river tunnels and the city subways, not yet built, the Hudson Companies will connect the Delaware, Lackawanna & Western, Erie, Pennsylvania and possibly the Central Railroad of New Jersey terminals in Hoboken, Jersey City and Communipaw with the New York subway at Dey street, and again at Fourth avenue and Ninth street and will furnish a direct route to Herald Square, N. Y., by the tunnel from Hoboken to Christopher street and the

WHY DON'T YOU CUT OPERATING EXPENSES BY USING



Sheffield Inspection Motor Car No. 15

(Automobile Type)

Ready for service, can be operated at any speed desired at will of operator, up to thirty miles per hour, and ten miles per hour on the reverse.

A Revelation in Motor Car Building

We have them for light passenger service

Send for New Motor Car Catalogue No. 518

FAIRBANKS, MORSE & CO.

AT THE NEAREST BRANCH HOUSE.

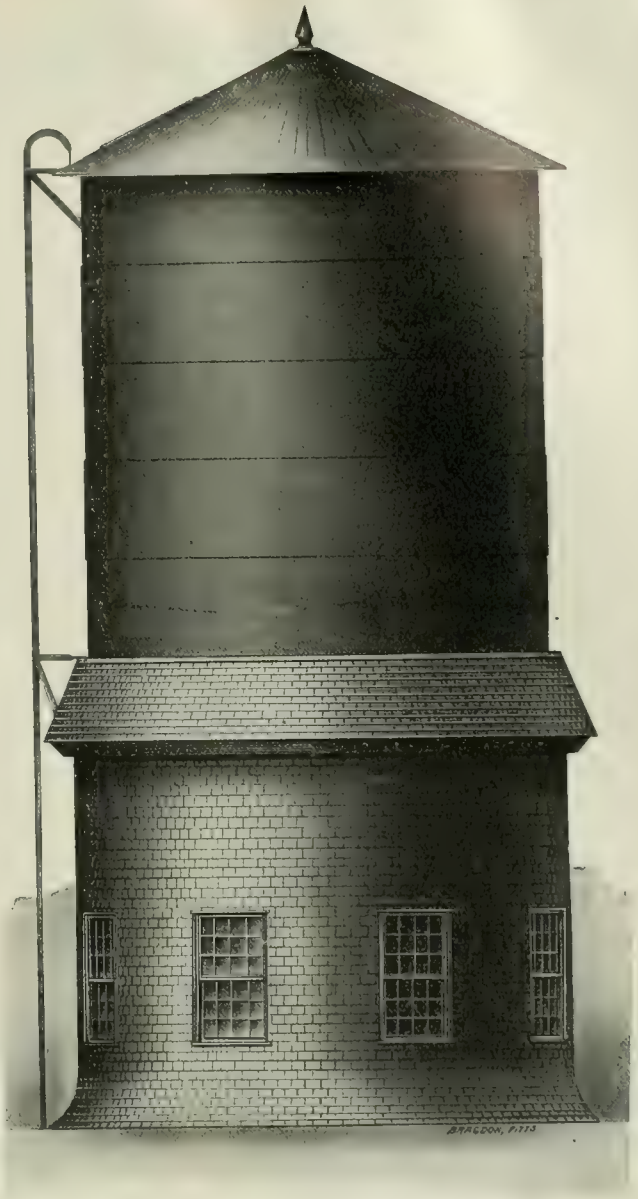
Chicago, Ill.	St. Louis, Mo.	Omaha, Neb.
Detroit, Mich.	St. Paul, Minn.	Denver, Colo.
Cincinnati, Ohio.	Louisville, Ky.	San Francisco, Cal.
Cleveland, Ohio.	Minneapolis, Minn.	Los Angeles, Cal.
Indianapolis, Ind.	Kansas City, Mo.	Salt Lake City, Utah.
New York, N. Y.	London, Eng.	Portland, Ore.

THE RAILROAD GAZETTE

83 FULTON ST. NEW YORK

SWITCH LAYOUTS

PRICE $1.00



"PITTSBURGH"

Continuous Water Softener on Substructure. Type "A" Steel Construction.

WATER SOFTENERS

FOR SIMPLICITY
EFFICIENCY
DURABILITY

STAND ALONE

RAILROAD OR INDUSTRIAL

PRESSURE and GRAVITY FILTERS

PITTSBURGH FILTER MFG. CO.

PITTSBURGH, PA.

WRITE US FOR CATALOGUES AND PRICES

subways in New York under Eighth street and up Sixth avenue. The Hudson Companies will build the Jersey City terminal station of the Pennsylvania under the present terminal, and has a 999-year contract to carry passengers and baggage from the terminal to points in New York.

HUDSON STREET RAILROAD.—Articles of incorporation filed by this company in New Jersey, with a capital of $3,000,000, to build and operate a street railroad in Jersey City, from Washington and Plymouth streets through various streets, 31 routes in all. The incorporators include: Pliny Fiske, of Rye, N. Y.; W. G. Oakman, of Roslyn; W. C. Fiske and A. Freedman, of New York City; David Young, of Newark, N. J., and William G. McAdoo, of Yonkers, N. Y. Affiliated with the Hudson Companies and the Hudson & Manhattan, which see.

HUMBOLDT NORTHERN.—Incorporated in California, to build from Arcata, Cal., to a point near the mouth of the Klamath River, in Del Norte County, 70 miles. Branches are also to be built south from Arcata to Fairhaven, 15 miles and west for 10 miles. W. Carson, J. M. Carson and A. H. Connick are named as incorporators. (Mar. 17, 1905.)

HUNTINGTON, COLUMBIA CITY & NORTHWESTERN TRACTION.—A company under this name is planning to build an electric road from Huntington, Ind., north through Columbia City, skirting Lake Wawasee and through Syracuse to Goshen, 55 miles. Rights of way are also being secured for a line south from Huntington through Marion, Elwood and Noblesville to Indianapolis, an additional 95 miles. A. E. Weist, Jr., is General Manager.

I

*IDAHO NORTHERN.—This road, which now runs from Nampa, Idaho, north to Emmett, 27 miles, has, according to its published time table, 45 miles additional under construction. An extension from Emmett east to Horseshoe Bend, 20 miles, was projected a year ago.

ILLINOIS & KENTUCKY.—Incorporated to build from a point in Williamson County, Ill., through Saline, Pope and Hardin Counties. (Mar. 17, 1905.)

ILLINOIS & MISSOURI.—Chartered in Illinois to build from Quincy, Adams County, Ill., southerly through Melrose and Fall Creek to East Hannibal, in Pike County, Ill. E. H. Osborn and Lyman McCarl, of Quincy, Ill., are incorporators. (Mar. 17, 1905.)

ILLINOIS & WISCONSIN.—Incorporated in Illinois to build from Chicago northwest to Barrington, 30 miles. R. E. Burke, C. E. Crafts and A. L. Shiffman, of Chicago, are interested. (Mar. 17, 1905.)

*ILLINOIS CENTRAL.—Announcement is made that contracts have been let for building a line from Corinth, Miss., southeast, to Haleysville, Ala., 80 miles, as follows: To C. D. Smith & Co., of Birmingham, for building from the north end, and to George O. Clifton & Co., of Chicago, from the south end, work to be finished by January, 1907. Rights of way have also been obtained for extending the line southeast through Marion and Winston Counties, Ala., and are now being secured in Walker County. The southern terminus of the line is to be at Birmingham.

——*A new connecting line is being built from Herrin, Williamson County, Ill., to Ziegler, Franklin County, seven miles, by C. D. Smith & Co., contractors, of Memphis, Tenn. This road is to connect two different lines in the coal district and to reach new mines. Two miles built in 1905.

——*Connecting line from the terminus of the Effingham branch into Indianapolis. Track laid from Indianapolis southwest to Unionville, 51 miles.

——*Contract let to W. J. Hutton, of Memphis, and to Lorimer & Gallagher, of Chicago, for building a belt line from Woodstock to the Nonconnah yards in the southern part of Memphis, Tenn.

——Articles of incorporation filed for a line from Shawneetown to Golconda, Ill., 30 miles. A branch is also planned from the Fairview mine, in Harbin County, to the Ohio river.

——Surveys reported in Vermilion County, Ill., and western Indiana for an extension south from Kankakee, Ill., connecting with the Lake Erie & Western near Rankin, Ind.

——Proposed improvements to line in the neighborhood of Mattoon, Ill., cutting down Magnet hill and depressing the tracks through the city for about two miles.

——*Branch line under construction from Philipp City, Tallahatchie County, Miss., on the Yazoo & Mississippi Valley, north along the Tallahatchie river to the Panola County line, thence east to the main line of the Illinois Central at or near Sardis, about 60 miles.

——This company is making surveys to shorten the Memphis-Louisville line. It is to be built from Mayfield northeast to Grand Rivers, Ky., about 30 miles. When completed it will shorten the distance about 25 miles over the present route via Paducah.

——See Alabama Western

——See Yazoo & Mississippi Valley.

ILLINOIS, IOWA & MINNESOTA.—This company, which operates 125 miles of railroad from Rockford, Ill., southeast to Momence, is making surveys for an extension from Rockford northeast to Milwaukee, Wis., 98 miles. Grading to be commenced this spring. E. W. Troxel, Aurora, Ill., is Chief Engineer.

ILLINOIS VALLEY.—Incorporated in Illinois to build from Joliet southwest to Morris, thence west through Marseilles and Peru to Spring Valley. F. W. Bedard, La Salle, Ill., and C. E. Hook, Ottawa, are interested. (Mar. 17, 1905.)

*IMBODEN & ODELL.—This company, whose proposed railroad is to run from Charleston, W. Va., via Blue Creek, Coco, Quick and Pond Gap, to Summerville, W. Va., 44 miles, has given a contract to T. J. Carmack, of Charleston, for building from Blue Creek Station to Quick, 10 miles, grading completed on this section and track laid from Blue Creek to Tunnel No. 1, two miles. The work includes one 350 ft. bridge and five tunnels. Contracts will soon be let for 25 miles from Charleston to Blue Creek, and from Quick to Pond Gap. C. P. Peyton, Charleston, W. Va., is Chief Engineer. (Mar. 17, 1905.)

INDIANA BELT (Electric).—Chartered in Indiana with $10,000 capital to build an electric railroad from Indianapolis to Greenfield, through Maxwell, Eden, Pendleton, Noblesville, Lebanon, Danville, Martinsville, Franklin and Shelbyville. The officers are: Charles A. Barnes, President; Everet Hatfield, First Vice-President; Irving Tyner, Second Vice-President; P. Bidgood, General Manager; Thomas Beecher, Secretary and Treasurer. F. Bidgood, of Logansport, is Chief Electrical Engineer.

*INDIANA HARBOR.—Contract let to the F. L. Hartigan Construction Co., of Chicago, Ill., for building a branch from Indiana Harbor, Ind., southeast to Dune Park, 18 miles. Grading completed. Track laid for two miles.

INDIANAPOLIS & CHICAGO AIR LINE (Electric).—Organized in Illinois to build an electric road from Indianapolis to Chicago, about 175 miles. The maximum grade will be 1 per cent.; the work will include building six steel bridges. C. Knowlton, 305 Terminal Station Building, Indianapolis, Ind., is General Manager.

*INDIANAPOLIS & LOUISVILLE (C., I. & L.).—Grading contracts let to Williams & MacRitchie; to the Pound Construction Company, and to Thomas Glynn, for building from a point on the main line of the Chicago, Indianapolis & Louisville, one mile north of Quincy, Ind., southwest through Cataract, Jordan, Patricksburg, Clay City, Howellsville and Midland, to Victoria, on the Illinois Central. Work is to be commenced at once, and other contracts will be let shortly. Maximum grades will be 0.9 per cent. There will be two steel bridges. L. W. Parker is President and W. A. Wallace, Chief Engineer, both of Chicago.

INDIANAPOLIS & WESTERN TRACTION.—Under this name a company, with $1,500,000 capital, plans to build a high-speed electric road between Indianapolis and Terre Haute, Ind., about 52 miles. The company will enter Terre Haute over the lines of the Terre Haute Traction Co. and Indianapolis over the tracks of the Indianapolis Railway & Terminal Co. P. L. Saltonstall, of Boston, President, and S. Reed Anthony, Treasurer. Randall Morgan, Vice-President of the United Gas Improvement Co., of Philadelphia, which controls a number of interurban properties in Indiana, is said to be largely interested in the new company.

*INDIANAPOLIS, CRAWFORDSVILLE & WESTERN TRACTION.—Part of this proposed line from Indianapolis, northwest to Crawfordsville, Ind., 42 miles, under construction. W. D. Ball, First National Bank Building, Chicago, Ill., is the Engineer in charge.

INDIANAPOLIS, LOGANSPORT & SOUTH BEND TRACTION.—This company is planning to build a line from South Bend south to Logansport, Ind., through Bremen, Bourbon, Argos and Rochester. Rights of way secured and several townships have voted subsidies.

——The Common Council of Mishawaka, Ind., at a recent meeting granted a franchise for 35 years, to become operative on the completion of the line from Logansport to the southern limits of Mishawaka.

INDIANA ROADS (Electric).—Three independent surveys have been made for building an electric railroad from Hartford City, Ind., southwest to Alexandria, 21 miles, by the following companies: Indianapolis, Hartford City & Salina Traction, of which W. H. Maxwell is President, and in which C. G. Buell and Freeman Wilson, of Fairmont, are also interested; Indianapolis, Hartford City & Western, which has been formed by former members of the first company, also proposes to build a line, and the Fort Wayne & Wabash Valley Traction Co., an opposition road to the Muncie, Hartford City & Fort Wayne, which road it proposes to parallel from Fort Wayne to Hartford City.

——*Contracts reported let to A. M. Weedon, of Alexandria, and P. T. O'Brien for building an interurban road from Fort Wayne, Ind., northwest to South Bend, 70 miles air line. There will have to be 25 bridges. A. J. Behymer, of Elkwood, is an incorporator.

*INTERSTATE (VIRGINIA).—Contract let by this company to J. E. Rodes & Co., of Knoxville, Tenn., for building an extension from Appalachia to Norton, Va., 10 miles, and from Kelleyview to Roaring Fork, six miles.

INTERSTATE TUNNEL RAILROAD.—Charter in New Jersey and New York to operate a tunnel railroad from Jersey City under the North river to the Borough of Manhattan, New York City. Application has been made to the city authorities for a franchise to extend the tunnel from the North river at the foot of Chambers street east to Park Row. John B. McDonald is President of the new company, and S. L. F. Deyo, Chief Engineer. The plans of the company are before the Rapid Transit Commission for consideration.

*IONE & EASTERN.—Incorporated in California to build a railroad from Ione to Sutter Creek, 14 miles. Finished from Ione to Mountain Springs, 6½ miles. Work in progress to Amador, six miles further. Proposed branch from Sutter Creek to Volcano, 13 miles. H. E. C. Feusier, Ione, Cal., is Chief Engineer. (Mar. 17, 1905).

IOWA CITY & EASTERN (Electric).—Under this name the Cedar Rapids & Iowa City, which last year completed 23 miles of its road between Cedar Rapids and Iowa City, proposes to build an extension from the latter point to Muscatine, Ia., 39 miles.

IOWA TRANSFER.—Representatives of the Wabash, the Chicago, Burlington & Quincy, the Chicago, Rock Island & Pacific, the Chicago Great Western, the Des Moines, Iowa Falls & Northern, the Chicago, Milwaukee & St. Paul and the Des Moines Union railroads have organized a company under the above name, with $300,000 capital, to build a union freight yard in Des Moines. The company has bought land in East Des Moines as a site. The directors of the new company include: T. G. Ross, of the Chicago, Burlington & Quincy; Carroll Wright, and C. W. Jones, of the Chicago, Rock Island & Pacific; S. C. Stickney, of the Chicago Great Western, and C. E. Hubbell and J. A. Wagner, of the Des Moines Union. C. E. Hubbell is President; T. G. Ross, Vice President; J. A. Wagner, Secretary and Treasurer. The company will do the work with its own forces. The plans include the laying of two miles of track to be built early this spring.

IOWA VALLEY INTERURBAN.—This company is seeking incorporation in Benton County, Ia., with a capital of $100,000, to build from Belle Plaine to Vinton, 28 miles. Necessary franchises have been secured and ratified. Two surveys have been made, one through Keystone and Garrison, the other running about two miles east of Keystone. The office of the company will be at Belle Plaine. Geo. W. Voss is President; Thos. F. Murray, Vice-President; W. A. Mall, Treasurer, and H. R. Mosnat, Secretary and General Manager.

IRVINGTON RAILROAD.—Incorporated in New Jersey to build a railroad two miles long from Elizabeth to Irvington. T. E. Swain, Camden, N. J., is an incorporator. (Mar. 17, 1905.)

J

JACKSONVILLE, FERNANDINA & SOUTHERN.—Chartered in Florida, with capital of $250,000, to build a railroad from Jacksonville, northeast through Duval and Nassau Counties, to Fernandina, about 28 miles. Eugene E. West is President; John R. Young, Vice-President; Samuel A. Swann, Secretary, and Frank Adams, Treasurer. Others interested in the company are William A. Evans, of Fernandina, and John W. West, of Valdosta.

JACKSON, YAZOO CITY & MEMPHIS.—Application made by this company in Mississippi for a charter to build a railroad from Vicksburg east and north to Memphis, about 230 miles. The proposed line is via Yazoo City, crossing the Sunflower river near Woodburn, Sunflower County, and paralleling the Yazoo & Mississippi Valley from Jackson to Yazoo City. Incorporators include I. N. Barnwell and E. S. Crane, of Yazoo City.

JAMESTOWN & YOSEMITE VALLEY.—Incorporated in California to build from Jamestown southeast to a point at or near Maricopa, 40 miles; also an intermediate branch 35 miles long into the Yosemite Valley. T. S. Bullock and S. D. Freshman, San Jose, Cal., are incorporators. (Mar. 17, 1905.)

JAMESTOWN, DIAZ & CHERRY VALLEY.—Chartered in Arkansas, with $1,000,000 capital, to build from Jamestown east through Diaz, Jackson County, and thence to Cherry Valley, Cross County, 65 miles.

*JASPER & EASTERN (ATCHISON, TOPEKA & SANTA FE).—This company, which is building a railroad from Kirbyville, Tex., via De Ridder and Cravens to Alexandria, La., 100 miles, with a branch from Oakdale to Cravens, an additional 25 miles, has given a contract to the Lantry-Sharp Contracting Co., of Kansas City, Mo., for building the section from Kirbyville to Cravens, 57 miles. Grading has been completed from Kirbyville to mile 38, and track laid as far as mile 31. Other contracts will shortly be let for building the Oakdale branch. This work includes a bridge at the Sabine river, which is to have a 100-ft. through plate girder span, one 215-ft. fixed truss span and one 215-ft. draw span. Contract for the substructure of this bridge let to Cahman & McMurray.

JEFFERSON CITY, JERICHO & SOUTHWESTERN.—Proposed new line in Missouri from Minden, Barton County, northeast to Eldon, 125 miles. J. C. Long, R. E. Collins, E. R. Chappell and J. B. Myers are named as incorporators. (Mar. 17, 1905.)

JELLICO, BARBOURSVILLE, MANCHESTER & BEATTYVILLE.—Organized in Tennessee to build from Jellico, Tenn, northeast to Beattyville, Ky., 70 miles. (Mar. 17, 1905.)

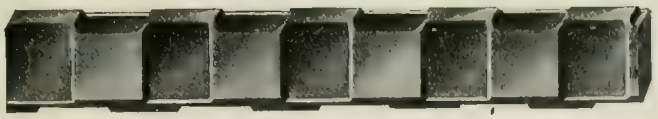
JENNINGS & NORTHERN.—Reported that this company is receiving bids for grading an extension from Jennings, La., to Keadle, 33 miles. C. C. Carey, Jennings, La., is Secretary. (Mar. 17, 1905.)

JERICO & SOUTHWESTERN.—This company, organized early last year in Missouri, to build a railroad from Jerico, Mo., southwest to a connection with the Missouri Pacific, 20 miles, has completed surveys. Maximum grade 1 per cent. and curvature 3 degrees. A bonus has been granted by the town of Jerico Springs and right of way to Lamar, Mo., secured, but nothing has been done since completing its surveys. J. C. Long, Madison Hotel, St. Louis, Mo., can give information.

JOHNSON CITY, BAKERSVILLE & SOUTHERN.—This company proposes to build a road from Johnson City, Tenn., to Bakersville, N. C., 40 miles, 22 miles of which will be in Tennessee, via Unicoi and Limestone Cove, Tenn., and Magnetic City and Big Rock Creek, N. C. About 8½ miles of line from Unicoi to Davisville, Tenn., was built some four years ago and surveys have been made from Davisville as far as Johnson City, 18½ miles. The balance of the road is now under survey and eight miles are to be built at once. C. B. Allen, of Johnson City, is Vice-President.

*JOHNSON CITY SOUTHERN (SOUTHERN).—Contract let to W. J. Oliver, of Knoxville, Tenn., to build this road. Projected route is from Marion, N. C., to Johnson City, about 80 miles. The work will be heavy, as the road passes through the Blueridge Mountains. It will reach coal fields in Virginia.

JOLIET & SOUTHERN TRACTION.—Incorporation granted this company in Illinois, with $10,-



THE CORRUGATED STEEL BAR

FOR STEEL CONCRETE WORK WAS GIVEN HIGHEST AWARD

GOLD MEDAL

BY THE SUPERIOR JURY

LOUISIANA PURCHASE EXPOSITION

ALSO

LEWIS AND CLARK EXPOSITION, AT PORTLAND, OREGON, 1905

SEND FOR 1905 CATALOGUE—DESIGNS FURNISHED FREE OF CHARGE

ST. LOUIS EXPANDED METAL FIREPROOFING CO.

FRISCO BUILDING GENERAL AGENTS ST. LOUIS, U. S. A.

000 capital, to build an electric railroad from Joliet, Will County, Ill., southwest through Will, Grundy and Livingston Counties to a point in Dwight County. Office of the company at Joliet. The first board of directors includes: H. A. Fisher, F. E. Fisher, L. D. Fisher, F. E. Stoddard and J. A. Jarvis, all of Joliet.

JOLIET, NEWARK & SOUTHWESTERN.—Incorporated in Illinois to build from Joliet west through Will, Kendall and La Salle Counties, 55 miles. Hr K. Thunemann, O. L. Miller, N. L. Sweetland and R. C. Bibbins, all of Newark, Ill., are incorporators. (Mar. 17, 1905.)

JONESBORO, LAKE CITY & EASTERN.—This company, which operates 55 miles of road in Arkansas, has filed an amendment to its charter, increasing its capital from $225,000 to $525,000. The increase is made for the purpose of building a branch line from Dell, Mississippi County, Ark., south through Luxora and Osceola, 20 miles, at an estimated cost of $300,000.

JUNCTION RAILROAD.—This company's tunnel under Neville street, Pittsburg, is to be abandoned and new tunnel pierced at a cost of about $2,000,000. This change is made necessary in connection with the removal of the company's tracks from their present location at Junction Hollow to Boundary street. In the cut from the Monongahela river to the mouth of Neville street tunnel the line will have a grade of 32 ft. in the mile less than the present line.

K

*KANAWHA & WEST VIRGINIA.—Contracts let to Rinehart, Wyatt & Co., of Charleston, W. Va., for building this road from Blue Creek to Charleston, W. Va., 13.5 miles. Contract let to the American Bridge Co., for a bridge over the Elk river at Blue Creek; also for building from Belva to Little Elk Creek, four miles.

*KANSAS CITY, MEXICO & ORIENT.—This to build from Kankakee through the counties of Kankakee, Grundy, La Salle, Henry and Rock Island to Rock Island City. William R. Burleigh, La Grange, Ill., and Gideon S. Thompson, Berwyn, Ill., are incorporators. (Mar. 17, 1905.)

KANSAS CITY & EXCELSIOR SPRINGS.—Chartered in Missouri, with $850,000 capital, to build a railroad from Kansas City northeast to Excelsior Springs in Clay County, Mo. W. J. Thurman, McKinney, Tex.; A. E. Martin, C. D. Pratt, J. Williams and Eugene G. Jaccard, of Kansas City, are interested.

KANSAS CITY & LEAVENWORTH (Electric).—This company, operating an electric line from Kansas City to Leavenworth, 30 miles, is reported sold to Clarence S. McClellan, of Mt. Vernon, N. Y., who represents an eastern syndicate. The new owners, it is said, will extend the line to Atchison, Kan., and St. Joseph, Mo.

KANSAS CITY, GALVESTON & MEXICO.—Chartered in Oklahoma, with $10,000,000 capital, and offices at Guthrie, Kansas City, Mexico City and New York, to build a railroad from Kansas City to Port Progresso, State of Yucatan, Mex. Projected main line is through Kansas, Indian Territory and Texas, passing through Denison, Dallas, Waco, Austin and San Antonio. Three branches are also proposed. One from Wagoner and Sapulpa, Ind. T., west to Guthrie; another from Dallas west to Fort Worth, and a third from Austin to Houston and Galveston. Incorporators include G. V. Pattison, H. W. Pentecost and N. D. McGiney, of Guthrie.

*KANSAS CITY, MEXICO & ORIENT.—This company is building a railroad from Kansas City, Mo., via Wichita, Kan., Fairview, Okla. T., Sweetwater and Presidio, Tex., across the international boundary into Mexico and via Chihuahua, Minaca and El Fuerte to Topolobampo, on the Pacific coast in the state of Sinaloa, 1,660 miles. From Kansas City to Lone Wolf, 436 miles, under contract to the Union Construction Co., of Kansas City; from Lone Wolf to Topolobampo, 1,224 miles, under contract to the International Construction Co., of Kansas City. The road is complete and in operation from Wichita, Kan., to Oakwood, Okla. T., 156 miles; Sweetwater to Knox City, Tex., 76 miles. Grading completed from a point 30 miles north of Wichita, through Wichita, Fairview and Diaz, Tex., to Sweetwater, 500 miles, and for 35 miles south of Sweetwater. Track laying is in progress from Custer City, Okla. T., north to Oakwood, and from Clinton, Okla. T. south. The St. L. & S. F. tracks will be used between Custer City and Clinton.

On the Mexican division, grading has been completed for 75 miles east of Chihuahua and 60 miles southwest of Minaca, and for 82 miles northeast of Topolobampo. Track laid for 71 miles east from Chihuahua (in operation) and 50 miles west of Minaca and road in operation from Topolobampo northeast to Las Hornillas, 72 miles. Additional track laying under way southwest of Minaca.

The Chihuahua & Pacific, which is to be part of this system, is in operation from a point west of Chihuahua to Minaca, 125 miles.

The line in Texas will be known as the Kansas City, Mexico & Orient Railway of Texas, formerly the Panhandle & Gulf.

——See Kansas City, Outer Belt & Electric.

——See Guthrie, Fairview & Western.

KANSAS CITY, NEVADA & SPRINGFIELD.—The preliminary survey of this proposed line from Kansas City to Springfield, Mo., has been completed. President T. P. McDonough states that the road is independent of any established railroad.

*KANSAS CITY, OKLAHOMA & HOUSTON.—Grading in progress on this proposed road between Honey Grove, Tex., and the Red River, 22 miles. Contracts for grading 84 miles from the Red River to a point in Indian Territory on the Choctaw, Oklahoma & Gulf will soon be let. M. J. Smith, South McAlester, Ind. T., is Chief Engineer; B. P. Beam, Kansas City, Mo., is President.

KANSAS CITY, OLATHE, LAWRENCE & TOPEKA (Electric).—Wyandotte County, Kan., Commissioners have granted a franchise to this company to build a system of electric roads from Kansas City south to Olathe. Right of way has been secured through Johnson County. The ultimate end of one branch will be Topeka. Another branch will probably be extended into Allen County to Iola and thence to Chanute. The main line will extend through Rosedale. The project is being financed by New York capitalists, who are represented by W. B. Strang, President and General Manager of the company, of Linwood Boulevard, Kansas City, Mo.

*KANSAS CITY OUTER BELT & ELECTRIC (K. C., M. & O.).—This company, which early this spring let contracts for building its line to afford terminal facilities for the Kansas City, Mexico & Orient and other companies, will complete the double-tracking of its road and build a bridge over the Missouri river.

*KANSAS CITY SOUTHERN.—Contract let to W. O. Wilbourne, of Edgerly, La., for building a line from Lockport Junction, on the Lake Charles branch, southwest to Union Sulphur Mine, about six miles. Grading not yet commenced. Maximum grade will be 0.5 per cent. and maximum curvature 7.3 deg.

KANSAS CITY, TULSA & SOUTHWESTERN.—Incorporated last year to build a railroad from Kansas City, Mo., to Wichita Falls, Tex. Is making surveys from Joplin, Mo., to Tulsa, Ind. T., 126 miles. W. H. Hendren, Tulsa, Ind. T., is Chief Engineer.

*KANSAS CITY VIADUCT & TERMINAL RAILWAY.—This company is selling bonds to secure funds to build a viaduct between Kansas City, Mo., and Kansas City, Kan. The company has been granted a franchise to build on a private right of way from Kansas City, Mo., at Bluff and Sixth streets, to Kansas City, Kan., at Fourth street and Minnesota avenue, 1 6-10 miles. The proposed structure will be of steel and concrete, 60 ft. wide. Work is under way, and is expected to be completed in about two years.

KANSAS, MEDICINE VALLEY & WESTERN.—Chartered in Kansas, with a capital of $500,000, to build a railroad from Independence, Kan., to the coal fields near Trinidad, Colo., about 260 miles. The proposed route is from Independence, Kan., through Montgomery, Chautauqua, Elk, Cowley, Sumner, Harper, Barber, Pratt, Comanche, Kiowa, Clark Ford, Gray, Haskell, Grant, Stanton, Stevens and Morton counties, Kan., to Trinidad, Colo. Surveyors are locating the line between Anthony and Medicine Lodge. The incorporators are T. A. Noftzger, F. D. Brooks, F. C. Firestone, M. D. Hoopes, Joseph Thompson and P. G. Walton, of Anthony, Kan. C. F. Coon, of Port Anthony, Kan., is President.

KANSAS, OKLAHOMA & POTEAU.—Incorporated in Oklahoma Territory, with capital stock

of $10,000,000, to build from Guthrie, Okla. T., east [illegible], Logan, Lincoln and Payne counties, to Wellston, Ind. T., and another line from a point near the Kansas state line in the north [illegible] part of the Osage Nation, through Pawnee County, Okla. T., and the Creek Nation, by way of an intersection with the first mentioned line at Pawnee, Ind. T. J. W. McNeal and Luther West, of Guthrie and Frank M. Daly, of Nevada, Mo. are incorporators. (Mar. 17, 1905.)

KANSAS, OKLAHOMA, TEXAS & GULF. This company, incorporated last year, has done nothing towards building its proposed line. Surveys are being made and rights of way secured. Construction work was to be commenced at Granite, Okla. T., in February, continued for 35 miles west to the Eggleston Industrial Company's works. The company will build a spur about three miles long at Granite, and expects to have the work completed in six months. Thos. L. Eggleston, of Granite, Okla. T., is President.

KANSAS, OKMULGEE & GULF. This company, which has a capital of $2,500,000, has filed a mortgage for $3,000,000 to raise funds to build its projected road from Kansas City south through the Cherokee, Creek and Choctaw Nations, to a point on the Red river near the 96th meridian. A branch line is also to be built from Okmulgee, Ind. T., northeast to Joplin, Mo. Total distance, about 560 miles. F. H. Smith, of Okmulgee, Ind. T., is President.

KANSAS RAILROAD. Chartered in Kansas to build from a point on the Missouri state line through Crawford, Neosho, Wilson, Elk, Butler and other counties to the Oklahoma state line. T. J. Hudson, T. F. C. Dodd and T. C. Babb, all of Fredonia, Kan., are incorporators. (Mar. 17.

*KANSAS SOUTHERN (Electric). This company, which is building a line southeast from Iola, Kan., also north from Iola to Kansas City, a total distance of 150 miles, has let a contract for building from Iola to Humboldt, nine miles. Surveys have been completed for an additional 60 miles, for which grading contracts are to be let early in April. F. V. Crouch, Iola, Kan., is President.

KANSAS SOUTHERN & GULF. This company, which operates eight miles of road from Blaine, Pottawatomie County, Kan., south to Westmoreland, has obtained a charter to extend its road from the southern terminus south to Alma, Wabaunsee County, about 35 miles. O. J. Colmann, Westmoreland, Kan., is General Manager.

KENDALL & SULPHUR SPRINGS.—Chartered in Arkansas to build from a point in Cleveland County northeast to point near Sulphur Springs, Jefferson County, with a branch northwest to Dairysaw, in Grant County, a total of about 25 miles. W. E. Graham, M. F. Dail and N. T. White, of Kendall, Ark., are interested. (Mar. 17, 1905.)

*KENTUCKY MIDLAND. New line building from Madisonville, Ky., southeast via Earles to Central City, 26 miles. Contracts let to the Grigsby, Steger & Atkinson Construction Co., of Bonham, Texas. The work includes one tunnel 750 ft. long and a pile bridge one mile long. M. M. Wheeler, of Earles, Ky., is Chief Engineer.

KENTUCKY ROADS. The Louisville Property Co., which is supposed to be backed by the Louisville & Nashville, is reported as securing rights of way to build a road from Jellico up Greasy creek to Four Mile, a station near Pikeville, Ky., 40 miles. The line will reach coal fields.

Construction work is to be commenced at once on a narrowgage road to be built by John C. Day, of Breathitt County, from the Natural Bridge, in Powell County, Ky., on the Lexington & Eastern, east to Campton, in Wolfe County, a distance of 11 miles through rich coal and timber territory.

— Rights of way being secured by a new company, in which H. H. Molman and others of Madisonville, Ky., are interested, for a railroad from that place northeast to Cloverport, 80 miles. Rights of way through Muhlenberg and Breckinridge counties have been secured.

KENTUCKY ROADS (Electric). — Application made to the Montgomery Fiscal Court by John T. Collins and W. A. Thomason, of North Middletown, for authority to build an electric railroad from Paris, Ky., to Mt. Sterling, 30 miles. Work to be commenced at once.

KENTUCKY SOUTHERN. Permission asked to build a line from a point near Little Rock Castle river, in Laurel County, Ky., along the boundaries of Laurel, Rockcastle and Pulaski counties and over the Cumberland river to Tateville, where connection can be made with the Cincinnati, New Orleans & Texas Pacific, about 45 miles.

*KEWEENAW CENTRAL. Arrangements, it is said, have been made for the funds to build 32 miles of this road. Contract let to Frank Bushnell, of Lake Linden, Mich., for building 12 miles.

KINGSTON, BRIGHTON & NORTHERN.—Chartered in Virginia, with $100,000 capital, to build railroads to be operated by steam or electricity. The headquarters of the company will be at Cape Charles. W. E. Dickinson, of New York, is President; W. G. Smith of Cape Charles, Va., Vice President, and G. W. Morton, Secretary.

KLAMATH LAKE. Surveys reported completed for an extension of this road from Pokegama, Ore., in an easterly direction for 25 miles. H. Lindley, Pokegama, is President. (Mar. 17, 1905.)

KNOXVILLE & MARYVILLE (Electric). Contracts were to be let this spring by this company for building its proposed electric road from Knoxville south through Vestal, Rockford and Scottsville, to Maryville, 16 miles. The work includes the building of one steel or concrete bridge. W. S. Nash, of Knoxville, is President, and Smith & Steele are agents for the company.

KNOXVILLE, SEVIERVILLE & NEWPORT (Electric).—Chartered in Tennessee with $50,000 capital, to build an electric railroad from Knoxville, Tenn., southeast to Sevierville, about 30 miles. The incorporators include S. P. Condon, J. B. Brabson and Jerome Templeton.

L

LAC LA BELLE & CALUMET.—Surveys are being made under the charter of this road for a line from Red Jacket, Mich., through Kearsarge, Wolverine, Alfonez, Mohawk, and Phoenix to Lac La Belle, 30 miles. Surveys for an extension from Lac La Belle to Keweenaw will probably be made later. (Mar. 17, 1905.)

*LAKE ERIE & PITTSBURG. This road has been completed from Lorain, Ohio, southeast to Berea, 13 miles. It is to be extended from Berea northeast to Cleveland, with a branch to connect with the Newburg & South Shore. Grading in progress from Berea east across the Cuyahoga river to a point near Hudson, 17 miles. The road is eventually to be built via Streetsboro, Freedom, Newton Falls, Niles and Girard, to Youngstown and Lowellville. Recently reported sold to the Vanderbilt interests.

LAKE ERIE & SOUTHERN. This company, which proposes to build a line from Lorain, Ohio, via Grafton, to Wellington, is reported to have secured all rights of way. The route is from the harbor of Lorain, along which the company has 5,000 ft. of dock space, and land for terminal purposes, past the steam works in South Lorain to Grafton and thence to Wellington.

LAKE ERIE, MAHONING & SOUTHERN. New company with $2,000,000 capital, in Ohio, proposes to build a railroad from Youngstown to Salem, about 24 miles. Pittsburg and Chicago capitalists are said to be supporting this project. Connection is to be made with the Pennsylvania, Baltimore & Ohio and the Wabash.

LAKE SHORE & MICHIGAN SOUTHERN. Preliminary plans under way to relocate the line through Fort Clinton, Ohio. Much of the right of way secured. The work includes building a four track bridge over Portage river, a mile west of the present structure.

*LAKE SUPERIOR & SOUTHEASTERN (WISCONSIN CENTRAL).—Contract let to H. F. Balch, of Minneapolis, Minn., for grading 112 miles of road from Duluth to Ladysmith, Wis. Part of this road, from Owen to Ladysmith, the Owen & Northern, was completed last year. Grading work has been under way by McIntosh Bros., of Milwaukee, who have the contract, for the past ten months. Those two roads will form the extension of the Wisconsin Central to Duluth.

*LAKE SUPERIOR & SOUTHERN.—Chartered in Michigan to build a railroad from Huron Bay, on Lake Superior, on the northern peninsula of Michigan, southwest via Lake Michigamme. Forty miles have been graded and bridges and culverts built. Track laying is to begin early this spring. Contracts will be let during the next six months for additional grading, track laying and bridge work. M. C. Phillips, of Oshkosh, Wis., is President, and George A. Young, of the same place, Construction Engineer.

LAKE TAHOE RAILROAD & TRANSPORTATION CO. Incorporated to build from Truckee, Cal., to Lake Tahoe, 15 miles. Surveys reported in progress. W. S. Bliss, Crocker Building, San Francisco, is Chief Engineer. (Mar. 17, 1905.)

*LANSING MANUFACTURERS' RAILROAD. — The contract for building this belt line six miles long around the city of Lansing, Mich., connecting the Grand Trunk, Michigan Central and the Lake Shore, has been let to W. E. Tench & Co., of 273 Park street, Detroit, Mich.

LARAMIE, HAHN'S PEAK & PACIFIC. Capital reported furnished to complete this line to Centennial, and eventually to Grand Encampment. The line is graded from Laramie, Wyo., to Centennial, 30 miles, and seven miles of track laid. Work to be continued at once. F. A. Miller, Laramie, Wyo., is President. (Mar. 17, 1905.)

LAS VEGAS & TONOPAH. Chartered in Utah with capital of $4,000,000, to build a railroad from Las Vegas, Nev., to Tonopah, 215 miles. There are no towns of importance on the route at present, except Bullfrog, Rhyolite and Beatty, all about 115 miles from Las Vegas. The next town of importance is Goldfield, about 80 miles beyond Bullfrog. The line has been surveyed as far as Bullfrog. Construction was to be begun last year. Part of the grading is already completed, but no track laid. The company will do the track laying and grading, which will not be difficult, and will build its own bridges. Maximum grade westbound between Las Vegas and Bullfrog will be 1 per cent., eastbound 1.5 per cent., and the balance of the line 1 per cent. J. Ross Clark is President, and Arthur Maguire, Chief Engineer, Los Angeles, Cal.

LAWRENCEVILLE & WESTERN.—Incorporated in Virginia to build from Lawrenceville north west to Cochran, six miles, where connection can be made with the Seaboard Air Line. E. P. Buford, Lawrenceville, Va., is President. (Mar. 17, 1905.)

*LEWISTON & SOUTHEASTERN (Electric). — Construction work has been begun on this electric road from Lewiston, Idaho, through West lake, Cottonwood and Denver to Grangeville, Idaho, with a branch from Westlake to Nez Perces City, a total of 110 miles. The road is being built largely for freight traffic. Naylor & Norlin, Lewistown, Idaho, are the contractors. Additional contracts will be let soon. Col. Judson Spofford, Boise, Idaho, is the promoter.

LEXINGTON SOUTHERN (Electric).—Chartered in Kentucky to build an electric railroad from Lexington, Ky., south to Nicholasville, 15 miles; also to operate a line to Camp Nelson, and High Bridge. Headquarters at Lexington, Ky. J. W. Stoll is President, and E. B. Ellis, Secretary and Treasurer.

LIBERTY CITY, GLENNVILLE & MANASSAS.—Proposed new line in Georgia from Liberty City to Manassas, about 40 miles. H. W. Tippins, Manassas, Ga.; W. H. Bradley, Waycross, Ga., and J. K. Hines, Atlanta, Ga., are incorporators. (Mar. 17, 1905.)

*LIBERTY WHITE. Permission granted this company by the Mississippi Railroad Commission to change its eastern terminus to Columbia, in Marion County, necessitating 40 miles of new road, or to some point west of Columbia. About 15 miles of the extension now building east, it is expected will be completed shortly.

LIMA EASTERN. Chartered in Ohio, with $100,000 capital, to build a railroad from Lima to Marion, to be operated by gasolene power. The incorporators include F. C. Oleson and C. H. Chappell.

LINVILLE RIVER. This company, it is reported, will build an extension from Saginaw to Mortimer, N. C., 15 miles. J. T. Montgomery, of Lenoir, N. C., is Chief Engineer.

LITTLE BAY & HAMPTON. Incorporated in Arkansas, to build from Little Bay through Gordon and Woodberry to Hampton, 20 miles. H. M. McLachlin, Little Bay, Ark., is President. (Mar. 17, 1905.)

LITTLE ROCK & HOT SPRINGS (Electric). — Incorporated in Arkansas, with $2,000,000 capital stock, to build an electric railroad from Little Rock southwest to Hot Springs, 50 miles.

LITTLE ROCK & SOUTHERN. See Rock Island, Arkansas & Louisiana (C., R. I. & P.).

*LIVE OAK, PERRY & GULF. This company, which succeeded last October the Live Oak & Perry, has practically completed its road from Live Oak, Fla., to Perry, about 40 miles, and from Day, in La Fayette County, a branch 11 miles long, to Mayo and Alton. Contracts will be let shortly for building about 50 miles additional from Perry to St. Marks. Thomas Darling, of Live Oak, Fla., is President.

LONE ROCK & LA VALLE. Surveys will be begun at once for this road, which is to run from Lone Rock, Wis., through Plano, White Mound and Ironton, to La Valle, 35 miles. George Jamieson, Lone Rock, Wis., may be addressed. (Mar. 17, 1905.)

*LONG ISLAND. This company is making improvements which will cost $40,000,000. The company has already electrified the line from Flatbush Avenue to Queens and Belmont Park, from Woodhaven Junction to Rockaway Beach, from Hammels to Valley Stream and from Valley Stream to Jamaica. In addition the electrification of the North Shore branch to Whitestone Landing and to Port Washington from Long Island City and the line from Long Island City to Manhattan Beach is planned.

*Elimination of grade crossings along Atlantic Avenue Brooklyn from Flatbush Avenue to Woodhaven Junction and new terminal facilities at Flatbush Avenue Station practically completed.

*Elimination of grade crossings and general improvements on the Bay Ridge line from East New York to Bay Ridge. The Bay Ridge line crosses 115 streets at grade, and this work, with the relaying of the light track with 100-lb. rails, will cost about $7,000,000. Work under way.

LONOKE, PINE BLUFF & SOUTHWESTERN.—Chartered to build from Lonoke, Ark., to Pine Bluff, about 45 miles. The incorporators include: J. P. White, T. M. Fletcher and David Gates, of Roanoke, and M. J. Craig, of New York.

*LOUISIANA & ARKANSAS.—This road was organized to take over the assets of the Louisiana & Arkansas Railroad, operating a line 125 miles long between Stamps, Ark., and Winnfield, La. The present management has completed the northern extension from Stamps to Hope, 22½ miles, and the southern extension from Winnfield, La., to Jena, 39½ miles, making a total length of 187.2 miles. The line from Winnfield to Jena is not yet open for traffic, so that the mileage in operation is 147.7 miles. Two extensions are projected: one from Jena east to Natchez, Miss., 47 miles, the other from Packton, La., south to Alexandria, 36 miles. Grading completed and 10 miles of track laid.

*LOUISIANA & PINE BLUFF.—Incorporated in Arkansas, with capital of $300,000, all subscribed, to build a road from Huttig, Union County, to Wilmington, in the same county, 20 miles. Track laid on 3 miles, and contract for the balance of the road let to S. R. Neal, of Huttig, Ark. The incorporators are C. D. Johnston, E. A. Frost, F. W. Scott, A. W. Corkins and R. E. Rowland. The line will have a maximum grade of 0.5 per cent. It is to cross the Iron Mountain near Huttig.

LOUISIANA WESTERN (SOUTHERN PACIFIC). Surveys reported for an extension of this road from Lake Charles to the Calcasieu river, about 15 miles north of Leesville, La., 75 miles.

*LOUISIANA CENTRAL. Grading begun by the Louisiana Construction Co. on this proposed road from Monroe, La., south to New Iberia, 180 miles. G. W. Decker, Newport, Ark., is President. (Mar. 17, 1905.)

*LOUISIANA EAST & WEST.—This road, which is to have its northern terminus at Bunkie, La. (on the Texas & Pacific) and run south through Eola (on the Southern Pacific) to Ville Platte, will probably be extended further to Rayne. As soon as the first 25 miles of the line is built bonds to the amount of $250,000 will be sold to the Hibernia Bank & Trust Co., of New Orleans. Contract reported let to J. W. Dickinson for grading 10 miles of line south from Bunkie. C. J. Carpenter, Bunkie, La., is Superintendent.

LOUISIANA MIDLAND.—Charter filed in Louisiana, with $10,000,000 capital, and headquarters at Homer. The company proposes to buy or build a railroad from some point near Magnolia, Ark., running in a southerly direction through Columbia County, Ark., and through the parishes of Claiborne, Bienville, Natchitoches, Rapides and Calcasieu, La., to Crowley, Arcadia County, La. The officers are: George Hunter, St. Louis, President; Hugh C. Brown, Ruston, La., Vice President, and W. N. Crouch, St. Louis, Secretary.

*LOUISIANA RAILWAY & NAVIGATION.—Surveys completed, and as soon as right of way has been secured bids will be asked for building a line from Alexandria, La., northeast to

HYDROLITHIC

Concrete-Steel Battery Vaults

ARE FAR BETTER THAN WOOD OR STEEL



They are strong, portable, of light construction, and have been in successful service with railroads as storage wells for block-signal batteries about five years. In that time their permanently waterproof, non-corrosive, and indestructible character has been amply demonstrated.



E. J. WINSLOW COMPANY

138 JACKSON BOUL., CHICAGO, ILL.

Jena, about 30 miles. Rights of way for an extension of the main line from Latonier, east to New Orleans, 30 miles, have been secured, and bids are for grading and trestle work, also asked for double tracking the income at Maples and at Angola, where the line of the proposed road crosses the Mississippi river.

LOUISVILLE & INDIANAPOLIS TRACTION.—Rights of way secured for building from Jeffersonville, Ind., north to Seymour, about 60 miles. I. N. Perry, John Long, C. P. Casurbun, of Memphis and Henryville, are interested.

*LOUISVILLE & NASHVILLE.—An officer writes that grading for the following construction work is now under way.

*Henderson division.—revision of line and grades between Greenbrier, Tenn., and Guthrie, Ky., 257 miles. Walton, Wilson, Rodes & Co., Knoxville, Tenn., contractors.

*For revision of line and grades, Bakers Hill, Henderson division, Mason & Hoge Company, Frankfort, Ky., contractors.

*Knoxville division.—revision of line and grades from Saxton, Ky., to Corbin, Ky., 25.9 miles. Contract for this work let to Eddington, Griffiths & Co., Knoxville, Tenn., and Southern Contracting Company, Ludlow, Ky.

*Atlanta, Knoxville & Northern Railway.—Atlanta connection, extending from Ellen N on the Western & Atlantic Railroad to a connection with the Atlanta Belt Line, West End, Atlanta, 6.2 miles in Georgia. The contractors are: Wm. J. Oliver, Knoxville, Tenn.; Wright, Williams & Wadley, Dalton, Ga., and A. C. Wright and J. T. Pruden, Atlanta, Ga.

——*A contract for building a branch line up the left-hand fork of Straight creek has been let to the Callahan Construction Company, Knoxville, Tenn.

——*Contract let to Eddington, Griffith & Co., of Knoxville for a line from a point near Pineville, Ky., west 34 miles to Williamsburg, on the Knoxville division. The new line will connect by a shorter route the Cumberland Valley division and the Knoxville division.

——Surveys for a branch line from Louise, on the Clarksville Mineral branch in Montgomery County, Tenn., to the Tabor iron mines, about five miles.

——*Contract reported let to Dunno & Lelland, of Birmingham, Ala., to build an extension 20 miles long from the Northern Alabama to the Vulcan mines in the Warrior field (Ala.) at an approximate cost of $500,000.

——*This company is reducing the grade on its old line between Corbin and Saxton, Ky., on the Knoxville division, and between Knoxville and Etowah, Tenn., on the Atlantic division.

——*New low-grade line under construction from Etowah to Cartersville, Ga., where connection will be made with the Western & Atlantic, over which the L. & N. has trackage rights to Marietta. This work will finish the new Cincinnati-Atlanta line.

——*Contract reported let for reconstruction of the line between Guthrie, Ky., and Greenbrier, Tenn., on the St. Louis, Evansville & Nashville division, 25 miles, to J. E. Rhodes & Co. and E. H. Wilson, both of Knoxville, Tenn. This work will include new bridges over Red River and Sulphur Fork; 8.70 miles finished last year.

——*See Green River Valley.

*LOUISVILLE & NORTHERN RAILWAY & LIGHT.—This company, which has a capital of $5,000,000, is said to have begun work on building a system of electric lines in southern Indiana to connect with Louisville, Ky., or with the line of the Louisville & Southern Indiana Traction. The first section to be built is from Jeffersonville to Sellersburg, 12 miles. This will be followed by lines to Corydon, French Lick, West Baden and other lines in the southern part of the state. The incorporators are officials of the Chicago company which bought the public utilities of New Albany and Jeffersonville.

LOUISVILLE SOUTHERN.—According to local reports, an eastern syndicate has bought 10,000 acres of coal lands along the proposed extension of this road in upper Harlan County, Ky. It is the intention of the syndicate to build under this name a line from the coal properties to the Cumberland Valley division of the Louisville & Nashville, an extension of the Louisville & Nashville from a point on the Cumberland Valley division to the coal property in Cumberland valley, a distance of 35 miles.

*LOWVILLE & BEAVER RIVER.—Projected railroad from Lowville, N. Y., to Croghan, 11 miles. Two miles of track laid. J. T. Campbell, of Lowville, is the contractor. Location surveys have also been completed for a line from Page to Monteola, five miles. J. B. Brownell, Lowville, N. Y., is Chief Engineer. (Mar. 17, 1905.)

*LUXORA, JONESBORO & WESTERN.—Incorporated in Arkansas, with $500,000 capital, to build from Luxora, Mississippi County, to Jonesboro, Craighead County, 45 miles. Contract for grading the first 10 miles reported let to H. P. Liston, of Luxora, Kan. J. B. Driver, Luxora, is President.

M

McCLOUD RIVER.—This company, which last year completed seven miles of road in California, has projected a road to run from McCloud west to Mott, 17 miles, and from the end of the present track north to Merrill, Ore., an additional 77 miles.

McCORMICK & COLUMBIA RIVER.—Incorporated in the state of Washington, with a capital of $100,000, to build from McCormick, in Lewis County to Gray's river and Gray's Bay. Incorporators include: F. L. Hale, H. McCormick and A. N. Riggs. (Feb. 23, 1906.)

McRAE & DUBLIN.—Proposed line in Georgia from Dublin south to McRae, 25 miles. To connect with the Southern at McRae and with the Macon, Dublin & Savannah, at Dublin. One mile of track laid. G. M. Wilcox, Dublin, Ga., is interested. (Mar. 17, 1905.)

MADISON & GOODLETTSVILLE.—Chartered in Tennessee to build a railroad from a point near Madison, Davidson County, on the main line of the Louisville & Nashville, north to a point near Goodlettsville, six miles. The incorporators include: John Geddes, J. B. Keeble, E. B. Duval, R. S. Willock and John W. Judd.

MADISONVILLE, HARTFORD & EASTERN.—Articles of incorporation filed in Kentucky, with headquarters at Hartford, to build a railroad from Madisonville northeast to Fordsville or Cloverport, about 80 miles. The incorporators are: R. E. L. Simmerman, J. W. Ford, H. H. Holeman, Rowan Holbrook, G. R. Lynn, Dr. J. P. Ross, John T. Moore, of Hartford, Ky.

MANCHESTER, DORSET & GRANVILLE.—Proposed line from Manchester, Vt., via Dorset to Granville, N. Y., 21 miles. Completed as far as Dorset, eight miles. Work may be resumed this year. O. W. Norcross, of Worcester, Mass., is President. (Mar. 17, 1905.)

MANHATTAN & LONG ISLAND (Electric).—Incorporated in New York, with capital of $10,000,000, to build an electric railroad 80 miles long, connecting Long Island City and Northport, L. I. The directors include: Edward Mackey, D. T. Meyer, H. H. Boutell, S. Y. Sauber, F. M. Walter and George E. McArdle, all of New York, and William R. Stockwell, of Yonkers, N. Y.

*MANILA & DAGUPAN.—This company, operating about 186 miles of road in the Philippine Islands, is reported to be building an additional 50 miles. H. L. Higgins, of Manila, is Chief Engineer.

*MANILA & SOUTHWESTERN.—Grading work under way on this new line by D. A. Smith & Sons, of Manila, Ark., for a distance of 65 miles. The route is from Wynne, Cross County, Ark., northeast to Manila, Mississippi County. The district is level and heavily timbered. About two miles of trestle will be required at the St. Francis river, also a drawbridge. R. L. Williford, of Manila, is President, and William Kerr, Jonesboro, Ark., is Chief Engineer.

MANITOWOC, GREEN BAY & NORTH-WESTERN.—See Chicago & North-Western.

MANUFACTURERS BELT LINE.—Incorporated in Indian Territory with $500,000 capital stock, to build a railroad from a point on the Midland Valley in the Cherokee Nation to Tulsa, then, in a circle around that place, the diameter of the circle not to exceed six miles, to coal deposits near Dawson, Ind. T. The incorporators are: M. B. Baird, M. C. Hale and H. C. Stebbins, of Tulsa, and Major Moberly and Howard Elder, of Oklahoma City.

MARINE SHORE.—Proposed line in California from San Rafael northerly to Point Pedro and thence to Ignacio, 20 miles. J. A. McNear and G. P. McNear, of Petaluma, Cal., are incorporators. (Mar. 17, 1905.)

MARION & NORFOLK.—Organized in Virginia to build a railroad. Surveys reported. J. H. Hyde, E. P. Prentise, W. K. Bixbee and R. M. Galloway are incorporators. J. H. Glenn is Secretary and Treasurer.

MARION COUNTY.—Incorporated in Arkansas to build from Yellville east to the mouth of Buffalo river, 25 miles, where connection can be made with the Iron Mountain. J. C. Smith, Thomas Combs and J. E. Williams, of Little Rock, are directors. (Mar. 17, 1905.)

MARION, MATTHEWS & MUNCIE (Electric.)—Incorporated in Indiana to build an electric railroad from Marion southeast to Matthews, 16 miles, and from Matthews to Muncie, an additional 16 miles. Such a road would parallel the Chicago, Indiana & Eastern from Matthews to Muncie. The incorporators include: Samuel Ecker, Jr., of Matthews, and George G. King, William W. Adams, W. T. Nelson and W. S. Whitney.

MARLINGTON & CAMDEN.—Chartered in West Virginia to build from Marlington northwest to Camden-on-Gauley, 30 miles. G. H. Campbell, Kane, Pa., and J. N. Campbell, Warren, Pa., are incorporators. (Mar. 17, 1905.)

MARSH FORK (TIDEWATER).—Incorporation has been granted this company in West Virginia to build an extension of the Tidewater to the Ohio river at the mouth of the Great Kanawha river, approximately 100 miles from Surveyor Station in Raleigh County, on the Deepwater, which is the West Virginia end of the Tidewater route. The officers of the company are: W. N. Page, President; G. W. Imboden, Vice-President; W. H. Evans, Secretary; G. H. Church, Treasurer; J. J. Corell, Assistant Treasurer; Raymond DuPuy, General Manager, and H. Fernstrom, Chief Engineer.

MARYSVILLE & SUSANVILLE.—Articles of incorporation filed in California to build from Marysville to a point in the Honey Lake Valley near Susanville, and from Susanville to between the California-Nevada boundary line. Total length, approximately, 200 miles. Authorized capital, $7,000,000. Names of incorporators not given. (Mar. 17, 1905.)

MEDFORD & CRATER LAKE.—Projected line in Oregon. Surveys made and rights of way secured for 12 miles. Contracts for grading between Medford and Eagle Point let to Charles Ewing, of Medford, and others. The whole line is to be 32 miles long. A. A. Davis, Medford, Ore., is President, and J. A. McCall, Chief Engineer.

MEMPHIS & NEW ORLEANS (ST. L. & S. F.).—Chartered in Arkansas, with capital of $6,265,000, to build a railroad paralleling the Mississippi river in eastern Arkansas, from Marion, Chitman County, to the Louisiana state line, about 180 miles. The incorporators include: L. F. Parker and C. R. Gray, both officials of the Frisco.

MEMPHIS & PENSACOLA.—Chartered in Mississippi to build a railroad from Memphis to Pensacola, Fla., via Meridian. The company hopes to have its line completed in two years. The incorporators include: E. T. Haynes, W. C. Roberts, G. A. Scott and H. I. Willey, of New York, and F. F. Woodworth, of Kinderhook, N. Y. (Mar. 17, 1905.)

MEMPHIS, INDIANOLA & GULF.—Proposed road from Memphis, Tenn., via Indianola, Dockery, Yazoo City and Jackson, Miss., to Gulfport, 450 miles. Preliminary surveys completed. Reported that contracts are to be let at once for building from Indianola to Dockery, 25 miles. W. E. Ringold, Lyon, Miss., is President, and R. Craig, Heathman, Miss., Chief Engineer. (Mar. 17, 1905.)

MEMPHIS, PARIS & GULF.—New line projected from Memphis, Tenn., through Little Rock, Ark., to Paris, Tex., about 400 miles. J. W. Brown, Camden, Ark., is President, and C. C. Henderson, Arkadelphia, Ark., is General Manager. (Mar. 17, 1905.)

*MENA & SOUTHEASTERN.—Chartered in Arkansas, with capital of $400,000, to build from Mena, Polk County, on the Kansas City, Southern, east to Black Springs, Montgomery County, about 40 miles. Surveys completed and construction work to begin at once. C. C. Goodman, C. A. Smith and J. H. Hamilton, of Mena, Ark., and J. H. Foster and V. R. Andrews, of Kansas City, are interested. Probably a project of the Kansas City Southern.

*MENA, HOT SPRINGS & EASTERN.—Proposed road from Mena, Ark., via Black Springs to Hot Springs, 85 miles. Work now in progress by the Arkansas Exploration Co. W. A. Carroll, Mena, Ark., is President. (Mar. 17, 1905.)

METEOR MOUNTAIN.—Incorporated in Arizona to build from Dennison, Ariz., on the Atchison, Topeka & Santa Fe, southerly to the mines of the Standard Iron Co., 40 miles, with a branch line from Sunset southeast to the mines of the same company, 10 miles. E. B. Knox and B. L. Clark, of Dennison, Ariz., are incorporators. (Mar. 17, 1905.)

MICHIGAN CENTRAL.—Tunnel under the Detroit river from Windsor, Ontario, to Detroit. Work to be commenced this month.

—— In order to have its tracks permanently settled by the time the tunnel under the river is completed, this company has notified the Common Council of Detroit, Mich., that it will separate all grade crossings between Livernois avenue and Fifteenth street in addition to its general agreement with that city to spend $200,000 a year for grade separation work. The total cost of the work to the railroad company will be about $1,200,000.

MICHIGAN ROADS.—A syndicate, in which Senator Burrows, of Michigan, S. J. Dunkley and O. W. Norton, of Chicago, are interested, is planning to build a railroad from South Haven, Mich., east via Fruitland, Bangor, Lake Cora, Pawpaw, Lawton and Kalamazoo to Detroit, about 180 miles.

MIDDLESBORO MINERAL.—Projected line from Middlesboro, Ky., to Harlem, 43 miles. Rights of way secured, but no work yet done. Henry Fonde, Nashville, Tenn., is interested.

*MIDDLETOWN & CECILTON.—Contract let to W. R. Polk & Co. for building the first nine miles of this road, projected to run from Middletown, Del., southwest to Fredericktown and Georgetown, Md., 12 miles. Grading completed for 7½ miles, but no track has yet been laid. Bids will soon be asked for building the balance. A branch is also projected from Cecilton to a point on Chesapeake Bay, an additional six miles. T. C. Cruikshank is President, and W. R. Polk, Secretary and General Manager, Wilmington, Del.

*MIDDLETOWN & ODESSA.—Work reported under way on this road by the contractors, the Dennis Construction Co., of Philadelphia, from Odessa, Del., to Delaware City, nine miles.

MIDLAND AIR LINE.—Organized in Arizona, to build from Des Moines, Ia., to Port Arthur, Tex. Incorporation papers filed in Iowa. Part of the right of way reported secured from Texas to the Missouri line, and is negotiating for the balance. Capital, $1,000,000. J. W. Crawford, J. O. Bleaksley, J. N. Brown and D. F. Keeler, of Lamoni; M. L. Temple, of Osceola, and A. W. Davis and M. C. Betts, Pleasanton, Ia., are incorporators.

*MIDLAND PACIFIC.—New line from Bakersfield, Cal., via Sunset, Cuyama, Santa Maria, Guadalupe, Pismo and the Sunset oil district, to Port Harford, on the Bay of San Luis Obispo, 140 miles. Grading completed by Wayn & Co. for 10 miles. Financing of rest of the line under way. Mark McDonald, A. Fiest and I. E. Blake, San Francisco, Cal., are interested.

*MIDLAND VALLEY.—This company has given contracts to Kalmann & McMurray, of Kansas City, and to Maney Bros., of Oklahoma City, for building an extension from Foraker, Okla. Ter., northwest to Silverdale, Kan., 29 miles.

MILWAUKEE & STATE LINE.—See Chicago & North-Western.

MILWAUKEE NORTHERN (Electric).—Incorporated in Wisconsin, with capital of $100,000, to build an electric railroad from Sheboygan, Wis., south for about 60 miles to Milwaukee, passing through Fond du Lac and Port Washington. John E. Uselding, of Port Washington; Peter D. Brueckbauer, of Elkhart, and John M. Saeman, of Sheboygan, are incorporators. Such a line would parallel the Chicago & North-Western.

MILWAUKEE, PEORIA & ST. LOUIS.—Incorporated in Illinois to build from Peoria, Ill., north through the counties of Peoria, Tazewell, Woodford, Marshall, Putnam, Bureau, Lee, Ogle and Winnebago to Rockford, 125 miles.

*MINNEAPOLIS & ST. LOUIS.—Under the corporate name of the Minnesota, Dakota & Pacific, the Minneapolis & St. Louis is to build a line from Watertown, S. D., its present most western terminus, a little north of west to La Beau, S. D., on the Indian Reservation border with a branch from Aberdeen, S. D., to Leola, in all about 250 miles. The parent road has issued $5,000,000 notes to cover cost of building this line.

——See St. Louis & Des Moines.

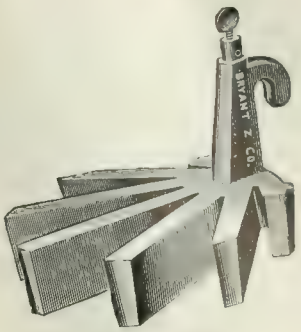
*MINNEAPOLIS, RED LAKE & MANITOBA.—This company, which recently completed a 26-mile extension of its road from Bemidji to Nebish in Michigan, has given a contract to Hal-



Round Signal Pattern Zinc



Combined Interlocking, Relay and Crossing Bell



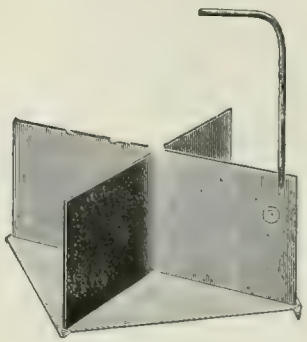
Crowfoot Zinc



Schoenmehl's Primary Batteries

SEE OUR EXHIBIT
AT THE
CONVENTION

BRYANT ZINC COMPANY
CHICAGO, ILLINOIS



Pan Bottom Copper

THE ONLY ELECTRIC
MOTOR SIGNAL
WITHOUT A
DASHPOT

Approved by Many Leading Railway Lines

SIGNALING

We Manufacture and Install Safety Appliances

THE AMERICAN RAILWAY SIGNAL CO.
CLEVELAND, OHIO



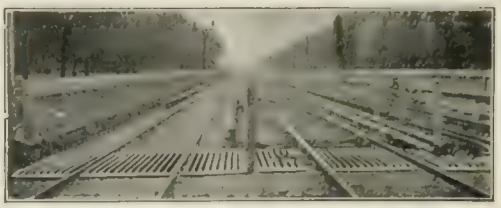
CLIMAX CATTLE GUARDS ON CHICAGO AND ALTON R. R.

THE

CLAY CATTLE GUARD

THE CLIMAX STOCK GUARD CO.

504 Title & Trust Bldg. CHICAGO



CLIMAX CATTLE GUARDS ON LONG ISLAND R. R.

verson & Carkon for rebuilding its old line from Nebish north to Red Lake, about 12 miles.

*MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE. A contract is reported let by this company to the Winston Bros. Co. for at once building a line paralleling the Farmers' Grain & Shipping Co.'s railroad. The proposed route is from Dent's Lake, north to the Canadian Pacific, crossing the Farmers' road at Starkweather, N. Dak.

——Reported that the Bismarck, Washburn & Great Falls road, purchased by this company, will be extended from Underwood to Minot, N. Dak., 60 miles.

——Extensive terminal improvements in Minneapolis planned.

MINNESOTA, DAKOTA & PACIFIC.—See Minneapolis & St. Louis.

MINOT, BISMARCK & SOUTHWESTERN.—Incorporated in North Dakota, with capital of $500,000, to build from Minot south, 100 miles. The incorporators include: L. L. Davis, O. M. Chaplin, C. J. Brunner and J. R. Ehr, all of Minot.

MISSISSIPPI & ALABAMA.—Surveys completed for proposed line from a point near Corinth, Miss., south through Alcorn, Prentiss, Tishomingo and Itawamba Counties, approximately 80 miles. J. T. Savage and Edward Mayes, of Jackson, Miss., are interested.

*MISSISSIPPI CENTRAL.—This company, which recently extended its road from Silver Creek, Miss., west to the Pearl river, 7.5 miles, has given a contract to the Worthington Construction Co., of Birmingham, Ala., for an extension from the Pearl river west to Brookhaven, 22 miles. The company is also projecting a line from Brookhaven across the state to Natchez, an additional 70 miles.

*MISSISSIPPI EASTERN.—Extension of five miles from Camp, Miss., now building, Quitman, Miss. The line now runs from Quitman to Camp, 12 miles.

MISSISSIPPI RIVER SUGAR BELT.—Chartered in Louisiana with $25,000 capital, to build from some point on the east bank of the Mississippi river below the city of Baton Rouge, La., to a point on the bank of the same river above the city of New Orleans, about 90 miles. The directors include: Edward Godschauk, Charles Godschauk, Edward Sarpy, F. E. Larue and Emile Godschauk.

MISSISSIPPI ROADS.—Incorporation asked for by a company with capital of $1,000,000, to build a lumber railroad 20 miles long from timber lands to the town of Mehan. C. S. Horton, S. B. Davidge, A. D. Hermance and Carl Herdic, of Williamsport, Pa., are interested.

MISSISSIPPI VALLEY & GULF.—Incorporated in Oklahoma, with capital of $50,000,000. Headquarters at Guthrie, Okla. T., and at Chicago, Ill. It is proposed to build from Keokuk, Ia., southwest through Missouri to a point on the Arkansas river in Arkansas. The incorporators include: E. L. Cochanour and S. S. Cochanour, of Keokuk; G. P. Dalton, of Muscatine; G. A. Mason and T. Rockenfeller, of Chicago, and H. W. Pentecost and I. M. Louden, of Guthrie.

MISSOURI, ARKANSAS & SOUTHERN.—Chartered in Arkansas to build a road from the Arkansas state line through Green, Lawrence, Sharp and Independence Counties to Batesville, 70 miles. The directors include: Robert W. Earnhart, N. E. Duffy and Lyman F. Reeder.

MISSOURI, KANSAS & TEXAS.—Surveys reported for an extension from Mineral, Kan., to Pittsburg, connecting at Mineral with the Parsons-Joplin branch. Would give the M., K. & T. connection with the coal fields around Pittsburg and an entrance into that city.

——Extension from Colmesneil, Tex., to Doucette, 10 miles. Said to be under consideration.

——New terminal yard at Kansas City. To have 14 tracks, each 3,000 ft. long. A 10 stall brick roundhouse will also be built.

See Granger, Georgetown, Austin & San Antonio.

See St. Louis, El Reno & Western.

*MISSOURI, OKLAHOMA & GULF.—This company, which operates a line 75 miles long from Wagoner, Ind. T., south to Dustin, has let a contract for the grading and bridge work to J. W. Hoffman & Co., of Kansas City, Mo., on an extension of the road from Wagoner, its present northern terminus, north to Afton, 70 miles. The work will not be difficult. Maximum curvature will be 4 degrees. Includes building four steel bridges and 2,000 ft. of trestle. The road is projected to extend north to Pittsburg, Kan., with a branch east to Joplin, Mo., on the northern end, a branch from Henryetta west to Oklahoma City, Ind. T., and a branch from Dustin south to Guertie, where it is to divide into three sections, the western one to extend to Rhome, Tex., where connection can be made with the Fort Worth & Denver City; the central branch to Denison, Tex., and the eastern branch to Rodessa, La.

*MISSOURI PACIFIC. Contracts let to C. D. Smith & Co., of Memphis, and to Scott & Sons, of St. Louis, for double tracking 25 miles on the St. Louis, Iron Mountains & Southern. The main line is to be double tracked seven miles north and eight miles south of Little Rock, and ten miles north of Texarkana. The work south of Little Rock will be heavy, necessitating the removal of about 50,000 cu. yds. of rock and about 500,000 cu. yds. of earth. A contract has also been given to Smith & Co. for making yards and other betterment work at Paragould and Helena, Ark., and other places. The work includes a yard at Lexa.

——No authority has yet been given for the proposed extension of this road from Atchison, Kan., to St. Joseph, Mo. The company has bought land in the city of St. Joseph for freight terminal facilities, which will be improved as required. The Missouri Pacific now runs trains over the Burlington tracks between Atchison and St. Joseph.

——Surveys being made for a branch from Joplin, Mo., southwest to Muskogee, Ind. T., 120 miles; also to be preparing to build the St. Louis cut-off from Lamar, Mo., northeasterly to a point on the St. Louis & Kansas City line. Neither have yet been authorized.

—See St. Louis, Iron Mountain & Southern.

See Springfield Southwestern.

*MISSOURI RIVER & NORTHWESTERN.—This company is building a line from Rapid City, S. Dak., via Scotts Mill, McGee's Mill, Big Bend, Placerville, Elkhorn, Silver City and Canyon City to Mystic, S. Dak., 33.6 miles. S. R. H. Robinson, of St. Louis, has the contract for part of the work. Grading completed for 19 miles and track laid for 22.1 miles on a section of the road not included in the above contract. Francis C. Tucker is Chief Engineer.

MISSOURI ROADS.—Surveys are to be made by Charles A. Gallagher, of Kansas City, for a railroad from a point south of Sedalia, Mo., north via Marshall and Miami, to Saline County, and on toward Iowa, altogether about 68 miles. Such a line would require a bridge over the Missouri river at Miami.

MISSOURI VALLEY (Electric).—A syndicate has been formed by Thomas Nevins & Son, of New York, and Denison Prior & Co., of Cleveland, with capital of $5,000,000, to build a high-speed electric railroad to carry freight and passengers from Kansas City, Mo., to St. Joseph, Mo., with branches to Leavenworth and Atchison, Kan. The work includes a bridge over the Missouri river. Entrance will be made into Kansas City over the tracks of the Metropolitan Street Railway. The board of directors include G. B. Blanchard, Charles P. Breen, George B. Tuggle, S. Facker, Wilson McAfee and Howard McAfee, all of Parkville, Mo.

*MOBILE & OHIO.—Contract reported let for building an extension of the Calhoun City branch from a point 10 miles west of Vardaman, Miss., the present terminus, to Calhoun City. Rights of way for two miles already secured.

MOBILE & WEST ALABAMA.—This company has completed location surveys for its line from Mobile, Ala., to Florence, and also a branch into Birmingham, and holds options on lands for terminals in Mobile, Birmingham, Tuscaloosa, Demopolis and Florence. Rights of way have been secured from Mobile to Demopolis. The company controls the Dauphin Island Dock & Railway Company's lines and property, including all of the Big and Little Dauphin Islands, except such land as is occupied by the United States Government. The road will have a maximum grade of 0.6 per cent. and maximum curvature of 6 degrees. A heavy traffic is expected in coal, pig iron, coke and export freight. From Tuscaloosa the grade is light, but there are some deep cuts. There will be several long trestles. Above Tuscaloosa the work is heavy, with rock cuts, several tunnels and several high viaducts.

MOBILE, JACKSON & KANSAS CITY.—This road, which has been completed from Mobile north to Middletown, Tenn., 367 miles, will eventually be extended north to Jackson, Tenn., 41 miles beyond Middletown.

——Financial arrangements reported completed for building a branch from a point on the main line near Montrose, in Jasper County, northeast to Meridian, Miss., 30 miles, also a branch projected northwesterly from Meridian to a point on the main line at Philadelphia, Neshoba County, Miss., about 35 miles.

*MONONGAHELA SOUTHERN. Grading is under way from Duquesne, Pa., via Thompson Run Valley to Mifflin yard and connection to the Wabash, about seven miles. The company is building four miles with its own forces, and Patrick Foley, Pittsburg, the remaining three miles. J. B. McIntyre, Pittsburg, is Engineer of Construction.

MONROE & LAKE PROVIDENCE. Proposed line from Monroe, La., to Lake Providence, 60 miles. Preliminary surveys reported finished. A. A. Gunby, Monroe, La., is President, and E. J. Hemley, Lake Providence, La., Vice President. (Mar. 17, 1905.)

*MONROE & NORTHAMPTON (Electric). Proposed electric road from Stroudsburg, Pa., through Delaware Water Gap, North Bangor and Roseta to Bangor, 15 miles. Contracts reported let. R. F. Schaeffer, Bangor, Pa., is President, and William McLean, Philadelphia, Chief Engineer.

*MONROE & SOUTHWESTERN. Work in progress on this proposed railroad from Monroe, La., southwest through Winfield to Natchitoches, about 85 miles. Track laid for a distance of 16 miles out of Monroe and 37 miles more under construction. L. N. Polk, Monroe, La., is Chief Engineer.

MONTANA NORTHERN. Work reported begun on a railroad to extend from Basin, Mont., to Kalispell, 200 miles. Marcus L. Hewitt, of Basin, is interested.

MOREHEAD & NORTH FORK. Incorporated in New Jersey, to build from Morehead, Ky., west to north fork of Licking river, about 14 miles. Includes one tunnel. E. W. Hass, of Clearfield, Pa., is Chief Engineer.

MORGANFIELD & ATLANTA. Projected new line from Morganfield, Ky., south to Providence, about 28 miles. Surveys completed and rights of way secured for most of the route. T. B. Young is President, and W. W. Olney, Chief Engineer, Morganfield, Ky.

*MORGAN'S LOUISIANA & TEXAS (SOUTHERN PACIFIC). Surveys have been completed by this company for a line from Baton Rouge, La., southwest to Lafayette, 53 miles, for which bids were recently let. Grading has been completed for about one mile at Lafayette and for one-half mile at Port Allen. The work includes building seven or eight bridges, the largest of which will be at the Chafalaya river. This is to have a 300 ft. draw span and a 200-ft. fixed span.

——Surveys also completed for an extension from Arnaudville, La., north to Port Barre, 12 miles. Rights of way being secured.

MORGANTOWN & DUNKARD VALLEY (Electric). Incorporated in West Virginia with $300,000 capital, to build from Morgantown, in Monongalia County, W. Va., west to Wadestown, 30 miles, and 12 miles south from this point to Mannington. W. W. Smith and George G. Johnson, of Morgantown, are interested.

*MORGANTOWN & KINGWOOD. This company, which operates 18 miles of road in West Virginia, has commenced work on an extension from Reedsville via Kingwood to Rowlesburg, 31 miles. Contracts for grading have been let to H. Renick, of Kingwood and to Talbott Bros., of Rowelsburg, and to Crawford & Lewis, of Albrights, for the tunnel work. Contracts are let in sections, the three sections being from Reedsville to Kingwood (12 miles), Kingwood to Trowbridge Ferry (10 miles), and Trowbridge Ferry to Rowlesburg (nine miles). Grading completed from Reedsville to Kingwood, 12 miles, and 10 miles of track laid on this section. The work includes building a girder bridge over the Cheat river and one tunnel 500 ft. long. F. K. Bretz, Morgantown, W. Va., is General Manager, and Julius K. Monroe, Chief Engineer, Kingwood.

MOUNT AIRY & EASTERN. This company has made preliminary surveys from Dam river to Stuart, 10 miles, but has not yet decided to build. S. A. White, Stuart, Va., is Chief Engineer.

MOUNT HOOD.—This company, incorporated in Utah, with a capital of $250,000, has completed grading on its proposed road from Hood River, Ore., to Dee, 18 miles. Track has been laid from Hood River to Odell, nine miles. The balance of the road will be pushed to completion. W. H. Eccles, Hood River, is President.

*MUNISING RAILWAY. This company has been granted authority to extend its main line west from Little Lake, in Marquette County, Mich., the terminus of a 10-mile branch, to Princeton Mine, about eight miles. Work is now under way, and the line will probably be ready for operation by June.

MUSKOGEE & TEXAS. Chartered in Oklahoma, with $4,000,000 capital, to build from Cushing, Okla. T., east through Payne County and the Creek Nation to Muskogee, thence south through the Choctaw Nation to Honey Grove, Fannin County, Tex., 250 miles. The incorporators include: Horace Speed and Thomas J. Low, of Guthrie; W. Eaton, H. G. Baker and N. R. Maskell, of Muskogee.

N

*NACOGDOCHES & SOUTHEASTERN. In operation from Hayward, Tex., to Woden, 11 miles. Extensions from Woden to Oil City, 4 miles, and from Hayward to Nacogdoches, under construction. W. H. Kimball, Nacogdoches, Tex., is Chief Engineer.

NAPA & LAKEPORT (Electric). Proposed electric railroad from Napa, Cal., north through Napa, Conn, Chiles and Pope valleys via Middletown and Kelseyville, in Lake County, to Lakeport, about 75 miles. Contract for grading and tracklaying will be let this summer, when the final survey and location of the line has been completed. About 12 miles of the work will be heavy. There will be one tunnel of 2,200 ft., one of 1,200 ft. and two of 500 ft. each. C. H. Miller, 209 Union Trust Building, San Francisco, is Chief Engineer.

NASHVILLE & HOPKINSVILLE INTERURBAN —Proposed railroad from Nashville, Tenn., north to Hopkinsville, Ky., 78 miles. The company is considering the use of gasolene motor cars for passenger and freight service. F. L. DeMarco, Sheffield, Ala., is interested, and P. H. Hall, of Chicago, is Chief Engineer.

OLIVER IRON & STEEL COMPANY

MANUFACTURERS OF

Bolts—all kinds, Nuts, Washers, Lag Screws, Rivets, Screw Railroad Track Spikes, Boat Spikes, Tie Rods, Upset Rods, Loop Rods, Track Tools, Tie Plates, Anti-creeper Device, Knuckle Pins, Air Brake Pins, Drift Pins, Drop Forgings, Car Forgings, Joist Hangers, Ladder Rungs, Bar Iron and Bar Steel.
W. U. Tel. Co.'s Steel Insulator Pins.
Telegraph and Telephone Pole Line Material.

PITTSBURGH, U. S. A.

ALABAMA FROG & SWITCH COMPANY

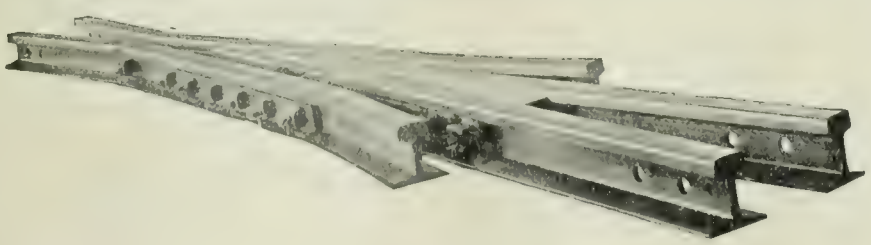
ANNISTON, ALA.

Manufacturers of

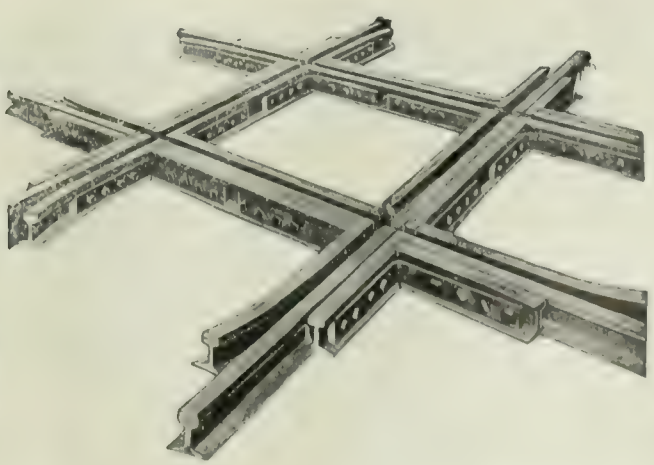
RAILROAD CROSSINGS FROGS and SWITCHES

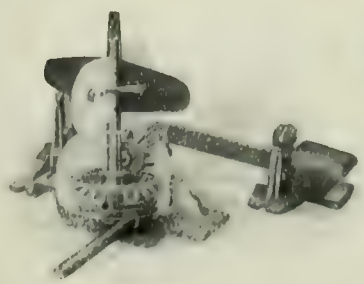
and Special Work of Every Description for Steam and Street Railways

The Indianapolis Switch & Frog Co., Springfield, Ohio, manufacturers of only High-Grade Track Work, in use wherever highest efficiency is required; highest in quality, design and efficiency. Frogs, Switches, Crossings and General Track Accessories.









NASHVILLE & HUNTSVILLE (Electric).—Proposed electric line from Meridian Tenn. through Nassville, Tenn., and Huntsville, Ala., and Montgomery, Ala. to Pensacola, Fla. Grading will soon be started on the first division, north of Nashville, and on the second division, south of Huntsville. J. H. Conner is President.

NASHVILLE & NORTHEASTERN.—See Cumberland River & Nashville.

NASHVILLE, CHATTANOOGA & ST. LOUIS.—This company is reported to be making preliminary surveys to build a line in Tennessee to the Tryon Ridge coal fields.

*This company has bought 12 acres of land five miles north of Atlanta, Ga., for a new yard. Grading completed, but no track laid.

NASHVILLE INTERURBAN.—This company is considering the question of using gasoline as motive power. The proposed line is to run from Nasvarlee, Tenn., south through Brentwood to Franklin, about 21 miles. Construction work was to begin last year. The work is very easy, the maximum grades in the city being 5 per cent and out of the city 2 per cent., with a maximum curvature of 10 deg. outside of the city. There will be one steel or concrete steel bridge over the Harpeth river at Franklin. Major E. B. Stahlman is President, and Charles S. Brown, Chief Engineer, Nashville, Tenn.

NATCHEZ & WESTERN.—Surveys in progress for an extension from the Black River, La., to a point near Alexandria, 75 miles. (Mar. 17, 1905.)

*NATCHEZ, COLUMBIA & MOBILE.—This company, which last year extended its road from Roonville, Miss., northeast two miles, is building an additional seven miles from the present terminus. R. B. Butterfield, Northfield, Mass., is General Manager.

NAUGATUCK VALLEY (Electric).—This company, which proposes to build an electric railroad from Naugatuck, Conn., via Beacon Falls to Seymour, 10 miles, has given a contract to C. W. Blakesley & Sons, of New Haven, for building from Naugatuck to Beacon Falls, five miles. Additional contracts will soon be let for completing the road from Beacon Falls to Seymour. W. G. Smith, Waterbury, Conn., is Chief Engineer.

NAVY, COAL, HARBOR & RAILROAD COMPANY.—Incorporated in Alabama to build a railroad from Foleytown Station to deep water at Fort Morgan, Ala. Connection will be made with the Bay Minette & Fort Morgan branch of the Louisville & Nashville. The incorporators include: Charles Barclay, T. C. Hand and W. C. Dinwiddie.

NEEDLES, SEARCHLIGHT & NORTHERN.—Under this name a railroad is to be built from Ibex, Cal., on the main line of the Atchison, Topeka & Santa Fe, to the mining district at Searchlight and Eldorado Canyon, Nev., about 23 miles.

***NEVADA NORTHERN.—Incorporated to build a railroad from Cobre, Nev., a point 140 miles west of Ogden, Utah, on the south, to Ely, 138 miles. Has let the contract to the Utah Construction Co., of Ogden, Utah, for the entire road. Grading finished for 70 miles and track laid for 19 miles. The road is being built by the Nevada Consolidated Copper Company, of San Francisco, to carry ore from the mines at Ely. Maximum grade 0.7 per cent. and maximum curvature 6 degrees. The company is also planning to build 10 miles of road connecting the mines with the smelter. This work will be much heavier than that on the main line. It is expected to have the road completed about May 1, and the branch to the mines about July 1. The cost of the road will be about $2,000,000. C. B. Beatty is Superintendent, and A. Judell, Chief Engineer.**

NEWARK & HACKENSACK RIVER (Electric).—Incorporated in New Jersey, with capital of $1,000,000, and headquarters at 763 Broad street, Newark, to build an electric railroad from Park Place, Newark, to the Hackensack river. The incorporators include: T. N. McCarter, Rumson, N. J.; C. A. Sterling, East Orange; A. H. Charlton, Elizabeth; J. J. Burleigh, Merchantville; A. R. Kuser, Bernardsville; T. C. Barr, Orange, and M. T. Cox, East Orange. The Jersey City & Hackensack River Railway Company, also incorporated with a capital of $1,000,000 by the same men, is to continue the line of the above company from that point to the intersection of Erie and Fourteenth streets, Jersey City, where it is to connect with the proposed line of the Interstate Tunnel Railway Company, which in turn is to construct the tunnel to the middle of the North River, connecting with the affiliated company incorporated in New York State. The approximate length of the two lines will be 7½ miles.

***NEW HOME VALLEY.—The proposed route of this road is from New Hill, N. C., to a point near Chapped Hill, about 20 miles. Contract for building the first three miles let to Ferrel & Noe, of Pittsboro, N. C. William Montcure, Raleigh, N. C., is President. (Mar. 17, 1905.)**

NEW JERSEY ROADS (Electric).—Plans are being made by a number of Essex County capitalists to build electric roads from Millville, paralleling the West Jersey & Seashore, through Port Elizabeth, Dorchester, Leesburg, Delmont, Eldora, Dennison, Seaville and Oceanview to Sea Isle City, with a branch from Dennisville to Goshen, Cape May Court House, Green Creek, Bennett and Cape May City; also for a road from Millville to Mauricetown, Haleyville, Dividing Creek and Port Norris.

Chicago capitalists have completed negotiations with William J. Thompson, of Gloucester City, for right of way, said to be owned by him, for a railroad from Gloucester City to Atlantic City, N. J. The cost of building between these places would be about $6,000,000.

***NEW JERSEY SHORT LINE (Electric).—This company, organized in New Jersey to build an electric railroad from Milltown to Elizabethport, 19 miles, has given a contract to the Schuylkill Stone Co., Philadelphia, Pa., for building the section of its road from Elizabethport to Mc Lean. The work includes eight steel bridges. Additional contracts will shortly be let for 5 and 10 and 50 bridges. Richard Ashbridge, Wetzel Building, New Brunswick, N. J., is Chief Engineer.**

NEW MEXICO RAILWAY & COAL COMPANY.—The plans of this company, according to its last yearly statement include an expenditure of $1,000,000 for improvements on its roads, also for building large shops at El Paso, Tex., at a cost of $500,000.

***NEW ORLEANS GREAT NORTHERN.—This road, which is being built by the Goodyear Syndicate, of Buffalo, N. Y., from Slidell, La., north through the valley of the Pearl river to Monticello, Miss., about 100 miles, has 49 miles in operation, including a 12-mile branch. W. J. Oliver, of Knoxville, Tenn., is the contractor. Connection is to be made with the New Orleans & Northeastern at Slidell. Frank H. Goodyear is President, and N. G. Pearsall, Covington, La., General Manager.**

***NEW ORLEANS TERMINAL.—Work under way by the St. Louis & San Francisco and the Southern Railway for the proposed joint terminal in New Orleans. The whole work will involve an expenditure of about $8,000,000. J. F. Hinckley, St. Louis, Mo., is Chief Engineer. James Stewart & Co., Pittsburg, Pa., contractors.**

***NEW PARK & FAWN GROVE.—This company, organized last year in Pennsylvania to build an extension of the Stewardstown railroad from Stewardstown via New Park to Fawn Grove, nine miles, has let the contract to John H. Dobbling, of York, Pa. Grading has been completed from Stewartstown for 6.5 miles, and track laid on 5½ miles. The work includes one steel bridge. S. M. Manifold, York, Pa., is Chief Engineer.**

NEWPORT & SPRINGVIEW.—Organized in Nebraska to build from Newport, in Rock County, to Springview, 35 miles. M. F. Harrington, O'Neill, Neb., is President, and E. L. Myers, Newport, Neb., Vice-President. (Mar. 17, 1905.)

NEWTON & NORTHWESTERN.—This company has decided to build an extension from a point on its present line in Webster County, Ia. Negotiations completed to buy the street railroad system of the Fort Dodge Heat, Light & Power Co., and utilize the Fort Dodge lines as an extension to be used for both freight and passenger service, steam to be for freight traffic. The proposed extension will be built from a connection with the existing street railroad tracks at Central avenue and Sixteenth street, Fort Dodge, south, crossing the Chicago Great Western and Illinois Central tracks on overhead bridges to gypsum fields near the Des Moines river. After crossing the river, the road is to be built south to a connection with the main line of the Newton & Northwestern, near the town of Lanyon.

***NEW YORK & JERSEY (Hudson River Tunnel).—This company announces the completion of the second of its twin tunnels under the Hudson river, from the foot of Morton street, Manhattan, to the foot of Fifteenth street, Jersey City. There is much additional work yet to be done, including an extension from the eastern end in Manhattan, northeast to Thirty-fourth street and Sixth avenue. The tunnels will probably not be placed in operation until May, 1907.**

NEW YORK & NORTH JERSEY RAPID TRANSIT.—This company has accepted the franchise granted by the Board of Aldermen of Paterson, N. J., and will buy a private right of way from that place to the Hudson river. Part of the proposed road will be on an elevated structure.

NEW YORK & STAMFORD (Electric).—This company, operating a line from New Rochelle, N. Y., northeast to Port Chester, 14 miles, which is controlled by the New York, New Haven & Hartford, has filed a certificate at White Plains seeking authority to build a line from Port Chester, west to White Plains, five miles. It is proposed to build the new line on private right of way.

***NEW YORK, AUBURN & LANSING.—Work under way on proposed road from Auburn, N. Y., south to Genoa. Rights of way are being secured for an extension from Genoa to Ithaca, a distance of 18 miles additional. The work includes a large overhead bridge at Auburn.**

NEW YORK CANADIAN PACIFIC.—Proposed railroad from New York City to Canada. Application filed at Albany for an extension of corporate existence. Authorized capital, $10,150,000. Proposed road 332 miles long. Verplanck Colvin is President, and George C. Van Tuyl, Treasurer, both of Albany.

***NEW YORK CENTRAL & HUDSON RIVER.—Work is in progress in four tracking the line at various points between Mott Haven Junction and Croton, on the Hudson division, 29 miles. At the junction of the main line of the N. Y. C. & H. R. old Spuyten Duyvil & Port Morris with the New York & Harlem at Mott Haven Junction, there is a large amount of rock cutting on both sides of the present double track. North of Spuyten Duyvil, along the shore of the Hudson, the shore line is being extended out into the river by filling in at available points, and from one to eight additional tracks are being laid west of the present three main tracks. This work includes a new cut-off, about completed, from a point just south of King's Bridge station, west to a point a few hundred yards east of Spuyten Duyvil, which will save nearly a mile in distance and a long and sharp curve.**

—*The new terminal improvements of this company in New York City include the rebuilding of the Grand Central Station and yard; the four tracking of the lines as far as Croton on the Hudson, and North White Plains on the Harlem division; the electrification of these lines and the tracking of the Port Morris branch from Melrose to Port Morris, two miles long. The depression of the new Grand Central yard west of Lexington avenue and between 44th and 50th streets, New York City, is about completed up to the line of the present yard. The Grand Central Palace block, between Lexington avenue and Depew Place and 43d and 44th streets, has been bought, and the Grand Central Palace is to be torn down to provide space for part of the new station building. This terminal improvement work was described in detail in the *Railroad Gazette* of October 20, November 10, November 17 and November 24.

—Surveys made near Brewster, N. Y., for proposed double tracking of the Harlem division. The double track at present extends from New York north as far as Goldens Bridge and is to be extended to Brewster, 8.3 miles. The most difficult work on this section will be between Brewster and Croton Falls, where several large cuts will have to be made and many fills. One bridge will have to be rebuilt. To be completed in about a year.

A bill has passed both houses of the New York State Legislature providing that this company's tracks in Tenth and Eleventh avenues, New York City, shall be removed from the surface of the streets. This would have to be done through condemnation proceedings by the city. It is not yet determined whether the tracks will be elevated or depressed in a subway. The tracks, which are used almost exclusively by freight trains, extend in the middle of the street from 60th street south to St. John's Park, about three miles.

The New York & Ottawa, which was bought by this company, is to be rebuilt to accommodate heavier cars and engines.

Reported purchase of a large plot of ground at West Albany, N. Y., on which to lay from 10 to 15 additional yard tracks.

See Franklin & Clearfield.

NEW YORK CONNECTING.—This company is to build in the interests of the Pennsylvania Railroad a viaduct railroad through Long Island City to the East river at a point opposite Ward's Island, and thence by means of a bridge to pass across Ward's and Randall's Islands to a connection with the New York, New Haven & Hartford. Work delayed by negotiation of terms with the city.

NEW YORK, NEW HAVEN & HARTFORD.—The company is planning to dig a tunnel from the Union Passenger Station in Providence, R. I., under the river to East Providence, where connection will be made with the company's east side lines to Boston, Worcester and Fall River. The cost of the tunnel, which will be about two miles long, will be about $2,000,000.

——*Contract for widening the cut through the city of New Haven, so that it will accommodate four tracks has been let to C. B. Blakeslee & Sons, of New Haven. The distance is 1.65 miles. Work well under way. The contract will involve raising the grades of 12 streets.

——Surveys made for the old Danbury, Ridgefield & Port Chester line, which it is proposed to build if the surveys prove satisfactory. The route is from Danbury, Conn., south to Port Chester, N. Y., about 32 miles. Such a line would reduce the railroad distance between New York and Danbury by about 15 miles.

——*Plans have been drawn up and authorized for the further double-tracking of the Highland division from Waterbury, Conn., northeast to Bristol, 10 miles. Much of the line will be entirely relocated and a new tunnel, 3,500 ft. long built at Pequabuck, Litchfield County. F. M. Smith is Assistant Engineer in charge.

——*The line through Needham, Mass., part of the Midland division, is to be connected at its eastern end with the Providence division by a line to be built from Needham east to Spring street, West Roxbury, 4.35 miles. The cost of the new line will be about $650,000. Contract let to T. Stuart & Son Co., of Newton, Mass. The trains of the Needham line now run over the Boston & Albany, between Newton Highlands and Boston.

——Surveys completed for a cut-off from Yalesville, on the Hartford division, northwest for eight miles to Plantsville, on the Northampton division. By such a line the freight traffic of the Northampton division could reach the Cedar Hill freight yard and thus the yard in the city would be relieved.

——*Contracts to J. W. Daly & Co., of New York, and of Mount isco, and C. W. Blakesley & Sons, of New Haven, for double-tracking a 2.5-mile section of the Highland division between Towners, N. Y., and Danbury, Conn. Nearly completed.

——*The Harlem River branch from Harlem River to New Rochelle, N. Y., at present double track, is being six-tracked. Contract let to New York Contracting & Trucking Co. Four of these tracks will be equipped electrically with the third-rail system. Estimated cost of the entire work on this branch, $7,701,891; $4,825,891 for the roadway and stations, and $2,286,000 for the electrical equipment and apparatus.

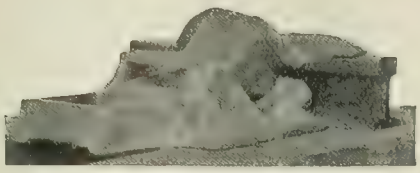
——*Three new four-track bridges on the New York division. In course of erection on Cos Cob, Westport and Naugatuck Junction. Daly & Holbrook, contractors for substructures, and Passaic Steel Co. and Pennsylvania Steel Co. contractors for superstructures. Bridge at Westport finished; at Cos Cob nearly finished; at Naugatuck Junction ready for street work.

——At a recent meeting of the directors of this company it was voted to at once build an electric road from Thomaston, Conn., south to Waterville, eight miles. Surveys made.

NEW YORK, OKLAHOMA & PACIFIC.—Chartered in Arkansas to build from Rogers, Ark., west to Folsom, N. Mex. Capital, $20,000,000. Offices at Alva, Okla. T., and Rogers, Ark. The proposed route is from Rogers to Prior Creek and Claremore, Ind. T., thence through Hominy, Bliss, Lamont, Jefferson, Alva, Beaver City, and Mineral City to Folsom, N. Mex. The proposed road will traverse the coal fields of Indian Territory, the wheat belt of northern Oklahoma, and reach the copper mining section of New Mexico.

***NEW YORK, PENNSYLVANIA & SOUTHWEST-**

HAYES DERAILS



THE LIFTING DERAIL

For operation by Switch Stand or Pipe Line.
Only two pieces.
Easily operated and maintained at all seasons of the year.
The standard derail for interlocking use.



THE PIVOT DERAIL

For hand operation.
Thrown over in a vertical semicircle on to and off of the rail.

HAYES TRACK APPLIANCE COMPANY,

GENEVA, N. Y.

FROGS CROSSINGS

CLEVELAND FROG & CROSSING CO.

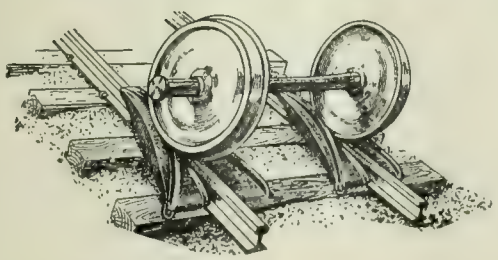
MANUFACTURERS OF

HIGHEST QUALITY TRACK WORK

CLEVELAND, OHIO

SWITCHES SWITCH STANDS

THE JOHNSON CAR REPLACER



The strongest, simplest, safest and most reliable Replacer on earth.
Works on any kind of road bed, including ice, snow, cinders, paving, plank or mud. Requires but one tie, as it is supported by the rails at both ends.

Highest Award on Car Replacers at the Louisiana Purchase Exposition, 1904.

Large numbers in actual use, one road having over 500 pair in actual use. Hosts of testimonials. A record of replacing a completely derailed 192,000-lb. compound engine in one and three-quarter minutes, from commencing to set the frogs until the engine was replaced and frogs removed from rail. Every frog guaranteed in quality and efficiency.

THE JOHNSON WRECKING FROG COMPANY

526 Citizen's Building CLEVELAND, OHIO, U. S. A. JOHN MACKENZIE, Pres.

MORGAN T. JONES, President, Inspecting Engineer.
J. A. FOULKS, C. E., Res. Mgr., New York.
G. W. GREENE, M. E., Res. Mgr., Pittsburg.
E. R. WILSON, M. Am. Soc. C. E. Secretary and Treasurer.

The American Bureau of Inspection and Tests

29 Broadway, New York Monadnock Block, Chicago Heeren Bldg. Pittsburg

INSPECTION OF ALL KINDS OF RAILROAD MATERIALS

LRN. New name of the Binghamton & Southern, which was chartered to build a railroad from Williamsport, Pa., northeast, via Montoursville, Hicks Grove, Camptown, Stevensville, St. Josephs and Vestal, to Binghamton, N. Y., 116 miles. Contracts for building the line let to Rogers & Co., 15 Wall Street, and the Colonial Construction Co., 141 Broadway, New York City. The maximum curvature is to be 8 deg. and the maximum grade 1 per cent. There will be a large number of bridges, one tunnel and one long steel viaduct. D. L. Baxter, 277 Broadway, New York, is General Manager. (Mar. 17, 1905.)

*A subcontract for grading 15 miles of this road from Wyalusing, N. Y., northeast has been let by the original contractors, the Colonial Construction Co., to Allen, Donnelly & Co., of Easton, Pa. (Mar. 17, 1905.)

*NEW YORK PHILADELPHIA (Electric). This company is to build nine miles of electric railroad from Milltown, N. J., to a point south of Metuchen, for which contracts will shortly be let. This is the holding company of the various street railway lines between Camden and Jersey City line. It proposes to build an electric line from Elizabeth to Camden by way of Trenton. The first three miles of the new road from Elizabeth west are nearing completion. Contracts for the section from Metuchen to New Brunswick will be let as soon as the second section is under way.

NEW YORK ROADS (Electric). E. H. Harriman is said to be planning to build a private electric road to his residence at Forest Lake, N. J. It is to run from Newburg Junction, N. Y., on the Erie, through Tuxedo, Arden and the mountains above Greenwood Lake, 10 miles. Work to be commenced early this spring.

*NEW YORK SUBWAYS. Bids for the construction of additional subways in Manhattan were asked for in January. Nineteen rapid transit routes, most of them subways, including three tunnels under the East river, have been laid out by the Rapid Transit Commission and approved by the Board of Estimate, but it does not yet appear which ones are first to be built. On most of the routes the commission has been unable to get the consent of the majority of the property owners, and application will probably be made to the court for authority to go ahead with the work.

—*Work under way at Joralemon street, Brooklyn, on the Manhattan Brooklyn tunnel. The proposed route of this line is from a connection with the existing subway at the intersection of Broadway and Park Row, Manhattan, southward to the Battery, and thence eastward under the East river, and under Joralemon and Fulton streets to the Flatbush Avenue Station of the Long Island R. R., Brooklyn. The entire line must, according to contract, be completed this year.

*NEW YORK, SUSQUEHANNA & WESTERN (ERIE). Contract let to Lesher & Wagner, of Jersey City, for building an extension of the Edgewater & Fort Lee branch. It runs from the western portal of the Bergen Hill tunnel north for one mile. A contract for a further extension of two miles will be let this spring.

*NEW YORK, WESTCHESTER & BOSTON (Electric). This company has been granted permission to build in the Borough of the Bronx, New York City, and work on grading the line has been going on for some time. A contract has been let to James P. McDonald, 42 Broadway, New York City, for building the line from 177th street, New York, northward, to the city boundary, about 4¼ miles. An officer of the company says that the defects in the charter of this road, which was incorporated in 1872, were fully cured by an act passed in 1903. The company has now been authorized by the State Railroad Commission to increase its capital from $1,000,000 to $20,000,000. The necessary right of way through New York City has also been granted. The proposed line is from a point on the Harlem river at 129th street, in New York City, north through West Farms, Westchester, Bay Chester, Pelham Manor, Pelham, New Rochelle, Larchmont, Mamaroneck, Harrison and Rye to Port Chester on the New York-Connecticut state line, with a branch from or near Pelham through Mt. Vernon, Alameda Park, Fairview Park, Tuckahoe, Arthur Manor and Scarsdale to White Plains, N. Y., a total length of 38 miles. A branch is proposed also from West Farms east to Throggs Neck on Long Island Sound. William L. Bull is President, and William A. Pratt, Chief Engineer, 30 Broad street, New York.

NORFOLK & CAROLINA COAST.—New company being formed by a syndicate represented by Rudolph Kleybolte & Co., of New York. Will ask for incorporation in Virginia, with a capital of $15,000,000. It is proposed to acquire about 500,000 acres of timber land in eastern North Carolina and build a railroad from Norfolk in a southern and westerly direction through Elizabeth City, Edenton and Belhaven, N. C., and through the counties of Beaufort, Pamlico, Craven and Carteret, with branches into Hyde and Tyrrell Counties, the southern terminus being at Beaufort, in all about 200 miles.

NORFOLK & WESTERN. This company has work under way which will be completed during 1906 as follows:

*Iaeger & Southern R. R. This road has recently been completed from Lynn, W. Va., up Dry fork of Tug river to coal fields for a distance of 20 miles, and will be extended 4.6 miles.

*Speedwell Extension. This line, recently extended from Cripple Creek, Va., one mile to ore properties, will be extended for an additional five miles.

*Pocahontas & Western will be extended 3.7 miles.

*Blackstone & Lunenberg will be extended 5.75 miles.

Contracts reported let for double tracking 18 miles from Montvale, Va., to Lowery to the following contractors: Quinn & Harmon, Philadelphia; Moran Phelon Contract Company, Pittsburg; Vaughn Construction Company, Roanoke, Va.; J. F. McCabe Company, Baltimore, and E. G. Nave Brothers, of Portsmouth, O.

NORMAN'S SOUTHEASTERN.—Incorporation asked for in Missouri, with a capital of $120,000, to build a railroad 12 miles long in Stoddard County. The incorporators include: W. W. Norman, S. A. Ruch and C. A. Vernon, of Huntsville.

NORTH CAROLINA & OHIO. Chartered in North Carolina to build from Raleigh, N. C., east through Wilson and Greenville to Washington, approximately 90 miles. The directors include: C. O. Haines and Adam Tredwell, of Virginia; John S. Cunningham, Steven C. Bragaw, L. J. Moore, C. M. Brown and W. Bragaw, of North Carolina.

NORTH CAROLINA CONNECTING.—Incorporated in North Carolina, with capital of $450,000, to build from Springhope, on the Atlantic Coast line, northwest to Roxboro, about 60 miles; also to build branches. The incorporators include: D. W. Gunn, of Roanoke, La.; D. J. Nysewander and S. P. Douglas, of Toledo, O.; T. F. Whittlesy, of Mobile, Ala.; W. H. Hood and H. H. Hood, of Henderson.

NORTH CAROLINA ROADS.—Henry C. Bridgers, of Tarboro, N. C., writes us that he is in the market for spikes, switches, steam shovels, angle bars, grading outfit, scrapers, etc., for building a proposed railroad from Farmville, N. C., 15 miles into Green County.

NORTH COAST. This company, incorporated in the state of Washington, with capital of $1,000,000, is said to have completed surveys for its proposed road, which is to run from Seattle to Wallula. The survey follows the Cowlitz Valley southeast of Tacoma and runs up the valley through Cowlitz Pass and along the Teton river to North Yakima. From that point it has not yet been determined which survey will be adopted. This may be a project of the Northern Pacific to secure a route through Naches Pass. The incorporators include: F. B. Dudley, of Niagara Falls, N. Y.; R. E. Strahorn, of Spokane; J. A. Kerr and John H. McGraw, of Seattle, and O. A. Fechter and J. J. Rudkin, of North Yakima.

*NORTHEASTERN TEXAS.—Work under way on the remaining 40 miles of this road between Red Water, Tex., and Texarkana. The line is completed for 14 miles from Red Water south to Daingerfield. It is intended ultimately to extend the line to Houston or Galveston. G. Munz, Red Water, Tex., is President, and R. E. Gray is Chief Engineer.

NORTHEASTERN CUBA.—See Cuba Eastern.

*NORTHERN ELECTRIC COMPANY.—To the 26 miles of standard gage road in course of construction by this company, from Chico to Oroville, Cal., will be added lines from Marysville to Meridian, and from Yuba City to Live Oak. The street railway lines at Marysville has been bought, and will be rebuilt at once as an electric road. The new articles of incorporation filed by the Northern Electric give Reno, Nev., as the principal place of business. The capital stock has been increased from $3,000,000 to $6,000,000. Henry A. Butters is President and F. A. Ross, Superintendent.

NORTHERN INDIANA (Electric).—Under this name the South Bend & Southern Michigan will build an electric line from South Bend, Ind., to Laporte, 27 miles. Six miles of the road has been built to Chain Lake and grading will be started on the balance of the line early this spring.

NORTHERN MICHIGAN.—Projected line between St. Ignace, in Mackinac County, Mich., and Sault Ste. Marie, in Chippewa County, 50 miles. Projected. A. S. Robinson is Chief Engineer.

NORTHERN NEW MEXICO & GULF. Incorporated in New Mexico with $300,000 capital, and headquarters at Elrito, Arriba County, to build from the Santa Fe Central at Santa Fe northwest toward Arizona. The proposed road will cross the Tesque Pueblo grant, follow the Rio Grande north from San Ildefonso and Santa Cruz by way of Santa Clara, and thence across the Rio Grande to Espanola. It will then follow the Chama river west and the Gallinas river into Sandoval County, and thence across the Canyon Largo into San Juan County via Fruitland, to the New Mexico-Arizona boundary, with a branch line to Farmington, Aztec and Durango, Colo. The incorporators include: William H. Coe, of New York; E. B. Miller, of El Rito; F. E. Coe, of Denver; G. H. Howard, of Santa Fe, and G. V. Howard, of Boulder, Colo.

NORTHERN PACIFIC.—Western papers report that this company controls the North Yakima & Valley Railroad, and that it will build a short line from its main line at North Yakima, Wash., to Tacoma, reducing the curvature and grades.

This company, it is said, has finally decided to build a cut off from Lind, in Adams County, Wash., west for about 100 miles to Ellensburg. This would shorten the distance between these two points over the present route by about 90 miles, the distance on the present line being 190 miles.

*Contract let by this company to Donald Grant, of Faribault, for building the first 15 miles of its proposed extension from Denhoff, N. Dak., west to Coalharbor, in McLean County, 54 miles; 27.85 miles completed last year.

—*Contracts reported let to Porter Brothers & Walsh, of Spokane, Wash., for extending its line from Culdesac, Idaho, southeast through a rich agricultural section bounded by the Snake, Clearwater and Salmon rivers, to Grangeville, about 55 miles. It is expected to have the line completed by the first of next year.

This company is to build a new short line from Washburn, Wis., to connect with the main line at Omaha Junction, about nine miles from Washburn. The company already has a line to that city, but the grades are so steep that the new line is to be built.

It is reported that this company will build a branch from Detroit, on its main line, to Bemidji, 60 miles.

A certificate has been filed in the State of Washington providing for a line in the Yakima Valley, from Toppenish to Mabton, Wash., about 20 miles.

Extension of the McHenry branch from McHenry, N. Dak., through the Fort Totten Indian Reservation to Oberlin, 40 miles, connecting at that point with a branch to Esmond. Projected.

See Portland & Seattle.

NORTH MISSISSIPPI & BAY SPRINGS. Application made in Mississippi for a charter to build a railroad from Burnsville, in Tishomingo County, south to the Itawamba County line, about 30 miles, connection to be made at Burnside with the Southern Railway. Incorporators include: F. J. Ozanne and E. B. Causey, all of Memphis, Tenn.

*NORTH YAKIMA & VALLEY. A contract has been let by this company to Allen & Mathieson for grading part of its proposed road through Naches Pass, in the Yakima Valley. George Donald, of North Yakima, Wash., is interested.

NORWAY & WESTERN. Incorporated in Maine, with capital of $150,000, to build from Norway, Me., to East Stoneham, and also from Norway to South Waterford, a total distance of 21 miles. The directors include: J. Bartlett, of Stoneham; L. S. Burnham, of Albany; W. G. Rand, of Boston; F. H. Noyes, of Norway, and W. H. Kilgore, of North Waterford.

*NUECES VALLEY, RIO GRANDE & MEXICO. This company, which is building a road from Carrizo Springs, Tex., via Darlington to Del Rio, 123 miles, is also planning to build a branch line to Aransas Pass, about 170 miles. Contract let to Ward & Lee, of Palestine, for building the first 20 miles. The company has a capital of $300,000, and W. A. Squires, Carrizo Springs, Tex., is General Manager.

O

OAKDALE WESTERN. Proposed road between Riverband, Cal., and Oakdale, six miles. The line will eventually be extended to Modesto, and will connect the Atchison, Topeka & Santa Fe with the Sierra Railway. W. F. Beard & Co. are the contractors. C. A. Morse, 611 Conservative Life Building, Los Angeles, Cal., is Acting Chief Engineer.

OAK GROVE AND GEORGETOWN. Organized in Alabama, to build from Oak Grove, Ala., northwest to Leaksville, Miss., 30 miles. M. L. Davis, Oak Grove, and J. W. Whiting, Mobile, Ala., are interested. (Mar. 17, 1905.)

OAKLAND, CHARLESTON & WESTERN.—Proposed road from Oakland, Miss., on the Illinois Central, southwest to Charleston, 12 miles. The offices of the company will be at Charleston. J. H. Larimer, Ingalls Building, Indianapolis, is President, and Butler Smith is Chief Engineer. (Mar. 17, 1905.)

OCEAN SHORE (Electric).—Incorporated in California with capital of $3,000,000, to build an electric road from the Bay of San Francisco to Santa Cruz and Monterey. Rights of way are being secured. Application made to the Board of Supervisors of San Francisco for a 50-year franchise for entrance through the streets of that city. Walter E. Dean is President, and Burke Corbert, Secretary and Treasurer.

OCEAN VIEW AND PINE BEACH.—Incorporated in Virginia with capital of $25,000, and offices at Norfolk, Va. H. L. Page is President; B. W. Leigh, Vice-President; and M. C. Elliott, Secretary and Treasurer.

OCILLA, PINEBLOOM & VALDOSTA.—New railroad chartered in Georgia with capital of $200,000. Construction work will be commenced at the terminus of the Douglas, Augusta & Gulf (formerly the Wadley & Mt. Vernon Extension) at the Satilla river, running through Willacoochee and Pinebloom in Coffee County, and thence through Nashville to Adel, Berrien County, about 40 miles. The principal office of the company will be at Pinebloom. B. B. Gray and others of Coffee County are incorporators.

OCONEE COUNTY.—Application made in South Carolina for authority to build from Westminster, on the Southern Railway, south to Fair Play, 12 miles. The incorporators include: W. P. Anderson and William Bibb, of Westminster; A. W. Shelor, of Walhalla; J. J. Halley and L. A. Edwards, of Oakway; J. R. Heller, of Fair Play; and J. W. Shirley, of Townville.

OGDEN & NORTHWESTERN.—Incorporated in Utah to build from Ogden to Brigham City, 20 miles. David Eccles is President, and H. H. Spencer, Vice-President, both of Ogden, Utah.

*OGLESBY & GRANVILLE.—Contract reported let to the Gentry Construction Co., of Chicago, for building its proposed road from Oglesby, in La Salle County, Ill., west to Granville, Putnam County, 12 miles. Grading begun. S. T. Crapo, Chicago, is President, and D. C. Dunlock, Granville, Ill., is Chief Engineer.

OHIO & MARSHALL.—Plans filed for proposed road through Ohio and Marshall Counties, W. Va., from Wheeling, east of the tracks of the Baltimore & Ohio, east through Mount de Chantal, along the creek to Elm Grove, thence up Big Wheeling, over to Ten-Mile creek, and through Vida to Waynesburg, Pa., about 40 miles. J. V. Thompson, of Uniontown, who is building a road from that place west to Waynesburg, and who owns large coal fields in that section, is interested in the company.

OHIO, KNOXVILLE & PORT ROYAL. Under this name, a consolidation of the Ohio River, Anderson & Tidewater, the Western Carolina and the Ohio, Knoxville & Port Royal has been made in South Carolina to build a railroad under the privileges held by these three companies from some point east to a terminus at Port Royal, S. C. Albert R. Martin, of Chicago, is President; F. A. Johnson, First Vice-President and

General Manager; and J. E. Breazeale, Secretary.

OHIO RIVER & COLUMBUS.—Proposed extension from Ripley, Ohio, to Maysville, Ky., 10 miles. No further developments to report at this time.

OHIO RIVER & GULF. Surveys made for this proposed road and five miles permanently located. The route is from Johnson Stand, Tenn., on the Southern (old Tenn. Central), north to Jamestown, 34 miles, through a territory containing timber, coal and oil. It is proposed eventually to extend the road north to the Ohio river near Louisville. The work includes one bridge. William Cooper, of Maryland, Tenn., is President, and J. E. Jones, of Monterey, Tenn., Secretary and Treasurer. Major R. J. Moscrep, of Maryland, Tenn., is the engineer in charge of the work.

OHIO RIVER NORTHERN. Chartered in Ohio with capital of $50,000 to build from East Liverpool to Lisbon, Columbia County, 21 miles. The incorporators include: John C. Wallace, Alfred T. Kelley, J. N. Vodrey, G. W. Clark and D. M. McLane.

OKANOGAN CENTRAL. Incorporated in the State of Washington, with capital of $2,000,000, to build railroads. The directors include: Frank Grogan, J. S. Jurey, W. R. Bell, J. J. McCafferty and M. G. Riley. Office at Loomis, Wash.

*OKLAHOMA & CHEROKEE CENTRAL.—Contract let to Maney Bros., of Oklahoma City, for building the first 14 miles of this proposed road from Chelsea to the Verdegris river. It is to eventually be extended to Pryor Creek via Bartlesville, Ind. T., in all about 60 miles. G. M. Green and C. R. Havighorst, of Guthrie, Okla. T., are interested.

*OKLAHOMA & NORTHWESTERN. This proposed road is to run from Elk City, Okla. T., to a point in Beaver County, about 100 miles. Grading begun by the company from Doxey, Okla. T., northwesterly for about 75 miles and track laying will be commenced early this spring. E. E. Niess, 171 La Salle street, Chicago, is President, and Henry Jarvis & Co., Chicago, are the engineers.

OKLAHOMA & TEXAS. Incorporated with capital of $5,000,000 to build a line from Oklahoma City to Wichita Falls, Tex., about 200 miles. Bridges will be built over the South Canadian river near Tuttle, Ind. T., over the Wichita river near Lindsay, Ind. T., where a right of way has been granted for 10 miles through that town, and over the Red river north of Henrietta. Surveys completed and contracts to be let soon.

*OKLAHOMA CENTRAL.- This road, which was formerly the Canadian Valley & Western, has commenced grading on its proposed road from Lehigh to Chickasha, Ind. T. A contract has been given to the Canadian Valley Construction Co., of Lehigh. Other contracts reported let as follows: M. B. Ryan, of Shawnee, Okla. T., all the bridges, trestles and culverts; E. N. Taylor, of Atoka, Ind. T., 400,000 ties and pilings; Walls, Hale & Crain, for grading the first 11 miles out of Lehigh; A. B. McKinley, all bridges and timber for the first three miles; and to the Wisconsin Bridge & Iron Co., Chicago, for building a steel bridge 86 ft. long over Leader Creek. The line is practically level, with 4 deg. of maximum curvature. The work includes seven girder bridges. R. L. McWillie, of Lehigh, Ind. T., is Chief Engineer. W. J. Terry, of Ada, Ind. T., will have charge of the work.

OKLAHOMA CITY, DENVER & GULF.—Incorporated in Oklahoma with capital of $19,425,000 to build from Shreveport, La., through Texas, the Choctaw, Chickasha and Seminole Nations in Indian Territory, and through Pottawatomie, Cleveland, Oklahoma, Canadian, Logan, Kingfisher, Blaine, Custer, Dewey, Woods, Day, Woodward and Beaver Counties in Oklahoma; thence to Denver, in all about 777 miles. The directors include: C. G. Jones, J. L. Wilken, E. Overholser, G. W. Carle and H. J. Edwards, all of Oklahoma City.

OKLAHOMA CITY, HENRYETTA & ST. LOUIS. This company, which was granted a charter with a capital of $3,000,000 in Oklahoma City, has filed a mortgage for $6,000,000 to secure funds to build its proposed line from Woodward, Oklahoma, southeast to Oklahoma City, thence east of Henryetta and Checotah, in the Creek Nation, about 280 miles. The incorporators include: H. W. Clergen, J. H. Wheeler, J. W. Shartel, J. W. Pryer and J. H. Dibble, all of Oklahoma City.

*OKLAHOMA CITY, LEXINGTON & SULPHUR SPRINGS (Electric).—Projected electric railroad from Davis, Ind. Ter., northward, crossing the South Canadian river at Redbank Crossing, five miles south of Lexington, thence north through Lexington to Oklahoma City, Ind. T., about 80 miles. Contract reported let to the Lovejoy Construction Co. for building the first 11 miles, to be completed during the present year. Chief Engineer Guy McGuire is quoted as saying that work will shortly be under way on the entire line. The work includes a steel bridge about 3,000 ft. long over the South Canadian river. (See Oklahoma Interurban.)

OKLAHOMA CITY TERMINAL. Chartered in Oklahoma to build a terminal railroad from a point two miles northwest of Oklahoma City through the city to South Oklahoma, about six miles, at an estimated cost of about $300,000; also to build side tracks, spurs and freight and passenger stations. The directors include T. D. Turner, J. H. Wheeler, J. L. Wilkin and R. D. Edwards, of Oklahoma City.

OKLAHOMA INTERURBAN. This company has bought material for building about three miles of electric railroad, and is also planning to continue its line to Lexington 10 miles. C. V. Eggleston, Oklahoma City, Okla. T., is President and General Manager.

*OKLAHOMA NORTHWESTERN. This company, chartered in Oklahoma to build from Denison, Tex., via Ardmore and Duncan, Ind. T., and Lawton, Hobart and Guymon, Okla. T., to Trinidad, Colo., commenced grading work in September of last year. A contract has been let to George B. Sutton, of Doxey, Okla. T., for building from Doxey to Berlin, 10 miles. Other contracts will soon be let. G. A. St. John, 171 La Salle street, Chicago, Ill., is Chief Engineer.

OKLAHOMA WESTERN.—Chartered in Oklahoma with authorized capital of $8,000,000 to build from Pawhuska, in the Osage Nation, via the Middle Saline reservation, Woodward County, and Kenton, Beaver County, to a point in Union County, N. Mex., passing through the Osage and Kaw reservations and the Counties of Pawnee, Kay, Noble, Garfield, Grant, Woodward and Beaver, in all 450 miles. The incorporators are W. Graham, Paul D. Howse and Sidney H. Selig, of Chicago, and John A. Stine and H. A. Noah, of Alva.

OMAHA & SOUTHWESTERN. See Union Pacific.

*OMAHA, LINCOLN & BEATRICE (Electric). Contract let to J. H. Piper, of Ashland, for grading this proposed electric road from Ashland, Neb., to the Platte river. Work under way.

ONTONAGON & SOUTHWESTERN.—Incorporated in Michigan to build from Ontonagon southwesterly to the Presque Isle river, 40 miles. T. Nester, Detroit, Mich., is President. (Mar. 17, 1905.)

OPELOUSAS, GULF & NORTHEASTERN.—Surveys in progress for this proposed road from Melville, La., to Opelousas, 25 miles. Contracts will shortly be let. One steel bridge. T. H. Lewis is President and Ira W. Sylvester, Chief Engineer, both of Opelousas.

*OREGON & EUREKA.—This company is building with its own forces a branch line from a point on the main line at Camp 13 to Trinidad, Cal., three miles, and another from Little River Spur Camp Nine to Camp Sixteen, 3 miles. Grading completed for 3.5 miles and track laid for 2.5 miles. The company is planning to extend the line from Trinidad, Cal., to Redwood creek, 30 miles additional, for which surveys have been completed. W. W. Peed, Eureka, Cal., is Chief Engineer. It has not yet been decided when contracts for other work will be let.

OREGON & IDAHO.—Organized to build a railroad from Ontario, Ore., to Emmett, about 30 miles. To be built at once. Bids asked for the work, but no contracts have yet been let. The work will be light and includes a bridge over the Snake river. Maximum grade 1.5 per cent., and the maximum curvature 5 deg. O. V. Allen, of Boise City, Idaho, and O. C. Wright, of Sumpter, Ore., are the engineers in charge. Information will be furnished by Mr. Wright.

OREGON & SOUTHEASTERN.—Surveys completed for building an extension from Eighteen-Mile Post to Bonita, Ore., 10 miles.

OREGON EASTERN (SOUTHERN PACIFIC).—Incorporated in Oregon with capital of $1,000,000 to build a railroad from Natron, Ore., the present terminus of the Springfield branch of the Southern Pacific, east to Ontario, Ore., on the Oregon Short Line, about 320 miles. This is a Southern Pacific company.

*OREGON RAILROAD & NAVIGATION.—Branch from Elgin, Ore., to Joseph, Ore., 63 miles. Grading under way. This is to develop the Wallowa Valley, now a stock raising country, but rich in agricultural possibilities.

——Line from Riparia, Wash., to Lewiston, Idaho, 72 miles, now being graded. This will be used jointly by the Northern Pacific, which in turn will build on to Grangeville, Idaho, 50 or 60 miles from Lewiston, its line being used jointly by the O. R. R. & N. The latter line will be built this spring, giving a through line from Riparia to Grangeville, a fine wheat country. There is nothing competitive about this building, the Harriman line builds half, the Hill line the other half, and they both will use the whole jointly.

See Deschutes Railroad.

OREGON ROADS. Application made to the City Council of Portland, Ore. for a franchise to build an electric railroad from Portland south through the Willamette valley and to the Coos Bay region.

OREGON SHORT LINE. Extension under the name of the St. Anthony Railroad, from Marysville, Idaho, to Dwelles Inn on the western boundary line of Yellowstone Park, 75 miles up the Henry Fork of the Snake river. The 65 mile stage ride from Monida to Dwelles, near the lower Geyser Basin, will thus be eliminated. To Marysville the new line will run through an agricultural section and beyond is a heavy timber country. The line to Marysville has been completed.

Thirty five additional miles of spurs in southern Idaho and northern Utah to the beet fields. The longest of these spurs is from Logan, Utah. Contract for building five miles from Hyrum, Utah, north to Mendon, to Soren Hansen, of Hyrum.

See Yellowstone Park.

OREGON WATER POWER & RAILWAY. This company, operating 52 miles of railroad in Oregon, is making surveys to build an extension from Cedarville to Irondale, 7.5 miles.

OREGON WESTERN. See Southern Pacific.

OUACHITA & NORTHWESTERN. Application for a charter made in Louisiana to build a railroad from Clarks, Caldwell County, northwest to Weston, Jackson County, about 30 miles. The incorporators include: F. C. Broadway, C. E. Slagle and J. F. Whitehead.

*OVERTON COUNTY. Contract for building 19 miles of this road from Algood, Tenn., north to Livingston let to the Cumberland Construction Co., of Livingston, Tenn. B. Armitage, Philadelphia, Pa., is Chief Engineer.

P

PACIFIC & GULF TERMINAL. Company organized by J. R. Crawford, C. L. Crawford, D. A. Southerland, M. E. Rives and S. J. Lazarus, of San Francisco, with capital of $1,500,000, to build a railroad from San Pedro to Los Angeles, about 25 miles.

PACIFIC COAST. The Pacific Coast Co. is to build a branch of its Pacific Coast Railway from a point on the line at Santa Maria, Cal., to Shuman, three miles; also from Santa Maria to Shuey, seven miles.

*PACIFIC & IDAHO NORTHERN.—Contract let to Slick Brothers, of Council, Idaho, for building 6.5 miles of an extension from Council, Idaho, to Stevens, 14.50 miles. Track has been laid from Council for about four miles. Surveys made for an extension from Stevens to Meadows, 16 miles, and beyond that place to Leeds, Idaho, an additional 10 miles. A. E. Fox, Weiser, Idaho, Chief Engineer.

PACIFIC RAILWAY.—Incorporated under this name in Washington, with a capital of $3,000,000, to build a railroad from Seattle southeast to Wallula, Wash., about 300 miles. The name of the company has since been changed to the Chicago, Milwaukee & St. Paul of Washington. The company has taken over the tidewater lands recently bought in the name of James T. Woodward, President of the Hanover National Bank, New York, and will form the western end of the Chicago, Milwaukee & St. Paul. H. R. Williams, formerly General Manager of the Chicago, Milwaukee & St. Paul, is President, and E. J. Pearson, late Chief Engineer of the Northern Pacific, Chief Engineer.

*PAN-AMERICAN.—Contracts let to Lyons Bros. and Everett & Gordon, of Tonala, Chiapas, Mexico, for extending the road from Coapa to San Bonita, 125 miles. Surveys for an additional 31 miles from San Bonita to the Guatamala Boundary under way.

PANHANDLE & GULF.—See Kansas City, Mexico & Orient.

PARAGOULD & MEMPHIS.—This company operating a line from Cardwell, Mo., to Manila, Ark., 24 miles, proposes to build the following extensions: From Cardwell north to Poplar Bluff, Mo., about 50 miles; from Cardwell west to Paragould, 12 miles; from Manila southwest to Marked Tree, 30 miles, and from Manila southeast to Osceola, 16 miles. Nothing has been done since last year, but projects not abandoned. W. E. Winnis is Chief Engineer; F. Quinn, General Manager, and J. E. Thomas, Second Vice-President, all of Cardwell, Mo.

PARIS, DEPORT & SOUTHEASTERN.—Organized in Texas to build a railroad from Paris to Rosalie, in Red River County. R. F. Scott is President; Geo. I. Terrell, First Vice-President; J. G. Wright, Second Vice-President; W. H. Grayson, Third Vice-President; C. I. Broad, Treasurer, and J. J. Dickerson, Secretary.

*PARKERSBURG BRIDGE & TERMINAL (WABASH). New line from Johnson, W. Va., west to Little Hocking, Ohio, 11 miles. Surveys completed and rights of way secured. Grading started some time ago, but work was suspended. Permission granted by the Secretary of War to build a bridge across the Ohio river. S. D. Brady, Parkersburg, W. Va., is Chief Engineer.

PAULS VALLEY.—Chartered in Oklahoma, with $5,000,000 capital, to build from Ada, Ind. T., southwest to Wichita Falls, Tex. The directors include: J. C. Amendt, Chicago, President; W. M. Freeman, Vice-President; Albert Kennie, Secretary and Treasurer; J. B. Thompson, S. J. Garwin and J. C. Hybarger, of Pauls Valley, and A. P. Williams, John Upshaw and P. J. Stovall, of Wanetta.

*PAWNEE RAILROAD.—Contracts let to Johnston & Grommett Bros., of Afton, Ill., for grading and track work, and to the Wisconsin Bridge & Iron Co., of Milwaukee, Wis., for the steel bridges on an extension of this road from Pawnee, Ill., southeast, 16 miles, to Taylorville, on the Baltimore & Ohio and the Wabash.

PEA RIVER VALLEY & GULF. Projected line in Alabama from Opelika, southwest through Union Springs, Brundige, Enterprise, Chancellor, Geneva, Darlington and DeFuniak Springs, Ala., to Portland, Fla., on Choctawhatchee Bay, on the Gulf of Mexico, about 190 miles. No track laid. The company intends to buy a short existing line running north from DeFuniak Springs, about 12 miles. Time for asking bids for the work has not yet been fixed. The work will be light; maximum grade 1.1 per cent., and light curvature. Includes three small bridges. Surveys completed for part of the line. Connection to be made at Opelika, the northern terminus, with lines running northwest to Birmingham, Ala., and northeast to Atlanta, Ga. From the southern terminus at Portland there is a favorable water route through the East Pass into the Gulf of Mexico.

PEARL RIVER VALLEY. Incorporated to build a railroad from Jackson, Miss., up the Pearl River Valley through the counties of Rankin, Scott, Leake, Neshoba, Noxubee, Kemper, Winston and Lowndes to Columbus, Miss., or to a point south of Columbus and crossing the state line into Alabama. The incorporators include: Roy Hogue of Biloxi, Miss.; W. D. Harrington, Fulton, Ala., and F. Herrick, of Milwaukee, Wis.

PELHAM BAINBRIDGE & GULF. Chartered in Georgia, with a capital of $100,000, to build from Pelham, Ga., on the Atlantic Coast Line, southwest via Bainbridge to Fairchilds, on the Chattahoochee river, about 52 miles. It is the intention to eventually extend the road to a point on the Gulf coast. The incorporators include: J. W. Everett and J. L. Hand of Pelham.

PENDLETON SOUTHERN. Chartered in Oregon to build from Pendleton, in Umatilla County, southwest to Heppner, Morrow County, 45 miles. C. J. Smith, C. H. Carter, T. C. Taylor and J. R. Raley, of Pendleton, Ore., are named as incorporators. (Mar. 17, 1905.)

PENINSULA (Electric). Incorporated in California, with capital of $5,000,000 to build an elec

tric railroad from San Jose by way of Stanford University, Palo Alto, Redwood City and San Mateo to San Francisco, with a branch line to Los Gatos and a number of other branches, aggregating 204 miles. The directors are O. A. Hale, F. F. Chapin, G. Lyon, W. C. Andrews and A. E. Wilder. It is expected that the San José & Los Gatos Co., of which O. A. Hale is President, and also the Mt. Hamilton Exploitation Co., will be merged into the new corporation. The latter has completed two surveys to the summit of Mt. Hamilton, one by way of Evergreen and the other by way of Alum Rock. The plans of the new organization include reaching the upper portions of the valley with electric lines, with San Jose as a center, and roads on both sides of the southern extension of the bay, terminating at San Francisco on one side and at Oakland and Alameda on the other. It is not improbable that the Southern Pacific is interested in the new company.

PENNSYLVANIA. This company has work under way as follows:

- - *Extension of the classification yard at Hollidaysburg, Pa., and on an extensive westbound yard at that place.

——*New yard facilities at the Morrisville, Pa., terminus of the Trenton cut-off.

——*At Philadelphia the widening and lengthening of the tracks on the south side of the new Broad street station.

- - - *At East Liberty, Pittsburg, a new passenger station and new freight houses.

——*On the Cherrytree & Dixonville, a branch line is being built from West Brownsville Junction, up the valley of the Monongahela, 4.5 miles, where connection is to be made with the Pennsylvania, Monongahela & Southern, which is now under construction for the purpose of further developing the Monongahela valley.

*Other work to be carried out during the present year includes the extension of the four-track system on the Middle and Pittsburg divisions, and revision of alinement and grades in connection with that work. The four tracking between New York and Pittsburg will soon be complete, with the exception of two three-track sections, one seven miles long between Spruce Creek and Tyrone Gorge, and the other one 3.5 miles immediately east of Conemaugh.

*The low grade freight line from Yorkhaven on the Susquehanna, eastward to Glenloch, will soon be completed, and will furnish an independent route with maximum grades of 0.3 per cent. eastbound and 0.6 westbound between Marysville, west of Harrisburg, and Morrisville, near Trenton, which are 137 miles apart.

*Construction will be started at once on an additional freight line about 50 miles long from Morrisville, Pa., to Newark, N. J., which is being built under the corporate name of the Pennsylvania & Newark, and one from Glenloch, Pa., to Philadelphia, 20 miles.

——A line is to be built to relieve the Pittsburg division, between Pitcairn and Blairsville, 43 miles, and one between Johnstown and Altoona, 39 miles. It has not decided whether the latter will be used for freight or passenger service. With these changes the company will have a double track road independent of its four-track main line, from Pittsburg to Philadelphia and New York, with the exception of 26 miles on the Middle division, between Petersburg and Marysville, and a short section between Parkesburg and Thorndale on the Philadelphia division.

——*Work is under way on the tunnel line into and through the city of New York. All the necessary land for the terminal station in New York City has been bought and for most of that needed for the terminal yard in Long Island City. The contract has been let for building a drawbridge over the Hackensack river between Newark and the Hudson river.

——*Work is being pushed on the Bergen Hill tunnel which is being driven from both ends. The John Shields Construction Co., of New York City, contractors.

——*Work is under way on a power house at the terminal station, New York City. The tunnels under the city are being driven westward from the main shaft at First avenue and in both directions from the intermediate shafts at Thirty-second and Thirty-third streets between Fourth and Madison avenues. The United Engineering & Construction Co. has the contract for building the two tunnels under the Hudson river let to the O'Rourke Engineering Construction Co. S. Pearson & Son, Ltd., have the contract for the tunnels under the East River from New York to Long Island City. Work on both contracts in progress. Contracts for electrification and equipment let to Westinghouse, Church, Kerr & Co.

*On the West Jersey & Seashore it has been determined to electrify a line from Camden via Newfield to Atlantic City. Contract for the electrification given to the General Electric Co. and for other work to P. McManus, of Philadelphia.

——*The four-track system on the Pittsburg division has been completed between Bolivar and Blairsville Intersection and work is being pushed between Beatty and Donohoe, and on the revised line between Beatty and Southwest Junction. From Beatty to Southwest Junction 13½ miles the new work requires an expenditure of about $1,250,000, and allows the abandonment of the Donohoe tunnel, single track, about 3,000 ft. long. It includes 400,000 cu. yds. of excavation, 500 cu. yds. of culvert masonry, 300 cu. yds. of overhead masonry, 50,000 lbs. of cast iron drain pipe and 50,750 lineal feet of tracklaying. When it is completed the present road is to be used only for handling eastbound freight. On the four-track line between Beatty and the east end of the Donohoe tunnel the work includes 700,000 cu. yds. of excavation, 1,000 cu. yds. of bridge masonry, 50,000 lbs. of cast iron drain pipe and 14,000 lineal feet of track laying. H. S. Kerbaugh, Inc., has the contract on the eastern and the Drake & Stratton Co. on the western end. Between Beatty and Greensburg, eight miles, about one mile of the existing line will be used. The rest will be a new four-track line on a new right of way.

*Other contracts at a cost of about $5,000,000 are reported let for the four-track work on the Pittsburg division. These include digging a new channel 4,000 ft. long for the Conemaugh river to change its course so as to avoid two new bridges. The contracts are as follows: For grading and masonry from Sang Hollow, Pa., to Seward, to H. S. Kerbaugh (Inc.), Philadelphia; from Seward to N. F. tower, at New Florence, to McMemanin & Sims, Philadelphia; from that point to the Coke Ovens east of Lockport (to include changing the course of the Conemaugh) to the Eyre Construction Company, of Philadelphia, and from the Coke Ovens to Bolivar, to Thomas F. Kerns & Son, of Pittsville. This work covers about 16 miles, and is to be completed this year.

*Other contracts reported let in connection with four-tracking and straightening of lines on the Middle division include the following: Masonry for the bridge to be built over the Juniata at Mount Union, and for the masonry, grading and change of the line between that place and Newton Hamilton, about three miles, to the Drake & Stratton Co.; from the latter place to Vineyard, four miles, to P. McManus, of Philadelphia, and from Vineyard to Ryde, not quite two miles, to the Thomas McNally Co., of Pittsburg, and for building a stone arch over the Juniata at Ryde, to Sparks & Evans, of Philadelphia.

*The Drake & Stratton Co. are reported to have a contract for building the Third street branch of the Duquesne Way elevated, at Pittsburg, at a cost of about $125,000. The work includes two bridges, one over Tenth and one over Third street.

*Contract reported let to Kerbaugh & Co. for building a double-track freight line, about 20 miles long, for the Northern Central around

Dixon's Silica-Graphite Paint

ONE QUALITY
FOUR COLORS

Dixon's Ticonderoga Flake Graphite as a paint pigment, being inert, forms with the linseed oil vehicle, an elastic instead of a hard and brittle coating. Dixon's Flake Graphite is a lubricant, and this lubricating property insures thorough application, as well as saving in labor and brushes. Dixon's Silica-Graphite Paint will not crack nor blister, is suited to all climates, readily covers other paints, and is the most durable coating for the preservation of all classes of metal and wood construction.

Write for "Colors and Specifications"

Joseph Dixon Crucible Co.
Jersey City, U. S. A.

ESTABLISHED 1827. OLDEST AND LARGEST OF THE KIND IN THE WORLD



Erecting Shop, Pittsburg and Lake E
Structural Steel Work Painted

the city of York, Pa., to start at Big Conewago creek, a short distance south of York Haven, running south to Emigsville, thence around the north and west sides of York and meeting the main line near the Maryland state boundary.

*Double tracking of five miles on the Petersburg branch. Contract reported let to Menamin & Simms of Philadelphia, for double tracking on the Petersburg branch from Cloverdale to a point west of Clover Creek Junction, 2½ miles. Contract reported let to the Millard McGraw Construction Co., of Philadelphia, for similar work from Clover Creek Junction to Franklin Forge, 2½ miles. Contracts call for completion of the work by May 1.

*Proposed low grade freight line within the city limits of Philadelphia. The proposed route starts at the intersection of 56th street and the main line, and runs west under 62d street and Lancaster avenue, paralleling Malvern avenue; thence under 63d street, Gross street, 64th street and 66th street to a point west of the eastbound thoroughfare; thence it will curve to the north, passing over 68th and 69th streets; thence southward, crossing over 73d and under Haverford avenue, Westminster street, Vine street, over Race, Arch and Ashhurst streets to the city line at Cobb's creek, between Coleman avenue and Woodbine street. The ordinance provides that no street is to be crossed at grade.

*Contract let to the John T. Dyer Co. for making a large yard at West Morrisville, the junction of the Trenton cut-off with the New York division. There will be about 50 miles of track laid.

Surveys reported for a new freight line around the city of Baltimore, to be about 10 miles long. Will be a surface road the entire distance, leaving main line of the Philadelphia, Baltimore & Washington at Stemmer's Run. Connection to be made with the Frederick Road extension on the south side of Baltimore.

See Cherry Tree & Dixonville.

See New York Connecting.

PENNSYLVANIA & NEWARK. See Pennsylvania.

PENNSYLVANIA LINES WEST. Double-tracking of the Cleveland & Pittsburg from Steubenville, Ohio, to Bellaire, 25 miles. Twenty five acres of land bought in the town of Burlington, O., a mile north of Wheeling, W. Va., on the west side of the Ohio river. It is stated that the company will remove the 250 houses in the town this summer and establish large yards on the site.

The work to be carried out by the Pennsylvania Company and its controlled lines, including the Vandalia, during the present year, includes double-tracking at a cost of $1,200,000, track elevation in Indianapolis at a cost of $270,000, and a new freight house at the same place to cost $380,000. Bids for the freight house will soon be asked.

*The work of depressing the tracks in Allegheny City, Pa., begins at Ridge avenue and runs to a point 700 ft. west of Washington avenue, a distance of about 5,000 ft. A contract for the grading and masonry has been let to the Columbia Contracting Co., Pittsburg, Pa. Work now in progress. There will be three overhead highway bridges, which have been contracted for. Contract let to the Kerbaugh Construction Company, of Philadelphia, for completing the track work through Allegheny, from a point near Marion avenue to Island avenue. Tracks will pass beneath the crossings at North avenue, Pennsylvania avenue and Washington street. The work will cost in the neighborhood of $1,000,000.

Elevation of tracks in Cincinnati eliminating 28 crossings and costing about $1,500,000. Only a small part, including separation of grades at Rookwood Crossing of Eastern avenue and a foot subway at Brooklyn street, contemplated in 1906. Plans have been approved by city, but revised ordinance must be passed before work will be started.

Second track on the Cincinnati Division of the Pittsburg, Cincinnati, Chicago & St. Louis between Foster, O., and Morrow, 10 miles. Preliminary surveys made.

PENNSYLVANIA ROADS. Charters have been granted in Pennsylvania to the following companies, of all of which Edison Ripley, of Sherman, N. Y., is President. Northern Middlesex Street Railway; Chenango Northern Street Railway; Midland Street Railway; Central Newcastle Street Railway; Chenango Street Railway, and the Newcastle Northern Street Railway.

Surveys completed for a line from Pittsburg east to the Atlantic seaboard through central Pennsylvania counties. The final survey leaves Alleghany by way of Millvale, Sharpsburg and Etna, paralleling the old Pittsburg & Western, across the county to a point on the river near White Rock, thence following the Alleghany to the mouth of the Kiskiminetas and thence down that stream to a point near Leechburg, thence toward Southbend and Shelocta, whence it follows the line surveyed about two years ago to Indiana; thence to Two Licks Creek, following that stream through Pine Flats to Summit, and thence to Cherrytree and east along the west branch of the Susquehanna, through Clearfield, Center Union and Snyder Counties. No definite information as to who is behind this project.

PENNSYLVANIA WESTERN.—Charter granted in Pennsylvania to build from Redbank Junction, in Armstrong County, to Enon, in Lawrence County, 60 miles. Surveys made, but nothing done toward securing the right of way. Edward B. Taylor, Sewickley, Pa., is President.



lroad, McKees Rocks, Pennsylvania.
Dixon's Silica-Graphite Paint.

Dixon's Silica-Graphite Paint

ONE QUALITY
FOUR COLORS

The steel work and metal surfaces of railroad bridges, viaducts and buildings are quickly weakened and destroyed by sulphurous gases, cinders and steam, combined with exposure to the elements. For adequate protection, the paint used must be of inert pigments and linseed oil. Dixon's Silica-Graphite Paint is of correct proportions of the best inert pigments and linseed oil that can be used in paint making. Time tests the efficiency of a paint. Dixon's four standard colors have service records in all climates.

Write for "Colors and Specifications"

Joseph Dixon Crucible Co.
Jersey City, U. S. A.

ESTABLISHED 1827. OLDEST AND LARGEST OF THE KIND IN THE WORLD

This work involves a tunnel from Lancaster avenue to Gross street.

*Agreement reached with the city authorities of Philadelphia in regard to elevation of tracks from Venango street to Norris street. From Venango to Cambria street a retaining wall will be built, and from Cambria street to Norris street a steel viaduct. The Philadelphia & Reading tracks will pass underneath at Trenton avenue near Lehigh avenue. The cost is estimated at $1,500,000, of which the city will pay $750,000.

*New terminal station at Washington, D. C. Thompson Starrett & Co. have the contract.

Surveys made for extending the Turtle Creek branch, which runs from Stewart, Pa., on the Pittsburg division, northeast to Export, 10.4 miles, east to Blairsville, on the West Pennsylvania division, about 18 miles.

*Work reported begun on an extension of the Monongahela division from its present terminus at West Brownsville, southwest to Rice's Landing, in Green County, Pa., 12 miles. The new line will run through a rich coal region, hitherto without transportation facilities. It is expected to complete it this spring, when a line will be built from the southern terminus north through Washington County to a connection with the Ellsworth branch, making a loop.

*Contract for a 14-mile extension from Brownsville, Pa., to Rice's Landing let to S. M. Green, of Uniontown, Pa. Keller & Crossan, of Philadelphia, will do the grading.

PENSACOLA & MEMPHIS AIR LINE. Incorporated in Mississippi to build a railroad from Memphis, Tenn., via Watervalley and Meridian, Miss., to Pensacola, Fla., 400 miles. H. J. Forsyth, of Memphis, and J. W. Buchanan, Attorney for the St. Louis & San Francisco, are incorporators. (Mar. 17, 1905.)

PENSACOLA & NORTHEASTERN. Chartered in Alabama to build a railroad from Augusta, Ala., southwest to Pensacola, Fla., about 100 miles. Incorporators include F. C. Bren, J. S. Avery, C. M. Cavington, S. B. Milligan and C. W. Lamar, all of Pensacola.

PENSACOLA, ALABAMA & WESTERN. According to newspaper reports this company is being backed by a French syndicate, and has already spent $60,000 for preliminary surveys for its proposed road from Memphis, Tenn., to Pensacola, Fla., with a branch to Birmingham. The cost of the entire road would be about $2,000,000. W. B. Ayer, of Carnegie, Pa., has made some of the surveys.

PENSACOLA, COLUMBUS & WESTERN. This company is reported incorporated in Tennessee, Alabama and Florida with W. S. Keyser, President, and J. P. Stillman, Treasurer.

PEORIA, BLOOMINGTON & CHAMPAIGN. Organized in Illinois to build a railroad from a point in Champaign County to Peoria, Ill., about 90 miles. Headquarters at Champaign. Organizers are interested in the Chicago, Bloomington & Decatur.

PEORIA, LEKIN & SOUTHEASTERN. Organized in Illinois, with a capital of $100,000, to build a railroad from Pekin south through Parkers, Mason, Menard, Sangamon, Christian and Montgomery counties to Ramsey, in Fayette County, on the Toledo, St. Louis & Western, about 130 miles. It is proposed to enter Peoria over the Terminal Company's tracks from Pekin. The principal office will be in Peoria. The incorporators and first board of directors include: Guy Talbott, Robert P. Jack, W. T. Irwin and E. A. Borrill, of Peoria; P. L. Saltonstall, of Boston, Mass., and W. H. Trumbull, of Salem, Mass.

*PERLA NORTHERN. Work in progress from Perla, Ark., northerly through Butterfield and thence northeast through Lonsdale to Wilmington, Garland County, 23 miles. Eight miles completed last year. The line is eventually to be extended to Waldron, Ark. A. Strauss, Chemical Building, St. Louis, Mo., is President. (Mar. 17, 1905.)

PHILADELPHIA & READING.—Announcement has been made that the plan for abolishing grade crossings on the New York division of this road has been agreed upon by the railroad and the Philadelphia city authorities. The plans call for the elevation of the tracks from Spring Garden street, near the terminal, north through Ninth street, for a distance of about one mile, on an elevated steel structure. This is to a point just south of Columbia avenue station. Thence north the line will be on an earth embankment, crossing about ten streets on bridges to Cumberland street. At this point the tracks will be depressed, reaching the low grade at the Huntington street station, and remain depressed passing Germantown Junction to about Seventeenth street, where they will again be raised, with a grade of 1.06 per cent., and continued on an elevated structure to Wayne Junction, crossing about seven streets on elevated structures.

Surveys under way for a new line to supersede the present line between Pottsville and Shamokin, which has two heavy grades. The plan provides for a road to leave the Schuylkill river at Schuylkill Haven and to use the Minehill, branch via Cressona, West Wood Junction and Middle Creek, a subsidiary of Tremont. A tunnel will have to be built from Middle Creek to the North river, but it will be only half as long as the tunnels heretofore planned in the vicinity of Minersville. West from this tunnel the line would pass through Valley View and Hegins, and run thence via Klingerstown to the Susquehanna river. This would give a route from Clinton to Sunbury, 15 or 20 miles shorter than the present.

*A grading contract has been let to Smith & Campton for work from Pottstown, Pa., to Linfield, work now under way. The cut at Linfield, which is one of the longest on the division, will be widened 32 ft. to accommodate two additional tracks. Grading is also under way between Topton and Alburtis. Six miles of track will be laid early this spring.

*Work in progress on a subway to be built under the tracks at Rutherford station and one between Rutherford and Boyd stations. The company is gradually abolishing grade crossings and building subways on its line entering Harrisburg, Pa. Work will be commenced shortly by the Central Pennsylvania Traction Co. on a subway to pass under the Reading tracks at Paxtang avenue, Paxtang, and work is now in progress on a subway under the Reading tracks near Beaver station.

PHILADELPHIA & SCHUYLKILL VALLEY. Chartered in Pennsylvania with $150,000 capital, to build a 15-mile line from Mill Road and Keystone avenue, Upper Darby Turnpike, Delaware County, to the northeast corner of Fifth and DeKalb streets, Bridgeport, Montgomery County. The directors are: Loren N. Downs, Bryn Mawr, President; W. Robinson Molinaird, W. Evans Smith, George A. Chrisman, Ernest S. Chrisman, William Darling and William H. Ford of Philadelphia.

*PHILADELPHIA & WESTERN (Electric).—Chartered to build a railroad from Sixty-third and Market streets, Philadelphia, west to Parkesburg, in Chester County, 45 miles. Work under way. W. T. Van Brunt is President and Jaques M. Bramlette, Philadelphia, General Manager.

*PHILADELPHIA RAPID TRANSIT.—A contract has been given to the E. E. Smith Contracting Co. to build the Market street subway around the City Hall from Fifteenth street eastward to Juniper street. Now in operation from the west bank of Schuylkill river to 15th street. The cost of the work will be about $3,000,000.

*PHILIPPINE ROADS. A syndicate composed of Cornelius Vanderbilt, J. G. White & Co., of New York, Charles M. Swift, Detroit, William Salomon & Co., H. R. Wilson, Heidelbach, Ickelheimer & Co. and the International Banking Co., all of New York, has been given contracts for building 100 miles on the Island of Negros, 100 miles on Panay and 95 miles on Cebu, at an estimated cost of $10,000,000. The work is being carried on by J. G. White & Co. who made the preliminary survey on the island of Panay. Construction work will be easy from Iloilo to Capiz, but cost will be about $35,000 a mile this being due to the necessity of providing against great floods. On the Island of Negros the line is from Jimamaylan on on the west coast to Escalante on the northeast. Beside the port of Escalante, will be on excellent harbor, which the bay has been dredged from the mouth, and should provide [illegible] Island of Negros. It is estimated that once the railroad is completed the sugar output may be increased to 500,000 tons, while the present output is less than 80,000 tons. In the hinterland there are thousands of acres of hinterland at present in a state because of difficulties of transportation. It is planned to build trunk lines from the main line of the road reaching these timber lands.

Bids have been submitted by Speyer & Co., of New York, for building lines in southern Luzon, from Manila to Batangas, with branches to Santa Cruz and Lucena; Pasacao to Legaspi and Tobaco, and Manila to Cavite and Naic, 29 miles. In northern Luzon Speyer & Co. propose to build 86 miles of branch lines to be operated in connection with the existing railroad from Manila to Dagupan, also a line from the latter place to Camp Number One, an additional 25 miles. They propose to build all the above lines without the government guarantee. A second bid has been submitted by the same people for building a line from Dagupan to Laoag, conditional upon the acceptance of the former bid. On the latter they ask for the full guarantee. Speyer & Co. propose to operate the new lines in connection with the present railroad in Luzon, making an aggregate length of 208 miles. There were no bids submitted for the railroads on the islands of Leyte and Samar.

The conditions which obtain on the islands of Panay and Negros are practically duplicated on Cebu, so far as railroad construction is concerned. Cebu, the main city on the island is on the west coast, and Argoa, a cable port, is on the east coast.

*PIERRE & FORT PIERRE BRIDGE & RAILWAY. Incorporated in South Dakota, with capital of $10,000, to build a railroad three miles long from the western terminus of the lines of the Chicago & North Western, in the city of Pierre, over the Missouri river to the eastern terminus of the lines of the Pierre, Rapid City & Northwestern, in the town of Fort Pierre. The estimated cost of the work is $900,000. The principal work is the bridge over the river. The incorporators are: R. W. Stewart, O. H. McCarty, of Huron; Marvin Hughitt, John M. Whitman and J. B. Redfield, of the Chicago & North Western.

*PIERRE, RAPID CITY & NORTH WESTERN (CHICAGO & NORTH WESTERN). The Winston Bros. Co., of Minneapolis, which has the general contract for building this extension of the North-Western from Pierre, S. Dak., west through Stanley and Lyman Counties, to Rapid City, about 155 miles, has sublet a six-mile section of the work to the Calhoun Construction Company, of Spearfish, S. Dak. The work will begin at a point about 25 miles west of Rapid City.

PIKE COUNTY. Incorporated in Arkansas, to build a railroad from Gordon, in Clark County, northwest to Hollywood, about 14 miles. The incorporators include: C. C. Jackson, C. G. Carpenter and M. J. Hall, of Clark County, and William Grayson and N. W. McLeod, of St. Louis.

PINE BLUFF & SOUTHERN. Chartered to build from Pine Bluff, Ark., via Ladd, Barry and Yorktown, to Star City, Mo.; S. C. Alexander, W. H. Langford and R. G. Atkinson, of Pine Bluff, Ark., are directors.

PINE BLUFF NORTH & SOUTH.—Incorporated in Arkansas with a capital stock of $600,000, to build a road from Pine Bluff, Ark., to Lonoke, 46 miles. Incorporators include: E. C. Howell, William Nichols, W. N. Trulock, C. S. Bacon and E. B. Bloom.

PINEVILLE & NORTHERN.—Incorporated in Missouri with capital of $50,000 to build from Pineville, McDonald County, northeast about 40 miles to Monett, where connection is to be made with the St. Louis & San Francisco. The stockholders include: John A. Sturges, Adair W. Noel and E. E. Coffee, of Pineville. Office at Pineville.

PINEY RIVER & PAINT CREEK. New line to be built by the MacDonald Colliery Co. from Beckley, Raleigh County, W. Va., north to a point near the mouth of Mossy creek, in Fayette County, connecting with the Deepwater Railroad.

PITTSBURG & BUTLER STREET.—Contract let to the Ferguson Contracting Co., of Pittsburg and New York, for the grading, masonry work and track laying on this proposed electric railroad from Etna, Pa., north to Butler, touching Mars and Velancia. The officers of the company are principally Pittsburg capitalists, several of whom are connected with the Pittsburg Trust Co.

*PITTSBURG & CROSS CREEK. Chartered in Pennsylvania, with $70,000 capital, to build from Pryor Station on the main line to the Wabash Pittsburg Terminal northerly along the north branch of Cross creek to a connection with the Pittsburg, Cincinnati, Chicago & St. Louis at Burgettstown, Washington County, Pa., seven miles. Contract reported let to the Giannini Construction Co., of Pittsburg, Pa. The directors are: N. F. Sanford, Pittsburg, President; J. W. Boilean, B. U. Young, S. A. Wartman, W. Craig Lee, F. P. Patterson and J. R. C. Huston.

*PITTSBURG & LAKE ERIE.—Contracts reported let for a railroad from Beaver, Pa., to East Liverpool, O., 24 miles, with the intention of ultimately extending the line to Steubenville, O.

PITTSBURG & WESTMORELAND. Charter granted this company in Pennsylvania to build a road from North Huntingdon in Westmoreland County, to Herminie, 5 miles. R. B. Irwin, Harrisburg, Pa., is President. (Mar. 17, 1905.)

*PITTSBURG, BINGHAMTON & EASTERN.—Organized under the laws of Pennsylvania and New York to build a road from Ansonia, Pa., crossing the Lehigh Valley at Towanda, Pa., and the Northern Central at Canton, Pa., to Binghamton, N. Y., 143 miles. Maximum grade 1½ per cent. The road will reach numerous coal mines. Contract let to John R. Lee & Co., of New York. E. H. Gay & Co., of Boston, are the financial agents, and E. W. Sawyer, New York, is Superintendent.

PITTSBURG, INDEPENDENCE & OKLAHOMA. Chartered in Kansas to build from Pittsburg, Crawford County, southwest via Independence to Ponce City, in Kay County, Okla. T., about 150 miles. The incorporators include: A. C. Stitch, A. W. Shultbis, J. B. Zeigler and A. Steinmetz, of Independence, and Charles Mitchell, of Cherryville.

PITTSBURG RAILWAYS (Electric). Proposed extensions on the north and south sides of the Ohio river to connect Pittsburg with the Beaver Valley Traction Company's system, which it recently purchased.

PITTSBURG SUBWAYS. Application made by a syndicate headed by Murray M. Verner and Mayor William B. Hayes, for a charter to build a subway to cost $10,000,000, starting at Oliver avenue and Smithfield street, reaching the surface at Neville street, in Bellfield, where the line will become a surface line. A franchise for the line through the down town district has already been granted.

PITTSBURG, SHAWMUT & NORTHERN. See Brookville & Mahoning.

PITTSBURG, SUMMERVILLE & CLARION. Location surveys being made for an extension from Mill Creek, Pa., to Hallton, 36 miles. Two miles completed last year.

Several short extensions of branches contemplated in the near future. Charles Heidrick, Clarion, Pa., is President.

*PITTSBURG, WESTMORELAND & SOMERSET. Contract let to H. Frank Stark, of Greensburg, Pa., for building an extension south to Somerset, about 8 miles.

PLACERVILLE & LAKE TAHOE. Incorporated in California to build from Placerville, El Dorado County, to Pino Grande and thence to Tallac, 65 miles. Eight miles to Camino completed last year. J. H. Swift, J. D. Brown, S. J. Bassett and W. J. Barnett, of Placerville, Cal., incorporators. (Mar. 17, 1905.)

PLANT CITY, ARCADIA & GULF. This company, operating 15 miles of road out of Plant City, Fla., is planning to extend its road south through Hopewell, Alafia, Keysville, Fort Grace, Castalia and Lilly, to Arcadia, 60 miles, through timber territory. Frank A. Wheeler, of Plant City, Fla., is Chief Engineer.

PORT ANGELES & EASTERN.—The British American Finance Co. reported organized to build this road from Port Angeles, Wash., to Olympia, 135 miles. Surveys for the entire line completed and 10 miles graded out of Port Angeles. G. A. Cushing, Port Angeles, is President. (Mar. 17, 1905.)

*PORT ARTHUR & HOUSTON SHORT LINE.—Proposed road from Port Arthur to Houston, Tex., 85 miles. The new line will provide a short connection between Houston and Port Arthur. Financial arrangements about completed and engineers now making surveys. Contract let to H. S. Best, of Port Arthur, Tex., for building the first 40 miles. There will be four steel bridges and two draw bridges. F. J. Hart, 507 Missouri Trust Building, St. Louis, Mo., is President.

PORTLAND & BRUNSWICK (Electric).—Application made to build an extension through Yarmouth, Falmouth and Cumberland, Me., 12 miles. E. J. Lawrence, A. B. Page, S. A. Nye, A. F. Gerald and C. W. Davis, of Waterville, Me., are interested.

PORTLAND & LEWISTON.—Incorporated in Maine with a capital of $130,000 to build a road from Morrills Corner, in Portland, through West Falmouth, West Cumberland, Gray, North Gray, New Gloucester and Upper Gloucester to Auburn, 32 miles. The proposed route is practically the same as that of the Lewiston & Portland Railroad recently incorporated. The directors are: E. W. Gross, of Auburn; John W. True, of New Gloucester; Louis A. Goudy, L. M. Leighton, T. M. Jackson and J. A. Bextrue, of Portland, and Frank Reddan, of Boston.

PORTLAND & RUMFORD FALLS.—Extension projected from Oqisissoc, Me., north to Megantic, where connection can be made with the Canadian Pacific. Rights of way secured from the Maine lake region to the Canadian border, where 100,000 acres of land have been bought. Three different routes are under consideration, all of which permit of easy construction. The country is level and very heavily wooded.

*PORTLAND & SEATTLE.—Organized by the Northern Pacific and the Great Northern. The road is being built from Kennewick, Wash., on the Columbia river, opposite Pasco, west along the north bank of the Columbia river to Vancouver, Wash., about 250 miles. The work includes a tunnel 2,000 ft. long at Cape Horn and bridges over the Columbia and Willamette rivers. When completed, this line will give both roads a much more direct line from the east to Portland. This line parallels the Oregon Railroad & Navigation Company's line which runs along the south bank of the Columbia river from Wallula west to Portland.

PORTLAND & SOUTHEASTERN.—Chartered in Arkansas to build from Portland, Ashley County, Ark., south to the Louisiana line, about 20 miles. H. C. Bradley, I. Kirk and H. C. Christy, of Cleveland, Ohio; J. C. Bain, of Portland, and F. N. Vetter, of Buffalo, N. Y., are interested.

PORTLAND & SOUTHWESTERN. Incorporated in Oregon with $100,000 capital to build a railroad from Scappoose to Nehalem Bay. The incorporators include H. G. Platt and G. J. Perkins, of Portland.

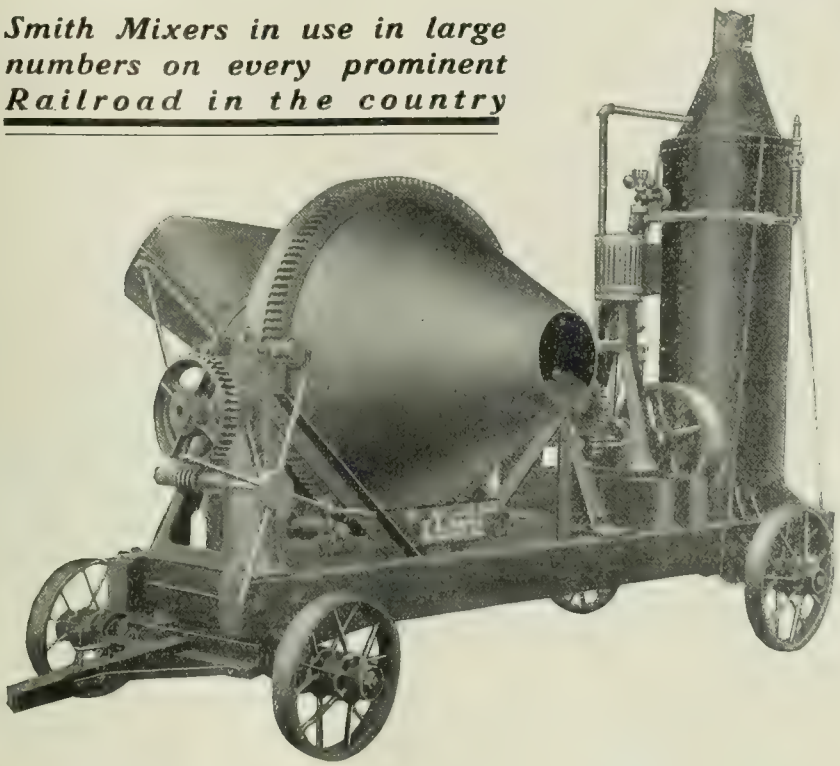
*PORTLAND, NEHALEM & TILLAMOOK.—Projected line in Oregon from Portland west through Washington County and south through Tillamook County. Entrance to Portland over the existing line to be made. Contract let to the Atlas Construction & Supply Co., of San Francisco, for laying track on first 20 miles. Other contracts let to Clark & Dixon, of Forest Grove, for clearing the right of way, and to Thompson Bros., for grading first three miles from Hillsboro.

POWELL'S MOUNTAIN MINERAL.—Proposed line in Tennessee and Virginia from Lone Mountain, Tenn., via Griggs, Xerxes and Nile, to

1600 SMITH MIXERS

NOW IN USE

Smith Mixers in use in large numbers on every prominent Railroad in the country



¶ The fact that we have sold so many of these machines in less than five years is the best argument we can offer in their favor.

¶ Contractors everywhere buy the machinery that will save them the most money.

¶ Engineers who do not have to consider expense buy machinery that gives the best results—in the shortest time.

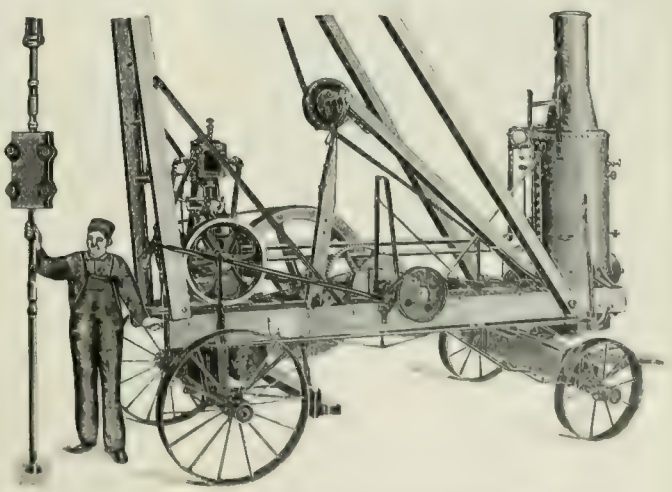
¶ They all buy Smith Mixers in preference to any other on the market, because the Smith Mixer is the most rapid, thorough and economical.

The Cyclone Drilling Machine

is another money-maker. A well known New York Contractor recently stated that he placed one "Cyclone Contractor" on his work in place of eight (8) steam drills, and it did the drilling for blasting ahead of a 2½ yard steam shovel, as well as the eight drills.

WRITE FOR CATALOGUE.

These machines are sent out on trial, or on iron bound guarantee, to do the work as represented.



Contractors Supply & Equipment Co.

Main Office, CHICAGO
510 Old Colony Bldg.

NEW YORK
170 Broadway

PITTSBURG John L. Kirk Ferguson Bldg.
ST. LOUIS 900 Wainwright Bldg.
KANSAS CITY 509 W. 5th St.
ST. PAUL 201 German-Am. Bank Bldg.
ATLANTA 1333 Candler Bldg.

W. H. C. Mussen & Co., Montreal, Que., Canadian Agents.

Surveyed 70 miles and thence via Chinchport to St. Paul, a total of 95 miles. Surveyed, 60% grade of old grade to be used. This is to connect to local part of the Cairo & Tennessee River, which will run from Cairo to Norfolk. L. W. Goode, 111 Broadway, is President of the Cairo & Tennessee.

PRESCOTT & MOUNT UNION.—Incorporated in Arizona to build from Whipple Barracks, via Prescott, to Palace, 25 miles. Completed and in operation from Prescott to Whipple Barracks, two miles. T. L. Wright, Prescott, Ariz., is President and General Manager.

PRESCOTT & NORTHWESTERN.—This road, which now runs from Prescott, Ark., northwest to Liberta 33 miles, is being extended from Liberta to Daisy, 17 miles. W. N. Bemis, Prescott, is President.

PUBLIC SERVICE CORPORATION.—Petition has been made by the Public Service Corporation of New Jersey for authority to build an electric road from Elizabeth, N. J., to Rahway, about eight miles.

PUEBLO, OKLAHOMA CITY & NEW ORLEANS.—Incorporated in Oklahoma with capital of $30,000,000 to build from Pueblo, Colo., southeast to New Orleans, 1,035 miles air line. Preliminary surveys made, and it is hoped to have financial arrangements completed early this year. The initial work will be started between Oklahoma City and Woodward. The incorporators include: J. H. Wheeler, W. C. Burke, R. A. Wooldridge, George H. Dodson and J. H. Wright, all of Oklahoma City.

PUYALLUP VALLEY TRACTION.—Contracts reported let for the grading and bridge work on this proposed road from Tacoma, Wash., east to Puyallup, nine miles. There will be three bridges, 120, 220 and 240 ft. long, respectively, and about 1,550 ft. of trestle at bridge approaches. Fred J. Chamberlain, of Puyallup, is President, and L. A. Nicholson, Chief Engineer, Tacoma, Wash.

Q

QUINNESEC & WESTERN.—Incorporated in Michigan with $120,000 capital stock to build a railroad about 15 miles long in Menominee County, connecting with the Wisconsin & Michigan. The incorporators are W. T. Fitzgerald and S. N. Harrison, Peshtigo, Wis.; E. C. Eastman, Marinette; J. B. Barton, Hinsdale; and O. A. Koss, J. C. Fitzgerald and T. M. Butters, Chicago.

R

*RAHWAY VALLEY.—Six mile line in New Jersey from Roselle to Kenilworth. Connection with the Delaware, Lackawanna & Western under construction.

*RALEIGH & PAMLICO SOUND.—Construction work to be pushed on this proposed road from Raleigh, N. C., east via Wilson, Snowhill and Greenville to Washington, 114 miles. The company has recently been placed under new management, which is planning to extend the road from Washington to New Bern, N. C. Track laid for 9½ miles and an additional five miles of grading completed. Charles O. Haines, President and General Manager; Adam Treadwell, Secretary and Treasurer, and John W. Stewart, Chief Engineer, with offices at Raleigh, N. C.

*RALEIGH & SOUTHPORT.—This company, formerly the Raleigh & Cape Fear, is building an extension from Lillington, the present southern terminus, to Fayetteville, 30 miles. Contract for grading let to W. J. Bradshaw. The work includes three bridges, the largest 500 ft. long, with trestle approaches, of from 1,000 to 1,500 ft., over the Cape Fear river at Lillington, for which contract has been let to the Virginia Bridge & Iron Company, of Roanoke, Va.

REDBLUFF & FALLRIVER.—Incorporated in California with $1,000,000 capital, to build from Redbluff, on the Southern Pacific, northeast via Shingletown to Fallriver mills, about 40 miles. The directors include: D. L. Miles, E. R. Walbridge and H. P. Stice, of Redbluff; P. E. Vilas and A. Thacher, of Shingletown; S. Leavett, of San Francisco; and O. P. Montelius, of Oakland.

*RICHMOND & CHESAPEAKE BAY (Electric).—This company, which proposes to build an electric railroad from Richmond, Va., north to Ashland, 15 miles, and thence to tidewater by a route not yet determined, has surveys under way. Contracts for grading have been let to Phillips & Alport, of Richmond, Va., and to H. H. George, also of Richmond, for the first 10 miles. A contract has also been given to Charles Gasser for masonry. There will be one overhead viaduct at Richmond, about 2,700 ft. long. Frank J. Gould, of New York, is President, and C. P. E. Burgwyn, Chief Engineer, of Richmond, Va.

RICHMOND, RAPPAHANNOCK & EASTERN.—This company, which proposes to build an electric railroad from Richmond, Va., to Urbana, on the Rappahannock river, about 60 miles, is reported to be controlled by Philadelphia and New York capitalists, is negotiating for the sale of $1,250,000 bonds to build its railroad from Ellersons, near Richmond, Va., east to Urbana, near the mouth of the Rappahannock river, about 60 miles. S. O. Burns, of New York, is President.

RIO GRANDE, SIERRA MADRE & PACIFIC.—The proposed extension of this road will run from Nueva Casas Grandes, Mexico, southeast to Santa Maria Valley, up this valley and south through Galeana, El Valle, Cruces, Namiquipa, Santana and Temosachic to San Pedro, through a timber section, 180 miles. Fifty miles of the work will be heavy. There will be four steel bridges and five tunnels. W. C. Greene, New York, is President, and J. P. Halleban, of El Paso, Tex., Chief Engineer.

*RIO GRANDE WESTERN.—Contract let to the Utah Construction Co. for the extension of the Bingham branch from the mouth of Bingham Canyon to Pleasant Green and Blackrock, Utah, 17 miles. The work includes the excavation of about 234,000 cu. yds. at Pleasant Green and about 400,000 cu. yds. near Blackrock. About 13 miles completed last year.

ROARING FORK.—Chartered in Virginia to build from Norton, in Wise County, to the junction of Pot Camp on Roaring Fork of Powell river, connecting at Blackwood, Va., with the Louisville & Nashville. Cavin Pardee, who is interested in the East Tennessee & Western North Carolina, is President. (Mar. 17, 1905.)

ROCHELLE & WESTERN.—Chartered in Louisiana, with capital of $1,000,000, to build from Rochelle, La., northwest to Winnfield, 20 miles; also from Rochelle east to Harrisonburg, 35 miles. Headquarters at Monroe. The incorporators include: C. H. Denkelman, J. C. Simpson, N. S. Cutright and E. T. Lamkin.

ROCHESTER & SOUTHERN (Electric).—Application made in New York for a charter to build an electric railroad from Rochester southeast to Elmira, about 120 miles, with several branch lines. George A. Engert, of New York, represents the company at Rochester. When incorporation has been granted, a company known as the Rochester & Southern Construction Company is to be incorporated, with capital of $100,000, to build the road. Right of way for about 90 per cent. of the way has been obtained. The incorporators of the company will probably include: Walter B. Duffy, Benjamin E. Chase, Stephen C. Hollister, William A. Sutherland and others, of Rochester; William W. Clark, County Judge of Steuben County; O. F. Lieders, of Wayland; J. M. Edwards, of Danville, and George A. Engert, of New York.

ROCHESTER, SCOTTSVILLE & CALEDONIA (Electric).—Chartered in New York State, with capital of $500,000, to build an electric railroad from Rochester, N. Y., to Caledonia, in Livingston County. Among the directors are H. C. Brewster, J. N. Beckley and Senator Morton Lewis, of Rochester.

*ROCHESTER, SYRACUSE & EASTERN (Electric).—This company has completed its road from Rochester to Lyons, N. Y., 36 miles; it is projected to Syracuse, a total distance of 80 miles. T. H. Mather, Syracuse, N. Y., is Chief Engineer.

*ROCKDALE, JOLIET & LOCKPORT.—Rights of way reported secured for this road between Rockdale, Ill., and Lockport, and contracts for grading let. Frederick Bennett, Joliet, Ill., is President. (Mar. 17, 1905.)

ROCK ISLAND & MONMOUTH.—Incorporated in Illinois to build from Rock Island, Ill., south through the counties of Rock Island, Mercer and Warren to Monmouth, 50 miles. The incorporators and first board of directors include: J. E. McGrath, C. W. Church, T. A. Church and L. G. Church, all of Chicago.

*ROCK ISLAND, ARKANSAS & LOUISIANA (C., R. I. & P.).—This company has been organized by the Chicago, Rock Island & Pacific to take over the Arkansas Southern and to build various extensions of that road and of the Rock Island in Arkansas and Louisiana. A connection is now being built from Haskells, Ark., on the Rock Island's Hot Springs branch, south to Eldorado, the northern terminus of the Arkansas Southern, 107 miles, with a branch from Summerville southeast to Crossett, an additional 36 miles. Contracts for grading, track laying and bridge work on this line given Craney, Dalhoff & Peters, and to Collins Bros., of Rock Island, Ill. Track laid for 35 miles, from Haskells south toward Fordyce. The old Arkansas Southern is in operation from Eldorado, Ark., south to the southern boundary of Winn Parish, La. The consolidated company's charter gives it authority to build various extensions, as follows: From Crossett to some point on or near the Mississippi river in Louisiana; from a point upon the Haskell-Eldorado line to Malvern, Ark.; from a point at or near Juction City, La.; to Shreveport, La.; from a point at or near the southern boundary of Winn Parish, Louisiana, to Alexandria, La., from Alexandria southward to the Gulf of Mexico; from Alexandria westward or southwestward to the western boundary of Louisiana, and from Alexandria, La., to a point upon the Mississippi river at or near the city of Baton Rouge, La., or the city of New Orleans or upon the Mississippi river between Baton Rouge and New Orleans.

*ROCK ISLAND SOUTHERN (Electric). This company is building an electric road from Galesburg, Ill., west to Monmouth, 15 miles.

ROCKLAND, JASPER & NORTH WESTERN.—Chartered in Texas with capital of $100,000, to build from Rockland, Tyler County, Tex., east to Jasper, Jasper County, 25 miles. The incorporators include: W. W. Kyle, S. K. Stone and W. W. Cunningham, of Beaumont.

ROCK LEDGE & SOUTHERN.—Incorporated in Ohio to build from a point on the Hocking Valley, in Fairfield County, Ohio, south through Vinton, Jackson and Scioto counties to Portsmouth, 65 miles. G. M. Merritt, C. P. Cole, R. M. Dreisbach and H. H. Johnson are incorporators. (Mar. 17, 1905.)

*ROGERS SOUTHWESTERN.—Contract let to the W. R. Felher Construction Co., and work under way on its proposed road, to run from Rogers, Ark., on the St. Louis & San Francisco, to a point on the Kansas City Southern, either at Gentry or Siloam Springs, Ark., about 30 miles. W. R. Felher, of Rogers, Ark., is President.

ROODHOUSE & VIRDEN.—An officer writes that this projected road will run from Roodhouse, Ill., east through Delta, Scottville and Modesto to Virden, 32 miles. To be operated by electricity, oil or gas motors. E. M. Husted, of Roodhouse, is President and Chief Engineer.

RUSSELL'S ISLAND & DEEP LAKE.—Incorporated in Florida to build a road from Deep Lake, Lee County, to the Gulf of Mexico, near Russell's Island, about 12 miles. The incorporators are: Henry C. Butcher, Jr., H. Radcliffe Roberts and Walter G. Langford. (Mar. 17, 1905.)

S

SACRAMENTO & LAKE TAHOE.—Incorporated in California, with $7,500,000 capital stock. The incorporators are: Chas. Wesley Reed, W. S. Graham, Leo Alexander, Thos. H. Nicholls, Jas. H. Swift, T. O. Sadler, E. F. Haas, John A. Black and H. G. Raymond.

SACRAMENTO SOUTHERN.—Incorporated, with a capital of $3,000,000, to build a railroad from Sacramento, Col., to Stockton, with a branch line beginning at Walnut Grove and running southwesterly to Antioch. The directors include: I. W. Hellman, Jr., Charles Holbrook, J. C. Kirkpatrick, J. M. Israel and C. A. Sharp. The Southern Pacific has for a long time held rights of way along the route mentioned.

SAGINAW & SOUTHWESTERN (Electric).—Incorporated in Michigan, with $50,000 capital, to build a railroad from Saginaw southwest via St. Charles, Chesaning and Elsie to St. John's, about 50 miles, where connection will be made with the Lansing & Suburban. The directors include: A. S. Courtright, of Lansing; W. G. Emerick, W. S. Linton, E. P. Waldron and C. E. Linton, of Saginaw. Offices at Saginaw.

ST. ANTHONY.—See Oregon Short Line.

ST. JOSEPH, ALBANY & DES MOINES.—Rights of way are being secured for this proposed road from St. Joseph, Mo., northeast to Des Moines, Ia., about 200 miles. F. C. Mordaunt, of Chicago, is President.

ST. LOUIS & DES MOINES.—Incorporated in Iowa, capital stock of $100,000, to build a railroad from Des Moines to St. Louis. The officers of the company are: President, George J. Porter; Vice President, Frank N. Morley; Secretary and Treasurer, Albert E. Little, all of Boston. It is understood that this is the proposed extension of the Minneapolis & St. Louis from Des Moines to St. Louis. Headquarters at Des Moines.

ST. LOUIS & NORTH ARKANSAS.—Extension projected from Seligman, Mo., northwest to Joplin, Mo., about 60 miles. Construction not yet authorized.

——Proposed extension from Leshe, in Searcy County, Ark., the present eastern terminus, east to the Mississippi river. Nothing done.

*ST. LOUIS & NORTHEASTERN (Electric).—This company is building a line from Staunton, Ill., via Edwardsville to East St. Louis, 37 miles, and from Hillsboro, Ill., to Staunton, 20 miles. The Central Illinois Construction Co., of Edwardsville, the contractor, has completed the grading work and all the track has been laid but two miles. W. H. Tarrant, of Champaign, Ill., is Chief Engineer.

ST. LOUIS & SAN FRANCISCO.—Extension of line 100 miles west from Quanah, Tex., probably to Hale Center, Tex., about half-way to Roswell, N. Mex. Proposed.

——Projected extension from Brady, Tex., to Waring, on the San Antonio & Aransas Pass, about 100 miles.

—— Line projected from a point opposite Joppa, Ill., to Paducah, Ky., 20 miles.

——Proposed extension of the Ozark & Cherokee Central from Okmulgee, Ind. T., to Shawnee, Okla. T., 75 miles.

——Extension of the St. Louis, Memphis & Southeastern from Hoxie to Little Rock, Ark. Preliminary surveys made. Nothing being done.

——See Bonnerville & Southwestern.

——See Frisco, Oklahoma City & Texas.

——See Memphis & New Orleans.

*ST. LOUIS, BROWNSVILLE & MEXICO.—This road is now completed from Brownsville, at the southern extremity of Texas, north to Bay City, 283.50 miles, and from Robstown east to Corpus Christi, 16 miles, and also a branch from Harlingen, 25 miles north of Brownsville, west to Fordyce, 80 miles. Extensions are projected from Robstown northwest to San Antonio, 125 miles, and northeast from Bay City. Work is under way by the contractor, P. M. Johnston, of St. Elmo, Ill., to Algoa, 59 miles. Track has been laid on this section from Algoa south to Brazoria, 32 miles. From Algoa there will be two divisions, one east to Galveston and the other north to Houston. Surveys completed and rights of way secured. Building of the line to San Antonio has not yet been begun. W. P. Homan, Corpus Christi, Tex., is Chief Engineer.

Reported that this road will be extended from Brownsville, Tex., across the Rio Grande river southward to Tampico, Mex., 290 miles. This line, if built, would shorten the distance between Galveston and central Mexican points, 285 miles.

*ST. LOUIS, EL RENO & WESTERN.—An extension is being built from El Reno through Canadian, Caddo and Kiowa Counties, Okla. T.

*ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—This company has completed five miles of its northwestern-southern cut-off from Gurdon to Greenwood, Ark. The present contract provides only for an extension to a point 40 miles north of Gurdon, but the road will eventually be extended. A contract will shortly be let for extending the line northwest to Greenwood, where the branch to Fort Smith is already in operation.

—*Contract let to Johnston & Grommet Bros. for the clearing, grading and bridging of the new line from Endora, Ark., south to Gilbert, La., 78 miles. The work is not heavy, the maximum grade being 3 per cent. and the maximum curvature 1 per cent. without any important steel bridges, trestles or tunnels.

——Surveys reported being made by this company for a line from Henson, Mo., south to a point on the Mississippi river opposite Hickman, Ky., 25 miles.

— Plans reported made for laying about 109 miles of second main track, and to increase terminal facilities at Little Rock and other places in Arkansas.

ST. LOUIS, LITCHFIELD & EASTERN.—Incorporated in Illinois to build a road from Litchfield to Alton, Ill., 40 miles. The officers of the company are: J. H. Belt, of Bunker Hill, President; J. E. Kelsey, of Bethalto, Ill., Vice-President; H. R. Budd, Bunker Hill, Ill., Secretary, and C. E. Drew, Bunker Hill, Treasurer.

ST. LOUIS MANUFACTURERS' RAILWAY.—The lines of this company will, it is reported, be extended so as to make a St. Louis entrance for

SOUTH BALTIMORE STEEL CAR & FOUNDRY CO.

MANUFACTURERS OF

CONTRACTORS DUMP CARS
RAIL CARS

For Prices and Catalogue address
BENJAMIN WATSON, Eastern Representative

COFFEE EXCHANGE BUILDING,
66-70 BEAVER STREET, NEW YORK.



Contractors and Railroads —Attention

New York Elevated R. R. has a number of excellent Forney type engines for sale, 4 ft. 8½ in. gauge. Desirable for Suburban, Logging, Plantation, Contractors, Switching and light railroad service generally.

Locomotives, new and second hand; all types, weights and gauges.

Cars, passenger, box and flat; new and rebuilt.

Contractors Dump Cars—A Specialty.

Rails, all weights; angle and plain plates; bolts and nuts; frogs and switches; spikes, etc.

BENJAMIN WATSON,
Coffee Exchange Bldg. 66-70 Beaver St., New York.

the Kansas City Southern. It is intended to bridge or tunnel the Mississippi so as to connect with the railroads terminating at East St. Louis; and in the other direction the plans do not stop short of the Gulf of Mexico. Adolphus Busch is President.

ST. LOUIS, MOUNTAIN PARK & EL PASO.—Chartered to build a railroad from St. Louis to the Gulf of California. Right of way for 13½ miles, and ground within the city for a station have been granted at Anadarko, Okla. T.

***ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.**—This company, which proposes to build a line from Des Moines, New Mexico, west and south through Clifton House, across the Red river and through the Cimarron Canyon to Moreno Valley, N. Mex., 120 miles, with a branch from Clifton House north to Raton, 6 miles, has begun work near Raton. Henry Koehler, of St. Louis, Mo., is President; Fisk & Robinson of New York City are interested.

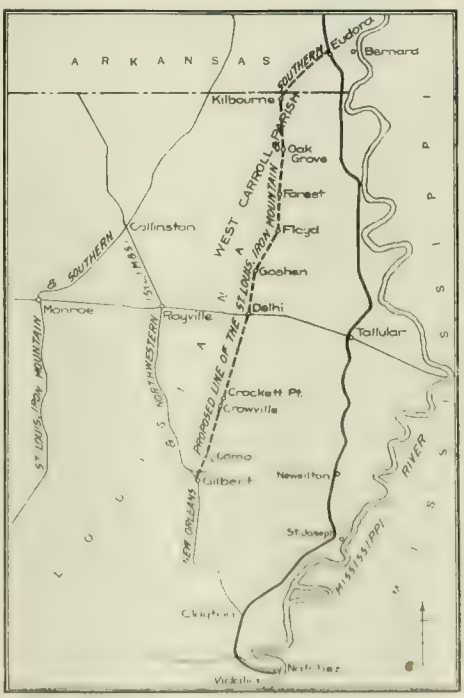
***ST. LOUIS SOUTHWESTERN.** Improvements during the present year to cost $2,000,000. The most important include the completion of a bridge over the Red river at Shreveport, La., and a terminal system at that place which will require eight miles of track. This work is to be finished about May 1, at a cost of about $500,000 for the bridge and $150,000 for the terminals. Construction work will also be carried out improving the line in Louisiana and Texas. Between Texarkana and Mt. Pleasant, the grade will be reduced and the curves eliminated. New 75 lb. rails will be laid between Noell Junction and Dallas, also between Tyler and Waco, and between Louisville and Shreveport. The improvements include the building of a number of steel bridges and concrete arches, and the widening of embankments. Drainage conditions will also be improved.

Proposed extension from the southern terminus at Gatesville to Hamilton, Tex. Surveys were made some time ago for a distance of 33 miles, but no definite action has been taken toward beginning the work.

ST. LOUIS, VANDALIA, TERRE HAUTE & EASTERN TRACTION. Mortgage filed with the Chicago Title & Trust Co., and certificate of incorporation filed in Illinois showing capital of $1,000,000. The company intends to connect St. Louis with Terre Haute by an electric road and has leased the right of way from the latter place to the Illinois state line. Right of way also reported secured from St. Louis to Effingham. Construction work is to be commenced at the Terre Haute end. The directors include Peter Chase, of Decatur; Lewis H. Bissell, Effingham; C. W. Mills, H. J. Wanner and W. B. Baldwin, Chicago. W. B. Wanner is Secretary, 119 La Salle street, Chicago.

ST. MARY, SUWANEE & GULF. Incorporated in Florida, with capital of $20,000, to build from a point in Baker County west through Columbia and Hamilton Counties to Live Oak, Suwanee County, and west through the counties of Suwanee, Lafayette, Taylor, Jefferson and Wakulla, a distance of about 180 miles. The incorporators include Frederick Drew, T. P. Alston, G. L. Drew and R. N. Ellis, Jr.

ST. MARYS & WESTERN.—This company has completed the first 10 miles from St. Marys, Pa., to Trout Run, on its proposed road from Johnsonburg, Pa., via St. Marys to Benezette, 25 miles. E. L. Willard, St. Marys, is Chief Engineer.



St. Louis, Iron Mountain & Southern.

***ST. PAUL & DES MOINES.** Organized in Iowa with a capital of $1,000,000, to build an extension of the Des Moines, Iowa Falls & Northern from Iowa Falls north to Mason City. The line has been located northeast from Iowa Falls halfway to Hampton. Construction work will be started shortly by the contractors, the Iowa Construction Co., organized by the officers of the Des Moines, Iowa Falls & Northern.

SALT LAKE & OGDEN (Electric).—This Utah road, now operated by steam, is to be electrified and be extended from Layton north to Ogden, about 15 miles, together with other improvements. Opened to Layton.

***SAN ANTONIO & GULF (SOUTHERN PACIFIC).**—Contracts reported let to W. O. Robertson, of San Antonio, for building this proposed road from Stockdale, Tex., east to Cuero, 40 miles. The building of this road is to comply with the requirements of the Southern Pacific merger bill passed by the Legislature at its last session.

SAN DIEGO EASTERN. Incorporated in California, with $10,000,000 capital, to build from San Diego, Cal., eastward to the Colorado river at Yuma, about 225 miles. Surveyed and rights of way and franchises through the city of San Diego acquired. Construction not yet started. George W. Marston, San Diego, Cal., is President; John E. Boal is Vice-president, and L. L. Boone, Secretary.

SAN FRANCISCO & NORTHWESTERN (A., T. & S. F.). This company, which recently added 1.3 miles of new line, bringing its southern terminus to Shively, Cal., is making plans for a connection south to San Francisco, 260 miles.

***SAN FRANCISCO, IDAHO & MONTANA.** The route of this proposed road is from Butte, Mont., southwest through Salmon City, Boise and Caldwell, Idaho, and Mason City, Nev., Gold Camp McDermitt, thence to Winnemucca, Nev., with an extension from Mason City west to the northern part of California Valley. Track laying will commence this year. Contracts for part of the grading are let and others are being let. The work includes a steel bridge over the Snake river. It is the plan to build 240 miles from Boise to Winnemucca by January, 1907. William Peyton Mason, Elks Building, Minneapolis, Minn., is President, and C. E. Bryant, Boise, Idaho, is Chief Engineer.

SANGAMON VALLEY. Incorporated in Illinois to build from Decatur west to Quincy, about 140 miles, also branches from the proposed route at Springfield and Petersburg. G. M. Skelly, J. F. Melick, J. S. Sutton and C. F. Morrow, of Springfield, are interested.

SAN MARCOS VALLEY INTERURBAN. Chartered in Texas, with a capital of $500,000, to build an interurban line from San Marcos, Tex., to Dallas, passing through Martindale, Lockhart and Prairie Lea, about 74 miles. Not settled whether the motive power will be steam or electricity. The prospects for building the road are good. The maximum grade will be 1 per cent., with a maximum curvature of 4 degrees. There will be no heavy work; two steel bridges will be required, with about 1,000 ft. of pile trestlework. A. P. Fisher of St. Louis, Mo., is President, and George W. Megrew, of Houston, Tex., Chief Engineer.

***SAN PEDRO, LOS ANGELES & SALT LAKE.** Contract let to the Utah Construction Co., of Ogden, Utah, for building spans near Poplin

Utah, approximately 147 miles in length, and connecting one location of the old main line at Ucon on about five miles.

Surveys reported being made for a branch from a point on this road in Salt Lake City southeast about 100 miles to the coal fields of Carbon and Emery Counties, paralleling the main line of the Rio Grande Western.

Branch to connect to Bluestone, Nev., from the nearest point on the line in Southern Nevada is said to be about 120 miles.

Arrangements made by this company and the Nevada Light, Mining & Co. for building a branch from Caliente, Nev., north to Pioche, 30 miles. The exact distance between Pioche and Caliente was graded for a proposed narrow-gage road some years ago so that now little needs to be done but lay the track.

SAN SABA & COLORADO VALLEY.—Surveys made for this proposed railroad from Lometa, Tex., on the Gulf, Colorado & Santa Fe, west to San Saba, 22 miles. There will be one steel bridge over the Colorado river about 150 ft. long. The company plans to use steam locomotives for freight trains and gasolene motor cars for passengers. Orton G. Campbell, of Dallas, Tex., is interested.

SANTA FE & EASTERN.—This road is to be built from Sugarite, N. Mex., for a considerable distance through a rich mineral country.

SAVANNAH RIVER.—Organized, with capital of $100,000, to build from Augusta, Ga., south to Clyo, in Effingham County, where connection is to be made with the Seaboard Air Line, about 90 miles.

*SEABOARD AIR LINE.—This company has let a contract to Blair Burwell, of Jacksonville, for building part of its proposed extension from Wacissa, Fla., southeast to Perry, 80 miles. Work under way. The road will be extended through Jefferson County into Taylor County and to Perry, connecting there with the Suwanee & San Pedro, now controlled by the Florida Railroad, of Live Oak. The proposed road will cross the Aucilla river, Econfina river and Long Creek before reaching Perry, and will traverse a timber section.

Surveys reported for a branch from Odenville, St. Clair County, Ala., northeast via Asheville to Gadsden, 32 miles.

——Preliminary surveys made for a new line from Elberton, on the present Portsmouth-Atlanta route, eastward to Augusta.

Surveys being made for an extension from the southern terminus of the Atlanta & Birmingham Air Line at Jacksonville, Ala., south to Anniston, 12 miles.

SEABOARD TRACTION.—Application made to the City Council of Portsmouth, Va., for the right of way for an electric railroad to run from Smithfield, Va., through Portsmouth, Suffolk and Petersburg to Manchester, opposite Richmond, Va. To be completed within two years. L. R. Britt, of Norfolk, is President, and W. H. Robinson, General Manager.

SEATTLE & EASTERN.—Organized, with $4,000,000 capital, to operate railroads in the state of Washington. W. H. Goldson, E. C. Gill and M. E. Heavey, of Seattle, and John McQuaid, of Issaquah, incorporators.

*SEBASTIAN COUNTY (Electric).—Proposed electric road from Fort Smith, Ark., via Bonanza, Jenny Lind, Greenwood, Salem, Huntington, Mansfield, Prairie Creek and Midland to Hartford, 45 miles. Not determined when grading will be started. S. A. Williams, Fort Smith, Ark., is President.

SEWARD PENINSULA.—This company, organized under the charter of the Nevada Trust Co., proposes to build during the coming summer a line from Nome, Alaska, to Kougarok, 125 miles. It is being financed by New York and Nevada capitalists.

SHAWNEETOWN & WESTERN.—Incorporated in Illinois, with capital of $50,000 and office at Golconda, to build from Shawneetown, Gallatin County, southwest through Hardin, Saline, Pope, Johnson and Massac Counties to the Ohio river, 55 miles. The incorporators and first board of directors include: John Gilbert, H. B. Pierce, J. L. Murphy and W. H. Moore, all of Golconda and Charles E. Turner, of New York City.

SHELBYVILLE & OHIO RIVER (Electric).—Proposed electric line from Shelbyville, Ky., through Eminence and Newcastle to Carrollton and Milton; $1,000,000 in bonds issued to provide funds for construction. According to the announced plans of the promoters, work is to begin shortly, commencing at Eminence, at Newcastle and at Shelbyville. The company proposes to build a large power house at Eminence. Luther H. Leber, Eminence, Ky., is interested.

SHORT LINE DEVELOPMENT & CONSTRUCTION COMPANY.—Chartered in Washington, with a capital of $3,000,000 and headquarters at Seattle, to build railroads in Alaska. The incorporators include: Thomas Flammer and Martin Bosworth, of Seattle, and Grant Hamilton, of Denver.

*SHREVEPORT & NORTHEASTERN.—New line projected from Shreveport, La., northeast via Homer to Memphis, Tenn., about 275 miles. Surveys completed from Shreveport to Homer, and right of way secured. Contract let to A. Kinnebrew & Co., of Homer. Grading completed for about 18 miles. A. K. Clogman Shreveport, La., is President.

SHREVEPORT, JONESBORO & NATCHEZ.—Organized in Louisiana, with capital of $1,500,000, with offices at Jonesboro, Jackson Parish, to build from Jonesboro southeast through the parishes of Winn, Caldwell, Catahoula and Concordia, to Natchez, Miss.; also from Jonesboro south through Jackson, Bienville, Bossier and Caddo parishes, to Shreveport. The incorporators include: C. E. Neeley, of St. Louis; W. W. Brown and W. W. Ramsey, of Camden, Ark.; W. D. Hutchinson, J. S. Craigie of Jonesboro, La.; R. N. Garrett, of Eldorado, Ark.; C. A. Henderson, of Arkadelphia, Ark.

SHUBUTA & SOUTHWESTERN.—Incorporated in Mississippi, with capital of $25,000, to build from Shubuta, Miss., to Eucutta, about 18 miles. F. H. Kaupp is President, and J. H. Griffith, Secretary.

SIERRA & EASTERN.—Incorporated at Bakersfield, Cal., with Los Angeles as the principal place of business, to build from Tehachapi, Cal., east to Searchlight, Lincoln County, Nev., 200 miles. The company is capitalized at $2,500,000. J. A. Chanslor and C. A. Canfield, of the Associated Oil Company, are interested. H. M. McIntosh, of Chicago, is a director.

SIKESTON & SOUTHWESTERN.—Chartered in Missouri, to build from Sikeston, Mo., to a point on the Mississippi river, opposite Hickman, Ky., 20 miles. J. F. Gould, E. M. Sikes and Walter L. Hensley, of Farmington, Mo.; G. B. McCoy, of Sikeston, and M. McGoney, of St. Louis, are incorporators.

SIOUX CITY & IRETON (Electric).—Organized in Iowa, with capital stock of $500,000 and Sioux City as headquarters. Proposes to build from Sioux City north to Ireton, Ia., 38 miles. Electric power will probably be used. The directors are James Ahrens, D. Montgomery, M. A. Karr, Henry Memen, H. D. Eilers, J. G. Grabner, Wm. McAuliffe, L. Borschers and Thomas Stinton. The company has already been granted a franchise to construct and operate its lines on the streets of Ireton. Arrangements will probably be made with the Sioux City Traction Company for entrance into Sioux City over its lines.

SIOUX CITY, HOMER & SOUTHERN.—This new company, which is building a line from Sioux City, Ia., south to Homer, Neb., 17 miles, has completed the line to Dakota City, seven miles. Steam will be used as a motive power until the entire road is completed, after which it is planned to use gasolene-electric motor cars. John H. Becker is President.

SIOUX FALLS & WESTERN.—Incorporated in South Dakota, with capital of $10,000, to build 210 miles of railroad as follows: Two lines from Sioux Falls, one to Greenwood through the counties of Minnehaha, McCook, Hutchinson, Douglas and Charles Mix, and the other from Sioux Falls through Minnehaha, Lincoln, Yankton and Bonhomme Counties to Bonhomme.

SNOWBIRD VALLEY.—Chartered in North Carolina to build from Andrews, Cherokee County, on the Southern Railway, along Hickory creek and over Long Ridge mountains, thence down Bear and Snowbird creeks into Grand County, about 15 miles. The incorporators include: C. N. Hickerson, E. G. Hennermann and W. B. Hamrick, of Andrews, N. C., and W. A. Lewin, of Staunton, Va.

*SOMERSET RAILWAY.—This company has ten miles completed on its proposed line from Deadwater, Somerset County, Me., through Mayfield and the townships of West Moxie, Squaretown and Indian Pond, where a crossing is made over the Kennebeck river to Lake Moxie, thence north to a junction with the Canadian Pacific at some point in Aspinth, and thence north about six miles to Birchpoint, in Tomhegan, in all 41 miles. The general contract has been given to J. G. White & Co., of New York City, and other contracts have been let for tracklaying and bridge work. Tracklaying, it is expected, will be finished early this spring. The work is light, the maximum grade being 1 per cent. There will be four steel bridges.

*SOUTH & WESTERN.—This road is building an extension from the coal fields of southwest Virginia, in Wise, Dickinson and Buchanan Counties, south through Virginia, Tennessee and North Carolina to connections in South Carolina with the Southern, the Seaboard Air Line and the Atlantic Coast Line, a total distance of 300 miles of main line. Work is now under way by the Carolina Construction Co., of Bristol, Tenn., which was organized by George L. Carter, President of the S. & W., in North Carolina, and it is said that this company may get the entire contract. Other contracts have been let to Walton & Wilson and J. L. Rode & Co. for 50 miles between Kingsport and Erwin, but work has not yet been begun. The maximum grades southbound will be 26 ft. to the mile. There will be a number of bridges. George L. Carter is President, and G. A. Kent, Chief Engineer, Bristol, Va.

*Active work has been started in the digging of the tunnel through Clinch Mountain near Speer's Ferry, Va. The contractors, Walton & Wilson, of Knoxville, have agreed themselves to complete the work within 18 months.

See Spartanburg & Northern.

SOUTH ATLANTIC TERMINAL COMPANY.—Chartered in North Carolina, with capital of $150,000, to build a railroad from Wilmington, south to Southport, Brunswick County, about 30 miles. H. A. Dougherty, of New York City, and D. W. Bullock, of Wilmington, and others are interested.

*SOUTH BEND & SOUTHERN MICHIGAN (Electric).—This company has about completed its road from South Bend, Ind., via Niles, Berrien Springs and Scottdale to St. Joseph, Mich., 34 miles. The work includes a steel bridge 1,200 ft. long over the St. Joseph river and a number of other bridges. George Townsend is contractor and A. J. Hammond, Chief Engineer.

This company proposes to build a line from South Bend to Buchanan, Mich., 14 miles. See Northern Indiana.

SOUTHBOUND RAILROAD.—Surveys made by Capt. A. H. P. Cornell for this railroad from Winston-Salem, N. C., south via Arcadia to Wadesboro, about 90 miles.

SOUTH CAROLINA ROADS.—Announcement made by Dr. W. Gill Wylie, President of the Southern Power Co., of Chester, S. C., that this company will build a railroad from Harmony, S. C., on the Seaboard Air Line, southeast to Camden, about 60 miles, connection to be made at Fort Lawn with the line running to the company's works at Catawba Falls. The cost of the work will be about $600,000.

*SOUTH DAKOTA CENTRAL.—This company will begin grading early in April on an extension from Rutland, S. Dak., north to Watertown, 60 miles. Part of the work to be done by the company's men, the balance to be let on contract. J. L. Wagner, of Sioux Falls, is Chief Engineer.

SOUTHEASTERN RAILROAD.—Surveys have been completed and rights of way are being secured for this proposed railroad to be built from Leslie, Ark., southeast to Garner, 105 miles, and thence to Little Rock. The proposed road will have a ruling grade of 0.6 per cent. and curves of 8 degrees. Contracts for the work will soon be let. George L. Sands is President, and S. W. Lee, Chief Engineer.

*SOUTHERN.—Contracts let to William J. Oliver, of Knoxville, Tenn., to double track its line from Morristown to Knoxville, 42 miles, and build a line from Chattanooga, Tenn., southwest to Stevenson, Ala.

*Contract let to the Callahan Construction Co., of Knoxville, Tenn., for building six tracks from Shark's Gap to Lonsdale, Tenn., about six miles.

*New line from Chattanooga, southwest to Stevenson, Ala., 42 miles. Contracts for the tunnel through Lookout Mountain and for masonry in connection with Tennessee River Bridge have been let. W. J. Oliver & Co., Knoxville, Tenn., have the contract for the tunnel, and B. H. Hardaway for the bridge masonry at the Tennessee river. The tunnel and bridge are the most important work, and until this work is well advanced the contract for grading will not be awarded. The maximum east-bound grade is 33 ft. per mile, maximum west-bound grade 1 per cent., with a maximum curvature of 6 degrees. This new line will include a draw bridge across the Tennessee river about 15 miles west of Chattanooga, several small bridges, one short tunnel about seven miles from Chattanooga and a small amount of trestle.

*Announcement has been made by W. J. Oliver, of Knoxville, Tenn., who has the contract for building 68 miles of line from Bushnell, N. C., to Maryville, Tenn., that work will be begun at once at Bushnell. The proposed route extends west from Bushnell along the north fork of the Little Tennessee river for about 50 miles, thence northward to a connection with the Knoxville & Augusta at Maryville. About three miles of the line from Bushnell was graded two years ago. This extension will be a low-grade line and does not present any difficult features of construction except several tunnels near Bushnell.

Proposed line from Pioneer, Tenn., to Winfield, on the Cincinnati Southern. No action has been taken, although surveys were completed some years ago.

Surveys under way for a line around Lynchburg, Va. The new line will be used by freight trains to avoid entering the city over the heavy grades. Two routes are being surveyed, one above and one below the city.

*Rights of way secured for building a branch from French Lick Springs, in Orange County, Ind., on the Chicago, Indianapolis & Louisville, southwest to Jasper, Dubois County, about 20 miles. The work includes a tunnel 2,000 ft. long, for which a contract has been let to a contractor of Knoxville, Tenn. It is expected to have the line in operation by Oct. 1, 1906.

Bids for building yards at Cumberland Gap asked. The work includes five miles of new track, round-house and turn table.

Between $200,000 and $300,000 will, it is said, be spent at Hamilton Springs, Tenn., where five miles of track is to be laid and a new turn table built.

See Asheville Southern.

See Johnson City Southern.

SOUTHERN BOULEVARD (Electric).—Application made in New York City for permission to build an electric road from the intersection of the Southern Boulevard and East 174th street to a connection with the Union Railway at the intersection of Crotona avenue and Pelham avenue, all in the Borough of the Bronx.

SOUTHERN PACIFIC.—At least 387 miles of new branches and feeders have been authorized to be built by the Southern Pacific as follows:

*A line from Drain, Ore., on the San Francisco-Portland line, midway between Eugene and Roseburg, westerly down the valley of the Umpqua, thence southerly to Coos Bay, on the Pacific Coast, 82 miles. This line has just been begun and is to be completed in 1906. It runs through a timber and agricultural country. It is being built under the charter of the Oregon Western.

*A line from Natron, Ore., up one of the forks of the Willamette, across the Cascades, south to Klamath Lake in southern Oregon, where the Government is to open a wide area by irrigation. This line will also develop a fine timber section and will be 152 miles long.

*Extension 16 miles long from Hazen, Nev., on the main line, southeasterly, into the heart of the irrigated country. The entire country round Carson Lake, in Nevada, will have water next year from the Government's Carson project. It is now a sage brush desert.

——*A line 15 miles long from Santa Cruz, running up from the ocean coast 15 miles on the Pacific Coast, to proposed large cement works. As a result of Government irrigation plans and private operations, there is more demand for cement now in California than three large factories can supply.

— *A line through lower California in the irrigated districts, south of the boundary line and back to Yuma on the main line, making on the main line a loop of 70 miles, of which 40 or 45 miles are completed.

Under the name of the Cananea, Yaqui River & Pacific, in Mexico, a 52 mile line has been surveyed from Batamotal near Guaymas, on the Gulf of California, southeasterly to the valley of the Yaqui. This also is a rich agricultural country, but eventually the new line will serve many mines in the foothills of the Sierra Madre mountain. This line is part of the South-Pacific concession in Mexico. The Greene properties are in northern Sonora, and it is not improbable that Harriman and Greene interests later on will find a way of connecting

TIE PLATES TIE PLATES

WOLHAUPTER Q & W and SERVIS

HIGHWAY CROSSING SIGNALS. ELECTRIC BLOCK SIGNALS. HIGHWAY CROSSING GATES

The Railroad Supply Company

CHICAGO NEW YORK

COPPERED AND TINNED CHANNEL PINS, BOND WIRES, BATTERY CHUTES

WOLHAUPTER Q & W and SERVIS

TIE PLATES TIE PLATES

—— Surveys reported being made by this company for an extension from Arnaudville north to Port Barrie, 12 miles, and from Lafayette northeast to Baton Rouge, 52 miles, all in Louisiana. The Baton Rouge extension crosses the Atchafalaya at a swampy point, and a large number of trestles will have to be built.

——*The Shattuck & Desmond Construction Co., of Los Angeles, is grading between Santa Cruz and Davenport, 12 miles, on extension from Santa Cruz, Cal., north via Davenport, San Gregoria, Pescadero and Half Moon Bay to a junction with the Southern Pacific near Colma, approximately 68 miles.

Survey for a tunnel through the Siskiyou mountains, in north California, to be ready for operation within three years. When completed the tunnel will greatly reduce the grade and shorten the distance by seven to ten miles between Sacramento and Portland. It is proposed to run through the tunnel by electric power.

An agreement, it is said, has been reached by this company and the Atchison, Topeka & Santa Fe, under which the California Northwestern, which is controlled by the Southern Pacific will be extended north from Sherwood to Pepperwood, Humboldt County, Cal., six miles southeast of Scotia, about 10 miles, where connection will be made with the San Francisco & Northwestern, which is owned by the Santa Fe, furnishing a direct route from San Francisco to Eureka.

—— See Cananea, Yaqui River & Pacific under Mexico.

—— See Galveston, Harrisburg & San Antonio.

—— See Houston & Texas Central.

—— See Houston, East & West Texas.

—— See Morgan's Louisiana & Texas.

—— See Oregon Eastern.

—— See San Antonio & Gulf.

—— See Southern Pacific under Mexico.

SOUTHERN TRACTION. Proposed electric line from Altoona, Pa., south through South Altoona, Eldorado, Canan Beryl, Duncansville, Newry, Freedom and McKees to Roaring Springs, with a loop starting from a point on the main line at Beryl and running east through Hollidaysberg, and thence west to the main line at Duncansville. The work includes one overhead crossing and nine small steel bridges. F. G. Patterson, Pittsburg, Pa., is President, and H. C. Gwin, of Altoona, Pa., Chief Engineer.

SOUTH SIDE COAL & IRON COMPANY. This Arkansas company plans to build a railroad from Paris, Ark., east to Dardanelle, 38 miles, with branches aggregating 12 miles. George D. Locke is Vice-President, Missouri Trust Building, St. Louis.

SPARKS, MOULTRIE & GULF. This road, which was operated for some time, but abandoned, is to be rebuilt and operated from Adel, in Berrien County, Ga., north to Sparks, and thence west to Moultrie, in Colquitt County, about 18 miles. At Adel connection is to be made with the South Georgia & West Const., at Sparks, with the Nashville & Sparks and the Georgia Southern & Florida roads, and at Moultrie, with the Atlantic & Birmingham and Georgia Northern.

SPARTANBURG & NORTHERN. Proposed road from Spartanburg, S. C., to the North Carolina state line, where connection will be made with the South & Western, now under construction from the coal fields of Kentucky, Tennessee and Virginia. Application for a charter. G. L. Carter, of the South & Western, is President.

*SPOKANE & INLAND (Electric). This company, incorporated in the state of Washington last year, with capital of $3,500,000, is building an electric railroad south from Spokane to Palouse and Colfax. The proposed route is from Spokane via Moran, Prairie, Freeman, Mt. Hope and Waverly to a point in Spring Valley to be known as Spring Valley Junction. At this point the road will divide into two branches, the east arm extending via Oakesdale and Garfield to Palouse, and the West arm via Rosalia and Thornton to Colfax, a total length of about 140 miles. The company intends ultimately to extend the road to Pullman, Wash., and to Moscow, Idaho. Preliminary surveys have been made and part of the right of way secured. From Spokane, south, grading has been completed to Waverly, 33 miles, and track is laid for 12 miles. Contracts have been let for building the entire road. The work includes a number of bridges and tunnels. J. P. Graves, of the Spokane Traction Company, is President, and Alex. Lunfer, Chief Engineer.

*SPOKANE-COLUMBIA RIVER RAILROAD & NAVIGATION. Grading work under way on this proposed road from Spokane, Wash., southwest to Ringold Bar, on the Columbia river, where water connection will be made to Portland. The contract calls for the completion of 63 miles of the line by May 1, 1906, and an additional 85 miles by December 1, 1906. Track laying was begun about January 15 by the Eldenbell Construction Co., 42 Broadway, New York, who have the contract. Additional contracts for grading and bridge work have been let to M. P. Zindorf, of Connell, Wash. The work will be light. William F. Kyle is President, and W. S. Foster, Chief Engineer, both of 142 Wall street, Spokane, Wash.

*SPOKANE INTERNATIONAL (CANADIAN PACIFIC). This company, incorporated in the State of Washington, is building a line from Spokane to the International boundary at a point near Movie, B. C., on the Canadian Pacific's Crows Nest Pass line, 130 miles. Contracts have been let to Twohy Brothers and to Winter, Parsons & Boomer, of Helena, and to Grant, Smith & Co., of Chicago, which include the heaviest work on the line in Idaho and Washington. The maximum grade is to be 1 per cent. Over this route, by the Canadian Pacific and the Minneapolis, St. Paul & Sault Ste. Marie, the line from Spokane to Minneapolis and St. Paul will be 10 miles shorter than by any existing road. There will be three large bridges and two short tunnels through rock. C. W. Chapin is President and E. G. Taber, of Spokane, is Chief Engineer.

*SPRINGFIELD SOUTHWESTERN (MISSOURI PACIFIC). Contract let to the Willier Construction Co., of Springfield, Mo., to grade 32 miles of its road from Crane, Mo., on the St. Louis, Iron Mountain & Southern, northwest to Springfield, Mo. Clearing practically completed, grading well under way, no track laid. E. F. Mitchell is Engineer of Construction, with headquarters at St. Louis, Mo.

STANDARD & BATON ROUGE. Organized in Louisiana, with headquarters at Monroe, to build a railroad from that place through Ouachita and Caldwell Parishes to Standard, in Catahoula Parish and south to Cheneyville, about 115 miles. The officers and directors include: J. B. York, President; J. E. Rutherford, Vice President; C. J. Santag, Secretary and General Manager.

STEUBENVILLE & CANTON (Electric). Grading on this proposed electric road from Steubenville, O., via Richmond, Bergholz, Carrollton, Malvern, Waynesburg and Waco to Canton, O., 61 miles, is to be begun as soon as financing, now under way, is completed. T. H. Loomis, Steubenville, is Chief Engineer.

STILLMORE AIR LINE. This company, which operates a road from Wadley, Ga., southwest to Collins, 54 miles, is planning to build an extension from its northern terminus via Warrenton to Comak, about 10 miles. It is intended to ultimately extend the road from Comac north to Elberon, 50 miles, where connection will be made with the Seaboard Air Line.

STONE CANYON. Incorporated in California with capital of $300,000, to build from San Miguel on the Southern Pacific, north through San Luis Obispo and Monterey Counties to Nelson creek, 21 miles. Directors include: J. A. Chanslor, W. A. Sloan, W. G. Stafford, I. W. Hellman and E. W. Mason.

STONEVILLE & SOUTHWESTERN. Organized in Mississippi to build from Stoneville, in Washington County, southwest to a crossing of the Yazoo & Mississippi Valley, thence southwest through Issaquena County to Ben Lomond, on the Mississippi river, about 50 miles. The incorporators are R. W. Carrington, F. H. Ivy and C. A. Douglas, all of Leeland.

STROUDSBURG & NORTHAMPTON (Electric). This company, which proposes to build a trolley line from Stroudsburg, Pa., south to Bethlehem, 30 miles, and eventually to Easton and Philadelphia, has applied for a franchise at Stroudsburg. Charles H. Latta, of Bethlehem, Pa., is General Manager.

*SUGAR CREEK & NORTHERN (WHEELING & LAKE ERIE). This Wabash cut-off will be almost an air line from Bolivar, Ohio, northwest to Orrville via Sugar Creek, 26 miles. Contract let to J. C. Garland & Co., of Toledo, and work

[illegible] over T[illegible] to Sugar Loaf.

SOMERSET VALLEY.—This company, which operates 22 miles of road in Somerset County, Pa., is planning to extend its line [illegible] to Berlin, to Pocono City, [illegible] miles.

SUSQUEHANNA & NEW YORK.—Proposed extension from Ralston, Pa., to Loyalsock Center via Roaring Branch and Blackhorse. The survey follows Lycoming Creek from Ralston, the present terminus, to Roaring Branch, and then west, entering at Liberty, and thence down Blackhorse Creek to Loyalsock Center, about 26 miles.

Surveys under way for grade revision on the line from Short Run, Pa., northeast to Liberton, eight miles.

SUSQUEHANNA CENTRAL.—Chartered in Pennsylvania, with $1,000,000 capital, to build 100 miles of railroad through Clearfield, Center and Clinton Counties, Pa. James K. Gardener, of Ridgeway, is President.

SYLVANIA & SAVANNAH.—Chartered in Georgia to build a railroad from Sylvania, Ga., east to a point on the Savannah river, between Hutchins Ferry and Poor Robin Landing, about 20 miles. The incorporators include: T. A. Mock, L. H. Hutton Co., S. S. White and W. I. Cooper, of Sylvania.

SYRACUSE, LAKE SHORE & NORTHERN (Electric).—Incorporated in New York, with a capital of $2,250,000, to build a street railroad from Syracuse to Baldwinsville, 15 miles. The company is also to take over the Syracuse, Lakeside & Baldwinsville road, which was recently bought by the Beebe interests for $550,000. The road will be improved and probably soon extended north to Fulton and possibly to Oswego. The directors of the new company are: H. S. Holden, C. M. Warner, A. K. Titcomb, C. D. Beebe, W. Nottingham, W. A. Holden and W. K. Pierce, of Syracuse, and C. B. Benson, of Minetto, N. Y.

SYRACUSE NORTHERN TRACTION.—Incorporated in New York, with a capital of $1,000,000, to build an electric railroad from Syracuse and North Bay, on Oneida Lake, and Brewerton, Onondaga County, and Bridgeport and Snakelton's Point, in Madison County. The directors include: William M. Brown, of Newcastle, Pa.; W. K. Niver, W. H. Plump and L. L. Waters, of Syracuse.

T

*TACOMA EASTERN.—A certificate has been filed by this company, which operates 55 miles of road in the state of Washington, seeking permission to build extensions in Pierce and Lewis Counties; one from Park Junction via Kapowsin and Eatonville to Elbe, seven miles, and one from a point beyond Park Junction to a point in section 12, township 14, range 4 east, three miles. Contracts reported let. The work includes a bridge over the Nisqually, three miles east of Elbe, with approaches 1,300 ft. long.

TACOMA TRANSIT.—Incorporated in Maine, with capital of 1,000,000, to build in the state of Washington. M. W. Baldwin and H. E. Mason, of Portland, Me., are interested.

*TALLAHASSEE SOUTHEASTERN.—See Seaboard Air Line.

*TALLULAH FALLS.—Contract let for an extension from Dulards, Ga., to Franklin, N. C., 17 miles. Seven miles completed. W. A. Seymour, Otto, N. C., is Chief Engineer.

TAMPA NORTHERN.—Organized in Florida, to build from Tampa north. Financial arrangements said to have been made and the first 45 miles of road to be built at once. Contracts are being let for construction material. It is believed that the road will cross the state line into Georgia and form a connection with the Atlanta, Birmingham & Atlantic. Benjamin Thompson, of Tampa, is Chief Engineer.

TAYGARTS & CHEAT RIVER.—Chartered in West Virginia to build from Cecil, Taylor County, on the Baltimore & Ohio, east to Rowlesburg, Preston County, about 20 miles. The incorporators include: J. Baumgartner, S. McNiel, C. H. Moran and A. R. Stuart, of Baltimore, and G. H. Clapp, of Aberdeen, Md.

*TENNESSEE RAILROAD.—Contracts let to Eskridge & Carroll, of Huntsville, Tenn., and Burgin, Carson & Co., of Pioneer, Tenn., for extending this road from Buffalo Creek, Tenn., to Smokey Creek, 18 miles.

TENNESSEE ALABAMA INTERURBAN.—Permission granted this road to build an electric railroad from Army Post through Chickamauga Park to Dicktown, Tenn., via Ringgold and Catoosa Springs, Ga., connection with the Western & Atlantic at Ringgold, and also with the Louisville & Nashville, giving a short route to Dicktown. The work includes a tunnel at Missionary Ridge.

*TENNESSEE & ATLANTIC.—Organized, to build a railroad from Huntsman to Fellico Plains, Tenn. E. C. Mayes is President, and Sam P. Sparks, Secretary.

TENNESSEE & GULF.—The Tennessee Industrial Railroad has changed its name to the Tennessee & Gulf Road and will build from a point on the Cumberland river near the mouth of Harpeth river to Clifton, [illegible] 70 miles. The new company has changed its proposed route from the Harpeth river to the south side of the Cumberland river, about four miles below the former location. The company proposes also to build a branch from the main line at Lobelville, in Perry County, to Nashville.

TENNESSEE, GEORGIA & SOUTH CAROLINA (Electric).—Organized in Georgia, to build from Clayton, Rabun County, west through Union and Fannin Counties to Dicktown, Tenn., and thence through Walker County to Chattanooga. Merrill Skaggs, Blue Ridge, Ga., said to be interested. (Mar. 17, 1905.)

TENNESSEE INDUSTRIAL RAILROAD.—See Tennessee & Gulf.

TENNESSEE ROADS (Electric).—A company is being formed to build an electric road from Harriman, Tenn., southwest through Alamo, Manus, Gay, Brownsville, Pleasant, Wright and Bolton to a connection with the electric road at Raleigh, giving connection to Memphis, in all about 80 miles.

*TEXAS & GULF.—Charter filed in Texas to build from Timpson to a point on the Gulf of Mexico about 150 miles, and also to a point on the northern border of the state of Texas, about 100 miles. Grading completed from Timpson south 20 miles. The Grigsby Construction Co. are the contractors. (Mar. 17, 1905.)

Surveys made for an extension from Long View, Tex., north to a point near Marshall, 17 miles. (Mar. 17, 1905.)

*TEXAS CENTRAL.—Contract let to J. H. Owens, of Galveston, Tex., for building the proposed extension from Stamford, Tex., to a point 44 miles west. The work includes one 75-ft. bridge. Contracts also let for rails and ties. Over 90 per cent. of the line will be tangent.

*TEXAS, NEW MEXICO & PACIFIC.—This company, chartered in Texas, has given the general contract to the Rock Island Construction Co., First National Bank Building, Chicago, and is making surveys for its proposed road. The line is to run from McKinney, in Collin County, Tex., west by northwest through Denton, Decatur, Bridgeport, Graham, Belknap, Haskell, Rayner, Espuela, Emma and Lubbock, in Texas, west to Roswell, N. Mex., about 500 miles. The company plans to build a number of towns along the proposed route and grading contracts will be let as soon as surveys are completed. There will be six important steel bridges. Jesse Shaine is President, and M. J. Healy, General Manager, McKinney, Tex.

*TEXAS, OKLAHOMA & NORTHWESTERN.—Chartered in Oklahoma, with capital of $2,500,000, to build a railroad 450 miles long. The proposed line runs from a point on the boundary line between the Chickasaw Nation and Caddo County, in Oklahoma Territory, northwest to a point on the Cimarron river, in Woodward County, traversing the counties of Caddo, Custer, Dewey and Woodward; also an eastern line through the counties of Blaine, Kingfisher and Logan to Guthrie, and a western line through the counties of Roger Mills and Day. The directors are: A. H. Linton, Jos. Deveraux, Charles Seeley, and C. L. Carpenter, of Guthrie, and Henry Knapp, of New York. According to a despatch from Guthrie, dated March 8, grading has been begun between Weatherford and Taloga, by the Knapp Construction Co., which has the contract for building from Weatherford through Taloga to Woodward.

TEXAS ROADS.—John H. Kirby, of Houston, Henry King and others, have applied for a charter for a road to run from Burr's Ferry, in Jasper County, to Rockland and Chester, in Tyler County, 80 miles. This is to form a connecting link in the so-called Yoakum System. Contract for the work, it is said, will be given as soon as surveys are completed.

——Application made by a company in Texas to build a railroad from Dayton, in Liberty County, to the oil fields, about eight miles. M. Eastham, R. A. Grear, T. H. Bass and R. Silverman, all of Beaumont, incorporators.

——Contracts to be let soon for building 80 miles of railroad from Abilene, Tex., north to Munday, in Knox County. Major J. D. Beardsley, of Gibsland, La., has made a contract with the towns of Abilene, Anson, Stamford, Haskell and Munday whereby the road will receive a bonus of $125,000, also the necessary right of way and ground for stations. Surveys made.

A number of northern capitalists are planning to build a railroad from Lometa, Tex., on the Gulf, Colorado & Santa Fe, southwest through San Saba and Menardville to Del Rio, on the Southern Pacific, about 200 miles. Half of the line will follow the valley of the San Saba. Rights of way secured by Orton G. Campbell, of Dallas, from Lometa to San Saba, 22 miles. Possibly a Santa Fe project.

*A road, which has been under consideration for some time, and of which Ed. Kennedy is said to be a promoter, is to be built at once under the supervision of the Houston, Beaumont & Red River Construction Co., which has given the contract for the first 40 miles to P. R. Turney. The proposed route is from Houston, Tex., northeast through North Dayton, Perryman, Batson, Saratoga, Kountz, Jasper and Leesville to Alexandria, La., about 200 miles, crossing the Sabine river at a point 80 miles north of the Southern Pacific and 100 miles south of the Houston East & West Texas, passing through a rich agricultural section of southeast Texas. Contracts for the balance of the route to be let as soon as surveys completed.

A syndicate of capitalists of Cincinnati, O., in connection with Mayor T. W. Perkins, of McKinney, Tex., is planning to build a railroad from McKinney to Decatur.

Surveys made by William S. Carlysle & Co., of Chicago, for a railroad from Trinity, Tex., southeast to Livingston, 32 miles.

Plans under consideration by Captain Thomas H. Dodge, of Laredo, Tex., for a railroad from Laredo down the valley of the Rio Grande river to Rio Grande City, about 150 miles.

——Contracts reported let for an interurban line from Dublin at the junction of the Texas & Pacific and Texas Central southerly to Hamilton, 35 miles. This road may also be extended north from Dublin 30 miles to a junction with the Texas & Pacific at the Fairfield cutoff, or into Gordon, on the main line of the Texas & Pacific.

——Two factions are projected to Rio Grande City, Tex., one the Laredo & Rio Grande, from Laredo south 100 miles, and the other, the San Antonio & Rio Grande City, from San Antonio south 225 miles.

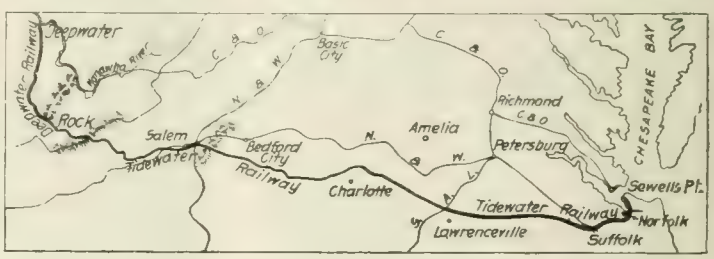
——Reported that a railroad is about to be built from Velasco, Tex., to San Antonio, about 225 miles. J. W. Gates and L. J. Polk, formerly First Vice-President of the Gulf, Colorado & Santa Fe, are said to be interested. (Mar. 17, 1905.)

*TEXAS SOUTHEASTERN.—This company, which recently completed its road from Diboll, Tex., west to the Neches river, nine miles, is building from the river northwest to Weches, 25 miles.

*THOMASVILLE & DENTON.—Contract reported let to E. L. Probst & Co., of Charlotte, N. C., for building the first seven miles of this proposed road from Thomasville, N. C., south to Denton, 15 miles. Milton Jones, of Thomasville, is President. (Mar. 17, 1905.)

TIDEWATER & WESTERN.—Chartered in Virginia to take over the Farmville & Powhatan, which operates 92 miles of road in Virginia, from Bermuda Hundred to Farmville, with a branch from Coalboro three miles long. It is proposed to extend this road either to Danville or Lynchburg. The directors of the new company include: T. F. Jeffress, H. W. Anderson, L. C. Lewis, J. S. Elliett and James M. Boyd, of Richmond, Va.

*TIDEWATER RAILWAY.—This company, which is building a line under the above name from Norfolk, Va., via Roanoke, west through the state of Virginia for 332 miles, and from that point under the name of the Deepwater for an additional 118 miles to the New river coal regions of West Virginia, has completed about 70 per cent. of the grading from Norfolk west to mile post 103. From that point grading has been started to mile post 362, and from the latter point to the end of the Deepwater (mile 450) about 75 per cent. of the grading is completed. The entire line, including the Deepwater, is under construction and is to be ready for operation by December, 1907. Track has been laid from mile post 5 to post 8.5 and from mile post 20 to post 27 on the Tidewater, and for 50 miles from Deepwater, W. Va., on the Deepwater. The work includes a number of important bridges and tunnels. L. Peterson, Norfolk, Va., is Chief Engineer. The contracts let are as follows: Section A—From Southern Railway crossing near Hurt, Va., westerly 20 miles, to J. G. White & Co., 43 Exchange place, New York. Section B—From Meherrin, Va., easterly 22 miles, to A. & C. Wright & Co. and W. R. Bonsal & Co., Hamlet, N. C., about 30 miles. Section D 2—From Brookneal easterly 6½ miles, to Butler Bros. Construction Co., 1170 Broadway, New York. Section E—From Brookneal westerly 20 miles, to Carpenter, Frazier, Boxley & Co., Clifton Forge, Va. Section F—From Southern Railway crossing near Hurt, Va., easterly 32 miles, to Lane Bros. Co., Esmont, Va. Section G—From Roanoke easterly 23 miles, to D. A. Langhorne & Co., Alderson, W. Va. Sections H, I, J, K, L—From Roanoke to Bluestone river, 112 miles, to MacArthur Bros. Co. and Arthur F. MacArthur, Chicago, Ill.



Tidewater and Deepwater Railways.

——The MacArthur Bros. Co. has sub-let part of the work through Virginia and West Virginia as follows: Mason, Hanger, Coleman Company, Frankfort, Ky., grading and tunnel, $250,000; P. J. Millett, Paris, Ky., bluff work, $250,000; D. J. McDonald, Aurora, Ill., grading, $225,000; Mike Elmore, Alliance, Neb., grading, tunnel and bluff work, $600,000; Bates & Rogers, Chicago, masonry, $300,000; James Hearn & Co., Ada, W. Va., grading, 65,000; W. N. Camp & Co., Roanoke, Va., grading, $100,000; Carpenter & Boxley, Clifton Forge, Va., grading and tunnel, $377,000; Chill & Purnell, Eggleston, Va., bluff work, $100,000; J. C. Zobrist & Co., Roanoke, Va., grading, $60,000; Ingles & Shelburne, East Radford, Va., grading, $70,000; W. H. Johnson, Salem, Va., part of section 263, all of section 264 and part of section 265, grading; Litz & Co., Graham, Va., sections 359 to 362, grading and tunneling. A contract for bridges and a mile-land trestle has also been let to the Virginia Bridge & Iron Company.

See Marsh Fork.

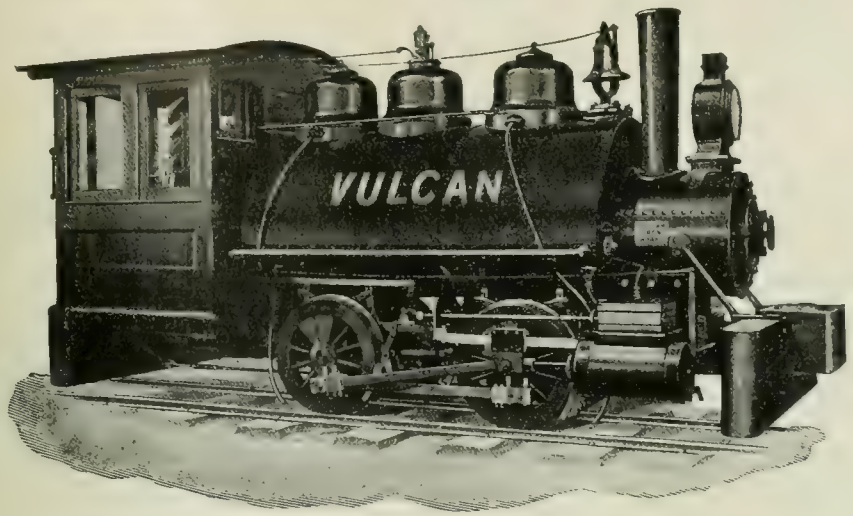
TOLEDO & INDIANA (Electric).—Proposed electric road from Bryan, Ohio, via Hicksville, to Fort Wayne, Ind., 41 miles. Grading to be begun June 1. There will be a number of bridges. E. Darrow, Toledo, Ohio, is Chief Engineer.

TOLEDO & ANN ARBOR (Electric).—This company, which is building an electric road from Toledo, Ohio, to Ann Arbor, Mich., 48 miles, has secured about 80 per cent. of the right of way. Nearly 13 miles of the roadbed has been graded.

TOLEDO & JACKSON (Electric).—Incorporated in Michigan to build an electric road from Toledo, O., northwest to Jackson, Mich., about 70 miles. Rights of way and franchises secured.

Are You In Want

of a new engine on your construction work? Our sales confirm the report that the **Vulcan Dinkey** is becoming more popular every year. We are building a **Contractors Dinkey** that is second to none—one that is backed up by over fifty-five years of experience.



We have increased our out-put and are now in a position to give you very prompt delivery on the standard sizes.

May we send you our folders and specifications?

Asking us questions costs you nothing

Vulcan Iron Works,

Wilkes-Barre, Penna., U. S. A.

BALDWIN LOCOMOTIVE WORKS

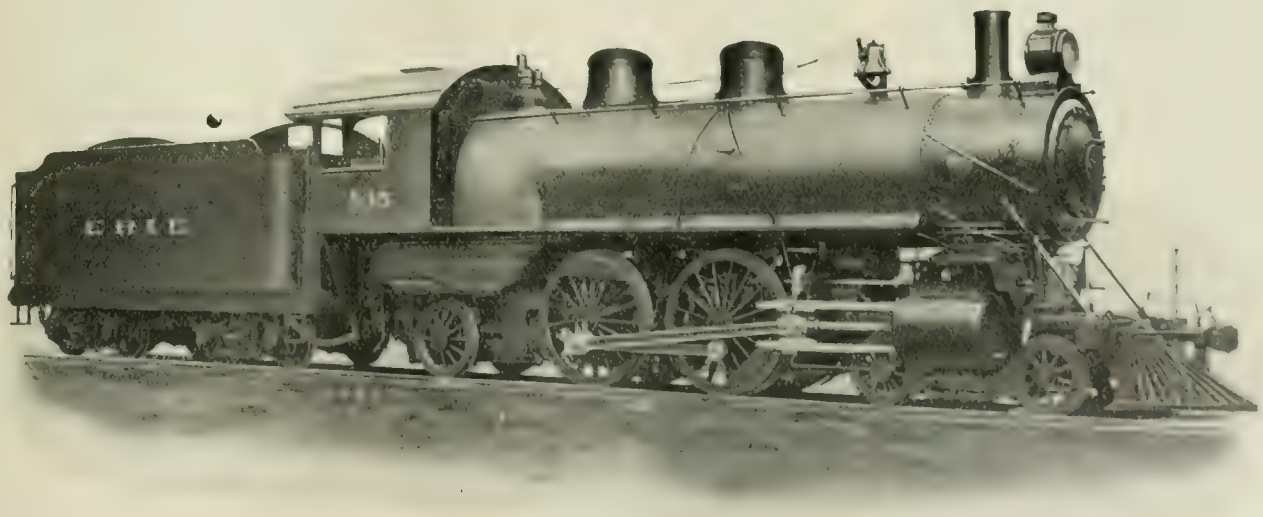
BURNHAM, WILLIAMS & CO.

PHILADELPHIA, PA., U. S. A.

MANUFACTURERS OF

LOCOMOTIVES

BOTH SINGLE EXPANSION AND COMPOUND AND FOR ALL GAUGES OF TRACK



BALANCE COMPOUND ATLANTIC TYPE LOCOMOTIVE FOR THE ERIE RAILROAD

Locomotives particularly adapted for Logging and Industrial purposes.
Locomotives for Mines and Furnaces.
Electric Locomotives built in conjunction with the Westinghouse Electric & Manufacturing Co.
Electric Motor and Trailer Trucks for Railway and Suburban Service.

Cable Address "Baldwin" Philadelphia

C. R. Bird, William Nagle, S. A. Foster and W. J. [illegible], of Toledo, and M. K. [illegible], of Wyandotte, are interested.

•TOLEDO & LIMA (Electric).—E. L. Ayers & Co., of Chicago, have the contract for grading and concrete bridge work on this new electric line.

•TOLEDO, ANN ARBOR & DETROIT (Electric).—This road, from Toledo, O., across the Michigan state line and via Lambertville, Milan, Petersburg and Dundee to Ann Arbor, Mich., 55 miles, is under contract to the Patrick Hirsch Co., of 35 St. Clair Building, Toledo. J. H. Clauss, of Fremont, is President. (Mar. 17, 1905.)

TOLEDO, DEFIANCE & SOUTHERN.—Incorporated in Ohio with capital of $10,000,000, to build an electric road from Toledo to Cincinnati.

TOLLEDO, FORT WAYNE & INDIANAPOLIS.—Organized with $3,000,000 capital to build from Toledo to Indianapolis. Rights of way secured. W. H. Strang, of New York, is President.

•TOLEDO, FOSTORIA & FINDLAY (Electric).—Contract reported let to Cressaw & Kretzman, of Findlay, for grading the extension of this road from Fostoria to Pemberville, 17 miles. The completion of this extension will give the road an entrance into Toledo over the Lake Shore Electric, connection being made between Pemberville and Woodville over the Lake Erie, Bowling Green & Napoleon.

TOLEDO, MARSHALL & NORTHERN.—At a meeting of the stockholders in Marshall, O., the capital stock was increased from $800,000 to $2,000,000. The company is to begin work on its proposed line from Bay City, Mich., southwest through Oliver, Marshall and [illegible] to Montpelier, O.

•TOMBIGBEE VALLEY.—Contract let to Beatty & Williams, of Heating Springs, Ala., and R. M. Newell, for building a 12 mile extension. N. G. Robb, Fairfield, Ala., is Chief Engineer.

TONOPAH & GOLDFIELD.—This company, which last year completed 30 miles of road from Tonopah to Goldfield, Nev., is making surveys for a further extension from Goldfield southerly to Beatty, an additional 80 miles.

•TONOPAH & TIDEWATER.—This company is building, with its own forces, a road from Tonopah, Cal., via Amargosa Valley to Beatty, Nev., 158 miles. Thirty miles have been graded, and track is laid for 13.5 miles. The work is easy. Maximum grades 2 per cent. with easy curves. F. M. Smith, of San Francisco, Cal., is President, and John Ryan, of Stags, Cal., is Chief Engineer.

TONOPAH TERMINAL.—Incorporated in California to build a railroad from Tonopah via Goldfish Junction and the north end of Lone Mountain to Silver Peak, 100 miles. Clapp Bros., of Philadelphia, are said to be interested. W. C. Wynkoop is President, and S. H. Park, Secretary.

TOPEKA, FRANKFORT & NORTHWESTERN.—To run from Topeka, Kan., northwest through the Counties of Shawnee, Jackson, Pottawatomie and Marshall to Frankfort, 60 miles. Beginning of work authorized. P. L. Wise, Topeka, Kan., is Chief Engineer. (Mar. 17, 1905.)

•TRINITY & BRAZOS VALLEY (COLORADO & SOUTHERN).—Contract let for extending this road south from Mexia to Houston, Tex., and from Dallas to a point near Mexia, in all about 230 miles, to P. M. Johnston & Co., of Mexia. Grading already begun at three or four places. The lines run through a rolling prairie country. Maximum grade will be 0.5 per cent.; maximum curvature, 4 degrees. The work includes three steel bridges of about 60 ft. each. P. G. Burns, Mexia, Tex., is Chief Engineer.

TULSA, TEXAS & GULF.—Organized, with $10,000,000 capital, by L. Howard Lee, of Oklahoma City, to build from Matagorda Bay, Tex., north to Oklahoma City, Okla. T., and Tulsa, Ind. T., about 600 miles. The directors include: M. H. Smythe, Gainesville, Tex.; H. V. Pentecost, Guthrie; J. W. Helt and M. S. Lee, Oklahoma City; D. D. Merry, Roswell, N. Mex., and L. Howard Lee, of Oklahoma City. The promoters say that financial backing for the enterprise has been secured and that construction will soon be started.

TULSA, TURNERSVILLE & TEXAS.—Chartered in Oklahoma Territory, with capital of $3,500,000, to build from the northeastern corner of Indian Territory southwest to Shawnee, Okla. T., passing through the Cherokee and Creek Nations and Pottawattomie County, 150 miles. The incorporators are: E. Turner, V. N. Sayre and W. S. Harsh, of Muskogee; Joseph M. Nell and W. N. Spurlock, of Guthrie.

U

UNION PACIFIC.—There have been 201 miles of new branch line construction officially announced as follows:

*The Omaha cut-off, which is being built under the name of the Omaha & Southwestern from South Omaha, Neb., to Lane, 115 miles. The existing line is 20.43 miles long. Estimated cost $2,000,000. Substitutes light for very heavy grades, and double for single track.

*A line being built from Hershey on the main line near North Platte, Neb., up the valley of the North Platte to Northport, 150 miles, through the corn belt. W. C. Bradbury, of Denver, has the contract.

*Connecting line being built under the name of the Topeka & Northwestern, from Topeka on the Kansas City main line northwesterly to Onaga, Kan., 40 miles, through an agricultural section. This line connects at Onaga with another Union Pacific line to Kansas City. Kilpatrick Bros. & Collins, of Beatrice, Neb., have the contract.

*About 100 miles of line in southern Wyoming will be double tracked. Three sections are as follows: Between Hermosa and Hermosa Junction, two miles, completing the double track between Cheyenne and Laramie, with the exception of 25 miles between Hermosa and Buford. Lookout to Hanna, 50 miles. This portion of the work will be the most costly to be carried out by the company, the grading near Medicine Bow being unusually heavy. The third section is between Rock Springs and Point of Rocks, 25 miles.

New articles of incorporation filed in Nebraska for an extension of the Cedar Rapids branch from its northern terminus at Spalding, Neb., northeast for a distance of 150 miles into South Dakota. The proposed line will cross the Chicago & North Western's Wyoming line.

Agreement reached by this company and the Northern Pacific to jointly build a railroad into the Clearwater district, Idaho. The road will traverse a distance of between 300 and 500 miles, through an undeveloped section. This project has been a subject of dispute between these two companies for a number of years. See Oregon Railroad & Navigation Company.

Union Pacific officials have announced that all needed terminals in Seattle, Wash., for an extension of the Harriman Lines to that city are secured. Surveys on the line to be built from Portland to Seattle, under the charter of the Washington Northern, are being made as rapidly as possible.

See Yellowstone Park.

See Washington Northern.

•UNIONTOWN & WHEELING SHORT LINE.—Work begun on this proposed railroad from Uniontown, Fayette County, Pa., west to Wheeling, W. Va., 68 miles. The company is building with its own force the abutments for the large bridge to cross the Monongahela river at McCann's Ferry, and has let contracts to the American Bridge Co. and the Jones & Laughlin Steel Co. for the superstructure. The total cost of the bridge will be about $1,000,000. Contracts will shortly be let for grading and also for building seven tunnels on the line of the proposed road. J. V. Thompson, of Uniontown, Pa., is interested.

UNION TRACTION OF IOWA.—Organized in Iowa, with capital of $100,000, and office at Marshalltown, to build an electric road from Marshalltown north to Grundy Center, thence northeast to Waterloo, Iowa, and another line from Marshalltown south to Newton, Iowa, where connection is to be made with the Interurban Railway Company of Des Moines, which is to extend its Des Moines-Colfax line from Colfax to Newton. The total length will be 78 miles. The officers are: D. T. Denmead, of Marshalltown, President; J. E. Sedgewick, of Waterloo, Vice President; L. C. Norris, of Marshalltown, Secretary, and George E. Lichty, of Waterloo, Treasurer.

UTAH RAILROAD.—Surveys reported for a railroad from Salt Lake City, Utah, to Portland. The survey passes from Salt Lake City to the south end of Salt Lake; thence to Winnemucca, Nev., and thence northwest to Diamond Pass, through the Cascades in Eastern Lane County, south of Diamond Peak, and to the Willamette valley, near Springfield. President Moffatt, of the Denver, Northwestern & Pacific, is said to have had a part of the same route surveyed several years ago.

V

VALDEZ, MARSHALL PASS & NORTHERN.—Chartered in New Jersey to build a railroad in Alaska from Valdez, on the bay of that name, to Eagle City, on the Yukon river, 413 miles. The incorporators include: F. D. Pierce, F. H. Huck, John D. Fearlake and Kenneth Rose, all of New York, and La Grand Bonker, of Jersey City. Offices at 243 Washington street, Jersey City.

VALLEY RAILWAY.—Incorporated in Wisconsin with capital of $25,000, to build from Green Bay southwest through Depere, Kaukauna and Appleton to Menasha, about 35 miles. The incorporators include: T. W. Orbison, Ackworthy, E. O'Keefe, R. Ackworthy and O. C. Smith, all of Appleton.

VANDALIA.—Reported that this company will spend about $2,000,000 during the year for double-tracking between Indianapolis and the Illinois state line.

•VINCENNES, WEST BADEN & LOUISVILLE TRACTION.—Contract let to a Pennsylvania contractor to build line from Vincennes, Ind., via Jasper to French Lick, at about $2,000,000. Contract also given to a Philadelphia company to build the power plant, either at Pittsburg or Otwell, for about $300,000.

•VINITA & WESTERN.—This company, which is building a line from Vinita, Ind. T., north via Timber Hill and Centralia to Coffeyville, Kan., 50 miles, has given a contract to Winter & Walt for building the first 10 miles, eight miles of which has been completed. The work includes a bridge over the Verdegris river. Contracts for the balance of the road to be let early in April. H. A. Genung, Vinita, Ind. T., is Chief Engineer.

•VIRGINIA & CAROLINA COAST.—Contract let to J. G. White & Co., of New York, for building its proposed road from Mackey's Ferry, N. C., over Pamlico river by ferry, through Bayboro and over the Neuse river to Beaufort, N. C., about 113 miles. Work now under way. The officers of the company are: R. T. Goodell, President; F. E. Dewey, General Manager, and A. N. Bullitt, Chief Engineer, all of Norfolk, Va.

VIRGINIA & KENTUCKY.—Surveys made to extend this line, which runs from Wise, Va., to Norton, along Birchfield Creek and Crane's Nest river up Long's Fork, through Stanley and Yates Gap and down Holly Creek to Clintwood, Va., 24 miles. F. M. McClure is Superintendent, at Wise, Va.

•VIRGINIA & SOUTHWESTERN.—Contract reported let to Walton, Wilson, Rhoades & Co., of Knoxville, Tenn., at between $5,000,000 and $6,000,000 for building 70 miles of its proposed road from Clinchport, Va.

VIRGINIA LIGHT & POWER COMPANY.—Chartered in Virginia with $25,000 capital to build an electric railroad from Richmond, Va., north about 18 miles, to Ashland, and eventually farther north. A line from Richmond to Ashland would parallel the Richmond, Fredericksburg & Potomac. The incorporators include: H. W. Anderson, President; T. S. Wheelwright, Vice-President, and G. B. Williams, Secretary and Treasurer, of Richmond.

•VIRGINIA ORE & LUMBER COMPANY.—This company, whose head office is at Roanoke, Va., has given a contract to the Vaughan Construction Co., of that place, for building 12 miles of road from Town Creek, on the Winston-Salem division of the Norfolk & Western, in Henry County, Va., west to Stuart's Knob, in Patrick County, Va. F. A. Hill and H. D. Lafferty are interested.

•VIRGINIA PENINSULA.—Proposed road to be operated by gasoline motors. The line is from Newport News, Va., through Bethel, Poquoson, Gratton, Yorktown, Gloucester and a number of smaller places, with a main line 20 miles long and 10 miles of branches. Contract given to the Pennsylvania Steel Co. for the rails. Work will be light, as there are no grades over 1 per cent. and no curves. W. A. Post is President; J. L. Patton, Vice President, and J. L. Smarye, Jr., Engineer, Norfolk, Va.

VIRGINIA ROADS (Electric).—Capitalists of Big Stone Gap, Va., propose to build 100 miles of electric roads, and it is said that they have begun surveys. The objective points are Appalachia, Stonega, Norton, Wise, Toms Creek and Dorchester. Valuable mineral and timber property will be reached by the proposed lines.

W

WABASH.—See Parkersburg Bridge & Terminal.

See Wabash Pittsburg Terminal.

See Western Maryland.

See Wheeling & Lake Erie.

WABASH & ROCHESTER TRACTION.—Bids were asked as soon as the completion of roadbed and track from Wabash, Ind., northwest to Rochester, 30 miles. The original line has been shortened and straightened, and new franchises have been granted. R. S. Vivian, 107 Dearborn street, Chicago, Ill., has charge of the work.

•WABASH PITTSBURG TERMINAL.—This company is building a connecting line four miles long from the track of the West Side Belt Railroad one mile east of Castle Shannon, Pa., extending to the head waters of Thompson's Run into a 2,000-car yard which is being built at the junction of this line and Monongahela Southern, a subsidiary railroad of the United States Steel Corporation. This line will make connection between the Wabash System and the Homestead, Bessemer and Braddock plants of the United States Steel Corporation. Connection at Clairton (Pittsburg) between the West Side Belt Railroad and the St. Clair Terminal Railroad of the United States Steel Corporation. Work under way.

WABASH SOUTHERN.—Incorporated at Springfield, Ill., with a capital of $10,000, to build from Zeigler north to Shumaway, 80 miles.

WACCAMAW RAILROAD.—Chartered in North Carolina, with capital of $250,000, to build a railroad from a point on the Cape Fear river near Oldtown, Brunswick County, west to Lake Waccamaw, thence to connect with the Atlantic Coast Line at Bolton, and with the Seaboard Air Line at Manlyville, 50 miles. The incorporators include: E. Nelson, of Detroit; E. S. Hartwell, Chicago; J. E. Clark, C. E. Clark, E. H. Sellman and W. H. Chadbourn, of Wilmington, all of whom are connected with the Waccamaw Land & Lumber Co.

WALLOWA VALLEY.—Incorporated in Oregon, with $500,000 capital, to build from Elgin, Ore., down the Grand Ronde to the mouth of the Wallowa and up that river to the valley of the same name in eastern Oregon. It is proposed to extend the road eventually to Joseph, a total distance of 35 miles. Surveys being made, and the rights of way reported secured as far as the Wallowa river. The incorporators include T. S. Potter, George F. Heusner and Robert Bell.

WALLULA PACIFIC.—Chartered in the state of Washington to build a railroad from Wallula to Vancouver, Wash., about 250 miles. The incorporators are: L. Gerlinger, of Portland, and G. M. Lyons and Joseph Stapleton, of Vancouver.

WARREN & DE VALL'S BLUFF.—Incorporated in Arkansas, with capital of $1,000,000, to build from Warren through Bradley, Cleveland, Jefferson, Lonoke and Prairie Counties, to De Vall's Bluff, 90 miles. The incorporators include W. T. Thompson, J. G. Thweat, W. R. Watson, N. McLeod and H. D. Maxwell.

WARREN, JOHNSVILLE & SALINE RIVER.—New line chartered in Arkansas with capital of $50,000 to build from Warren, Bradley County, southeast 25 miles. S. H. Fullerton, of St. Louis, Mo., is President; C. L. Robinson, of St. Louis, Secretary, and J. F. Forsyth, of Warren, Ark., General Manager.

WASHINGTON, BALTIMORE & ANNAPOLIS (Electric).—This company, which has applied for permission to operate its suburban cars in the city, has organized a subsidiary company to be known as the Baltimore Terminal Co. to build a terminal in Baltimore. President George T. Bishop, of Cleveland, is reported as saying that the new company has $5,000,000 to spend in making these improvements. The company expects to operate high speed electric cars between Baltimore and Washington, 31 miles, with a branch 14½ miles long.

WASHINGTON CENTRAL.—Incorporated in Washington, with capital of $500,000, to build from a point near Grays Harbor, Chehalis County, easterly through Chehalis, Lewis, Thurston and Yakima Counties. G. E. Long and M. D. Sayles, of Portland, Ore., and E. V. Bloomfield, of Centralia, Wash., are named as incorporators. (Mar. 17, 1905.)

•WASHINGTON, IDAHO & MONTANA.—Contract reported let to Wren & Greenough, of Spokane, Wash., for building this proposed road from Palouse, Wash., east 50 miles into Idaho.

JOHN B. WATSON
BROKER, ENGINEER
Rails, Locomotives, Cars, Steam Shovels
Railway and Contractors' Equipment generally
Bought and Sold on Commission only
DREXEL BLDG. PHILADELPHIA, PA.

RELAYING RAILS
BOUGHT AND SOLD
BLOCK-POLLAK IRON CO.
FIRST NAT'L BANK BLDG. - - - CHICAGO

Completed from Palouse to Flat Creek, Idaho, 20 miles. The road will traverse a rich timber territory. F. H. Thatcher, Winona, Minn., is President, and Arthur B. Clark, Portland, Idaho, Chief Engineer.

WASHINGTON NORTHERN (UNION PACIFIC).—This company, recently incorporated in the interest of the Harriman Lines, in the state of Washington, projects a railroad from Portland to Seattle and Everett, crossing the Colorado river at Kelso. The incorporators include: Jacob Furth, J. C. Trenhome and F. K. Stuyverne, through the last named of whom land has been bought. There have been secured at a cost of about $1,000,000, 70 acres of tide lands for railroad terminals at Tacoma, Wash., the company agreeing to build terminals and warehouses within 20 months.

WASHINGTON ROADS. The Eastern Washington Construction Co., a company organized in Washington with a capital of $500,000, has finished a survey for a railroad from Farmington, Wash., southeast to Princeton, Idaho, 20 miles, and has secured most of the rights of way. A contract has been made with the town of Farmington to build the road within two years from Farmington to Princeton. From Princeton the road will be extended to Leland, Idaho. J. H. Abbott is President; W. J. Nichols, Secretary, and E. Tappan Tannatt, Chief Engineer, all of Spokane. (Mar. 17, 1905.)

The Hamilton Lyman Lumber Co., owning large tracts of timber lands in Skagit Valley, is to build a railroad from Hamilton on the Great Northern west to Sterling, 15 miles.

According to newspaper reports, Henry J. Pierce, President of the International Traction Co., of Buffalo, N. Y., in connection with Eastern capitalists, will build a railroad through the valley of the Cascade mountains in Washington, connecting Tacoma, Seattle and other cities, the total length to be 162 miles. Surveys made through Cowlitz Pass. The officers are: Frank A. Dudley, President; R. E. Strathorn, Vice-President and General Manager, and A. G. Smith, Secretary and Treasurer, of Buffalo, N. Y.; James A. Kerr, of Seattle; A. Fechter and John J. Rudkin, of Spokane, are directors.

WATERTOWN TRANSPORTATION COMPANY.—This company proposes to build from Watertown, S. Dak., west to Lake Kampeska five miles. C. H. Hamilton, Watertown, S. Dak., is President.

WATERVILLE & OAKLAND (Electric).—Col. A. E. Gerald, managing director of this company, has under consideration construction of an electric railroad from Waterville south to Augusta, Me., about 25 miles.

WAYNESBURG & WASHINGTON.—Narrow gage road 29 miles long from Washington, Pa., south to Waynesburg, 18 to be changed to standard gage and an extension built south to Dotysburg and eventually to West Virginia. Surveys for the extension completed.

WAYNESBURG SOUTHERN.—New line chartered in Pennsylvania, with capital of $120,000, to build in Green County, Pa., from Waynesburg south to the state line, 12 miles. Thomas F. Barrett, of Pittsburg, is President. The directors include: E. McSweeney, of Pittsburg; A. I. Cook and E. Barrett, of Waynesburg.

WEBSTER & VERLEN.—Incorporated in South Dakota with headquarters at Grenville, S. Dak., to build from Webster, in Day County, to Verlen, in Marshall County, 50 miles. R. O'Conner and F. A. Dabney Grenville, S. Dak., are among the incorporators. (Mar. 17, 1905.)

*WESTERN ALLEGHENY.—See Bessemer & Lake Erie.

WESTERN MARYLAND.—This company has surveys under way for 155 miles of new road. Part of this is probably between Uniontown, W. Va., and Wheeling, 68 miles.

*Double tracking line from Baltimore to Emory Grove. Contract given to Walter A. Thorne for widening the roadbed on the first section from Fulton station to Walbrook.

Surveys, it is said, will shortly be made for a low grade line from some point on the main line above Westminster, Md., to Williamsport. Two routes are under consideration. One, starting at Westminster, runs direct to Frederick, thence west to Catoctin and South mountains, where it is proposed to pierce a tunnel about two miles long. The other route begins on the main line near Monocacy and traverses a level section, striking the South Mountain at about the same point as the other route.

*WESTERN PACIFIC.—This company, controlled by the Gould interests, is building a line from Salt Lake City, Utah, west via Wells, Elko and Winnemucca, Nev., and Beckwith, Oroville, Marysville and Sacramento, Cal., to Oakland, opposite San Francisco, 937 miles. Construction work was begun in October of last year. The work includes the building of about 73 tunnels aggregating 66,000 lineal ft. Part of the work from Oakland, Cal., east to the Nevada state line, 359 miles, and from Salt Lake City to the west edge of the desert, 110 miles, is under contract to the following contractors: The Utah Construction Co., of Ogden, Utah, 110 miles in Utah and 171 miles in California, and E. B. & A. L. Stone, 185 miles in California. Grading has been completed on about 30 miles, but no track has yet been laid. Additional contracts will not be let for several months to complete the gap from the Utah-Nevada state line west, to the Nevada-California line, 129 miles. The company now has about 2,400 men at work and is advertising for 10,000 men guaranteeing employment for a year and a half. Work is being pushed on the approaches of the 6,000 ft. tunnel being built on the section between Oroville and the Nevada line, and the 7,300 ft. tunnel from Spring Garden creek to the Middle Fork of the Feather river. The route at Oakland, Cal., runs via Third street, following the general direction of the Southern Pacific as far as Niles, entering the Niles canyon on the opposite side of the creek from that occupied by the Southern Pacific. High grades are averted in the eastern ends of Alameda County by building a 4,000 ft. tunnel from a point in Niles canyon. From the east portal of the Niles canyon tunnel the route runs to Livermore and then to a connection with the Almeda and Gangnin, over which it secures an entrance into Stockton. From Stockton to Sacramento the roads will run between the tracks of the Southern Pacific and the Sacramento river. From Sacramento to Oroville the road will run between the tracks of the Southern Pacific and the Sacramento river and north of Oroville will follow the North Fork of the Feather river for a considerable distance, and thence run southeasterly to Beckwith Pass. Maximum grade is to be 1 per cent. From the eastern end of Beckwith Pass the road will run to the north of Pyramid lake, and from that point straight to Winnemucca. From Winnemucca to Wells it will follow the tracks of the Southern Pacific, and from Wells to the southern end of Great Salt Lake, thence to the terminals of the Rio Grande Western in Salt Lake City.

WESTERN RHODE ISLAND.—Incorporated to build from Croweset Bay, through Apponaug, Crompton, Anthony, Hope, North Scituate, Harmony, and Chepacket to Burrillville, 30 miles. Geo. W. Prentice, James S. Keavon and Franklin P. Owen, Providence, R. I., are interested. Nothing done for past two years, but the project has not been abandoned.

WESTERN TEXAS & GULF.—Incorporated with a capital of $500,000, to build from San Angelo, Texas, to Big Springs and to Stanton, with the intention of ultimately extending the road north to Amarillo, Texas. L. H. D. Croston, J. T. Watt, and T. P. Speers all of Dallas, W. P. Edwards and J. W. Pinson, of Big Springs, are interested.

WEST FORK BELT.—Incorporated in West Virginia to build in Harrison County from a point near Meadowbrook on the West Virginia Short Line to a point near Bloom. J. W. Jones, C. H. Jenkins and J. M. Brownfield, of Bartmont, W. Va., are incorporators. (Mar. 17, 1905.)

WEST MICHIGAN.—Incorporated in Michigan with $750,000 capital stock to build from Benton Harbor and St. Joseph to Dowagiac, Cassopolis, Paw Paw, and Kalamazoo, about 80 miles. The directors are D. E. Browne, Pittsburg, Pa., A. P. Cady, H. D. Dean, E. E. Stevens and A. H. Dean, Benton Harbor.

WEST MICHIGAN INTERURBAN.—Incorporated in Michigan, with $1,000,000 capital stock, to build an electric road from Grand Rapids to Hart, in Oceana County, via Muskegon, 65 miles. F. H. Cross, Grand Rapids, is Chief Engineer. P. A. Sims, Muskegon, and J. K. Flood, Hart, Mich., are incorporators. (Mar. 17, 1905.)

WEST PITTSBURG & ELLWOOD CITY (Electric).—Organized in Pennsylvania to build an

electric railroad from Newcastle, south to Ellwood City via West Pittsburg, about 14 miles. Chas. A. Maxwell, G. H. Ling, C. L. Dunham and others of West Pittsburg, and C. H. Aiken, of Newcastle, Pa., are interested. Another company, to be known as the Crescent Line, has also applied for a charter to build over the same route from West Pittsburg to Newcastle. In this Frank S. Hunt, James R. Martin, C. H. Aiken and others, of Newcastle, are interested.

WEST SHORE TRACTION.—Organized in Alabama, with capital of $600,000, to build an electric road from Mobile south to Alabama Port, 22 miles. The company is said to be backed by New York capitalists, and all rights of way secured.

WEST TEXAS & NORTHERN.—Charter filed in Texas, with capital of $500,000, to build from Kerrville, Kerr County, north through Kimble, Mason, Menard, Concho, Tom Green, Coke, Sterling, Glasscock, Howard, Martin, Dawson, Lynn, Lubbock, Hale, Swisher, and Randall counties, to Amarillo, in Potter County, 450 miles. The incorporators include: E. P. Sears, J. T. Pinson, J. W. Pierson, John T. Witt, E. H. D. Gaston, J. A. Wilhite, all of Dallas; Will P. Edwards, W. R. Cole, G. L. Brown, S. H. Morrison, all of Big Springs. The offices at Big Springs.

WEST VIRGINIA MIDLAND.—Chartered in West Virginia, with capital of $500,000, to build from Sutton, on the Baltimore & Ohio, southeast via Webster Springs to Marlinton, about 50 miles. The incorporators include: Col. John T. McGraw, of Grafton; former Congressman C. P. Dorr and J. E. Weddell, of Webster Springs; G. A. Hechner, of Palmer, and C. D. Elliott, of Parkersburg.

WEST VIRGINIA, PITTSBURG & ATLANTIC.—This company reported incorporated to build from Rowlesburg, W. Va., to Durbin, 100 miles. C. W. Mosser and C. E. Mower, Hendricks, W. Va.; E. D. Baker, Beverly, W. Va.; H. A. Armstrong, Parsons, W. Va., and R. F. Whitner, Philadelphia, are incorporators.

*WHEELING & LAKE ERIE.—Between Jewett, Ohio, the junction of the Wabash-Pittsburg Terminal and the Wheeling & Lake Erie, and Toledo, all lighter rail is being replaced with standard 90-lb. section; the relaying of the entire line to be completed this year.

——*Twenty passing sidings, with a capacity of 80 cars each, are being built on this line, and as many others extended to the same capacity.

——*New 1,000-car yard at South Huron, Ohio. Contracts already let for building a slip 1,400 ft. long and 200 ft. wide, and for four ore conveyors and car dumpers.

— See Sugar Creek & Northern.

*WHITE RIVER VALLEY (C., M. & St. P.).—This company has put in operation the new extension of the Chicago, Milwaukee & St. Paul, from Chamberlain, S. Dak., west to Presho, 40 miles. The road will be extended west an additional 175 miles to Rapid City.

WHITE SULPHUR SPRINGS.—Chartered in Arkansas, to build from Van Buren to Uniontown, Ark., 15 miles. The officers include: R. P. Allen, Van Buren, President; Jas. H. Van Brunt, St. Joseph, Mo., Vice-President; J. L. Rea, Van Buren, Secretary, and B. E. Powers, Van Buren, Treasurer.

*WICHITA FALLS & RED RIVER.—Work in progress on this road from Wichita Falls, Texas, to Byles, 22 miles. The work includes the removal of 250,000 cu. yds. of embankment, one new station, and a wooden trestle 540 ft. long. J. W. Field, Wichita Falls, Texas, is Chief Engineer. (Mar. 17, 1905.)

WICHITA MOUNTAIN TRACTION.—Incorporated with $250,000 capital, to build an electric railroad from Roosevelt, Okla. T., east, traversing Kiowa, Comanche and Caddo counties, to Apache, 50 miles. The incorporators include: W. R. McKnight, E. A. McCoulter, C. L. Johnson and Guy H. Parker, of Roosevelt, and John A. McKeene, of Hobart. Office at Hobart.

*WICHITA VALLEY RAILROAD.—This company was incorporated last fall in Texas, with capital of $200,000, by Col. Morgan Jones, of Taylor County; N. Harding and George Thompson, of Fort Worth. B. F. Yoakum and Edwin Hawley, of New York, and Frank Trumbull, of Denver, Colo., are directors. It will take over the Wichita Valley Railway, which extends from Byers to Seymour, Tex., 75 miles. The new company has let contracts to J. P. Nelson, of Seymour, Tex., for grading, and to E. F. Hopkins, St. Louis, Mo., for bridge work on an extension from Seymour southwest through Knox and Haskell Counties to Stamford, Jones County, 60 miles. The road connects with the Fort Worth and Denver City (Colorado & Southern), and it is expected that the C. & S. will soon take control. Additional contracts for building from Stamford to Abilene will soon be let.

WILLAMETTE VALLEY TRACTION.—Grading begun on this electric road at Salem, Ore. It is proposed to build north to Portland, 50 miles. The promoters of the road say that it is being financed by New York capitalists. The project is known under the above name, although it does not appear that the company has as yet been incorporated.

WILMAR & SALINE VALLEY.—Chartered in Arkansas to build from Wilmar to Bailey, Drew County, 13 miles. E. W. Gates, A. H. Gates and H. C. Rule, of Wilmar, Ark., are incorporators. (Mar. 17, 1905.)

WILSON NORTHERN.—Incorporated in Arkansas, with $100,000 capital, to build from Wilson to Keiser, both in Mississippi County, 10 miles. M. J. Blackwell and E. H. Green, Wilson, Ark., and Charles T. Coleman, Little Rock, are incorporators. (Mar. 17, 1905.)

WINSTON-SALEM SOUTH BOUND.—Organized under a charter granted by the legislature of North Carolina, to build a connection between the Norfolk & Western and the Southern on the north and the Atlantic Coast Line and the Seaboard Air Line on the south, about 80 miles long. W. T. Brown is President, and James S. Dunn is Secretary and Treasurer.

WISCONSIN CENTRAL.—See Lake Superior & Southeastern.

WISE TERMINAL.—Preliminary surveys made for an extension from Glamorgan north to a connection with the proposed extension of the Chesapeake & Ohio's Big Sandy branch from Pikeville, Ky. The new line would open up a rich coal and timber district.

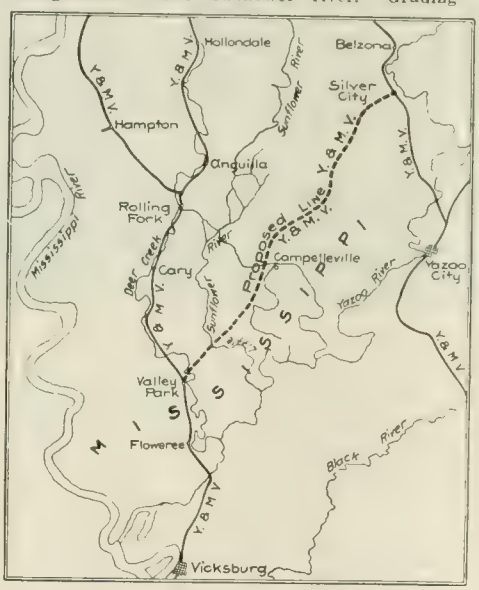
WORCESTER & PROVIDENCE (Electric).—Incorporated in Rhode Island to build a street railroad through North Providence, Smithfield, North Smithfield and Burrellville. The officers are: F. C. Hindes, of Boston, President; F. W. Tillinghast, Providence, Vice President; Charles H. Wilson, Boston, Secretary and Treasurer.

WYOMING ROADS.—Plans are being made by G. L. McFarlane and F. E. McClure, who represent a number of Pittsburg capitalists, to build a railroad from Sheridan, Wyo., to Buffalo, about 50 miles.

——Application made last year to the Chamber of Commerce of Boise, Idaho, for right of way for 10 miles east and 20 miles west from the city, and for 40 acres as a site for machine shops for a railroad from Casper, Wyo., west through Teton Pass to Hailey, Blaine County, Idaho, west through the mountains to the South Boise Valley, crossing the Snake river near Nyssa, through the Malheur Valley to Vale, Ore., thence west to the coast at some point in West Oregon, 898 miles. F. L. Evans, of Boise, the Secretary of the Missouri Lincoln Trust Co., St. Louis, is interested.

Y

*YAZOO & MISSISSIPPI VALLEY.—A new line of this road will be built from Silver City in Yazoo County, on the Tallahatchie branch, southwesterly through Sharkey County to a point on the main line at Valley Park, in Issaquena County, about 42 miles. Contract for grading let to M. J. Roach & Co., of Memphis, Tenn. The entire length of the line will be within the Mississippi delta, and it will be nearly level. There will probably be one drawbridge over the Sunflower river and a steel bridge over Little Sunflower river. Grading



Yazoo & Mississippi Valley.

completed for about 20 miles and track laid for about 10 miles.

——*This company is building a branch line from Philipp, in Tallahatchie County, Miss., north for 14.66 miles into the Delta country. Contract let to the Hemingway Construction Company of Jackson, Miss.

——*Track laying reported under way on a new branch from Webb, Miss., east to Parchman, eight miles.

——*This company is building a line from Helm, Miss., west and north, 12.8 miles, toward Arnold. Grading is almost completed and about half the track has been laid.

—— No action yet taken on a projected cut-off from Etter, Tenn., to Lake View, Miss., 6¼ miles.

On the Yarbough-Swan Lake cut-off, about 12 miles of road south from Yarbough, Miss., completed. The line is projected to Swan Lake, an additional eight miles.

*YELLOWSTONE PARK (UNION PACIFIC).—Grading under way on this proposed road, which has been located from St. Anthony, Idaho, southeast to Marysvale, 18 miles. The Utah Construction Co. has the grading contract for this portion of the work. W. H. Bancroft is President, and William Ashton, Chief Engineer, both of Salt Lake City, Utah.

*YELLOWSTONE PARK.—Incorporated last fall in Montana with a capital of $3,000,000 to build a railroad from Bridger, Mont., on the Northern Pacific, southwest to Cooke, in the northwest corner of the National Park. Frank A. Hall, of Philadelphia is President. Contract for grading 18 miles of road from Bridger, Carbon County, to the Bear Creek Coal region reported let, also contract for excavation work to Weast Bros. Russell Kimball is Engineer of construction. This project has no connection with the company incorporated under the same name by the Union Pacific.

YOSEMITE SHORT LINE.—Proposed 60 mile line from the Sierra Railway to a point in Tuolumne County, Cal., into Yosemite valley, 60 miles, with a branch from Crocker Station to the Hetchy Hetchy valley. Surveys completed.

YOUNGSTOWN & OHIO RIVER.—Incorporated in Ohio, with $10,000 capital, to build a railroad connecting Youngstown with the Ohio river. The southern terminus is to be at East Liverpool, and a branch to be built to Salem. G. W. Hill, M. P. Goodman, C. H. Holland and others are incorporators. Office at Leetonia, Ohio.

*YOUNGSTOWN & SOUTHERN.—This company, which is using steam temporarily, is building a road from Youngstown, O., via Oakland, North Lima, Columbiana, Leetonia, Salem and Lisbon to East Liverpool, O., 51 miles. Sixteen miles of road is now completed. No contracts have been let for the balance, but it is expected to let them early this spring. S. J. Dill, 19 Wick avenue, Youngstown, O., is Second Vice-President and General Manager, and George Tod, Jr., is Chief Engineer.

YREKA & SCOTT VALLEY.—Incorporated in California, with capital of $750,000, to build from Yreka, Cal., into the Scott Valley. C. H. Morrison is President and J. E. Harmon, Secretary. (Mar. 17, 1905.)

YULE CREEK.—Incorporated in Colorado to build from Bryant, Garfield County, through Pitkin and Gunnison Counties, following the Crystal river to its confluence with Yule creek, and thence along this creek to its source. To cost about $200,000. G. W. Bowen, S. I. Heyn, Pope Clerk, A. E. Davis and R. E. Black, of Denver, and J. B. Bowen and W. R. Jewell, of Redstone, are interested.

Canada.

ASHCROFT, BARKERVILLE & FORT GEORGE.—Application being made for a charter to build a railroad in British Columbia, from Ashcroft to Fort George, approximately 300 miles. C. S. Riley and H. C. Crowe, of Winnipeg, Man., are interested.

ATLANTIC, QUEBEC & WESTERN.—Granted a charter by the Dominion Government, also a subsidy of $6,400 a mile, and a grant of 4,000 acres of land per mile by the Province of Quebec, to build from Gaspe Village, southwest to Causapcal on the Intercolonial, about 170 miles. The road is designed to make connection with a fast line of steamers, to avoid the dangers of the St. Lawrence river, and to gain 24 hours over the present route from Montreal. The same company will build south along the Gaspe coast 100 miles to a connection with the Atlantic & Lake Superior.

BELLA COOLA & FRASER LAKE.—A. P. Lexton and Edgar Dewdney, of Victoria, B. C., are petitioning for a charter to build a railroad from the mouth of the Bella Coola river, B. C., to Fort George on the Fraser river, approximately 400 miles.

*BRANDON, SASKATCHEWAN & HUDSONS BAY.—This company, which is building a line from Brandon, Man., south via Minto and Boissewain to the United States boundary, about 70 miles, commenced grading work last fall. Contract let to Guthrie & Co., of St. Paul, and a sub-contract to John Bradley, of Brandon. Track laid for two miles from the boundary north. The work includes a bridge over the Souris river. When completed the line will connect with the Great Northern at St. Johns, N. Dak. P. E. Thian, of Brandon, is Chief Engineer.

BRITISH COLUMBIA ROADS.—Robertson & Robertson, of Victoria, B. C., have applied to the Provincial Legislature for a charter to build a line from Penticton, B. C., to a point on the southern border of British Columbia, and branches.

BROCKVILLE, WESTPORT & NORTHWESTERN.—This company, which operates about 45 miles of railroad in Ontario from Brockville to Westport, has made a preliminary survey for 100 miles on its proposed extension to Sault Ste. Marie, about 450 miles. Final surveys completed for the first 20 miles.

BUFFALO, NIAGARA & TORONTO.—Organized in Ontario, to build from Niagara-on-the-Lake, through Niagara Township, St. Davids village, Stamford, Willoughby and Bertie townships, to Fort Erie, with one branch from St. Davids to St. Catherines and another from Firt Erie to Port Colborne and Welland. Incorporators said to be residents of St. Catherines, Ont.

CAMPBELLFORD, LAKE ONTARIO & WESTERN.—New line authorized by the Dominion Government from Blairton, Ont., on the Canadian Pacific, via Campbellford and Whitby to Leaside Junction, Ont., on the Canadian Pacific near Quebec. W. J. Crossen, Cobourg, Ont., said to be interested. (Mar. 17, 1905.)

CANADIAN NORTHERN.—This company's main line now extends from Port Arthur, Ont., on Lake Superior, west to Edmonton, Alberta, 1,264 miles.

——*Work under way on a cut-off from Vassar on the main line east of Winnipeg west to Ridgeville, Man., about 70 miles. Ridgeville is the terminus of a branch 12 miles long east from Emerson, which is on the international boundary. This cut-off will make a more direct line to Port Arthur, and Fort William for grain from the Canadian Northern lines in the wheat region in Brandon and Lisgar District; to make a direct line between the wheat district and the lake ports. By this line the distance will be shortened about 25 miles.

——*Contract reported given to the MacDonald-MacMillen Contracting Co. for the first 80 miles of a proposed line to Hudson Bay. The survey leaves the main line of the Canadian Northern at Etoimami, near Etwood, Sask., and runs northeasterly through The Pas, on the Cedar river, and Fort Churchill.

—— The province of Manitoba has voted to guarantee Canadian Northern bonds at the rate of $10,000 a mile for the construction of branches as follows: From Brandon, Man., west to the western boundary of Manitoba, 66 miles; from Winnipeg, east across the Red river, 25 miles; from a point between Winnipeg and Oak Point across the Assiniboine river to connect with the St. Charles and Winnipeg line, seven miles. One

E. L. ADREON, Jr.
President

E. W. HODGKINS
Vice-President

D. R. NIEDERLANDER
Secy. and Treas.

ADREON and COMPANY
(INCORPORATED)

General Railway Supplies and Equipment
IRON AND STEEL

SECURITY BUILDING - - - - - - - ST. LOUIS

ENGINEERING AND TRACK
Wolhaupter and Q. & W. Tie Plates
Chicago Crossing Alarm
Electric Signals
Bond Wires and Channel Pins
New and Relaying Rails
Round Bottom Steel Tanks
Walters Ballast Placers

MISCELLANEOUS
Cast Iron Smoke Jacks
Dressel Headlights and Lamps
Bordo Blow-off Valves
Bar and Band Iron
Hickory Handles
Shovels and Scoops
Perforated Metals

MECHANICAL AND CAR
Fewings Car Replacers
Brake Shoes
"Rea" Brake Control
Cast Steel Knuckles and Pins
M. C. B. Couplers
Ajax Diaphragms
Simplicity Bell Ringer

QUOTATIONS AND INFORMATION PROMPTLY FURNISHED

million dollars of bonds additional has been guaranteed for terminals at Winnipeg.

——Projected extension of the Hartney-Virden line from Virden, Brandon District, Man., its present terminus, northwest to Regina, Assiniboine, about 150 miles. Plans filed.

——This company has charters for the following new lines: From Regina, Assin., northwesterly to a point on the Red Deer river in Alberta, with a branch line west of the Saskatchewan river and running north to a point in or near Carlton, on the North Saskatoon river.

——From Regina north to Humboldt, thence northeasterly down the valley of Carrot Pass Mission, on the Saskatchewan. From a point on the main line between Humboldt and the South Saskatchewan river, northeasterly to a point at the crossing of the South Saskatchewan river by the Prince Albert branch.

——Under the name of the Edmonton & Slave Lake for a line north from Edmonton, Alberta, for 50 miles, passing through St. Albert.

*CANADIAN PACIFIC.—Double-tracking of the line from Winnipeg, Man., east to Fort William, on Lake Superior, 427 miles. Foley Bros., Larson & Co., have the general contract which includes a 400-ft. tunnel through rock. The work will include a cut-off from Winnipeg, east to Monson, Man., about 35 miles. The whole work is to be completed in three years. Contracts have been let as follows: Hoagland & Sharpe for change of line, 4 miles long, at Eagle river; two miles at Cross Lake, to John E. Bostrom; two miles at Kilmar, to include a tunnel about 400 ft. long, to Larson Bros.; three miles between Ostersund and Busteed, to Fred Peterson & Co.

——*Work was commenced last June on the Nicola, Kamloops & Similkameen, from Spence's Bridge, B. C., on the Canadian Pacific southeast for 40 miles to the coal mines, and 75 per cent. of the grading has been completed. Track laying is in progress. The work on the first 15 miles was very heavy, along the face of a steep rocky bluff. Maximum grade 1 per cent., and maximum curvature, 12 degrees. The line rises continuously from Spence's Bridge to its terminal at the coal mines, where the elevation is about 1,200 ft. There will be nine Howe truss bridges on masonry abutments and one tunnel about 400 ft. long. Loss, MacDonnell & Co. are the contractors. A. J. Cambie, of Spence's Bridge, is Chief Engineer, of the subsidiary road.

——*Extension of the Teulon (Man.) branch from Teulon, the present terminus, northeast to Gimli on the west shore of Lake Winnipeg, and north along the shore of Icelandic river. Contract let to J. D. MacArthur, of Winnipeg, for the first 10 miles.

——*Pheasant Hills branch from Kirkella, near the western boundary of Manitoba, northwest into Assiniboia, through Lipton, to Strassburg, 200 miles. On the extension from Strassburg 12 miles was completed last year. Work is under way on a further extension of this line which is projected to eventually reach Battleford, Sask., crossing the Prince Albert branch at Saskatoon. Foley Bros., Larson & Co., of St. Paul, Minn., contractors.

——*Work under way on a branch from Lacomb, Alberta, on the Calgary Edmonton branch, 114 miles north of Calgary, east 100 miles. Surveys being made; 51 miles in operation to Stettler. Foley Bros., Larson & Co., contractors.

——*Branch from Wetaskiwin, Alb., on the Calgary-Edmonton branch, 152 miles north of Calgary, east to Battleford, Sask., 250 miles. Whole line surveyed and located. In operation to Daysland, 51 miles. Foley Bros., Larson & Co., have the general contract. Sub-contract reported let to J. D. MacArthur, of Winnipeg.

——*Work under way on the Kootenay Central, a Canadian Pacific connecting line from Golden, B. C., on the main line south to Cranbrook.

*Contract reported let to Ironside, Rannie & Campbell, of Vancouver, B. C., for track laying, ballasting and bridging 45 miles of the projected Nicola branch between Spence's Bridge, B. C., on the main line, and Nicola Lake.

*A new line from Toronto north to Sudbury, Ont., from a connection with the Owen Sound branch at Woodbridge through Barrie, Balla, Parry Sound and Romford. The entire line will cost about $8,000,000, $2,000,000 of which will be required for the 58 miles from Byng Inlet north to Romford, on which the work is extremely rough, and there will be much rock cutting. Work on this section now in progress by contractors, Foley Bros., Larson & Co. A contract is also reported let to Geo. S. Deeks & Co., for building the southern section of this branch between Parry Sound and Bolton, 128 miles. Bids were asked for March 10 for the sections between Romford and French River Crossing, 40 miles. The maximum grade for the entire line will be 0.3 per cent., and the maximum curvature 6 degrees.

——*Contract let to Rogers & Quirk for a line from the Highlands near Montreal, down the south side of the Lachine canal to Cote St. Paul, about seven miles.

——Improvements to be made to the line. New tracks from Lethbridge, Alberta, west to Kootenay Landing, B. C., 200 miles. New bridges will be put in, new track and other improvements made.

——Projected line from Weyburn, Assin., northerly to Hayward, 100 miles, connecting the Souris and Pheasant Hills branches.

——Reported that a loop 20 miles long will be built around Field, B. C., to overcome several heavy grades. Estimated cost of the work, which will be heavy, through rock, is about $1,200,000.

——Bids asked for extending the North-Western branch from the present terminus at Sheho, Assin., northwest 16 miles and west 27 miles further.

——Proposed branch line 122 miles long, from a point near Wolseley, Assin., on the main line, southeast to Reston, Man., on the Arcola branch, near the western boundary of Manitoba, 122 miles.

——Projected line from Golden, B. C., on the main line, southeast, along the Columbia and Kootenay rivers, to Jaffray, on the Crow's Nest Pass branch, 180 miles.

——Surveys being made for a new line to eliminate the heavy grades on the existing line projected from Austin, Man., west to Carberry. The new line will parallel the projected line of the Grand Trunk Pacific, being only about 150 ft. distant from the route of that road, which passes about eight miles north of Carberry.

—— The charter of the Georgian Bay & Seaboard permits the Canadian Pacific to build from a point on Georgian Bay between Port Severn and Penetanguishene, southeasterly through Simcoe, Ontario, Victoria, Peterborough, Hastings, Lennox, Addington, Frontenac and Lanark counties, to a connection with its existing lines, 225 miles.

——Plans reported filed for branch from Woodstock to Niagara Falls via Brantford and Hamilton, about 10 miles, reported under consideration.

——Authority granted for an additional line through to Georgian Bay from Peterboro. This will give the company another terminal on the upper Canadian lakes. The new line would parallel the Grand Trunk.

——Plans approved for a line from the eastern boundary of Stratford, Perth County, Ont., through North Easthope, on the north side of the Avon river, to the boundary of Waterloo county.

——Plans approved for a line from Linwood, Ont., to Listowel, through the townships of Mornington and Elmer.

——Proposed branch, it is reported, will be built from the present line near Woodstock, N.B., southwest to Bancroft, Me., about 28 miles.

——See Esquimalt & Nanaimo.

——See Georgian Bay & Seaboard.

——See Guelph & Goderich.

——See Spokane International, under United States.

CANADIAN ROADS.—Application made to the Dominion Government by Tupper & Griffen, of Vancouver, B. C., for incorporation of a company to build a railroad from Osoyoos, on the International boundary, north to Enderby, B. C., about 130 miles.

——Application made to the Dominion Parliament by Robertson & Robertson, of British Columbia, for permission to incorporate a company to build a railroad from the city of Vancouver or a point on Burrard Inlet to the northern boundary of the province by way of Lillooet, the Fraser valley, Talca lake, Stinkine and Teslin lakes, or by the most feasible route through the Chilcotin valley.

——A number of Chicago and English capitalists, represented by Edward Copps, of Detroit, are planning to build a railroad from the north shore of Lake Superior to Hudson Bay.

——Application being made for authority to build a line from Crows Nest, Alberta, east to Lethbridge, and thence to Medicine Hat; also for a line from the Montana boundary north to Lethbridge and Edmonton, with branches to Calgary and Medicine Hat.

CANADIAN YUKON WESTERN.—Bill passed authorizing this company to issue stock and extending the time for building its proposed road from the Yukon river to the Pacific coast. J. H. Lamont, Prince Albert, Saskatchewan, said to be interested.

CAPE BRETON.—Subsidy granted this company for extending its line from St. Peters, N. S., northeast to Lewisburg, 77 miles. G. E. Johnson, St. Peters, N. S., is General Manager.

*CENTRAL ONTARIO. Grading work under way by Little & Culvertson, of Marmora, Ont., on seven and one-half miles of proposed extension from Bancroft, Ont., via Maynooth to Whitney, 40 miles. Grading from Bancroft completed for three and one-half miles and track laying finished to York river, one mile. A bridge with 100-ft. span is being built over this river. Other contracts will be let shortly. J. D. Evans, Trenton, Ont., is Chief Engineer.

COPPER RIVER & TELKAWA.—Organized to build a railroad from the mouth of the Copper river in British Columbia, to the mouth of the Telkwa river, about 210 miles. H. D. Lawson, E. V. Bodwell and James H. Lawson, all of Victoria, B. C., are interested.

*DAWSON, GRAND FORKS & STEWART RIVER. ——This company, incorporated in England with a capital of $2,500,000, to own and operate the Klondike Mines Railway Co., of Canada, has filed a mortgage on the completed road from Klondike City and Dawson to Sulphur Springs, about 30 miles. This section is to be completed in October of this year. The road is ultimately to be extended to the Stewart river, 54 miles further. H. B. McGiverin, of Ottawa, is interested.

ESQUIMALT & NANAIMO (Canadian Pacific). This company plans to extend its lines through Comax north to Campbell river; also to build branches from Duncan's via the Cowichan valley, northwest to Alberni and a branch from some point near Englishmen's river to Alberni canal, or a branch from Comax via Cumberland southwesterly to the Alberni canal. Under consideration but definite plans not yet decided upon by the Canadian Pacific.

GRAND TRUNK.—Depression of tracks at South Parkdale, Ont., to secure better entrance into Toronto. There will be little change of the present alignment, but additional tracks may be put in. The work, including land damage, is estimated to cost over $1,000,000.

*GRAND TRUNK PACIFIC. New transcontinental line in Canada from the Atlantic coast at New Brunswick to the Pacific coast, 3,400 miles. The 1,800 miles from Moncton N. B., to Winnipeg, called the Eastern division, will pass through the city of Quebec and will be built at the cost of the government of Canada and leased to the Grand Trunk Railway. This part of the road is still under survey. The government has appropriated $1,000,000 for rights of way and for terminals at Quebec and at Winnipeg. From Winnipeg to the Pacific coast the line will be 1,754 miles long. The Pacific ter-

[illegible] at Point Riquet, a new port on Bay [illegible] about 20 miles south of Port Stanley, Ont. This part of the line will be [illegible] east of and owned by the Grand Trunk Pacific Railway and is controlled by the Grand Trunk Railway Company. Besides the main line the company is authorized to build branches similar to those under Grand Trunk Pacific Branch Lines Company. The most important branch now included in this list is the Lake Superior branch, which will run from a junction with the Eastern division at Lake Superior Junction, Port William, Ont., on Lake Superior, 210 miles. In all actual construction work is going on about 1,000 miles.

*On the western portion of the main line the distance from Winnipeg to Edmonton, Alberta, is 775 miles, from Edmonton to the eastern slope of the mountains, 561 miles, and the rest of the line to Prince Rupert, 418 miles. From Portage la Prairie, Man., which is 56 miles west of Winnipeg, west to Touchwood Hills, Assin., 275 miles, surveys have been completed and approved, and the contract for grading let to the MacDonald & MacMillan Construction Co., of Westbourne, Man. From Portage la Prairie to a point just west of MacGregor the line will parallel the Canadian Pacific; thence it will run west to the Assiniboine river, with a 14-mile branch south into Brandon, Man. It will then across the Arrow river near Crandall, and run west to the Assiniboine river near Crewe, Marquette district, Man., and from there up the valley of the Big Cut Arm creek to a point a little north of Sumner, Assin. This is mostly level prairie country.

*From the Touchwood Hills west to Edmonton, 450 miles, the line will cross the Prince Albert branch of the Canadian Pacific near Saskatoon. Contracts for this section have been let as follows: From Touchwood Hills to Saskatoon, Sask., 140 miles, to the Canadian White Company (J. G. White & Co.), of Montreal; from Saskatoon to Edmonton, Alberta, 317 miles, to Foley Bros., Larson & Co., of St. Paul. A contract has also been let to Greer Bros., of Port Arthur, Ont., for 700,000 ties.

——*The Lake Superior branch from Lake Superior Junction on the main line southeast to Fort William, on Lake Superior, 210 miles, is in reality one of the most important ports of the whole line, as it is to form a chief link in the route for grain to the point of shipment in lake steamers to the Grand Trunk system in the East via Lake Huron and Georgian Bay. This branch is also under contract to Foley Bros., Larson & Co., who have given a sub-contract for 10 miles to Overn & Olson. At Fort William the company has secured terminals, including 1,600 acres of land. The municipality has contributed $300,000 and agreed to exempt the company from all taxes for 15 years. Permission has also been granted to run a track alongside the Canadian Pacific track from Port Arthur to Fort William. Specifications for the first 100 miles of this branch show very heavy work. The estimates include 300,000 yds. of solid rock, 250,000 yds. of loose rock and 6,000,000 yds. of earth work.

——The company is reported to be negotiating with the Canadian Northern for the double-tracking of the C. N. line from Winnipeg west to Portage la Prairie, 59 miles, over which the Grand Trunk Pacific wishes to secure trackage rights. Unless an agreement is reached the G. T. P. will shortly commence the construction of this link of its line, which would be the third line between Winnipeg and Portage la Prairie.

— The National Construction Co. is reported incorporated in the interest of the Grand Trunk Railway to build part of the Grand Trunk Pacific line. The nominal capitalization is $250,000, and the incorporators include Joseph Hobson, Robert S. Logan and Wenny Walker.

——Authority has been asked from the Canadian Parliament to organize the Grand Trunk Pacific Branch Lines Co. to build branch lines of the Grand Trunk Pacific as follows: From Moncton to Halifax; from the main line to St. Johns, N. B.; from various points on the main line to Montreal, to Ottawa and to North Bay; from the main line on the northeast of Fort William to a junction with the Grand Trunk north of Toronto, with the privilege of building a line to Sault Ste. Marie or Sudbury; from Winnipeg to the boundaries of Manitoba; from Brandon to the Grand Trunk Pacific main line, and to the international boundary; to Calgary from the main line; to Yorktown, Regina, Prince Albert, Battleford, Dawson City and Hudson Bay; from Calgary to the international boundary; from Vancouver to the Grand Trunk Pacific main line, and to a junction of the projected Pacific Northern & Omenica, whose charter has been bought by the Grand Trunk Pacific, and which is to run from Kitamaat, on the Pacific Ocean, north to the Skeena river; also from the north shore of Vancouver Island south or southeast along the west side of the island to Victoria.

— The Grand Trunk Pacific Railroad is also asking authority to operate its own steamships and hotels, and to develop water power along its main line and branches.

Bids asked this month (March) at the company's office in Ottawa, for building a section of its proposed road from Winnipeg to Superior Junction, and another from Quebec to St Maurice, both to be completed by September 1, 1907.

GREAT NORTHERN OF CANADA.—This company, according to the *Official Guide*, has 84 miles under construction. Contracts reported let to Mulkaney & O'Brien.

GREAT NORTHWESTERN TRANSIT.—This company is a consolidation of the Hudson Bay & Northwest and the Manitoba & Keewatin, and proposes to build a line from Winnipeg, Man., northeast to the eastern boundary of the province and thence east through the district of Keewatin to tidewater at the mouth of the River Severn, with branches to Lake Winnipeg, and to the main line of the Canadian Pacific. Howell, Mathers & Howell, Winnipeg, are interested. (Mar. 17, 1905.)

*HALIFAX & SOUTHWESTERN.—New line in Nova Scotia from Halifax southwest through Mahone Bay, Bridgewater, and Liverpool, to Barrington Passage, 196 miles. In operation from Halifax to Liverpool, 112 miles. From Liverpool to Barrington Passage, 84 miles, under construction. Atlantic Contracting Co., contractors. Maximum grade, 1.5 per cent.; maximum curvature, 7 degrees. T. H. White, Bridgewater, N. S., Chief Engineer. This is a Mackenzie Mann line.

*INTERCOLONIAL.—Work has been commenced by K. A. Morrison and Alex Finlayson, of Sable River, N. S., on a branch from North Sydney Mines, N. S., 2.6 miles long.

*Improvement plans for this road include $1,000,000 for new shops at Moncton, N. B., and an expenditure of $8,000,000 for betterments on the whole line. The line from Halifax to Truro, 62 miles, is to be double tracked.

JAMES BAY.—Extensions authorized from Toronto to Ottawa and thence to Montreal; also from French River to Ottawa and from Sudbury to Port Arthur to connect with the Canadian Northern.

KAMLOOPS & YELLOWHEAD PASS.—Application made to the British Columbia Parliament by Tupper & Griffin, of Vancouver, for authority to build from a point at or near Kamloops, north, following the valley of the North Thompson river, Canoe river and McLennans creek, to a point at or near Tete Jaune Cache, British Columbia.

KETTLE RIVER VALLEY.—Application has been made by this company for permission to increase its capital to $5,000,000, and to build extensions as follows: From Midway, B. C., to Hedley, in the Similkameen Valley; from Hedley, north for a distance of 20 miles to Twenty Mile Creek, and from this extension to Penticton, B. C., also for permission to secure trackage rights over the Columbia & Western between Grand Forks and Midway and on its branch lines. Contracts to be let about April 1 for building 50 miles of road northerly from Grand Forks, B. C., the present northern terminus.

KINGSTON & PEMBROKE.—Projected line from Sharbot Lake, Ont., northeast to Carleton Junction, on the Canadian Pacific, 40 miles.

KLONDIKE MINES.—See Dawson, Grand Forks & Stewart River.

*MIDLAND OF MANITOBA.—This company, chartered to build a railroad from Portage la Prairie southeast to the United States boundary line, will probably build its line through Gretna, Man. Contracts for building several miles near Portage la Prairie have been let and grading is under way on this section. Office at Portage la Prairie. James Fisher, of Winnipeg; Edward Brown and Charles Anderson, of Portage la Prairie, directors.

*MIDWAY & VERNON.—Organized to build a railroad from Vernon, B. C., to Kamloops and also to build a branch line from some point on the company's line to Penticton. Contracts reported let.

MONTANA, TABOR & EDMONTON.—Incorporation asked by L. M. Johnson, of Lethbridge, Alberta, for a company under this name, to build a number of branch lines from the international boundary through Alberta.

NIAGARA, ST. CATHERINES & TORONTO (Electric).—Application made by this company, operating 12 miles of electric roads in Ontario, for permission to extend its line from Thorold south to Port Colborne, thence east to Fort Erie and north to Niagara Falls, from Niagara Falls north to Niagara-on-the-Lake; also from Niagara Falls to Brantford, and from St. Catherines to Niagara-on-the-Lake. Permission will also be asked to absorb any company having similar powers.

NORTHERN ALBERTA.—Application made by A. J. Arnold, of Windsor, Ont., to authorize the Northern Alberta Railway & Coal Co. to build from Lethbridge via High river and Calgary to Edmonton, about 500 miles.

NOVA SCOTIA EASTERN.—This company, under new management, has made arrangements with the Provincial Government of Nova Scotia for building the projected line from Halifax to Guysboro, 125 miles. A grant of $5,000 a mile was given two years ago, but owing to failure to build, the charter expired. Sir Montague Allan, of Montreal, head of the Allan Line, is interested in the new company. Besides the line along the eastern shore from Halifax to Guysboro, the charter provides for a branch line from New Glasgow to County Harbor.

ONTARIO POWER DEVELOPMENT COMPANY.—This company plans to build an electric road from Niagara Falls, Ont., to Toronto, via Brantford, London, Paris and Ingersoll to Toronto, about 100 miles.

*ORFORD MOUNTAIN.—This company, which recently completed an extension from Windsor Mills, Que., to Kingsbury, 10 miles, is planning to build an extension of its Bolton branch from Potton Springs to a point near Troy, 10 miles.

PORT ANGELES & OLYMPIA.—Chartered in the State of Washington, with a capital of $4,000,000, to build a railroad from Victoria, B. C., to the northwest corner of Vancouver Island, about 270 miles. Connection to be made on the south end with the American shore at Port Angeles by ferry. Lester Turner, Jacob Furth, W. D. Hopkins, A. A. Arthur, all of New York, and M. J. Carrigan, of Port Angeles, are interested.

*QUEBEC & LAKE ST. JOHN.—Work is under way on the extension of this road from a point 12 miles west of La Tuque Junction, Quebec, to St. Maurice Keier, 28 miles. Joseph Paquet, of La Tuque Junction, is the contractor. The company has also projected a road from its northwest terminal at Roberval northwest to Chute a Fours, 30 miles.

QUEBEC, MONTREAL & SOUTHERN (DELAWARE & HUDSON).—Application made for authority to take over the Quebec Southern, which includes the South Shore, the United Counties and the East Richelieu Valley railroads to complete the line which the South Shore was authorized to build from Noyan Junction to the international boundary, to secure terminal lands and wharfs and to operate steamers on the St. Lawrence and Richelieu rivers. This is to be a Canadian holding company for the Delaware & Hudson.

REGINA & HUDSON BAY.—New line from a point on the international boundary between the second and third meridians, to Regina, and thence through Craven northerly to Carrot river and Fort Churchill. Incorporated. McGiverin & Hayden, of Ottawa, Ont., are the solicitors. Time for commencing the work and also for its completion extended by act of Parliament.

*ST. MAURICE VALLEY.—This company has given a contract to Ross, McRae & Chandler, of Shawinigan Falls, Que., for building its proposed road from Three Rivers to Shawinigan Falls, 22 miles. Grading has not yet been started. The work includes a steel deck truss bridge at Head Race, 112 ft. long; at the George crossing of the St. Maurice river, a steel bridge 270 ft. long, and at a second crossing of the same river a bridge of seven spans, each 150 ft. long. The company is also planning to extend from Shawinigan Falls to St. Jean des Piles an additional 10 miles. Surveys completed. Contracts for this extension to be let this year. L. A. Darey, Three Rivers, Que., is Chief Engineer.

SOUTHERN OF ALBERTA.—Incorporation asked for in Alberta, to build railroads in that province. J. J. Hill said to be interested.

STANDARD COAL & RAILROAD COMPANY.—This company recently organized with capital of $2,000,000, is making surveys for a line from Truro, N. S., west to Parrsboro, and thence north to Maccan, in all about 80 miles.

*TEMISKAMING & NORTHERN ONTARIO.—This company, which is building 100 miles north of its present terminus at Liskeard, Nipissing, Ontario, has 80 miles graded and 40 miles of track laid. The grading on the remaining 20 miles will be finished this spring, and it is expected to have the entire line in operation next fall.

VANCOUVER & NORTHWESTERN.—This company will apply to the legislative assembly of the province of British Columbia for permission to build a railroad from Vancouver eastward to the Pitt river, thence continuing east to Lillooet river and to the Stave river, thence to the Harrison river and north to a point at or near Lillooet, via Fort George, on the Fraser river by the most feasible route to the sixtieth degree of latitude.

*VANCOUVER, VICTORIA & EASTERN (GREAT NORTHERN).—Surveys, it is said, have been completed by this company for a line from Midway to Hope, B. C. Grading contracts let to the subcontractors from Seims, Shields & Co., general contractors, through J. W. Stewart, are in stations of 100 ft. each. Contractors and their stations from Midway, B. C., to the international boundary are as follows: Burns & Jordan, 259 stations; Johnson & Anderson, 97 stations, including 850 ft. tunnel; Johnson & Welch, 142 stations; D. J. Brown, 58 stations; D. A. Rankin, 62 stations; Bole Bros. & Moran, 66 stations; Geo. Chew, 104 stations; Burns & Jordan, 96 stations, including 400-ft. tunnel; Johnson & Welch, 82 stations; T. J. Gallagher, 123 stations; E. A. Carleton, 65 stations; P. S. Hughes, 144 stations; Gorman & Pierce, 124 stations. The total distance from Midway to the boundary is 30 miles, the length of the line south of the line is 47 miles, and from the point where it again enters Canada to the Keremeos, 17 miles, and from Keremeos to Princeton, 48 miles. Plans are now being made to ask for bids for the line between Keremeos and Princeton. James H. Kennedy is Chief Engineer, with headquarters at Midway.

VANCOUVER, WESTMINSTER & YUKON (GREAT NORTHERN).—Application to be made for permission to build branch lines south from Anderson Lake and Green Lake along Lillooet Lake to the international boundary.

*WINDSOR, ESSEX & LAKE SHORE (Electric).—Chartered in Michigan to build an electric railroad from Windsor, Ont., through Essex, Kingsville, Leamington, Wheatley, Tillsbury, and Chatham, with a branch from Tillsbury to Essex. Construction work has been commenced by the Keystone Construction Co., of Philadelphia, which has the contract; but no track has yet been laid. Maximum grade to be 2 per cent. The work includes one steel bridge. W. L. Wilson, Port Huron, Mich., is President, and P. Haseltine, Detroit, Mich., is Manager.

*WOLFE, MEGANTIC & LOTBINIERE.—The company has had its charter extended, and subsidies promised for its proposed road from Lime Ridge in the county of Wolfe, north to Quebec, about 100 miles. Right of way secured and contract let to W. G. Orcutt, of Boston. W. H. Lamby, Inverness, Que., is Secretary. (Feb. 23, 1906.)

Mexico.

CACAHUAMILPA CAVES EXPLORATION COMPANY.—This company has been organized in Mexico City, with capital of $400,000, to build a railroad from the marble deposits at Cacahuamilpa to the Hermosa station of the Cuernavaca division of the Mexican Central. The officers are: Senors Carlos Bach, President; Emilio Leycegui, E. Fernandez Castello, Javier Morales Cortazar, Lic. Gomez Perez and Jose Nozari.

CANANEA & TOPOLOBAMPO.—Surveys being made for this proposed line, to be built from Cananea, state of Sonora, Mexico, to Topolobampo, Sinaloa, 430 miles, giving an all-Mexican route from Cananea to the City of Mexico. Surveys reported finished from Cananea to Minaca, Chihuahua, 225 miles. W. C. Green, President of the Cananea Copper Co., is interested. (Mar. 17, 1905.)

*CANANEA, YAQUI RIVER & PACIFIC (SOUTH-

The Cincinnati Equipment Co.

CINCINNATI, OHIO, U. S. A.

LOCOMOTIVES—36-in. Gage.

3 7x12 Porter, 5-T.
20 9x14 Porter, Baldwin and Vulcans Saddletank.
1 12x18 Mason Forney type.
2 11x16 24-ton Baldwin American type.
1 14x20 26-ton Grant American type.
1 12x18 24-ton Baldwin Mogul.
1 12x18 22-ton Porter, 6-driver Saddletank, with pair trailers.
1 10x16 15-ton Porter, 4-driver Saddletank.
1 Climax geared No. 321, 20 tons.
1 Climax geared No. 195, 18 tons.
1 Climax geared No. 185, 18 tons.

LOCOMOTIVES—Standard Gage

1 16x24 35-ton Danforth & Cook American.
1 19x24 50-ton Baldwin Mogul.
1 18x22 45-ton 10-wheeler.
1 18x24 53-ton Rhode Island 10-wheeler.
1 11-18 22-ton Baldwin Saddletank.
1 14x20 25-ton Porter, 4-wheel Saddletank.
5 16x24 30 to 35-ton American type.
7 6-wheel Switchers, 30 to 35 tons.
2 4-wheel Switchers, 30 to 35 tons.
3 16x22 35-ton American type, 56-in. centers.
1 16x22 35-ton 50-in. centers.
1 4-driver Switcher, separate tender, 30 tons
1 Marion Center Plow.

STEAM SHOVELS.

1 Marion No. 263, 1½-yd. 45-ton Model "A

New Shovels in 1903

1 Victor No. 80, 80-ton, 3-yd.
1 Vulcan No. 704, 55-ton, 2-yd.
3 Vulcan Nos. 568, 631, 651, 45-ton, 1¾-yd.
1 Vulcan No. 664, 45-ton, 1½-yd.
1 Vulcan No. 525, 75-ton, 3-yd.
1 Bucyrus No. 589, 70-ton, 2½-yd.
1 Bucyrus No. 550, 65-ton, 2½-yd.
2 Marion Model 60.

CARS

40 Steel frame K. & J. & Western 6-yard, 4-ft., 8½-in. gage.
30 Steel frame Western 4-yard, 36-inch gage
Coaches, Flats and Gondolas.

Locomotive Repair Work Solicited.

ERN PACIFIC).—Work under way on this road from Batamotal, on the Sonora line of the Southern Pacific, down the Pacific coast to Guadalajara. Track will soon be laid as far as the delta of the Yaqui river, and it is expected to have the road completed to Torin, in the Yapui Indian country this spring. The line will run through Alamos to Mazatlan, and from that port to Guadalajara. It will probably cross the river at Chumapaco, ten miles above Torin. The bridge to be built over the Yaqui river will take some time to complete, and will be a costly structure. Engineers of the Southern Pacific are also making final survey for a road which is to be built through Guzman on the Mexican Central, in the state of Chihuahua, to Agua, Prista, in the state of Sonora, which will connect with the Cananea, Yaqui River & Pacific.

COAHUILA & PACIFIC. Extension to the Pacific coast of Mexico reported under consideration. The first work will be from Minaoa, the present western terminus, west to Ocampo, about 87 miles.

COAHUILA COAL.—Surveys made for an extension from Muzquiz in the State of Pueblo to Paredon, about 143 miles, to open up large coal fields.

*CORDOBA & HUATUSCO. Grading work in progress on this narrow gage line north from Cordoba, state of Vera Cruz, north through the coffee growing district of that state, about 75 miles. One of the bridges which is being built over an arroyo on this road will be 108 ft. long and 213 ft. above high-water mark.

GREAT MINERAL OF MEXICO. This company, recently organized with capital of $3,000,000, is planning to build an extensive system of railroads in northwestern Mexico. This company has acquired the Pittsburg San Jose Railroad, which at present is built out of San Jose del Stilo for about 25 miles. This is to be extended southward to a connection with the Kansas City, Mexico & Orient and northward to the city of Parral. The route of the proposed new line is through a rich mining section. M. B. Place, of Pittsburg, Pa., is the promotor. E. S. Stafford is Chief Engineer.

GRESORIA RAILROAD. The Dwight Furniss Co., of Guanajuato, Mexico, it is said, has bought this road and will extend it. The part of the line already completed to the mines of San Gregoria will be operated as a mineral road, and the main line is to run from Martil to Irapuato. Ignacio Ibarguengoitia, of Guanajuato, is President.

INTEROCEANIC OF MEXICO. This company, which belongs to the Mexican Government system of railroads, is completing financial arrangements to secure funds for changing from narrow to standard gage. The road runs from Mexico City east to Vera Cruz. The cost of straightening the line will be about $6,000,000, including surveys made to shorten the route and lower the grades.

JALISCO & MICHOACAN (Electric).—Capital stock increased from $1,500,000 to $10,000,000. Construction work to be begun soon in the state of Michoacan. The company is planning to build several hundred miles of road, and has been given a concession by the Mexican Government. William Backus, of Cleveland, Ohio, is Vice President, and J. M. Zermeno is Manager.

*KANSAS CITY, MEXICO & ORIENT.—Profiles and maps of the final survey for a line through the Sierra Madres have been submitted for approval to the Mexican Government. The maximum grade is to be 2½ per cent., and the maximum curvature 8 deg. According to the survey, the road will run for several miles along the brink of a gorge 6,000 ft. deep and a mile wide. See same company under United States.

*LA DICHA & PACIFIC. Incorporated in the City of Mexico, with a capital of $2,000,000 and principal office at La Dicha, state of Guerrero, in the interests of the Mitchell Mining Co., of La Dicha and New York, to build a narrow gage road from the company's copper properties at La Dicha west to Port San Marquez, 12 miles south of Acapulco, on the Pacific coast of the state of Guerrero, 75 miles. Maximum grades are to be 1½ per cent. Work in progress and several miles already graded. On the completion of the line the company plans to erect a 1,000 ton smelting plant at Port San Marquez. It is said that the Mexican Central will extend its Cuernavaca line south from the Balsas river to Chilpancingo, to which place it is the intention of the La Dicha & Pacific Company eventually to extend its line, thereby making a new through line from the City of Mexico to the Pacific coast at Port San Marquez. George Mitchell, of the Mitchell Mining Co., is one of the directors, and R. E. Morrison, of the City of Mexico, is Vice President and General Counsel.

*LINARES & GULF. This road, which is being built from Linares, state of Nuevo Leon, on the Mexican Central via Rio Conchos and San Miguel, San José and Tamaulipas to the Gulf of Mexico, has track laid to San José, about 38 miles. The work includes about three miles of very heavy work. Edward D. Self is Chief Engineer.

*MEXICAN CENTRAL. This company is actively engaged in the construction of the Manzanillo extension between Tuxpan, state of Jalisco, and Colima, the capital of the state of Colima, 45 miles. Work is progressing very favorably, from 2,000 to 3,000 men being constantly employed. It is expected that this line will be completed early in 1907. The contractors are Hampson & Smith, of Mexico City. There are a number of important bridges and 12 tunnels. Maximum grade to be 2 per cent and maximum curvature 9 degrees. Connections will be made at Colima with the Mexican National Construction Co.'s Railroad, recently bought, which runs to Manzanillo. This will give the Mexican Central the first line in Mexico to the Pacific coast.

*Branch line in the state of Coahuila, from Saltillo to Paredon, 41 miles. Expected that the work will be completed in June or July of this year. The work is being done by Hampson & Smith. No important bridges. Line is being built under Mexican Central standards, with 75 lb. steel rail, stone and iron bridges, steel water tanks and stone station buildings.

——If the Federal Government modifies the exclusive concession granted to the National of Mexico, to occupy a strip of country 20 miles wide, bordering the Rio Grande for 400 miles, the Paredon line will probably be extended to San Antonio, Tex., crossing the Rio Grande at a point about 25 miles above Laredo. Surveys made for this further extension.

This company's engineers have located the route for its proposed Mexico City Tampico line. The gap is from Apuleo to Tuxpan, 130 miles. This would make the distance from Mexico City to Tampico 240 miles instead of 780 miles as at present over the Mexican Central. The maximum grade will be 2½ per cent., with 6 degree curves. Construction work may be started this year.

Proposed branch line from Jimulco, in the state of Coahuila, Mexico, west to Valardena, about 30 miles. Nothing done.

MEXICAN INTERNATIONAL. An extension of this road from Durango, Mex., to Guadalajara, about 400 miles, has been located from Durango to Chalchihuites, 150 miles. It is reported that construction work on this section will soon be begun. Surveys for the rest under way.

Extension southwest from Durango, state of Durango, to the port of Mazatlan, state of Sinaloa, on the Pacific coast, 225 miles. Surveys approved by the Mexican Government but construction not yet authorized (Mar. 17, 1905).

Extension of the Papasquiaro line to the mining camp of Guanaceni, in the State of Durango. Projected. This would run through one of the richest mining sections in Mexico.

MEXICAN ROADS. Concession granted by the Mexican Government to John Lorenzo Gonzalez Trevino, of Monterey, to build from Garza Galan, in the state of Coahuila, to Morelos, 75 miles, where connection can be made with the Mexican International.

——Surveys completed for a railroad which Carlos Romero, of Guadalajara, Mexico, will build from Tapuesquite, state of Jalisco, to his mines. Contracts for the work to be let soon. Mr. Romero also owns a concession which he obtained from the federal government for the construction of a railroad from Etzatlan to Hostotipaquillo in the same state.

——William Niven, an American of Balsas, state of Guerrero, Mexico, is organizing a company to build a railroad from Balsas down the valley of the Balsas river to Cayuca de Catalan, about 100 miles through a territory rich in mineral resources.



RIGHTS OF TRAINS ON SINGLE TRACK

By H. W. Forman, a train despatcher of 30 years' experience, who has instructed and examined more than 10,000 railroad employes. It is in the form of a catechism and covers every imaginable condition under which train rules have to be used and interpreted. Bound in leather; gilt edges; 477 pages, 4 x 7 inches. Price, $2 50 prepaid. :: :: ::

THE RAILROAD GAZETTE

NEW YORK CHICAGO LONDON

——Oscar J. Braniff has obtained a concession from his property in the state of Vera Cruz to the cities of Leon and Salamanca.

——Rafael Davila and Salvador Cardenas Pena, of Monterey, have obtained a concession to build a railroad between Allende and Zaragoza.

——A. H. McKay, who represents Canadian lumbermen, is applying for a concession to build a 30 mile railroad from the Bialock colony, state of Tamaulipas, to connect with the Mexican Central at Aguelles.

——A railroad is to be built in the state of Yucatan by Juan N. Martinez and associates, from San Ignacio to Huchuema. Mr. Martinez obtained a concession from the Federal Government some time ago and is reported to be now ready to begin work.

——A narrow-gage line is projected between San Geronimo and Juan Felipe, state of Vera Cruz, 26 miles.

——A narrow-gage road is projected from the Buckeye mine of the Transvaal Copper Mining Co., to connect with its smelter at Campas, about 25 miles. Campas is 36 miles south of Nacozari, the nearest railroad point. Preliminary surveys to be made this month. Arthur W. Jenks is Manager of the Transvaal Copper Mining Co., at Campas, Sonora, Mexico.

——Concession has been granted by the Mexican Government to John Henderson to build a railroad from Port Lobos to the town of Caborca, in the state of Sonora, 36 miles. Surveys to be begun this summer. Six miles must be completed by July, 1907, and six miles more completed each year until the road is finished. Office at Nogales, which is the terminus of the Guaymas Railroad. Port Lobos is south of Guaymas, and Caborca is in the southern section of the Altar district. The line will be southeast of and parallel to the Guaymas & Nogales road.

——Concession granted by the state of Oaxaca to Charles A. Hamilton, President of the San Juan Taviche Mining Co., and work is to be started shortly on a narrow-gage railroad from Ocotlan to San Geronimo Taviche, about 17 miles. With the exception of five miles the work will be easy. Surveys completed.

—— Concession granted by the Mexican Government to Rafael Davila and Salvadore Gardenas Pena, of Monterey, to build a railroad from Allende in the state of Coahuila north to Zaragoza, about 15 miles. The proposed line will connect at Allende with the Mexican International. The terms of the concession require that the road shall be in operation within two years.

——The Descubridora Mining Co., which owns copper mines and the railroad from Conejos station, on the Mexican Central, to its mines, in the state of Durango, is planning to build an extension from Conejos to Inde, about 40 miles. J. F. Stone represents the company.

——According to reports from Mexico, the Royal Trust Co., of Chicago, which is affiliated with the Swift Packing Co., will build a narrow-gage railroad from Toluca to Puente de Ixtle and from Toluca to Zecualpan. R. J. Kerr, representing the Royal Trust Co.; Telesforo Garcia, owner of a concession from the Mexican Government for a parallel line; G. H. T. Shaw; Joan Henkel, who owns a narrow-gage road between Toluca and Tenango and Toluca and San Juan de las Huertoa, about 32 miles long, and C. V. Tackaberri, of the Los Arcos Mining Co., are interested. Negotiations have been completed for the purchase of the Henkel road. This will be the first link. It is proposed to issue $3,000,000 gold bonds, which have been underwritten by the Royal Trust Co. at 90, and stock to the value of $32,185 a mile of the road's length will be issued. G. H. T. Shaw, Chief Engineer for the road, has commenced surveys.

——A company of Mexican capitalists of Tlachichilco, state of Vera Cruz, is planning to build a railroad from that place southeast through La Perla, Aztecan and Coscomatepec, in the state of Vera Cruz, about 75 miles.

——The Compania Mexicana Cacahuamilpa, which was organized last year in the City of Mexico, with $400,000 capital, will, it is reported, build a railroad from Cacahuamilpa to Hermosa, on the Mexican Central. Carlos Bach is President.

——Preliminary surveys for a railroad from Sierra Mojada, the present terminus of the Mexican Northern, to Cuatro Cienegas, the terminus of the Mexican International. Victor Ginther of Santa Rosalia, is interested.

——The Metallurgica Mexicana has completed preliminary surveys for building a road from a point on the San Pedro branch of the Potosi & Rio Verde to its mines situated in the San Pedro district; also to other mines adjacent to San Luis Potosi.

——*The Mexican Flume & Lumber Co. is building a railroad from Quirio, state of Michoacan, on the National of Mexico, southeast 12½ miles into the timber belt surrounding Las Cruces, where the company's mills are situated. Part of the grading and bridging work has been finished. The company's New York address is 66 Broadway.

——The government of the state of Chihuahua has granted a concession to a United States company to build from Baca, on the main line of the Mexican Central, to Sierra de Almolya. Under the terms of the concession the road must be completed by 1908.

——Projected railroad from Ameca to Banderas Bay, on the Pacific Coast. Preliminary surveys reported completed by F. M. Ames, an engineer representing a syndicate of American capitalists, headed by A. W. Geist.

——Application made to the government of the state of Jalisco, by Carlos Romero, of Etazatlan, for a concession to build a railroad from Orendain, on the Mexican Central to Hostotipaquillo. It is claimed that financial backing has been provided for and that construction work is to be commenced as soon as the concession is granted.

——Reported that a road will be built by the Laredo Mining Co., from Saltillo, state of Coahuila, to Galeana, about 85 miles. Several preliminary surveys made, but route not yet definitely decided. C. C. Pierce, of Laredo, Texas, may be addressed.

——*Proposed extension of the Mexican Coal & Coke Co.'s line from its mines at Las Esperanzas, state of Coahuila, to Nogalitas, 24 miles, and eventually to Monterey, 150 miles further. Surveys finished. Messrs. Hampson & Smith, City of Mexico, are the contractors. G. A. Stranahan is the engineer in charge.

——A company is reported to have been formed to build a railroad from Tepic, territory of Tepic, west to the port of San Blas on the Pacific Coast, 30 miles. The sum of $800,000 is reported to have been given as a bonus for the enterprise, as well as right of way for the entire distance. Leon Balch is interested.

——A railroad 50 miles long is projected which is to extend from the San Antonio plantation near Ocatitlan, state of Vera Cruz, to a connection with the Vera Cruz & Pacific. R. K. Williams of Seattle, Wash., is reported to be in charge of surveys.

——Work is soon to be begun on a railroad from Sandias, state of Durango, on the Mexican International, to Sierra Candela, which is in a large lumber district. The firm of Balsiger Schuter Sucrs., of Durango, is interested.

MEXICAN ROADS (Electric).—The Jalisco Exploitation Co. is reported incorporated at Guadalajara, Mex., to build a standard gage electric road from Guadalajara southwest to the port of Chamela, on the Pacific Ocean, 150 miles. The first building to be from Guadalajara to the Soledad ranch, 24 miles, where water power can be obtained for an electric plant. M. C. Miller is President, and C. H. Wittemore, of Mexico City, General Manager.

——Concessions granted to Dwight Furness for an electric line from Guanajuato, state of Guanajuato, south to Irapuato, 25 miles. Surveys reported, and Mr. Furness is quoted as saying that the construction work will be begun and the line will be eventually extended to Salamanca, on the National of Mexico.

MEXICO CITY ROADS.—A syndicate of American and Mexican capitalists, in which Col. Felix Diaz and S. S. Neff, formerly General Superintendent of the street railway system in Mexico City, are interested, has made application to the Federal government for a concession to build a system of elevated and subway railroads in that city to cost about $5,000,000.

MORELIA & TACAMBARO.—This company, which has been granted a number of valuable concessions from the Mexican Government and the state of Michoacan, proposes to build a line from Ira Puata, on the Mexican Central, south to Tacambaro in the state of Michoacan, thence west to Ario, 225 miles. Contracts were to be let about the first of this year. The company is being financed by A. J. Peyton & Co., of New York, who has underwritten $1,200,000 of bonds to provide funds for building the first 60 miles. D. Knapp, New York, is Vice-President and General Manager.

NACOZARI RAILROAD. Extension from Nacozari, state of Sonora, south to Montezuma, 56 miles. To be built soon. James Douglass, 99 John street, New York, is President. (Mar. 17, 1905.)

NATIONAL OF MEXICO. Projected a branch from Tezintlan to Fubers to develop the oil fields owned by the Oil Fields Company of Mexico. Surveys made, and it is said that the road will soon be built.

Branch from a point on the main line through the Rio Lerma Valley, in the states of Guanajuato and Jalisco, east to Guadalajara, 50 miles. Surveys reported. Would parallel the Mexican Central. (Mar. 17, 1905.)

Reported that application will be made for a concession for an extension of the Morelia branch from Uruapan, state of Michoacan, west to Colima, 100 miles, and from Colima to the port of Manzanillo, on the Pacific Coast, 60 miles. The harbor improvements at Manzanillo, which have been in progress for several years under direction of the Mexican Government, will soon be completed, and the Government wishes to extend its system of railroads to that place. (Mar. 17, 1905.)

OAXACA & PACIFIC.—Incorporation asked for in Connecticut, with capital of $40,000,000, to build and operate railroads in the republic of Mexico. Samuel B. Howard, of Millbrook, N. Y.; A. W. Britton, of East Orange, N. J., and J. D. Baker, of Yonkers, N. Y., are incorporators.

OAXACA RAILROAD.—Application made by W. G. Seaver, of New York, for a concession to build a road to cost $37,000,000, from Mexico City to Merida, with a branch line to Belize, British Honduras. New York capitalists to furnish funds necessary for this work. No subsidy from the Mexican government. Col. James McNaught, First Vice-President of the Great Northern of Canada, it is said, will be the President of the road, and W. I. Allen, formerly General Manager of the Rock Island, General Manager.

PALMILLAS RAILROAD.—Extension through Ayapasco, Santa Rosalia, Crestones and San Miguel, in the state of Morelos, Mex., to connect with the Arcola Railroad at El Carmin. Projected. (Mar. 17, 1905.)

*PAN-AMERICAN.—Operates train service from San Geronimo, Oaxaca, through Tonala and Chiapas to Pipiñapan, 173 miles. Contracts let for construction from Coapa to San Bonita, 125 miles, and surveys being made from San Bonita to boundary of Guatemala, 31 miles. An advertisement offering for sale first mortgage bonds of the company is as follows: The road starts at San Geronimo on the National of Tehuantepec, and runs southeasterly through the states of Oaxaca and Chiapas to a point on the Guatemala border. At the present time about 200 miles of road are in operation, and construction work is rapidly progressing on the projected line, so that within 18 months the entire 300 miles of road will be in operation, furnishing a connection from the City of Mexico to the City of Guatemala.

PARRAL & DURANGO.—This company, which operates about 80 miles of road, is planning to at once build an extension from its southern terminus at Mesa de Sandia to Gunacevi, in the state of Durango, 50 miles, and it is said the road will eventually be extended to the Pacific Coast, 150 miles further. Surveys completed. The company is owned by Pittsburg capitalists. President, S. E. Gill, Pittsburg, Pa.

PITTSBURG SAN JOSE.—This company has completed its railroad from San Jose del Sitio, Mex., where the company's offices are located, to Vallecillos, 16 miles. Surveys to be made for line north to a connection with the Kansas City, Mexico & Orient. M. B. Place is General Manager.

*RIO GRANDE, SIERRA MADRE & PACIFIC.—This road, which is the property of W. C. Greene, and runs from El Paso, Tex., southwest to Terrazas, state of Chihuahua, Mexico, 250 miles, has begun an extension from Terrazas southwest to the new town of Dedrick at the junction of the Arres and Chico rivers, 120 miles. Work now under way. Concession granted by the Mexican Government for an extension 150 miles further to the port of Guaymas, on the Gulf of California.

ST. LOUIS, BROWNSVILLE & MEXICO.—Reported that this road will be extended under a concession, granted over a year ago, from Brownsville, Tex., across the Rio Grande river southward to Tampico, Mex., about 290 miles.

G.S. BAXTER & CO.

17 WILLIAM ST., NEW YORK

(TELEPHONE 5905 BROAD)

JACKSONVILLE, FLA.

MILL AND TIE CAMPS AT FARGO, CLINCH CO., GA.

DIMENSION CROSS TIES RAILROAD BRIDGE TIES SWITCH TIES LUMBER

SONORA RAILWAY. See Southern Pacific.

*SOUTHERN PACIFIC. According to newspaper reports this company has completed nearly 100 miles of the line, which it is building, under a concession granted by the Mexican Government, to J. A. Naugle, Assistant General Manager of the Sonora Railway, of Guaymas, state of Sonora, through the states of Sonora, Sinaloa, and Jalisco, and the territory of Tepic, to connect with the Cananea, Yaqui River & Pacific in the north, and with the Mexican Central in the south. The road is to be built in four sections, the first from some convenient point on the C., Y. R. & P. (which is controlled by the Southern Pacific) near the city of Alamosa, Sonora southeast to Culiacan and Sinaloa. The second section is from Sinaloa to Mazatlan, and the third from some convenient point on the line between Culiacan and Mazatlan, near San Diego to Tepic, in the territory of the same name. The remaining section is from Tepic to a point on the Mexican Central between San Marcos and Guadalajara, the capital of Jalisco, to which point the Mexican Central extension reaches.

TOLUCA & ZIHUATENAJO (Electric). Concession asked by Henkel Bros., of Toluca, who own short lines from Mexico City to San Juan de los Huertas, and to Tenango, to build an electric railroad from San Juan to Temascaltepec, Tejuplico and Cotzumala, thence along the valley of the Balsas river, to a point where it emerges from the Sierra Madre, thence along the coast to Zihuatenajo. Surveys completed and subsidies granted by the states of Mexico and Michoacan. This line would furnish a route from the gold and silver mines of Sultepec and Temascaltepec, and the copper country along the Balsas.

TORRES & PRIETAS.—Extension from Minas Prietas, in the state of Sonora, southeast to a point on the Yaqui river, to tap the San Marcial coal fields, which are owned by the Southern Pacific. Plans made. (Mar. 17, 1905.)

*TUXPAN VALLEY.—Projected line in Mexico from Tuxpan to a point at or near Jabonera, 70 miles. Surveys completed and grading in progress. C. B. Eames, of St. Louis, is President, and Geo. W. Deits, of the City of Mexico, General Manager. (Mar. 17, 1905.)

URBANO DE TAMPICO.—At a recent meeting of the Board of Directors of this road it was decided to extend its railroad to La Barra, passing through the towns of Talleres, Arbol Grande and Dona Cecilia. The company owns the street railways in Tampico. The motive power will be either steam or electricity. Angel S. Trapaga is President, at Tampico.

BRIDGE WORK PROPOSED.

United States.

ALABAMA

——The United States Senate has passed a bill authorizing the Alabama & Western to build bridges over the Black Warrior river between Green and Marengo Counties, and over the Alabama river between Clark and Monroe Counties, Alabama.

Both Houses of Congress have passed a bill authorizing the counties of Dale and Houston, Ala., to build a bridge over the Choctawhatchee river.

ANNISTON. Plans being made to build a viaduct at this place.

BESSEMER. A viaduct is proposed over the tracks at Tenth street to cost about $30,000.

BIRMINGHAM. A new steel bridge is to be built over Warrior river at Jasper's Ford, which will be the largest in Jefferson County. It will have four spans with a total length of 648 ft., to cost about $100,000. J. Kendrick is City Engineer.

Bids are wanted this month by the Board of Revenue, of Jefferson County, for building seven steel bridges. P. S. Milner is County Engineer.

DECATUR. Residents of the various counties are arranging to build a combined highway and electric railroad bridge over the Tennessee river under the direction of the Business Men's League of Decatur, which has permission from the United States Government to build a bridge to cost about $225,000 over the Tennessee river.

HAMILTON. Bids are wanted by M. Pearce, April 2, for building two steel bridges, one 290 ft. long and one 75 ft., over the Buttahatchie and New rivers in Marion County.

HUNTSVILLE.—The Nashville, Chattanooga & St. Louis proposes to build a bridge over the Tennessee river south of Byrd's Bluff. Surveys completed and the site located.

JASPER.—The Commissioners' Court of Walker County has granted permission to build a steel bridge, which will be the largest in the county, over the forks of the Mulberry and Sipsie rivers and the creek in the eastern portion of the county.

MONTGOMERY.—The Mayor has approved an ordinance providing for a bridge over the Central of Georgia tracks on Madison avenue.

SHORT CREEK.—The Ensley Southern, on its extension to Parish, in Walker County, will build two bridges over the Warrior river at a cost of about $200,000.

MOBILE.—On January 29 the House of Representatives passed the bill, previously passed by the United States Senate, authorizing the Mobile Railway & Dock Company to build a bridge or viaduct across the water between Cedar Point and Dauphin Island in Mobile Bay.

WATERS' FERRY. A bill is before the Committee on Interstate and Foreign Commerce of the Lower House of Congress authorizing the Commissioners' Court of Baldwin County, Ala., to build a bridge across the Perdido river at this place.

ALASKA.

NOME.—A bill has been introduced in the Upper House of Congress, authorizing a free bridge over the Snake river at this place.

SKAGUAY.—The White Pass & Yukon Railway will build three steel bridges on the line of its road and replace many of the present structures with steel structures.

ARIZONA.

CLIFTON.—The Arizona & New Mexico may build a bridge over the San Francisco river.

A committee has been appointed to build the proposed suspension bridge here to cost $350,000.

PHOENIX. The Maricopa & Phoenix is making plans to build a bridge to replace an existing structure.

ARKANSAS.

Both houses of Congress have passed bills authorizing the Campbell Lumber Co. to build two bridges across the St. Francis river, in Clay County, Ark.

A bill has been introduced in the Lower House of Congress authorizing the Campbell Lumber Co. to build a bridge over the St. Francis river, in Clay County.

The bill authorizing the Rock Island, Arkansas & Louisiana to build bridges over the Ouachita river and other navigable waters, in Arkansas, has been passed by both Houses of Congress.

BATESVILLE. The Commissioners of Independence County have been petitioned to build a steel bridge over the White river at this place to cost $75,000.

BENTONVILLE. The County Commissioners will ask bids early this summer for some bridge work in Benton County. Marion Douglas is County Clerk.

BERRYVILLE. Bids will be asked by Tom H. Faucher, County Judge, for putting up a steel bridge over the Osage river 600 ft. long, in Carroll County. E. M. Barr is acting County Clerk.

CULBERHOUSE. The Manila & Southwestern will build a long trestle over the St. Francis river in Craighead County.

FT. SMITH. The Ft. Smith Bridge Co. has secured permission from Congress to build a bridge over the Arkansas river between Ft. Smith and Van Buren, to cost $325,000.

LITTLE ROCK. County Road and Bridge Commissioner Richardt has made surveys for a steel bridge 14 miles from this place in Brodie Township.

The St. Louis, Iron Mountain & Southern reported planning to build a steel viaduct 170 ft. long on two concrete piers 15 ft. high to cost $25,000, on West Third street to replace the present wooden structure. At Twelfth street a viaduct 72 ft. long will replace the present structure over the tracks to cost $11,500, and at Thirteenth street the present bridge will be replaced by a steel structure 61 ft. long.

PERRYVILLE. Bids are wanted by J. N. Stone, County Judge, for building a steel bridge over the Fourchelafuve in Perry County.

PINE BLUFF. Viaduct proposed to be built over Third and Fourth avenues.

—A bill has been introduced in the House of Representatives authorizing the Pine Bluff North and South Railroad Co. to build a bridge over the Arkansas river here.

——Commissioner has been appointed for building a combined highway and railroad bridge to consist of 10 spans, with a total length of 3,200 ft. over the Arkansas river at this place. The appropriation of $20,000 has been made by the County Court to make soundings.

——Bids will soon be asked by the Bridge Commissioner for building a steel bridge over the Arkansas river in Jefferson County. The Lower House of Congress has passed a bill authorizing this work. E. J. Kerwin, County Judge, is Chairman; Jesse R. Core is County Clerk.

PROVO.—The Queen & Eastern Railroad, which is building a road between this place and Hot Springs, will shortly begin the construction of a large bridge over the Saline river.

VAN BUREN. The Fort Smith & Van Buren Bridge & Traction Co. has been incorporated, with $50,000 capital stock. It is proposed to build a bridge over the Arkansas river at Van Buren. A bill has been passed by the United States Senate and is now before the Lower House authorizing this work. H. E. Kelly is President.

CALIFORNIA.

FRESNO.—The Board of Supervisors is planning to build a steel bridge over the San Joaquin river at Pollasky to cost about $25,000.

HAYFORK.—The Board of Supervisors will build a bridge 330 ft. long over Trinity river at Lewiston. T. J. Montgomery is County Surveyor.

LOS ANGELES. Plans are being made for reconstructing the West Riverside bridge, at a cost of about $21,000.

City Engineer Harry F. Stafford writes us that a bond election will shortly be held for raising $800,000, part of which will be used to build proposed bridges as follows:

——At Main street over the Los Angeles river 310 ft. long.

——At Seventh street over the Los Angeles River, 310 ft. long.

At Macy street, over the Arroyo de los Posos, 200 ft. long, and a viaduct at Buena Vista street, over the Southern Pacific, the Santa Fe and San Pedro, Los Angeles & Salt Lake tracks about 850 ft. long.

NEVADA CITY. Bids are wanted April 4, by F. L. Arbogast, County Clerk, for building a bridge across Trout Creek at Truckee.

OXNARD. The Southern Pacific, it is said, will replace the present trestle over Santa Clara river with a new steel cantilever bridge.

PARKER. The Atchison, Topeka & Santa Fe may build a new bridge over the Colorado river at this place.

RED BLUFF. Tehama County may build a bridge 1,350 ft. long over Sacramento river, 50 spans with steel tubing and wooden beams, at a cost of about $34,000. W. F. Laming is City Engineer. The Board of Supervisors has under consideration the question of building two bridges over the Sacramento at the east end of the town.

A proposition is under consideration to bond Tehama County for $250,000 to build bridges as follows: In the eastern part of the county over the Sacramento river over the sand sloughs on the opposite side of the river from Red Bluff, a bridge over the Sacramento at Tehama and one between Corning and Vina in the southern part of the county is reported under consideration.

REDDING. Petitions have been made for a bridge over the Sacramento river, to cost about $25,000.

The Supervisors of Shasta County will build a steel bridge 150 ft. long over Cow creek. R. L. Redding is County Surveyor.

SACRAMENTO. Application has been made by the Southern Pacific to the War Department for permission not yet granted to build a bridge over the Carquinez Straits from the Nevada Dock to Fifth street, Benicia. The proposed structure will be more than a mile long, with a draw and cost about $3,000,000.

Plans being made by the Board of Supervisors for a concrete bridge over Rio Linda creek to cost about $20,000.

SAN BERNARDINO. According to reports a steel viaduct will be built on Mt. Vernon avenue at a cost of $20,000.

SAN FRANCISCO. The bridge at San Jose and Mt. Vernon avenues, over 200 ft. long over the

Seattle ... Locks will be widened to 43 ... at a cost of about $12,000.

... being made to put up a steel viaduct ... 1,000 ft. long to carry the electric ... tracks over the Southern Pacific ... at Channel street.

SAN JOSE.—Petition has been made for a bridge on San Antonio street.

SANTA ROSA.—Bids, it is said, will soon be asked for building a bridge here.

STOCKTON.—Two steel bridges, it is said, will be built here, one over the San Joaquin river above Stockton and the other over Burn's cut-off. R. C. Tunnelty, Stockton, is City Engineer.

STANISLAUS.—Plans are being made by the County Surveyor, A. L. Finny, for building a concrete bridge to consist of two arches each 100 ft. long, to cost about $24,500. Bids will be asked as soon as plans are completed.

TEHAMA.—The Board of Supervisors has under consideration the question of building a bridge over the Sacramento river at this place, to cost about $50,000.

TRUCKEE.—Bids, it is said, are wanted until April 4 by F. S. Arbogast, County Clerk at Nevada City, for building a trestle bridge over Trout creek.

VENTURA.—Arrangements have been made by the County Commissioners to raise $50,000 to be used towards building two bridges, one over Sespe creek near Fillmore, and the other over the Ventura river at Casistas Pass.

COLORADO.

ALAMOSA.—A bridge, it is reported, will be built over the Rio Grande river here. T. W. Jaycox is State Engineer, Denver.

CANON CITY.—The County Commissioners will build a bridge at the lower end of Fruitmere, to cost about $12,000.

——The newspapers say that a railroad bridge is to be built over the Royal Gorge. The bridge is to be 2,800 ft. above the hanging bridge of the Denver & Rio Grande, and is to be built as a part of an electric railway from Canon City to Florence. It is said that the line to the top of the Royal Gorge will be in operation this summer. The cost of all the railroads proposed will be $500,000, and the suspension bridge spanning the chasm $100,000 additional. The air line distance from Canon City to the highest point the road will reach is six miles, but a tortuous road 10 miles in length will be built.

COLORADO SPRINGS.—The Atchison, Topeka & Santa Fe may build new bridges at Costilla and Kiowa streets. Plans have been made by the City Engineer.

——Bids will be asked this spring by the Board of County Commissioners for a bridge 75 ft. long over Fountain Creek, in El Paso County. H. McAllister is Deputy County Clerk.

DENVER.—Plans are reported ready for building a bridge over Cherry creek at Lawrence street, to cost about $45,000.

DURANGO.—This city is planning to build a bridge over the Las Animas river, at Main avenue. The proposed bridge will consist of two spans of 60 ft. each, with 34 ft. roadway and 5 ft. sidewalks. Plans are to be submitted for a steel or a concrete and stone structure.

FLORENCE.—The Denver & Rio Grande has decided to replace many of the wooden bridges over the line of its road between Salida and Pueblo with steel structures.

MONTEVISTA.—A bridge will be built over the Rio Grande river 150 ft. long.

PUEBLO.—The Council has passed an ordinance appropriating $75,000 for a bridge, including a viaduct over the Denver & Rio Grande tracks at South Main street, to cost $95,000.

CONNECTICUT.

BRANFORD.—Plans are being made for a drawbridge over East Haven river, to cost $12,000, to be built jointly by the towns of Branford and East Haven.

BRIDGEPORT.—The New York, New Haven & Hartford will build a new four-track drawbridge over the Housatanic river, and three or more others of the same type; one at Cos Cob, one over the Connecticut river and one over Shaw's Cove at New London; also a new three-span bridge between Shelton and Derby, carrying double tracks.

HARTFORD.—The Court of Common Council is considering a proposition to abolish the Walnut street grade crossing by building a highway bridge to carry Walnut street over the tracks of the N. Y., N. H. & H. F. L. Ford is City Engineer.

LYME.—The plans for the new bridge of the New York, New Haven & Hartford over the Connecticut river have been approved by the Federal authorities, and it is reported that the bridge will be built in one year.

NEW HAVEN.—Petition has been made for a drawbridge over Mill river at Grand avenue. C. W. Kelly is City Engineer.

——A new drawbridge will be built at Double Beach between Branford and East Haven. The Secretary of War has ordered the present structure removed.

——The New York, New Haven & Hartford will replace the Connecticut river bridge, a single track structure, with a four-track bridge, to cost about $1,200,000. Introduction of heavier equipment will require strengthening a number of its bridges. C. M. Ingersoll is Chief Engineer, New Haven, Conn.

——Work will be started early next year on a bridge over Mill river at Humphrey street.

——The New York, New Haven & Hartford, in addition to building about 11 steel overhead bridges as a part of its four-tracking of the cut in this city will put up a single-track two-span bridge 113 ft. long on the Danbury branch at Winnipauk; a 650 ft. steel viaduct at Fall River, Mass.; a two-span, single-track bridge 117 ft. long over the Norwalk river at Norwalk; a two-track 70 ft. bridge at Stonington; a 50 ft. single-track bridge at Branchville, on the Danbury branch, and two bridges, 200 and 125 ft. respectively, to be built at Collinsville, on the Northampton division.

PUTNAM.—The Consolidated Railroad has agreed to stand a share of the cost of widening Front street, which includes an overhead water-tight bridge to carry four tracks.

WATERBURY.—A bridge is proposed on the westerly side of the Naugatuck river over the tracks of the New York, New Haven & Hartford.

WESTPORT.—Plans are being made for building a bridge over the Saugatuck river at State street.

WILLIMANTIC.—A resolution, it is reported, has been passed by the Board of Aldermen authorizing the making of plans for building a bridge at Main street, to cost $12,000.

DELAWARE.

DOVER.—The Kent County Commissioners have decided to build a bridge over Fannell's branch near Chestertown.

SHARPTOWN.—Residents of this place are agitating the question of building a bridge over the Nanticoke river.

WILMINGTON.—Newcastle County is reported making plans to spend $500,000 for two bridges over the Christiana river, one at Market street, to cost $250,000, and the other at Fourth street, to cost a similar amount.

——Chief Engineer Theodore A. Leison, of the water department, has completed plans for building a concrete bridge 335 ft. long with a 16 ft. driveway and two 4 ft. sidewalks over the Brandywine river. The cost of the proposed structure will be $35,000.

DISTRICT OF COLUMBIA.

WASHINGTON.—A concrete bridge is being built over Rock Creek on the lines of Connecticut avenue to cost $850,000, consisting of five 150-ft. spans and two 82-ft. spans; total length, 1,341 ft. The contractors are the District Construction Co. Two abutments and five 150 ft. arches have been completed; $150,000 has been requested of Congress to complete the bridge.

——A steel bridge is being built over the Anacostia river to consist of six fixed spans of three hinged plate-girder arches and of one trunnion lift draw of two leaves, total span of draw 100 ft. This bridge will cost $375,000. Contractors, Penn Bridge Company.

——Excavation has just started on concrete bridge with 125-ft. span over Piney Branch Valley on the line of Sixteenth street extension. Total cost of bridge $50,000. Contractor, Penn Bridge Company.

——The Commissioners of the District have requested an appropriation of $38,000 for building a plate-girder bridge 110-ft. long over Rock Creek on the line of K street.

——A bill has been introduced in Congress for the construction of a $900,000 steel bridge over the Anacostia river at the foot of Half street. This bill has been unfavorably reported on by the Commissioners.

——Bids will be asked this spring for the construction of five concrete-steel bridges, having spans varying from nine to 16 ft. Five thousand dollars is available for the work.

——A bill has passed the Senate providing for the appropriation of $500,000 for building the Memorial Bridge over the Potomac river. The proposed structure will be 3,500 ft. long with approaches, and will consist of six main spans of 192 ft. each, and one span 159 ft., and a number of smaller spans, and will cost when completed $5,000,000.

——The Potomac Highway Bridge built under the direction of the War Department is practically completed, and will probably be opened early this spring.

——The War Department is building a $100,000 concrete-steel bridge, consisting of three 50-ft. spans over the Washington Channel. This bridge is being built by the Penn Bridge Company and will be used when completed on the approach to the Potomac Highway bridge.

——The Baltimore & Ohio, as part of the elimination of the grade crossings on its road in the District of Columbia, is building a plate girder bridge 600 ft. long. The bridge will consist of 9-ft. plate girders resting on steel columns and concrete foundations. All steel work will be encased in ornamental concrete. The floor system will be of 24-in. I-beams supporting concrete steel slab. Cost of bridge $175,000. The Pennsylvania Steel Company has the contract for the steel. Foundations built by McMullen & McDermott. The contract for encasing steel work has not been let.

——The Baltimore & Ohio will also build a four-truss steel bridge over its tracks on the line of T street. The foundations for this bridge have not been begun. Cost of bridge $150,000. W. J. Douglas is Engineer of Bridges, D. C.

——On Jan. 16 the United States Senate passed the bill authorizing the Memorial bridge across the Potomac river from the most convenient point in Washington to Arlington Cemetery, in Virginia. The bill limits the cost of the bridge to $5,000,000, and appropriates $500,000 to secure plans and commence construction work. (Dec. 15, 1905, p. 192.)

FLORIDA.

——A bridge is proposed over St. Andrews Bay near Grassy Point.

——Both Houses of Congress passed the bill authorizing the building of a bridge over the navigable waters of St. Andrews Bay in Florida.

JACKSONVILLE.—An ordinance has been passed to issue bonds for building a bridge over the Hillsboro river, to cost $25,000.

PENSACOLA.—The date for receiving bids for the steel bridge to be built over the Perdido river, in Escambia County, has been postponed to July 1, 1906. A. M. McMillan is County Clerk.

ST. AUGUSTINE.—A bridge may be built over the Matanzas river, connecting this place with Anastasia Island.

GEORGIA.

ALBANY.—The Georgia Northern is planning to build a bridge over the river at a point known as the Narrows, about a mile above the Atlantic Coast Line bridge.

AMERICUS.—The County Commissioners will build a steel bridge 192 ft. long, consisting of one span of 60 ft. and steel trestle work, 132 ft. long, over Muskadee creek to replace the present Guerry bridge.

ATHENS.—The County Commissioners will build two large steel bridges; one over Elk river at Redussboal, in the northern part of the county, and the other over Limestone creek at the Huntsville and Brown Ferry road, in the southern part of the county.

——The Georgia Railway & Electric Co., it is reported, will build a combined street car and highway iron bridge at Lakewood avenue.

ATLANTA.—The Southern will build a new bridge from Madison street to the west end of the present bridge.

——A 600 ft. steel bridge will be built over Chattahooche river at Pace's Ferry, nine miles from Atlanta, between Fulton and Cobb Counties. E. B. Rosser, Chairman Road and Bridge Committee.

——Residents are agitating the question of replacing the present Bell street bridge with a new structure.

——The Bridge Committee recommends the completion of the Magnolia street bridge, at a cost of $9,000; the completion of the approaches to the Powell street underpass, to cost $4,250; for the approaches to the South Boulevard underpass, to cost $14,000, and that a sum of not less than $25,000, be appropriated to begin work on the Washington viaduct. Plans for the latter were to be completed by City Engineer R. M. Clayton and bids asked this month.

AUGUSTA.—A steel bridge may be built over the river at Center street.

——The War Department has issued an order requiring that all bridges over the Savannah river shall be built with draws not less than 80-ft.

CARROLLTON.—The Central of Georgia is putting in a new steel bridge over the Tallapoosa river near this place, and will build six others over the Flint, Big Tallapoosa, Etowah, Oostanaula and Chattanooga rivers and Chickamauga creek to accommodate the heavier rolling stock.

COLUMBUS.—The Birmingham, Columbus & St. Andrews Bay Railway Co., it is said, will build a bridge over St. Andrews Bay here.

CONCORD.—The Georgia, Florida & Alabama, to enter this place, may build two bridges over the river.

——The Baltimore & Ohio may build a new overhead bridge.

GAINESVILLE.—The County Commissioners have under consideration the question of building a new bridge over the Chattahooche river at New Bridge, three miles north of this place.

MONTICELLO.—Bids are wanted early this spring by E. H. Jordan for building a steel or wood bridge, 800 ft. long, over Murder creek, in Jasper County.

SAVANNAH.—Petition has been made for a bridge over the Savannah river.

SWAINSBORO.—Several bridges over the Ohoopee river in Emanuel and Tattnall Counties, that were carried away by floods, at a loss of about $200,000, may be rebuilt.

IDAHO.

——The bill authorizing the Spokane International Railway Co. to build bridges over Pend d'Oreille and Kootenai rivers, in Kootenai County, Idaho, has been passed by both Houses of Congress and signed by the President.

BONNER'S FERRY.—A bridge is proposed over the Kootenai river, to cost about $30,000.

COEUR D'ALENE.—The plans of the Northern Pacific for building a bridge over the Spokane river at this place with a span of 150 ft. and 43 ft. above the surface of the river has been approved by the Secretary of War.

PAYETTE.—The County Commissioners, it is said, have plans ready for building a steel bridge, to consist of two spans each 175 ft. long over Payette river.

WALLACE.—The Northern Pacific is planning to build a bridge over the Columbia river on its Idaho division, to consist of ten steel spans. About 20 other bridges will also be built by this company.

ILLINOIS.

——The United States Senate passed the bill, previously passed by the House of Representatives, authorizing the Kensington & Eastern Railroad to build a bridge over the Calumet river, in Cook County, Ill.

AURORA.—Plans are being made by M. J. Tarbell, Engineer, for two concrete steel bridges, each 153 ft. long with 60-ft. roadway, to cost about $50,000.

BELLEVILLE.—Plans are being made by L. L. Harper, City Engineer, for a reinforced concrete bridge over Richland creek, to cost $10,000.

BLOOMINGTON.—A bridge 80 ft. long will be built over the Sangamon river at the intersection of Champaign, Ford and McLean Counties. The cost, $20,000, is to be borne equally by the three counties.

CHICAGO.—Plans of the Bridge Department for improvements to be carried out during the present year include the building of two new movable bridges, four new stationery bridges, and the completion of four bridges now under construction.

——The Chicago, Rock Island & Pacific is planning to build several bridges on its main line between this place and Colorado Springs, and on the line between Burlington and St. Paul, also on its southwestern lines.

——This city, it is reported, has plans under way for 12 new bridges to cost approximately $3,000,000, of which about $1,000,000 will be spent this year. Four of the proposed bridges are to be fixed spans, over unnavigable water. There is to be one double-deck bridge at Kinzie street near the station. This bridge will be used to carry cars on one level and wagons and pedestrians on another. A $300,000 structure will also be built at North Halsted street. J. M. Patterson is Commissioner of Public works.

THE

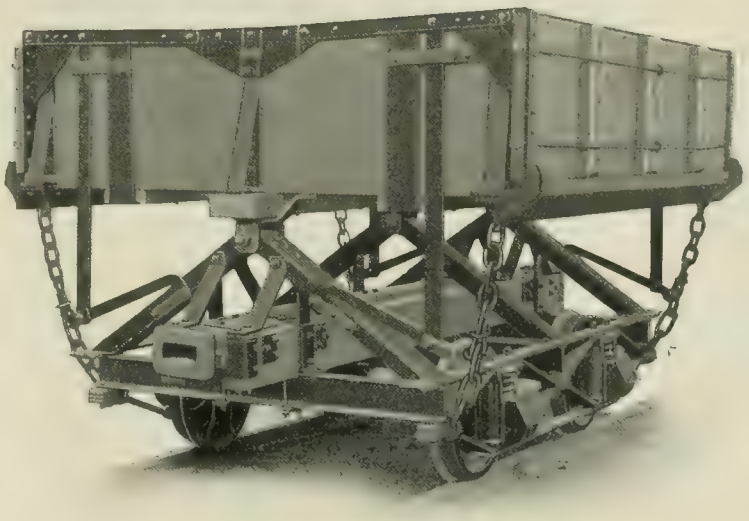
Kilbourne & Jacobs Mfg. Co.

COLUMBUS, OHIO, U. S. A.

LARGEST MANUFACTURERS IN THE COUNTRY OF

Contractors' Two-Way Dump Cars. 1½, 3 and 4 yard capacity for 36 in. gauge track; three-yard capacity for 36 in. gauge track; six-yard capacity for standard gauge track.

Hopper or Bottom Dump Cars. Six-yard capacity for standard track.



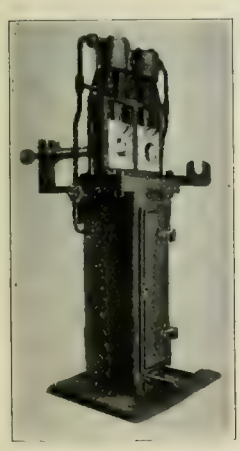
6-yard, Class E, Two-Way Dump Steam Shovel Car.

ALSO EXCLUSIVE MANUFACTURERS OF

"Boss" Solid Steel Drag Scrapers.
"Columbus" Solid Steel Drag Scrapers.
"K. & J." Square Box Wheel Scrapers.
"K. & J." Pressed Bowl Wheel Scrapers.
Contractors' Plows and Dump Carts.
Contractors' Wooden Barrows.
Steel Tray Barrows.
Tubular Barrows.
Wood and Steel Cars of all kinds.
Trucks of every description.

Write to us for No. 32 D. Car and No. 34 General Catalogues and Prices.

THE KILBOURNE & JACOBS MFG. CO.

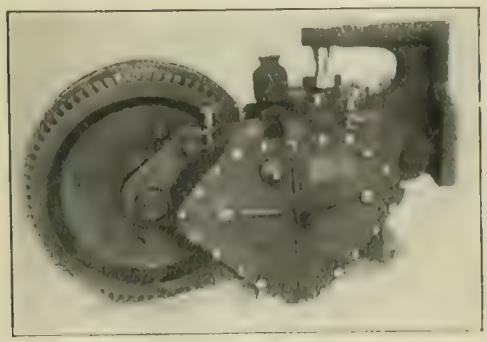


McGrath Pneumatic Flue Welder

Especially adapted for railroad work. Will weld and swedge a 2 in. or 2½ in. flue in *five* seconds, with one heat. Makes a perfect weld. Capacity of machine limited only by the facilities for heating the flues.

The following railroads and many others are using this machine :

Grand Trunk Railway System.
Baltimore & Ohio R. R. Co.
Philadelphia & Reading R. R. Co.
Michigan Central R. R. Co.
Long Island Ry. Co.
Fort Worth & Denver City R. R. Co.
Atlanta, Knoxville & Northern R. R. Co.
Erie R. R. Co.
New York Central & Hudson River R. R. Co.
Missouri Pacific Ry. Co.
Southern Pacific Co.
Butte, Anaconda & Pacific Ry. Co.
Richmond, Fredericksburg & Potomac R. R. Co.
Intercolonial Ry. of Canada.
Indianapolis Union Ry. Co.
San Pedro, Los Angeles & Salt Lake R. R. Co.
Delaware, Lackawanna & Western R. R.
Duluth, Missabe & Northern Ry.
Duluth, South Shore & Atlantic Ry.
Bangor & Aroostock R. R.
Canadian Pacific Ry.
Canadian Northern Ry.



McGrath Pneumatic Locomotive Turn-Table Motor

The most satisfactory and economical method of operating a turn-table. Two distinct sources of air supply. Will turn the heaviest engines.

Some of the railroads using these Motors :

Pere Marquette R. R. Co.
Baltimore & Ohio R. R. Co.
Long Island R. R. Co.
Atchison, Topeka & Santa Fe Ry
Lehigh Valley R. R. Co
Philadelphia & Reading Ry
Pennsylvania R. R
Pennsylvania Lines West of Pittsburgh
Canadian Pacific Ry
Richmond, Fredericksburg & Potomac R. R
Cincinnati, Hamilton & Dayton Ry
Toronto, Hamilton & Buffalo Ry
Northern Pacific Terminal Co
So. Pac. R. Railway Co
Washington Southern Ry. Co
Grand Trunk Ry. System

Sole Manufacturers

THE DRAPER MANUFACTURING CO.

PORT HURON, MICH.

Send for Descriptive Circulars and Prices.

COLLINSVILLE The Council [illegible] said has voted [illegible] over Prairie creek.

CROSSVILLE Bids [illegible] to be asked by Wilkins Bros., C. H. Stokes and Samuel Knight, for [illegible] a bridge [illegible] the Wabash, over a White County.

DANVILLE The Cincinnati, Chicago & St. Louis is reading a large concrete bridge here.

The Illinois Traction Co., it is said, will build a new [illegible] bridge over the Vermillion river, at a cost of $75,000.

DECATUR A reinforced concrete bridge will be built over the Sangamon river at South Monroe street.

GALESBURG Bids for seven new bridges in Elba township may be asked by the Bridge Committee of Knox County Board of Supervisors.

HARVEY The Blue Island, Riverdale & Hammond Electric road, it is reported, will build a new bridge over the Calumet river.

OAKDALE The question of building a new bridge over the Embarras river, it is said, is under consideration.

PEORIA.—The Chicago & Alton and Vandalia lines, it is said, have decided to withdraw from their terminal arrangements with the Peoria & Pekin Union, and are planning to build a bridge over the Illinois river at this place.

Plans reported completed for a bridge over the Illinois river here. The new structure will have four truss spans, each 142 ft. long. It will have a bascule or jackknife draw 151 ft. long. In addition, there will be four 80-ft. girders and five 40-ft. girders extending from the draw to the west shore. W. A. McCully, Peoria, is Assistant Engineer.

SPRINGFIELD The Baltimore & Ohio Southwestern is reported planning to put up a steel bridge 815 ft. long over the Okaw river, to cost about $80,000.

STERLING It is reported that the War Department has ordered the removal of four bridges over Rock river, which were built without the authority of Congress.

WAUKEGAN Plans are being made for building a concrete bridge at South Genesee street. It will consist of three or five arches and cost about $70,000.

INDIANA.

Congress has passed the bill authorizing the Southern Indiana Railway to build a draw bridge over the Wabash river, in Vigo County.

A bill has been passed by both Houses of Congress authorizing the Vincennes, West Baden & Louisiana Traction Co. to build a railroad bridge over White river, between Harrison Township, Knox County, and Washington Township, Pike County, the plans to be approved by the Chief of Engineers and the Secretary of War.

AUBURN. Bids, it is reported, will soon be asked for a concrete and steel bridge in this county. H. D. Boozer is County Auditor.

BLOOMFIELD. The Indianapolis Southern, on its new Indianapolis line near this place will build a viaduct 2,800 ft. long and cut the highest point 175 ft. high.

CAYUGA.—Bids, it is said, are wanted by the Board of County Commissioners at Newport, for the steel superstructure of a highway bridge over Wabash river at Cayuga. H. T. Payne is County Auditor.

ENTERPRISE.—The Chicago, Indianapolis & Evansville, it is said, is locating the site for building a bridge over the Ohio river at this place on its proposed road toward Owensboro, Ky.

EVANSVILLE The Board of County Commissioners will build six concrete bridges and one steel bridge in Vanderburg County. Harry Stinson is County Auditor.

FORT WAYNE.—An appropriation of $17,000 has been made by the County Council to rebuild the bridge over the Maumee river in Allen County.

Residents have petitioned the County Commissioners to build a bridge over St. Mary's river midway between the Wells Street bridge and the Van Buren Street bridge.

GERMANTOWN A new iron bridge will be built over Flat creek south of this place during the present year.

INDIANAPOLIS.—The City Council has made appropriations for building a bridge over the canal and Broad Ripple, retaining walls to Fall Creek bridge at Humboldt's Park, and for repairs to the West Washington Street bridge over White river.

The County Commissioners' budget for 1906, submitted to the County Council, asks for an appropriation of $190,000 for a new White River bridge.

Plans reported completed by the War Department for a concrete arch bridge at the Armory Post, near Indianapolis. The bridge will span a gulley inside the main entrance, a distance of 118 ft. and 35 ft. wide. The span between the angles will be 60 ft.

The appropriation of $18,000 for building a bridge over Eagle creek at Morris street was so low that bidders refused to bid on the work. It has been decided to ask the county to increase the appropriation for this work.

Plans have been completed by County Engineer H. Klussman and accepted by the County Commissioners, for building a bridge at Thirtieth street over Fall creek. The proposed structure will be a Melan arch consisting of three spans of concrete, or reinforced concrete structure 291 ft. long and 40 ft. wide, to cost about $75,000.

LA FAYETTE A bridge may be built by the Cleveland, Cincinnati, Chicago & St. Louis over [illegible] W. Main [illegible].

LA PORTE The Board of County Commissioners will build six iron bridges in La Porte County.

MARION The Chicago, Cincinnati & Louisville, it is reported, will build bridges over its tracks [illegible] Western and Butler avenues in West Marion.

NEWCASTLE Henry County will spend about $15,000 for bridges.

NEWPORT Bids are wanted early this month by H. [illegible] Davis, Auditor, for building a steel bridge 720 ft. long over the Wabash river, at Cayuga, in Vermillion County.

PETERSBURG The Louisville, West Baden & Vincennes Traction Co. reported planning to build a 1,000 ft. trestle leading to the bridge that is to span the White river, one mile north of this city.

Plans for the steel bridge over White river will be ready and bids asked for early in March. The new structure will have five spans, one 157 ft. long and four, each 103½ ft. long and 18 ft. wide. George A. Thompson, Petersburg, Ind., is Engineer.

PRINCETON Bids will be asked by S. R. Adams for some bridge work early this summer.

RICHMOND.—The County Commissioners will soon give contracts for building a number of small bridges in Wayne County.

The Pennsylvania has agreed to pay 60 per cent. of the cost of building a viaduct in West Richmond so that a new city street may pass beneath its tracks. The city is to pay the remainder.

TERRE HAUTE The United States Senate has passed a bill authorizing the County Commissioners of Vigo County to build a combined high way and electric car bridge over the Wabash river at the foot of Washington avenue.

WASHINGTON Bids are wanted early this month by H. H. Seitz for a steel and concrete bridge.

INDIAN TERRITORY

CHICKASHA Surveys, it is reported, are to be made by the Rock Island, to locate the site for a new bridge over the South Canadian river near this place.

PURCELL Plans have been made and funds have been subscribed to build a bridge between this place and Lexington, at a cost of $30,000. Action will be taken early this spring. J. W. Hooker is interested.

WAGONER Petition is being made by residents for new bridges to be built over the Grand and Verdigris rivers, at a cost of about $30,000.

IOWA.

ANAMOSA The Chicago, Anamosa & Northern will build six large bridges over the line of its road between this place and Waterloo.

COUNCIL BLUFFS. A bill is before the House of Representatives authorizing the Central Railroad & Bridge Co. to build a bridge over the Missouri river at or near this place.

The Supervisors of Pottawattamie and Harrison counties have ordered the establishment of a drainage ditch system for the relief of the Missouri river lowlands in those counties. This improvement will cost more than $200,000. The Chicago & North Western put in a claim for $38,000 for bridges which it will be compelled to build, but this claim was reduced to $10,000 by the appraisers.

DES MOINES. Plans are being made by George D. Dobson, of this city, for building a Melan arch over the Des Moines river at Locust street, to be similar to the one recently built on North Sixth street.

A concrete arch may be built over Indian creek at Frank street. S. L. Etnyre is City Engineer.

The Chicago Great Western, it is reported, has decided to spend about $300,000 for building concrete bridges between Des Moines and Kansas City during the coming summer.

A viaduct has been proposed, and plans submitted to the City Council last year, to be built over the railroad tracks on West Seventh street; other locations were also suggested, but nothing has been done. John J. Budd is City Engineer.

Plans have been submitted to the City Engineer for a Melan arch over the Des Moines viaduct over the tracks at Vine street.

IOWA CITY. The State University of Iowa is making surveys for a large bridge to be built over the Iowa river at Scales Bend, to consist of two spans of 135 ft. each.

IOWA FALLS The Des Moines, Iowa Falls & Northern, it is reported, will build a bridge over the Iowa river, to cost $40,000.

MARSHALLTOWN Residents are petitioning the Railroad Commissioners to change the site for the proposed railroad viaduct from Center street to South Third avenue.

MISSOURI VALLEY It is reported that work will soon be started to build three new piers in the Missouri river close to the Chicago, St. Paul, Minneapolis & Omaha Blair bridge. It is believed that the present bridge is to be enlarged and double tracked.

MUSCATINE. Bids will be asked early this spring by the Commissioners of Drury and Eliza Townships for building three iron bridges. Address Joseph Nussbaum, Muscatine.

SIOUX CITY The Lewis City [illegible] neer says that a 40 ft. bridge on concrete a[illegible]ents is to be built over Perry Creek.

Plans are being made for building a steel viaduct over the tracks at Wall street about 1,080 ft. long, with a 530 ft. filled approach stone or concrete wall.

TRAER Work will be begun at once on a bridge over the Iowa river six miles west of Solon, to cost about $9,000.

KANSAS.

EMPORIA Plans have been made by County Surveyor Alva J. Smith for building several bridges in Lyon County, a steel bridge at Badger creek, 54 ft. long; one at Appleby Ford, 70 ft. long, and a 30-ft. stone arch at Duck creek.

KANSAS CITY. The Chicago, Rock Island & Pacific, it is reported, will at once put up a two span steel bridge, each span 300 ft. long, over the Kaw river, to replace the structure destroyed by floods in 1903.

A franchise has been granted to a private corporation to build a viaduct over the west bottoms from Sixth street and Bluff street to James street. It is to be 1½ miles long and will cost $1,750,000.

OLATHE The Kansas City, Burlingame & Western will build a large number of plate girder and truss bridges along the line of its road from Kansas City to Council Grove, including one large structure over the Neosho river at Council Grove. A. L. Hartridge, Olathe, Kan., is Chief Engineer.

Plans reported completed for a 145 ft. viaduct at Cedar street.

SALINA Bids are wanted by G. J. Duncan, County Clerk March 20, for building three steel bridges in Saline County.

SMITH CENTER Bids are wanted this month by H. A. Clark, County Clerk, for building a steel bridge over the Solomon river at Cedar Vale, in Smith County, Kan. J. E. Kern, Kensington, Kan., is County Commissioner.

TOPEKA The War Department has approved plans for the railroad bridge to be built over the Kaw river by the Atchison, Topeka & Santa Fe.

The Board of County Commissioners will rebuild the Garden Avenue bridge.

A vote has been passed to issue bonds for rebuilding the Melan bridge over the Kansas river.

The Atchison, Topeka & Santa Fe and the Topeka Street Railway Co. are planning to jointly build a viaduct over the tracks of the former at Brunner street.

WESTMORELAND The Board of County Commissioners will build four steel bridges in Pottawatomie County. C. A. Grutzmacher is County Clerk.

KENTUCKY

ARTEMUS The Cumberland Railroad is planning to build a bridge over the Cumberland river. C. W. Stone, Warren, Pa., is President.

ASHLAND The Ashland & Ironton Bridge Co. has been organized with a capital stock of $1,500,000, to build a bridge over the Ohio river, connecting Ashland with Ironton, Ohio. O. E. Fischer has been appointed Chief Engineer, with office in Cincinnati. The Cincinnati, Hamilton & Dayton is interested in this bridge project.

CANTON Both Houses of Congress have passed the bill authorizing the building by Trigg County of a free bridge over the Cumberland river, to cost about $25,000.

CLINTON.—Hickman County will build four bridges this year. E. B. Samuel is County Clerk.

The Fiscal Court will probably ask for bids at its April meeting for a bridge 125 ft. long. J. A. Porter may be addressed.

DANVILLE. This city has voted to issue $30,000 of bonds for building a bridge. R. C. Brydon is City Clerk.

FRANKFORT. The Frankfort & Versailles Traction Co. is planning to build a bridge over the Kentucky river, near this place. James M. Pickrell, Winchester, Ky., is General Manager.

GUTHRIE Bids are wanted by F. M. Duffy for building an iron bridge 50 ft. long, in Taylor County.

HENDERSON.—A bridge, it is reported, will be built over the Ohio river near Towhead island.

HICKMAN.—A highway bridge 285 ft. long and 16 ft. wide may soon be built.

LAWRENCEBURG.—Bids will be asked by the Fiscal Court for building a steel bridge about 60 ft. long over Salt river between this place and Anderson. H. S. Wise is County Clerk.

LEXINGTON. The voters have authorized the issuance of $27,000 of viaduct bonds. T. P. O'Neill is City Engineer.

LOUISA.—Both Houses of Congress have passed the bill authorizing the Louisa & Fort Gay Bridge Co. to build a bridge over the Tug and Louis forks of the Big Sandy river.

LOUISVILLE.—The Louisville & Nashville is reported to be putting up 32 new steel bridges on the Kentucky Central division of its road, which will in future be known as the Cincinnati Atlanta division.

MUNFORDVILLE.—A bridge is proposed over Green river at this place, to cost about $40,000.

OWENSBORO.—The Chicago, Indianapolis & Evansville is making plans for building a bridge on the line of its proposed road over the Ohio river at this place.

A large number of bridges carried away by floods in Daviess County may be rebuilt.

Residents are agitating the question of putting up a combined highway and railroad bridge over the Ohio river here.

PAINTSVILLE Bids are being asked by W. E. Litual for building an iron bridge over Paint creek in Johnson County. W. P. Davis is Clerk of the County Court.

LOUISIANA.

A bill has been introduced in the United States Senate authorizing Caldwell Parish to build a bridge over the Ouachita river.

The United States Senate has passed a bill authorizing the Monroe & Lake Providence R. R. Co. to build a bridge across Boeuf river and Bayou Macon in Louisiana.

AVONDALE.—According to reports plans are being made for building a large bridge over the Mississippi river at this place near New Orleans. This is reported to be a project of the Southern Pacific.

BATON ROUGE.—The Illinois Central Co. and the Southern Pacific Co. will, it is reported, build a bridge over the Mississippi river here, at a cost of about $1,000,000.

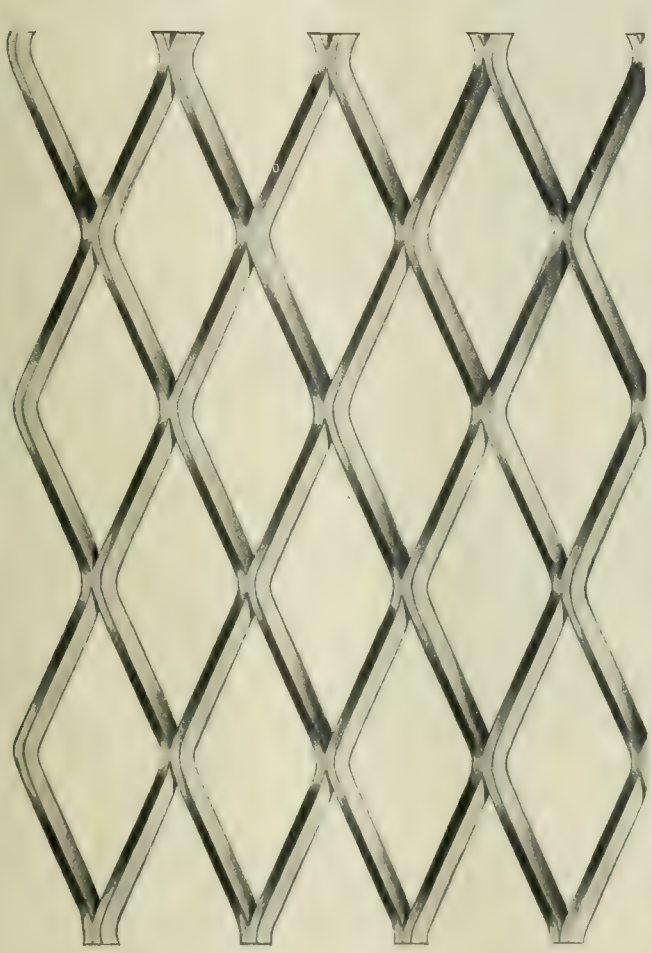
BOYCE. Both Houses of Congress have passed the bill authorizing a bridge over the Red river at or near this place.

COLUMBIA The Lower House of Congress on January 9 passed the bill, which had been previously passed by the Senate, authorizing Caldwell Parish to build a bridge over the Ouachita river.

Expanded STEEL

FOR

Concrete Reinforcement



also for Guards, Railings, Fencing and Every Service

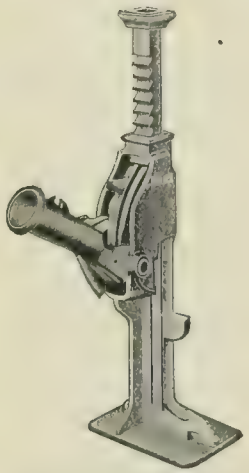
KNO-BURN
TRADE-MARK

Steel Plastering Lath

Strongest, Stiffest, Fireproof

NORTHWESTERN EXPANDED METAL CO.
OLD COLONY BLDG., CHICAGO
Write for catalogues

JACKS



No. 21 SIDE FOOT LIFT TRACK JACK.
For work in tunnels, or where track is close to wall, fence, plat form, etc.



No. 17 SINGLE ACTING TRACK JACK, 10 Tons.



No. 6 BALLAST GANG TRACK JACK, 15 Tons.

BARRETT QUICK-ACTING TRACK JACKS

Easily applied to any lifting purpose and easily removed.

Made of only the best materials.

No danger of breakage if you use a BARRETT.

BARRETT JACKS DO NOT COMPETE

with inferior jacks that are made to *look* "just as good."

THE DUFF MFG. CO., PITTSBURG, PA.
Works: ALLEGHENY, PA.

FAIRBANKS, MORSE & CO., Chicago
Agents for Railroad Department.

CONVINGTON.—The Parish Jury has decided to build a steel bridge, with a 16-ft roadway, over the Bogue Falaya river.

EVANGELINE.—Plans are being made by Acadia and Cameron Parishes to jointly build a bridge there, 600 ft. long over the Bayou Nepique. G. H. Brooks, of Crowley, La., may be addressed.

HOUMA.—This city will build a steel bridge over the Bayou Terrebonne. H. M. Wallace, Mayor.

JONESVILLE.—A bridge 375 ft. long is proposed over the Little river between this place and Trinity. Address I. E. Mullins.

MONROE.—Two steel bridges will be built over Bayou Boeuf. C. H. Peevy is a member of the Police Jury.

MORGAN CITY.—The Southern Pacific has decided to build a steel bridge over the Atchafalaya river at this place to cost $500,000. The proposed bridge will be built on the nine cylinder concrete piers just below the present structure, and will consist of six fixed spans 235 ft. 6 in. each, with a draw 272 ft. long, making a total length of about 1,682 ft. The company is also remodeling the San Jacinto bridge to carry heavier rolling stock.

NEW ORLEANS.—At a special meeting of the City Council it was decided to rebuild the Metairie bridge, and bids will soon be asked for the work.

——Negotiations are under way with the W. W. Bierce Company, Limited, for the building of a steel viaduct, 23 ft. high in the clear, over the tracks of the Southern Pacific. The central section will be 687 ft. 4 in. long, the eastern approach 675 ft. 6 in., and the western approach 942 ft. 9 in. The roadway will be 28 ft. wide, with carrying capacity for a single electric street car track, with a footwalk 6 ft. wide, to cost $54,760. W. J. Hardee is City Engineer.

SHREVEPORT. The City Council of Shreveport has begun preliminary work toward the construction of a free traffic bridge over the Red river, and will make the surveys in accordance with the direction of the War Department under the act recently passed by Congress. John M. Dortch is City Engineer.

MAINE.

ROXBURY.—The Portland & Rumford Falls is building a steel bridge 65 ft. long on concrete abutments over Noisy brook; also one over the Swift river two miles above Byron. The contract for the concrete abutment work has been given to Metevier & Fisher.

WISCASSET.—The towns of Damariscotta and Newcastle have decided to jointly build a steel or concrete bridge over the Damariscotta river between these two places at a cost of about $15,000.

YARMOUTH.—The Portland & Brunswick, on its proposed extension to this place, is planning to build a steel bridge over the Royal river, 115 ft. long.

MARYLAND.

ANNAPOLIS.—Anne Arundel County Commissioners will build an iron bridge over the Patapsco river at or near the present wooden structure known as the Sweetser bridge.

BALTIMORE.—The Western Maryland, according to local reports, has given a contract to the Pennsylvania Steel Co. for rebuilding two bridges on the West Virginia Central, one over the Potomac at Gerstell and one at Dawson; also for four on the Western Maryland, one over Antietam creek west of Edgemont, over Marshy run east of Hagerstown, over the Conococheague at Williamsport and over the Little Conococheague.

——The Western Maryland is said to be planning to build a bridge over North avenue, at its Walbrook station, to carry double tracks, replacing the present single-track structure.

CHESTERTOWN.—Bids may soon be asked by Charles L. Dodd, Clerk, for building an iron bridge in Kent County.

GERMANTOWN.—The Baltimore & Ohio will build a new stone bridge over Big Seneca creek, east of this place. It will consist of three 65-ft. semi-circular arches.

WILLIAMSPORT.—Plans are being made by P. J. Courtenay, of Philadelphia, Pa., for a bridge over the Potomac river, to cost about $75,000.

MASSACHUSETTS.

ATLANTIC.—The New York, New Haven & Hartford is planning to build a four-track steel bridge to replace the present wooden structure over the Neponset river on its Plymouth division between this place and Neponset.

ATTLEBORO.—Plans for abolishing grade crossings have been completed and the town is ready to proceed with the work. The estimated cost is $800,000.

BARNSTABLE.—Bids will soon be asked by the County Commissioners for building the proposed bridge over the Bass river. The bridge is to be 700 ft. long and cost $20,000. Alfred Crocker is Clerk of the County Commissioners.

BOSTON.—Northern avenue bridge over Fort Point channel has been authorized by the Legislature, subject to the approval of the War Department.

——Estimates have been made for the rebuilding of Congress Street bridge over Fort Point channel.

——$40,000 is provided for the city's share of the expense of the reconstruction of bridge over railroad tracks at Norfolk, Harvard, Medway and West Selden streets, Dorchester.

——$32,000 for bridge and tunnel under railroad tracks at Temple street, West Roxbury.

——$5,000 for foot bridge over N. Y., N. H. & H. R. R. at Sarsfield street.

——$5,000 for foot bridge over N. Y., N. H. & H. R. R. at Northampton street.

——$120,000 for Brookline Street bridge across Charles river at Cottage Farm.

——A new bridge may be built at Federal street over Fort Point channel. Nothing decided.

——The Park Commissioners of Cambridge urge the erection of a new bridge on Boylston street. Arrangements under way to decide on the kind of bridge to be built.

——The United States Senate has been petitioned to authorize the Harbor and Land Commission to build a bridge over the Reserve channel in Boston, to connect I street with Summer street. William Jackson is City Engineer.

——City Engineer Jackson has plans made and approved by the Cambridge Bridge Commission for a bridge to be built at Brookline street between Cambridge and Brighton, to cost about $120,000.

FALL RIVER.—A bill has been introduced in the State Legislature providing for a new commission to build a bridge to replace the present Slade's Ferry bridge. It is proposed that the New York, New Haven & Hartford Railroad shall pay 60 per cent. of the cost, other electric roads 10 per cent., and the balance to be paid by the city of Fall River, by Bristol County, and by a number of other towns which will be benefited by the new structure; the remaining 30 per cent. not to exceed $500,000.

——The plans of the Joint Boards of Somerset and Fall River for the bridge over the Taunton Great river call for a bridge 60 ft. wide, with 44-ft. roadway and sidewalks of 8 ft., with an opening of 70 ft. on seven piers, each 50 ft. wide.

GLOUCESTER.—A proposition for building the Connecticut River bridge, which is to be about 1,200 ft. long, is now under consideration by a special commission appointed about a year ago. No definite action has been taken upon the matter as yet.

——Bids are wanted March 14 by the County Commissioners at Salem for building a rolling lift bridge over the canal at Gloucester, Mass. J. P. Hale is Clerk of the County Commissioners.

LAWRENCE.—The Boston & Maine may build a steel bridge over the Annisquam river on its Gloucester branch.

——A bill is before the legislature petitioning for authorization to build an additional bridge over the Merrimac river, at a cost of about $250,000.

LENOX.—Bids are wanted May 20 by the Board of Selectmen for building the superstructure of a bridge over the Ashley river. H. D. Norton, Springfield, Mass., is Engineer.

LYNN.—A bill has been signed by the Governor authorizing the Haverhill & Roxford to build a bridge over the Merrimac river.

NEEDHAM.—The New York, New Haven & Hartford, it is reported, will build a bridge over its tracks at High Rock street.

NEW BEDFORD.—Representatives of the various towns which are to bear a share of the cost of building the new $1,000,000 bridge over Acushnet river between Fairhaven and New Bedford are estimating the cost which each town will pay.

PITTSFIELD.—Plans are ready for building a new bridge over the Housatonic river at New West street, at a cost of about $7,500, to be built jointly by the city and the Pittsfield Railway Co.

——The Board of Public Works may build an iron bridge over the Boston & Maine tracks at Second street, to cost about $15,000.

SALEM.—The towns of Salem and Beverly will shortly ask for bids for building a bridge over the Danvers river, 1,200 ft. long, with a draw, to cost $100,000. James P. Hale, Salem, Mass., may be addressed.

SPRINGFIELD.—The Boston & Albany may build a steel bridge about 400 ft. long over the Chicopee river on its Athol branch.

——Work has been started by the Boston & Albany on a railroad bridge over the Connecticut river, at a cost of about $225,000. One side of this bridge has been completed.

——A proposition for building the Connecticut River bridge, which is to be about 1,200 ft. long, is still under consideration by a special commission appointed about a year ago. No report has been made and no definite action has been taken upon the matter as yet.

——The Bridge Commission has still under consideration the building of a bridge on the main line of the New York, New Haven & Hartford over Cerus Ruin at the southerly end of the city, to be built in connection with the project to change the railroad to the west side of the Connecticut river. Charles M. Slocum is City Engineer.

TAUNTON.—The special Grade Crossing Commission appointed by the Mayor of Taunton, Mass., it is said, has agreed to the plans made by the New York, New Haven & Hartford for the elimination of grade crossings at that place.

WATERTOWN.—Bids will probably be asked in July for building a concrete and steel bridge, to cost $50,000. W. F. Learned is Town Engineer.

WORCESTER.—A bill has been introduced in the State Legislature directing the County Commissioners to build a bridge over Lake Quinsigamond, to cost about $125,000.

MICHIGAN.

——A bill has been passed by both Houses of Congress authorizing the Board of Supervisors of Berrien County to build a bridge over the St. Joseph river, near its mouth, in Berrien County.

ALLEGAN.—Residents have voted to raise $9,000 for building a steel bridge over the Kalamazoo river.

ALPENA. A concrete bridge is proposed over the Thunder Bay river, near this city, to cost about $12,000; also a steel bridge over the same river in Green Township.

BATTLE CREEK.—The Common Council has been petitioned by residents to build a bridge over the Kalamazoo river on Barney street.

——The City Council may build two cement arches, one at Jefferson avenue and the other at Monroe street, to cost about $12,000.

BENTON HARBOR. The Board of Supervisors has decided to rebuild, jointly with St. Joseph Township, the Napier bridge, at a cost of about $22,000.

——The Michigan Terminal Co., to secure an entrance for its proposed road into this place offers to build a bridge over the Ship canal to cost $40,000.

BESSEMER.—Bids will be asked by the Township Board of Marenisco in Gogebic County, over the Presque Isle river. George Rupp, Bessemer, may be addressed.

CALUMET.—The Board of Commissioners of Iron County has authorized the building of a bridge over Brule river on the Crystal Falls-Florence road, to be paid for jointly by Iron and Florence counties.

DETROIT.—The New York Central will build a tunnel under the Detroit river at this place. The cost of the work will be in the neighborhood of $10,000,000.

The Grand Trunk, it is reported, will carry out its plan of building a bridge over the Detroit river, between Windsor and this place.

GRAND RAPIDS. The Board of Public Works is considering estimates prepared by City Engineer Anderson for building the Ann street bridge.

——The City Council has decided to locate the proposed new Melan concrete bridge at Second avenue. Plans are being made by the City Engineer.

GROSSE POINTE.—Residents have voted to issue $17,000 of bonds for repairing bridges over Fox and Connors creeks.

KALAMAZOO.—The City Council recommends the building of a steel bridge at Gulf street.

LANSING. The bill authorizing the Township of Ionia to bond itself for $10,000 for a bridge over the Grand river has been passed.

LOWELL. The Council has decided to accept the proposition of the Grand Rapids & Ionia Interurban to build three bridges over Flat river.

MANITOWOC.—A contract is reported let by the Chicago & North-Western to Greiling Bros., of Green Bay, at $40,000, for building the substructure of the steel bridge to be built over the extension of its road. The total cost of the work will be approximately $100,000.

MT. CLEMENS.—Bids, it is said, are wanted, Aug. 7, by William F. Kracht, City Clerk, for putting up a two span reinforced concrete bridge with a total length of 195 ft., and a roadway 50 ft. wide.

MUSKEGON.—Muskegon and Newaygo counties are seeking permission from the State Legislature to raise funds for building a bridge over the Muskegon river at Bridgeton, to connect these counties.

——A new iron bridge will be built over Ryerson creek, at Wood street. C. S. Gamble is City Engineer.

PONTIAC.—Bids are wanted by the City Council June 5 for building seven concrete steel bridges over Clinton river. Joseph H. Thorpe is City Clerk, and W. J. Fisher, City Engineer.

PORT HURON.—Bids are wanted March 30 by the Common Council for building a new bridge over the Black river at Military street, to cost about $65,000. W. W. Phillips is City Engineer.

ST. JOSEPH.—The question of building a new steel viaduct, to cost $50,000, is being considered by the city officials.

SAGINAW.—A committee has been appointed by residents to secure the building of a free bridge over the Tittabawassee river, at State street, to cost between $10,000 and $15,000.

TRAVERSE CITY. This city will issue bonds for $9,000, to build a steel concrete bridge on West Front street.

MINNESOTA.

——Both Houses of Congress have passed a bill authorizing the Minneapolis, St. Paul & Sault Ste. Marie to build a bridge over the Red river of the North, from Marshall County, Minn., to Walsh County, N. Dak., the usual provision as to approval of the plans by the Secretary of War being included.

On Feb. 7 a bill was introduced in the House of Representatives and referred to the Committee on Interstate and Foreign Commerce, authorizing the Wisconsin & New Duluth Bridge Co. to build a bridge across the St. Louis river between the states of Wisconsin and Minnesota.

DULUTH.—Two railroad bridges are proposed to be built over the St. Louis river, one above the old St. Louis & Duluth structure, and the other below it.

——The Lake avenue viaduct, it is said, will be repaired, at a cost of $13,000. T. F. McGilvray is City Engineer.

FARIBAULT.—The Chicago Great Western may soon rebuild a bridge over its tracks at Eighth street.

MINNEAPOLIS.—An ordinance has been introduced to authorize the building of three bridges in Southeast Minneapolis, to cost about $350,000.

——Hennepin County Commissioners will repair a number of bridges. H. R. Scott is County Auditor.

The Great Northern is planning to build a steel bridge over its tracks at Superior avenue, to replace the present wooden structure.

——This city, it is said, will build a new bridge over the Mississippi river. The plans for the structure have been approved by the War Department. It will probably take two years to complete the work.

The Minneapolis, St. Paul & Sault Ste. Marie will build a steel bridge.

——The Great Northern and Minneapolis & St. Louis railroads will rebuild the Holden street and Western avenue bridges.

——Bids have been asked for $215,000 of bonds to build Thirty-second avenue N. bridge over Mississippi river, and widen Washington Avenue S. bridge over the river, $140,000 for the former and $75,000 for the latter.

A concrete arch will be built over Minnehaha creek this summer. K. Ousted is Bridge Engineer.

A STEEL TANK

That Won't Freeze Up



100,000 Gallon Tank, C. B. & Q. Ry. Co., East Winona, Wis.

¶ There has been in the past a popular belief that steel tanks could not be as well adapted to cold climates as wooden ones, although it is universally admitted that in all other respects the steel tanks are much superior.

¶ A careful examination of the construction of our new type of steel tank will show that the vital parts are better protected against freezing than those of the usual wood tank with frost boxing around the pipes.

¶ The cylinder between the tank proper and the ground, which takes the place of the usual feed and discharge pipes, is built of sufficient size to prevent its freezing up. The pipe connections being made through the bottom and in the center of this cylinder cannot be interfered with by ice.

Chicago Bridge & Iron Works

105th and Throop Sts., Chicago

[illegible] Co. [illegible]

[illegible] Co. [illegible]

[illegible] Co. [illegible]

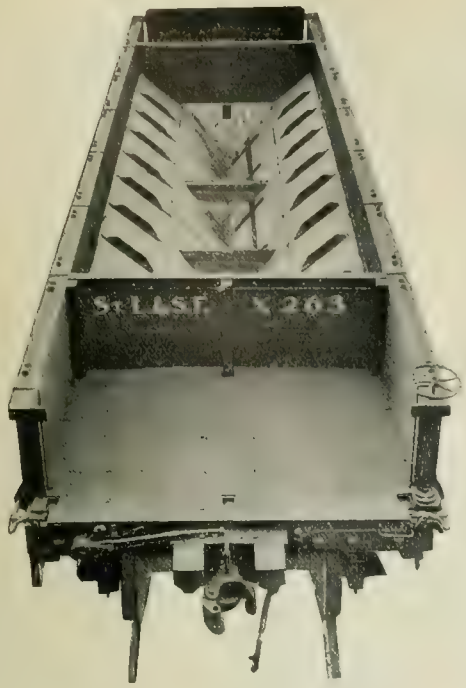
HAR

CONVERTIBLE [illegible]

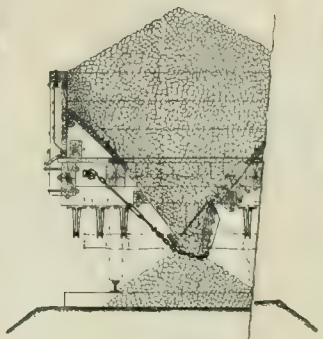
EARN DIVID[illegible]

ALL THE [illegible]

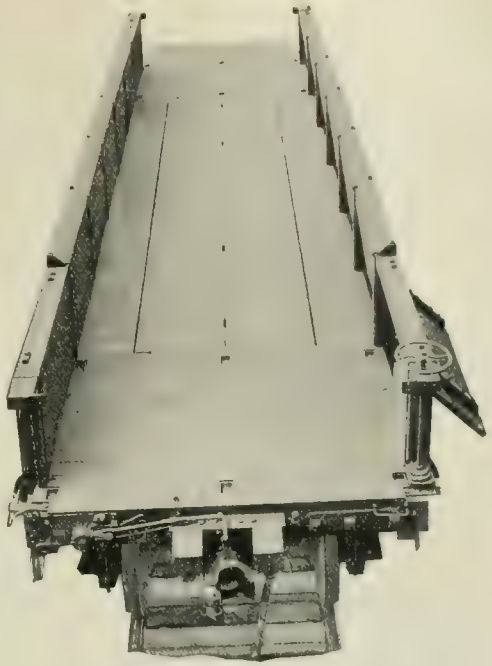
YEAR ARO[illegible]



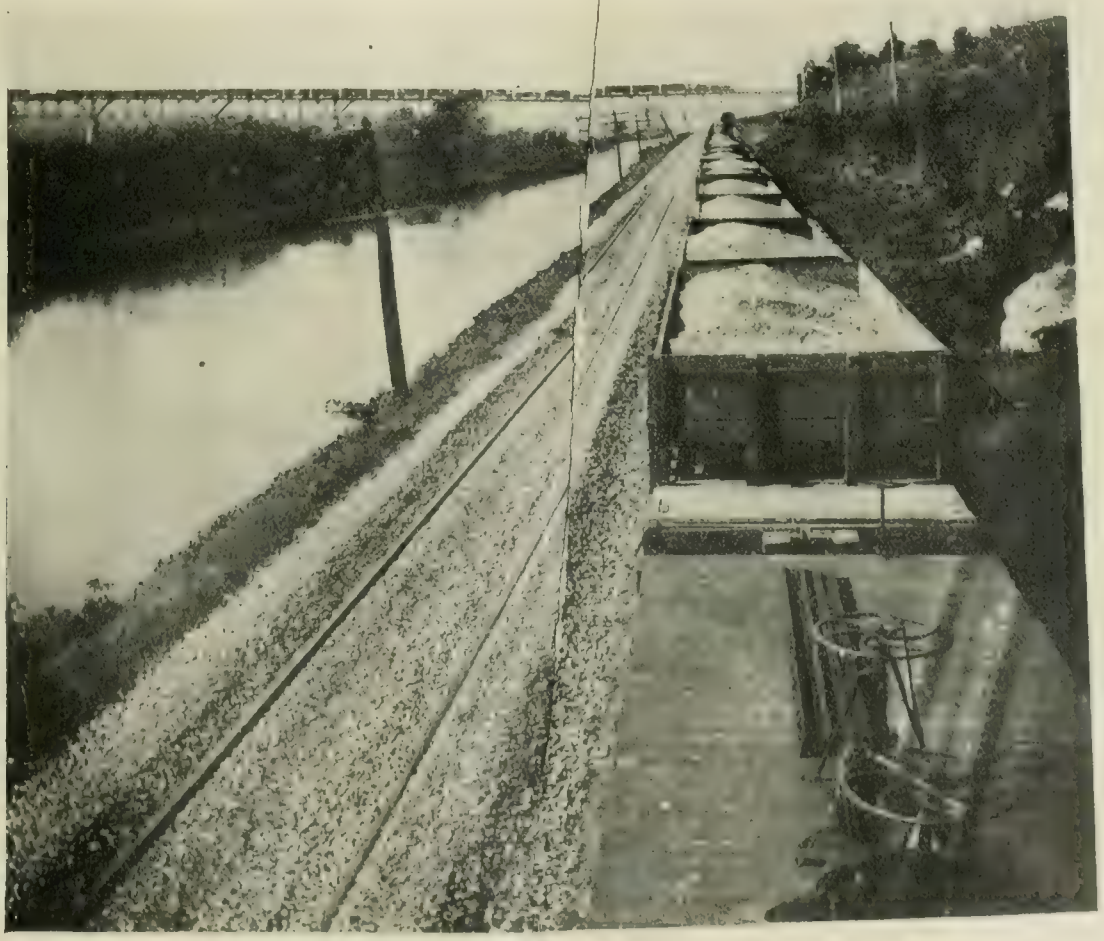
Plan View—As a Center-Dump Hopper Car. Same car shown opposite as Flat-Bottom Side Dump.



Cross Sect[illegible] As Center Dump H[illegible]ar.



Plan View—As a Side-Dump Level Floor Car. Same car shown opposite as Center Dump.



Showing Ballast distributed by HART CONVERTIBLE CARS

Absolutely dispensing with shoveling and placing ballast just **where** wanted and just the **amount** desired for any given condition.

Rodger Ballast Car Co.

RAILWAY EXCHANGE - - - - - CHICAGO, ILL.

Board of Aldermen for repairing Court Street Bridge, at a cost of about $70,000. S. M. Baird is City Engineer.

BROOKLYN.—The lowest bidder for building piers to bridges in connection with the depression of the Manhattan Beach division of the Long Island Railroad was Milliken Brothers, whose bid was $660,000. The work includes the placing of about 10,000 tons of steel. The contract for the concrete abutments for the bridges was awarded to See Bros. at $115,000.

ALBANY.—A bill has been introduced in the State Legislature to incorporate the Niagara Frontier Bridge Company for the purpose of building a bridge over the Niagara river from a point in the State Mile Reservation to the Canadian side. G. W. Knox and William C. Edwards, of New York, and A. E. Osler, of Ontario, and others are named as a commission to locate the site.

BUFFALO.—The Lackawanna has begun the erection of a four-span steel bridge over the tracks of the Erie. This bridge will be 800 ft. long and the superstructure will weigh 3,000 tons. It will cost $250,000. A number of other bridges in Buffalo are to be strengthened.

A bill has been passed by the Assembly and vetoed by the Governor for three successive years, which provides that the citizens of the County may vote to bond themselves for $100,000, and that Erie County and the town of Grand Island may build a steel railroad bridge over Niagara Falls to Grand Island, the estimated cost of which is placed at $1,000,000. Charles D. Marshall, of Buffalo, is interested and George C. Diehl is County Engineer.

Press reports state that the Delaware, Lackawanna & Western, the Lake Shore & Michigan Southern and the New York, Chicago & St. Louis have agreed to jointly make extensive improvements, which will include the elevation of a long stretch of track and the building of a viaduct.

The Aldermen have refused to accept the report of the Aldermanic Committee on Bridges, which voted to readvertise for new bids for the proposed bridge to be built over the Buffalo river at Ohio street, and have asked for a second report.

The Committee on Wharves and Harbors has been asked to make a report on the question of removing the railroad bridges over the Buffalo river, the United States authorities having begun action to compel their removal.

ENDICOTT, N. Y.—The Erie may build a steel bridge viaduct, with concrete piers 186 ft. long, to consist of three spans, one of 126 ft. and two of 30 ft., over its tracks.

FORT HUNTER.—The West Shore is rebuilding the bridge over the Schoharie at this place. The bridge will consist of three spans like the present structure, but much heavier.

GOUVERNEUR.—This city is planning to put up a steel plate girder over the Oswegatchie river at Main street, to cost about $18,000.

JAMESTOWN.—The Chautauqua Traction Co. and the Pennsylvania will jointly build an overhead crossing at Valley street, in Mayville, to cost about $25,000.

LONG ISLAND CITY.—Out of the city bond issues money, amounting to $175,000, will be used to build a retractile bridge over Dutch Kills creek. The plans have been completed by Engineer Edward A. Byrne, and bids may be asked for shortly.

LYONS FALLS.—The State Legislature will be petitioned to appropriate $30,000 for building an iron bridge over the junction of the Black and Moose rivers.

MT. MORRIS.—It was voted to bond the town for $10,000 to build two iron bridges, one over the Genesee river, between this place and Castile, and the other over the Kisequa creek at Tuscarora.

MT. VERNON.—A bill, it is reported, has been introduced authorizing an issue of $30,000 of bonds to build bridges between Mt. Vernon and Pelham.

NEWFANE.—The town directors have decided to build an iron bridge 400 ft. long over Eighteenmile creek at Burt, to cost about $15,000.

NEW YORK.—An ordinance has been passed by the Board of Aldermen appropriating $115,000 for the construction of a bridge over Mosholu Parkway in the Borough of the Bronx.

—Work is under way lengthening the train platforms of the Brooklyn Bridge, extending the present train shed over Park row and adding two new platforms, each 340 ft. long, at a cost of about $300,000.

The Manhattan bridge to cross the East river, from the Bowery and Canal street, Manhattan, to about Fulton and Gold streets, Brooklyn, will be a suspension bridge, 1,470 ft. long between towers, with a clear height at the center above high water of 140 ft. The two anchorage spans will each be about 725 ft. long. Total length of main structure, 2,920 ft.; total length, including approaches, about 9,900 ft. The Municipal Art Commission has agreed to the use of wire cables in the construction of the bridge. The tower piers have already been completed and contracts have been let for the anchorages. James W. Stevenson is Bridge Commissioner.

The United States Senate, on April 26, passed the bill authorizing the Spuyten Duyvil & Port Morris Railroad (New York Central) to build a bridge over Spuyten Duyvil creek and the Harlem river north of the Harlem river pier.

The Board of Aldermen has adopted a resolution favoring an issue of $1,000,000 of corporate stock for the proposed Hudson Memorial bridge to be built over Spuyten Duyvil creek, connecting Inwood Heights, Manhattan, with Spuyten Duyvil Heights in the Bronx. It is intended to have the bridge completed for the celebration in September, 1909, of the 300th anniversary of the discovery of the Hudson river.

The Board of Estimate last year has approved the following appropriations: $2,500,000 for the Commissioner of Bridges to pay for land taken for the Williamsburg bridge, and $600,000 for land for the Blackwell's Island bridge; also $200,000 for building steel bridges over the railroad tracks in the Bronx.

On the report of the Finance Committee, the Board of Aldermen has authorized the Bridge Commissioner to make changes in the accepted plans of the Blackwell's Island bridge, which will provide for six instead of four tracks, and will increase the strength of the iron road trusses, at an additional cost of $360,000. The Pennsylvania Steel Co. has the contract for building the bridge.

An ordinance is before the Board of Aldermen to authorize the New York Connecting Railroad to build a viaduct through Long Island City and a bridge from that place over the East River, Ward's and Randall's Islands, to a point in Westchester County, N. Y.

NIAGARA FALLS.—The Pere Marquette may build a bridge over the Niagara river at a point known as Swift Drift.

ONEIDA.—The Common Council has authorized the Mayor to present a petition to the State Board of Railroad Commissioners asking for the elimination of grade crossings at Seneca avenue by the construction of a viaduct over the New York, Ontario & Western tracks at Oneida creek.

RENSSELAER.—A bill has been introduced in the legislature authorizing an appropriation of $21,000 for the proposed bridge over the railroad tracks on Third avenue.

SANDY HILL.—The Counties of Washington and Saratoga, and the Union Bag & Paper Company, will build a bridge over the Hudson river, to cost about $60,000. R. R. Law, of Cambridge, N. Y., can furnish particulars. F. H. Snyder, of Argyle, is Washington County Clerk.

SCHENECTADY.—A viaduct over Cotton Factory Hollow is being considered, to cost about $20,000.

TOWNERS.—The New York, New Haven & Hartford, in connection with its double tracking of the Highland division, will replace the 1,500 ft. wooden trestle over the valley on the Harlem division of the New York Central with a steel structure 185 ft. long, and the balance will be filled in.

TROY.—Bids will soon be asked by Henry Schneider, Commissioner of Public Works, for putting up a steel bridge over the creek at Winter street, to cost between $6,000 and $10,000.

UTICA.—This city and Marcy are to build a bridge over the Mohawk river at Schuyler street, to cost $700,000.

—A bridge is proposed to be built by the West Shore over Bleecker street, to cost about $65,000.

According to press reports, the recent heavy rainfall and high waters last fall carried away about 150 highway bridges in central New York. The loss is so extensive that state aid will probably be asked to replace the bridges lost. Some of these were large structures.

VESTAL.—Petitions for a highway bridge over the Susquehanna river have been made by residents of the towns of Vestal and Union. The cost will be about $40,000.

WATERLOO.—The Board of Supervisors has passed a resolution to petition the Legislature for a new bridge over Seneca river, to replace the free bridge now maintained by Seneca and Cayuga counties.

—Bids will be asked by Superintendent of Public Works, C. M. Fanchot, at Albany, for building an iron bridge over the State canal, about 60 ft. long. H. G. Feehan is County Clerk.

WATERTOWN.—Henry E. Baker, City Engineer, is reported estimating the probable cost of viaduct bridge, about 840 ft. long and 50 ft. wide. The matter has been under consideration for some time, but no definite decision has been reached.

NORTH CAROLINA.

BEAUFORT.—The Beaufort & Western Railway Co. will build a bridge between this place and Morehead City. F. L. Merritt is President; R. F. Foster, Vice-President, and M. Manly, Secretary and Treasurer. The plans have been approved by the War Department.

CHARLOTTE.—At a joint meeting of the Board of County Commissioners and High Commission, it was decided to build steel bridges over many of the large streams in Mecklenburg County.

GOLDSBORO.—The Howland Improvement Co., which now leases the Atlantic & North Carolina Railroad, reports it will build a steel bridge over Stony creek near this place; also one over the stream near Newbern, to replace the present structures.

HALLISON.—Bids will be asked early in the summer by the County Commissioners for putting up a steel bridge 600 ft. long, over Deep river, in Moore County. Gilbert McLeod, of Carthage, can give information.

KINSTON.—The Kinston & Carolina Railroad, reports say, will build an iron bridge on its road, 300 ft. long, with a steel draw.

MOOREHEAD CITY.—The Atlantic & North Carolina is reported to be preparing plans for a bridge over Newport river at this place, to cost $200,000.

WAYNESVILLE.—Bids will be asked this spring by W. N. Noland for building an iron bridge 200 ft. long over Pigeon river, in Haywood County.

WELDON.—Residents have petitioned the Board of Aldermen to authorize bonds for the purpose of building a steel brige over the Roanoke river.

OHIO.

AKRON.—The plans submitted by the Baltimore & Ohio for a bridge over East North street have been approved by the City Council.

Plans are reported ready for building the North Hill viaduct, which is to be 2,700 ft. long, with 27 ft. roadway and 5 ft. sidewalks, the cost, $215,000, to be jointly borne by the Northern Ohio Traction & Light Co. and the city.

ASHTABULA.—Bonds to the amount of $200,000 have been authorized by the County Commissioners for building the bridge at Ashtabula Harbor. Lewis A. Amsden is City Engineer.

CHILLICOTHE.—Bids are wanted September 11 by C. H. Pinto, County Auditor, for building the superstructures of two steel bridges.

CINCINNATI.—Extensive repairs, it is reported, are to be made to the Liberty Street viaduct. J. E. Breen is City Engineer.

Mayor Leischmann, it is said, has signed an ordinance providing $425,000 for building a viaduct at Harrison avenue.

County Engineer Frank Krugg is reported making plans for an electrical lift bridge over the canal at Benton street, Lockland, to cost $24,814.

The Cincinnati, New Orleans & Texas Pacific is planning to build steel bridges, to include one of 1,000 ft. over South Fork, one over Lynching creek 510 ft. long, a viaduct over the Cumberland river of 800 ft., and a viaduct at New River with a combined length of 1,300 ft.

Repairs will be made to the Central bridge between this place and Newport over the Ohio river, at a cost of about $100,000. Address Col. R. W. Nelson, care Cleveland Trust Co.

The Pennsylvania is reported to be taking soundings to locate the site for a new bridge over the Ohio river at the east end of the city.

The Chesapeake & Ohio will build a steel viaduct, in connection with its track elevation, about three-quarters of a mile long, to connect with the Cincinnati, Hamilton & Dayton.

CLEVELAND.—This city will build the following bridges. A double roller lift bridge at Jefferson avenue over the new channel of the Cuyahoga river with a clear waterway of 120 ft.

A bridge at West 25th street and the N. Y. C. & St. L. tracks.

Bridges at East 93d street, at Warner road, at Broadway and at Harvard avenue in connection with grade separation work with the Pennsylvania.

Construction of a concrete steel bridge carrying six tracks of the C., C., C. & St. L. over Clark avenue.

—Bond issue has been authorized for a $2,000,000 bridge connecting the east and west side. William J. Carter is Chief Engineer.

—An ordinance is before the City Council asking for an appropriation of $25,000 to build a bridge over the Wheeling & Lake Erie tracks at Brookside park.

The steel viaduct, for which plans have been made by the Cleveland Short Line, to be built over the Cuyahoga river, Ohio canal and B. & O. tracks, from Newburg Heights village to Brooklyn Heights, will be about half a mile long and 165 ft. high. It will have masonry piers with steel towers and a steel superstructure. The estimated cost of the work is $1,000,000. Date for asking for bids not yet fixed. Plans approved by the War Department.

—Plans have been completed for a bridge over Clark avenue, for the Cleveland, Cincinnati, Chicago & St. Louis. G. W. Kittredge, Cincinnati, is Chief Engineer.

COLUMBUS.—Plans reported being made by County Engineer Walter B. Raun for a two-span bridge to cost about $90,000.

—An ordinance has been passed by the City Council authorizing the Board of Public Service to pay $63,000 toward building the Fishinger Mill bridge, the balance to be paid by Franklin County. George D. Jones is President of the City Council.

—The County Commissioners, it is reported, will build a viaduct over the Pennsylvania tracks at Reed avenue.

DAYTON.—The City Council has passed an ordinance to issue $120,000 in bonds, the proceeds to be used for building the new Washington Street bridge over the Great Miami river.

—The Board of Public Service has recommended that the Pittsburg, Cincinnati, Chicago & St. Louis be granted permission to rebuild its bridge over the Cooper Hydraulic at Bainbridge street.

—Plans are being made by City Engineer F. M. Turner for building a combined highway and street railroad bridge to consist of a 200-ft. span steel structure with concrete abutments, to cost about $300,000.

ELYRIA.—Petition has been made to the County Commissioners to build a bridge over Black river in Sheffield Township, at a cost of about $200,000, to replace the present structure.

FINDLAY.—Plans have been completed by Engineer Reigle for a number of steel viaducts on the line of the Lima, Findlay & Toledo Electric Railway over the tracks of the Cincinnati, Hamilton & Dayton.

—Hancock County Commissioners have under consideration the question of building a steel bridge at Mt. Blanchard, to cost about $10,000. J. O. Sutton is County Engineer.

FREMONT.—The Lake Erie & Western, which has been planning for a long time to build a bridge over the Sandusky river, has agreed with the state authorities where it shall be located, and, it is said, will at once put up the new structure, to cost $90,000.

GRAFTON.—Plans are being made by the Cleveland, Cincinnati, Chicago & St. Louis for building a double-track bridge over the Black river, to cost about $40,000, to be a single-span structure with concrete abutments and steel superstructure.

HAMILTON.—Plans have been submitted to the Board of County Commissioners by the Cincinnati Northern Traction Co. for a combined railroad and highway bridge over Two-Mile creek, to have an 82-ft. span, 58 ft. wide and cost about $15,000.

HOLMESVILLE.—An overhead bridge is proposed over the tracks of the Cleveland, Akron & Columbus. Wm. Anderson, Millersburg, is Commissioner.

IRONTON.—A contract has been given to the American Bridge Co., which calls for 12,000 tons of fabricated steel for the new bridge to

The Lidgerwood Rapid Unloader

IN USE ON PANAMA CANAL

AND PRINCIPAL AMERICAN RAILWAYS



LIDGERWOOD HOISTING ENGINES IN CHICAGO STOCK.

LIDGERWOOD MFG. CO.

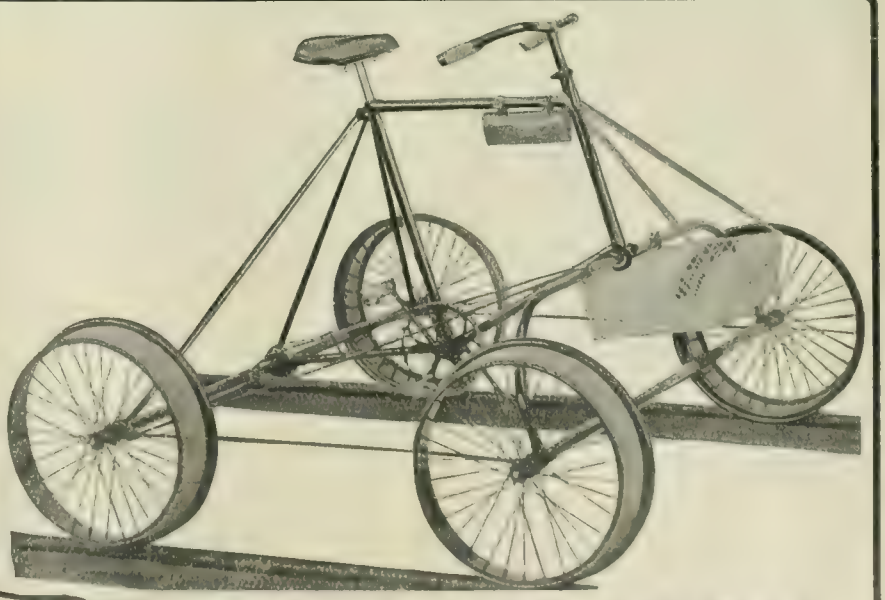
WALTER H. BALDWIN, SALES MANAGER

OLD COLONY BUILDING, CHICAGO

THE SUN NEVER SETS
On Hartley & Teeter Light Inspection Cars

AMONG THE FOREIGN LANDS IN WHICH THESE MACHINES ARE USED ARE THE FOLLOWING:

ALASKA, CANADA, MEXICO, COSTA RICA, CUBA, COLUMBIA, VENEZUELA, BRITISH GUIANA, ECUADOR, BRAZIL, THE SCANDINAVIAN PENINSULA, HOLLAND, FRANCE, SPAIN, SWITZERLAND, ITALY, GERMANY, AUSTRO-HUNGARY, ROUMANIA, RUSSIA, TURKEY, EGYPT, TUNIS, ALGERIA, THE GOLD COAST, UGANDA, CAPE OF GOOD HOPE, INDIA, SIBERIA, CHINA, JAPAN, JAVA, BORNEO, AUSTRALIA, NEW ZEALAND, AND FIJI ISLANDS.





THE GOLD MEDAL

HAS BEEN AWARDED THESE CARS BY THE SUPERIOR JURY OF AWARDS AT THE WORLD'S FAIR AT ST. LOUIS, MO., THUS DECLARING THEM TO BE THE HIGHEST TYPE OF LIGHT CARS, AND THEY STAND WITHOUT AN EQUAL.

Write us for catalogue.

LIGHT INSPECTION CAR CO.
HAGERSTOWN, INDIANA, U. S. A.

SOUTHWESTERN AGENTS

MESSRS. HANDLAN-BUCK MFG. CO.
ST. LOUIS, MO.

to cost [illegible] the Ohio river between this place and Aberdeen for the Cincinnati, Hamilton & Dayton.

LARUE.—The Cleveland, Cincinnati, Chicago & St. Louis has decided to build a bridge over the Scioto river to replace the present steel 100 ft. structure.

LORAIN.—The Lake Shore Electric Railway is making surveys for a bridge over Black river at South Lorain.

MARIETTA.—The Marietta, Columbus & Cleveland Railroad will rebuild a four-span Howe truss bridge over the Little Hocking river. Total length, 504 ft. D. L. Roberts, President, Marietta, Ohio.

MARION.—Bids are wanted October 24 by L. N. Hipsher, County Auditor, for building a bridge with a steel superstructure over the Scioto river at the site known as Newman bridge, to consist of one span 188 ft. long, to carry a single track, with a roadway of 16 ft.

NEW PHILADELPHIA.—The Board of County Commissioners, it is said, is considering the question of building two bridges.

OSBORNE.—Bids will be asked by the County Commissioners of Clark and Green Counties, for putting up a steel bridge 189 ft. long, over Mad river, to cost about $8,000. S. VanBird is County Supervisor, at Springfield, O.

PORT CLINTON.—The County Commissioners will build a steel bridge 225 ft. long, with a 16 ft. roadway, over Portage river, in Harris township. Henry Pafenbach is County Auditor.

PORTSMOUTH.—Plans have been completed by Engineer Platt for building a bridge for the joint account of Sylvania and Washington Townships. D. F. Davies, Jr., is County Auditor.

PORTSMOUTH JUNCTION.—The Norfolk & Western is considering the question of rebuilding the present bridge over the Scioto river at this place.

RAVENNA.—The Pennsylvania will build a bridge between this place and Kent.

READING.—The County Commissioners will replace the old two-stone arch at Douglassville, in Amity Township, Berks County, built in 1797, with a new iron bridge.

SALEM.—The Salem & Eastern Railway will build a bridge 110 ft. long over the Pennsylvania tracks, also a trestle about 800 ft. long.

SPRINGFIELD.—The Board of Public Service adopted a resolution requesting the City Council to provide funds for building a new bridge over Buck creek on Water street, to replace the former structure.

——Plans reported being made for building a viaduct across the Cleveland, Cincinnati, Chicago & St. Louis tracks at South Limestone street, to cost about $250,000.

——The Board of Public Service has under consideration the question of building a new bridge, to consist of two 80-ft. concrete steel arches, to cost $27,500, at the intersection of Sherman avenue and Nelson street. No funds have been provided. W. H. Sieverling is City Engineer.

STEUBENVILLE.—A bridge is proposed over the Ohio river, to cost about $80,000.

TIFFIN.—The County Commissioners will let contracts during the present year for some bridge work in Seneca County, to include a bridge 200 ft. long. C. J. Peters is County Surveyor.

TIPTON.—The County Commissioners have under consideration the question of building an iron bridge over the Sandusky river, at a cost of $10,000.

TOLEDO.—City Engineer Consaul has filed a partial report estimating the cost of a Y bridge at Cherry street at $30,000. A straight bridge 82 ft. wide, with a draw, will cost $525,000, and the removal of the present old Cherry Street bridge to Ash and Consaul streets will cost an additional $200,000. The consent of the War Department will have to be obtained as to the form of bridge to be constructed.

URBANA.—Champaign and Clark County Commissioners have decided to jointly build two bridges. S. S. Twitchell is a member of the Clark County Board.

WARREN.—Bids will be asked by D. J. Tinney, County Commissioner, at Niles, O., for building an iron bridge in Trumbull County. H. C. White is County Surveyor.

WILLOUGHBY.—The Lake Shore & Michigan Southern, it is reported, will build a concrete arch 153 ft. long and 55 ft. wide over the stream here.

YOUNGSTOWN.—The Pittsburg & Lake Erie will build a foot bridge over its tracks, 878 ft. long, to reach the Youngstown Sheet and Tube Works in East Youngstown. F. M. Lillie is City Engineer.

——Petition has been made for an overhead bridge at the foot of Elm street.

——Plans are reported being made by the City Engineer for an overhead bridge at Ardale street.

——A viaduct is proposed, to be 1,500 ft. long, to replace the present Credit Mobelier bridge, to cost about $110,000.

——Residents of this place are agitating the question of putting up three bridges; one at Elm street, one at Belmont avenue, and the other on the east side of Wick avenue. The Belmont avenue bridge is to be 725 ft. long, including approaches, which will be 95 ft. wide at the Federal street end.

——A bridge is proposed to be built from Federal street to Belmont avenue.

OKLAHOMA TERRITORY.

ANADARKO.—Three new bridges are to be built over the Washita river near this place.

EL RENO.—The Chicago, Rock Island & Pacific has under consideration the question of building a new iron bridge over the Canadian river near this place.

GUTHRIE.—The County Commissioners are having surveys made for building a new bridge 35 ft. wide over the Cimarron river.

——Plans have been made for building a viaduct over the Santa Fe tracks from Noble avenue, Guthrie, to Sixth street, West Guthrie. The cost of the work will be about $150,000. Work has not been started, as the necessary funds are not available.

KINGFISHER.—Kingfisher County may build about 18 new bridges.

LAWTON.—Contracts are to be let by Charles E. Gordon, Chief of the United States Geological Survey, with headquarters at this place, for building about 30 steel bridges in Comanche County.

NEWKIRK.—A number of steel bridges are to be built in Kay County. H. B. Davis is Deputy County Clerk.

OKLAHOMA CITY.—The County Commissioners have decided to build a new steel bridge 100 ft. long over the Canadian river at the foot of Robinson street.

Plans are being made by City Engineer Burke for stone or steel approaches to the Choctaw viaduct on Walnut street, to cost about $15,000.

UNION.—The Chicago, Rock Island & Pacific, it is reported, will build a steel bridge over the South Canadian river here.

WEATHERFORD.—The Colorado, Oklahoma & Southeastern will build a trestle 3,500 ft. long over the South Canadian river on the line of its proposed road between this place and Woodward, at a point near Putnam.

OREGON.

Bills were introduced on December 6 in both Houses of Congress, authorizing the Portland & Seattle Railway to build a bridge over the Columbia.

A bill was introduced in the U. S. Senate authorizing the Portland, Nehalem & Tillamook Ry. Co. to build a bridge over the lower Willamette river in Oregon, above Elk Rock.

HILLSBORO.—Contracts have been let to Wakefield & Jacobsen for building four bridges on the line of the Portland, Nehalem & Tillamook.

PENDLETON.—A bridge 18 ft. wide, with a central span of 120 ft., and approaches of 50 ft., is proposed to be built over the Nolin river.

PORTLAND.—Plans are being made for rebuilding the bridge on Grand avenue; also for the one on Williams avenue.

——The steel bridge over Union avenue is to have a total length of 420 ft. to consist of two Warren trusses, each 120 ft., and plate girders, to cost $55,000; and the one at Grand avenue, a total length of 360 ft., to consist of one Warren truss of 150 ft. and plate girders, to cost $45,000. W. C. Elliott is City Engineer.

——The Northern Pacific has given an order for 20,000 tons of steel for its bridges to be built over the Columbia and Willamette rivers. It is planning to have both bridges completed by 1907. The plans for the bridge over the Columbia river and slough call for 17 spans with a total length of 3,540 ft., with six 265 ft. spans over the Columbia slough and nine 169 ft. spans over the Columbia river on the Washington side, with a river draw 465 ft. long. This bridge and the one to span the Willamette will cost $3,000,000. Both bridges will carry two tracks. The Willamette bridge will have 21 concrete or stone piers.

——The Northern Pacific Terminal Co. has decided to build a system of elevated streets over the railroad tracks of the terminal yards at a cost of over $200,000. From Seventh street, near Kearney, a structure will be built gradually rising until it reaches Northrup, where it will intersect a similar structure extending over that street. At this point it will be 22 ft. above the tracks. One branch will follow Seventh street toward the river, descending gradually to the Albina ferry. The Northrup street structure will extend over the terminal company's tracks and gradually descend on Front street. The total length of the viaducts will be 1,600 ft.

ST. JOHNS.—The Northern Pacific is reported making surveys for building a bridge about 180 ft. above the surface of Willamette river on its new line into this place.

SPRINGFIELD.—The Southern Pacific is planning to build a bridge over the Willamette at this place.

UMATILLA.—A bridge may be built over the Umatilla river near this place.

PENNSYLVANIA.

——A bill was introduced in the House of Representatives December 19, authorizing the Fayette Bridge Company to build a bridge over the Monongahela river from a point in the Borough of Brownsville, Fayette County, to a point in the Borough of West Brownsville, Washington County, Pennsylvania.

——Both Houses of Congress have passed a bill extending the time for beginning construction of the bridge across the Monongahela river by the Counties of Washington and Westmoreland, Pa.

ALLENTOWN.—The Northampton County Commissioners have instructed County Engineer Cooper to prepare plans for a new bridge to be built over the Saucon creek at Shimersville.

ALLEGHENY.—The Wabash, it is reported, will build a bridge over the Allegheny river at this place, to cost $1,000,000.

——The Council Committee on the Tilghman Street bridge reports that the County Commissioners agree to pay $24,000 toward the cost, and the Lehigh Valley and the Allentown Terminal Railroad Co., $18,200.

BETHLEHEM.—The Bethlehem Street Bridge Company has been chartered at Harrisburg, Pa., to build a bridge to connect Bethlehem with South Bethlehem.

BLOOMSBURG.—The viewers on the proposed State bridge at Mifflinville have decided to report favorably on an overgrade crossing of the tracks of the Pennsylvania Railroad. The bridge will be 1,421 ft. long, 125 ft. of which is made necessary by the overgrade crossing. It will have a 24 ft. roadway and 6 ft. walk.

BOWMANSVILLE.—The Philadelphia & Reading, it is said, will build four large steel bridges in connection with its double track improvements on the line of its road in York and Cumberland counties.

CARLISLE.—The County Commissioners will build a bridge over Conodoguinet creek.

CHARLEROI.—The Mercantile Bridge Co., of this place, will build a bridge from North Charleroi to Monessen over the Monongahela river. The plans call for the building of four piers and for a bridge 36 ft. wide, to carry two tracks. It is to be a combined street railroad and highway bridge.

COLUMBIA.—The Borough Council has requested the Pennsylvania to make a number of improvements at this place, including the building of bridges at Bridge and at Union streets; also subways at Walnut and Locust streets.

DARBY.—An ordinance, it is said, has been introduced in the council for building a bridge at 58th street for the Baltimore & Washington Railroad Co.

ERIE.—The Grand Jury has been petitioned by residents of Greene and Harbor Creek townships to build an iron bridge 350 ft. long over Four Mile creek at Kane.

FAYETTEVILLE.—The Chambersburg & Gettysburg Electric Railway is planning to build a bridge over the Cumberland Valley tracks at West Fayetteville, to cost $10,000.

GLENOLDEN.—The City Council has passed an ordinance for the new Philadelphia, Baltimore & Washington bridge.

GREENSBURG.—The Jeanette, West Haven & Monongahela Street Railway Co., it is reported, will put up a steel bridge 600 ft. long over Big Sewickley creek.

HARRISBURG.—Funds amounting to $200,000 have been voted for, and is now available, for the rebuilding of the Mulberry street overhead bridge. The structure will probably be 1,500 ft. long, and will be built under the direction of the Board of Public Works.

The Pennsylvania proposes to build a bridge 800 ft. long and 45 ft. wide over the tracks at Greenwalt's crossing.

The Steelton & New Cumberland Bridge Co., incorporated some time ago, with a capital of $300,000, to build a steel bridge 4,500 ft. long over the Susquehanna river at Steelton, has not done anything as yet toward building this structure.

——Permission will shortly be asked for from the city by the Philadelphia & Reading, to build overhead bridges at Cameron, Hemlock and some other streets. M. B. Cowden is City Engineer.

The State Board of Public Grounds and Buildings will build a steel bridge over Penn's Creek, one mile north of Sellinsgrove.

——The court has approved the report of viewers recommending the building of bridges by the state over the Catawissa in Columbia County at the following places: Breisch's, $13,500; Catawissa, $20,000; Shermantown, $20,000, and Packer Mill, $25,000.

HATBORO.—The County Commissioners have decided to build a three-arch stone bridge over a branch of the Pennypack Creek, on Moreland avenue.

HUNTINGTON.—Blair and Huntington Counties will jointly build a bridge over the Juniata river in Tyrone Township.

KENSINGTON.—The Pennsylvania, it is said, is planning to abolish seven grade crossings between Front street and Frankford Junction, the work to cost about $1,500,000.

LANCASTER.—The building of an overhead bridge in the Twelfth ward is projected. Lee Masterton is City Engineer.

——The Lancaster & Eastern, which is building an electric line from Lancaster to Christiana, via Gap, will build bridges over Conestoga creek near Witmer's, and just east of Leaman Place.

LEWISBURG.—The Commissioners of Northumberland County have been directed by the County Judge to build the bridge over the Susquehanna river, between this place and Chillisquaqua Township. The building of this bridge has been under consideration for a long time. The work will cost about $100,000.

McKEESPORT.—A resolution has been passed authorizing the City Engineer to make plans for building an overhead bridge at Poplar street.

——A combined highway and electric railroad bridge is to be built over the Youghiogheny river at Thirteenth avenue. Former Mayor Robert R. Caruthers is said to be interested.

MANCHESTER.—A bridge is proposed to be built over the Ohio river connecting this place with Esplen.

MIFFLINVILLE.—Bids will soon be asked for new State Street bridge at this place, to cost about $45,000.

MILLHALL.—Viewers recommend the building of an iron bridge 120 ft. long, with 18-ft. roadway, over Fishing creek.

MILTON.—The Grand Jury recommends the building of a bridge over Brier creek in Washington Township.

MORAVIA.—A new bridge is to be built by the state at this place, to cost about $25,000.

MOUNT AIRY.—A bridge is proposed between this place and Roxborough over the Wissahickon at Allen's lane, to replace a former structure.

NEWCASTLE.—A bridge is proposed over the Neshannock creek to connect Cunningham and Water streets.

NEWPORT.—The Pennsylvania Railroad Co. will build an iron bridge over the river at this point, replacing a covered structure.

NORRISTOWN.—The Board of City Surveys has approved the ordinance for building two bridges, one over the Reading Railway at Gravers Lane, Chestnut Hill, and the other at Erie avenue.

PAISLEY.—The bridge to be built over the Monongahela river at McCann's Ferry by the Union-

NATHANIEL HAVEN, PRESIDENT H. D. BUSH, MANAGER

BALTIMORE BRIDGE COMPANY

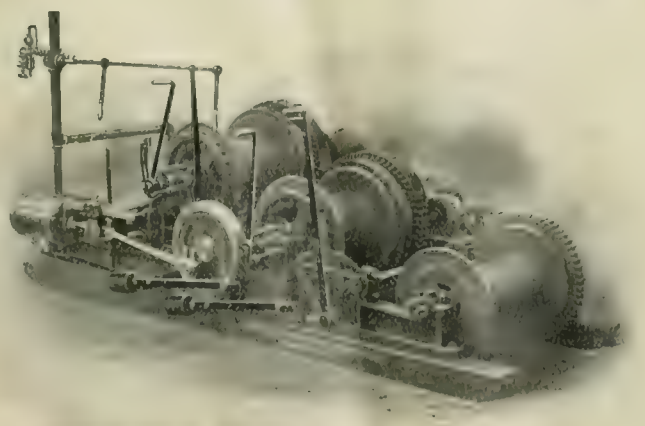
Steel Bridges and Buildings and Structural Work Generally



Spillway Bridge, New Croton Dam, 200 ft. Clear Span. Built by Baltimore Bridge Company, 1905.

GENERAL OFFICES AND WORKS: Bush St., and B. & O. R. R., Baltimore, Md.
NEW YORK OFFICE: 128 Broadway

LAMBERT



Standard Contractors' Hoist with Lambert Patent Swinging Gear

Steam and Electric Hoisting Engines and Cableways

Are strictly up-to-date and Built for Business and Adapted for

Bridge Building, Pile Driving, General Contractors, Hod Hoisting, Mining, Quarrying and other Hoisting and Conveying Purposes

LOG SKIDDERS AND LOADERS
FOR PINE, CYPRESS and HARDWOODS

Steel and Wood Derricks and Derrick Fittings

Send for Catalog No. 50

Lambert Hoisting Engine Co.

Main Office and Works, 115-121 Poinier St., Newark, N. J.
85 Liberty Street, New York City

Boston Philadelphia Baltimore Allegheny Cleveland
Chicago St. Louis Atlanta New Orleans

town & Wheeling Short Line will be a double deck structure somewhat similar to the Allegheny River bridge at Tenth street, Pittsburg. The upper deck will be used for a steam railroad and will carry [illegible] The lower deck will carry two tracks for the electric road and will also accommodate the highway traffic. The length of the structure will be between 1,500 and [illegible] The channel span will be 125 [illegible] above the river.

PHILADELPHIA.—Plans are being made, and an ordinance has been introduced to appropriate $50,000 for [illegible] Twenty-fifth street from Diamond street northward, the work includes the building of a railroad bridge, to cost, together with the land damages, about $100,000.

Preliminary work has been started on the concrete bridge over the Wissahickon creek and ravine at Walnut Lane. The plans call for a structure with a central arch of 225 ft., 60 ft. wide and 120 ft. high, with approaches of 45 ft. at each end. The cost of the structure will be about $200,000.

Plans have been completed by the Bureau of Surveys for a new bridge on the line of Allegheny avenue to carry eight tracks of the New York branch of the Pennsylvania over the main thoroughfare.

——The Board of Surveyors is considering the question of building bridges over the Chestnut Hill branch of the Reading Railway; also over the Reading's Port Richmond branch.

——The Philadelphia, Baltimore & Washington will build a new bridge in the vicinity of Paschalville, near Woodland avenue, to replace the present structure.

——The following bridges may be built.

Over the Schuylkill river at Passyunk avenue.

—At Allen's lane, over the Wissahickon creek.

—Wyoming avenue to the Spring Garden Street bridge.

——Front street, over the connecting railroad.

—Large street, under the Frankford branch of the Philadelphia & Reading.

——Montgomery avenue, near the connecting railroad.

——Cresson street, over Midvale avenue.

——Willow Grove avenue, over Germantown avenue.

——Bellefield avenue, under the Tabor branch of the Philadelphia & Reading.

PITTSBURG.—Plans are being made for building a steel bridge over the Ohio river at Legionville Station, about 25 miles south of Pittsburg. A charter will be applied for by the Hopewell & Harmony Bridge Co., to build this structure. William D. Evans, of Pittsburg, represents the company.

——Press reports state that the Pittsburg & Lake Erie is negotiating for a charter to build a bridge over the Monongahela at Lock No. 4, between Charleroi and Monessen.

——The Select Council has passed an ordinance providing for the building of a bridge at Washington avenue and Sedgewick street crossing of the Pittsburg, Fort Wayne & Chicago.

——The Pittsburg Union bridge is to be reconstructed and raised to a height of 70 ft. over the Allegheny river. The bridge is now only 40 ft. over the water line. The change has been ordered by the Secretary of War.

PITTSTON.—The Warwick Iron & Steel Co. will build a steel bridge 600 ft. long on concrete piers over the Schuylkill river.

ST. CLAIR.—The Schuylkill Electric Railroad Co. will build an overhead bridge 100 ft. long and 25 ft. wide over the Philadelphia & Reading tracks.

SARATOGA.—The County Commissioners are selecting the site for the 400 ft. bridge to be built over the Schuylkill river, between this place and Frick's Locks.

SCRANTON.—The Grand Jury is considering a petition for the building of bridges over Aylesworth creek and over Rushbrook, in Mayfield borough, also over the Lehigh river in Clinton Township.

——Four important bridges have been pronounced unsafe by an expert appointed to examine them. They are situated at Green Ridge, Elm, Lackawanna and Scranton, streets. It is recommended that new bridges be built at Scranton and Elm streets.

——Plans are being made for building a viaduct from Providence road to Mifflin avenue and Mulberry street, to be 865 ft. long and 54 ft. wide, to cost about $120,000.

——The City and the Scranton Railroad Co. are planning to jointly build a bridge over the tracks and the Lackawanna river at the foot of Mulberry street.

The Delaware, Lackawanna & Western will use steel girder construction for rebuilding the Lackawanna river bridge near Bridge street. Contract was let last year. The company will do the masonry work with its own forces.

Plans are being made by the Lackawanna Bridge Co., to build a bridge over the Lackawanna river at this place.

SHAMOKIN.—Petition has been made to the County Commissioners to build a bridge over Shamokin creek at Arch street.

The Board of County Commissioners has to build a new bridge at Market street.

A bridge is proposed to be built over Carbon Run Creek in Coal Township.

SOUTH BETHLEHEM.—A county bridge 48 ft. long and 50 ft. wide is to be built over Northampton creek.

SHELTON.—A plan, it is reported, is under way to build a steel bridge over the Susquehanna river between this place and New Cumberland.

SUNBURY.—The Sunbury Bridge Co. which has been chartered to build a bridge over the Susquehanna river from a point near this place to Shamokin Dam, in Snyder County, at a cost of $175,000, will jointly build a bridge to carry electric cars with the Sunbury & Selinsgrove Electric Railway Co. George W. Delo, of York, Pa., is interested.

SWISSVALE.—An ordinance has been passed for building two crossings to pass under the Pennsylvania tracks; also for two bridge crossings over the same tracks, to cost about $180,000.

WILKESBARRE.—No definite action has yet been taken toward building two bridges, one of which is to be a highway bridge between the tracks at North Wilkesbarre and the east end, at a cost of about $80,000; the other is to be a foot bridge over the tracks of the Lehigh Valley and Central Railroad tracks on East Market street.

Work may soon be commenced on the new Berwick-Nescopeck bridge connecting the counties of Columbia and Luzerne.

The Grand Jury has favorably reported on the question of building 50 small bridges costing from $100 to $2,000 each, and aggregating about $20,000.

——The Lackawanna & Wyoming Valley will build a bridge over the Susquehanna river between West Pittston and Duryea; also between Plymouth and Nanticoke on the new extension of its road.

——The Common Council has passed a $400,000 municipal loan ordinance, which provides for an item of $25,000 for building a bridge over the railroad tracks at Butler street.

——The Delaware & Hudson and the Jersey Central, it is said, have agreed to jointly build a bridge over the tracks between the east end and North Wilkesbarre.

WILLIAMSPORT.—The viewers report in favor of a plate girder bridge 42 ft. wide over Hagerman's Run at East Central avenue.

WOODBURY.—Viewers have been appointed to locate the site for a county bridge over Meadow Brook.

YARDLEY.—The high bridge over the Philadelphia & Reading across the Delaware at this place, it is reported, is to be superseded by a four track stone arch bridge.

YORK.—York and Lancaster capitalists, it is reported will build a bridge over the Susquehanna river at this place.

——The Northern Central is planning to build a steel bridge over Codorus creek.

——The York Street Railway Co. will build a subway 360 ft. long, 30 ft. wide, and 13 ft. high, under the Northern Central tracks at Richland avenue.

YORK FURNACE.—The Standard Oil Co., it is reported, will spend about $100,000 in building the proposed bridge over the Susquehanna river at this place, on condition that it is permitted to run a pipe line over the structure.

RHODE ISLAND.

NEWPORT.—The Government will spend $40,000 in deepening and widening the channel, and the state will spend an additional $100,000 in building a new lift drawbridge, with a span of about 100 ft. at Howland's Ferry. William H. Lawton is City Engineer.

PROVIDENCE.—Reports state that plans are being made for building a new bridge over Providence river at Point street to replace the present structure, which is 25 ft. wide, consisting of two shore spans of 140 ft. each and a draw 250 ft.

——The city and the New York, New Haven & Hartford are jointly building the Arthur Avenue bridge to eliminate grade crossings at Acorn, Grove and Dyke streets. The plans made by the City Engineer call for the building by the railroad of a steel bridge over the tracks from a point near the junction of Arthur avenue and Dean street to Harris avenue, at a cost of about $150,000. This part of the work is practically completed. The approaches with retaining walls of about 1,000 ft., to be built by the city, are not yet completed.

—A resolution has been introduced in the City Council authorizing the building of an additional bridge over the Woonasquatucket river at Harrison avenue.

TIVERTON.—The General Assembly has passed an act appropriating $170,000 for the bridge at Tiverton, to replace the present stone bridge.

WOONSOCKET.—Petition is being made for an appropriation of $11,000 for rebuilding Arnold Street bridge. John J. Mee, Alderman, may be addressed.

SOUTH CAROLINA.

CHARLESTON.—The Southern Railway is reported making surveys to locate the site for a new steel bridge to be built over the Hiwassee river.

ST. GEORGE.—Plans have been completed for building a bridge over Ashley river, in Dorchester county.

SOUTH DAKOTA.

ABERDEEN.—The County Commissioners, it is reported, have decided to erect ten bridges over various streams in Brown County. The largest will be a 300-ft. bridge over the James river.

CHAMBERLAIN.—Plans, it is reported, have been made by the Chicago, Milwaukee & St. Paul for building a bridge over the Missouri river, to be about 3,000 ft. long, at this place.

FAIRBURN.—Bids are wanted by the County Commissioners at Custer, April 3, for building a steel bridge 40 ft. long over French creek, in Custer County. W. A. Nevin is County Auditor.

MIDLAND.—The County Commissioners will build a bridge over Bad river. M. P. Kennedy is County Auditor, Ft. Pierre.

OACOMA.—An extension of time has been granted the Federal Railroad Co. for commencing the construction of the bridge over the Missouri river, to January 8, 1906, and for the completion of the bridge to January 8, 1908.

PIERRE.—Work will soon be commenced, it is said, on a new bridge over the Missouri river at this place by the Chicago & North Western.

OLIVET.—Bids are wanted April 3, by J. W. Wipf, County Auditor, for putting up a number of steel bridges in Hutchinson County, each from 40 ft. to 150 ft. long, over the James river.

YANKTON.—Both Houses of Congress passed the bill extending the time for commencing construction of a bridge across the Missouri river by the Yankton, Norfolk & Southern Ry. Co. to March 9, 1907.

Both Houses of Congress have passed the bill extending the time for commencing and completing the bridge of the Winnipeg, Yankton & Gulf over the Missouri river at this place.

TENNESSEE.

Bills were introduced in the Lower House of Congress Feb. 12 authorizing the Cairo & Tennessee River R. R. Co. to build bridges across the Tennessee and Cumberland rivers.

The bill reviving and declaring in force a bill to authorize a bridge over the Tennessee river in Marion County, Tenn., the bridge to be commenced within one year and completed in three years from Jan. 1, 1905.

BENTON.—The County Clerk has decided to build six new bridges, one each at Conasarga, Ducktown and Reliance, and three near Benton, at a total cost of $40,000, on which work is to be commenced at once.

BEATH.—Bids will be asked this spring by W. C. Stewart, of Gallatin, Tenn., for putting up a steel bridge 125 ft. long in Sumner, Harris Brown is County Clerk, at Gallatin.

CARTHAGE.—A private stock company is being organized to build a steel bridge 500 ft. long over the Cumberland river to cost $50,000. Bids are to be asked for this month. L. A. Ligon is Mayor.

CHATTANOOGA.—Local reports state that the Central of Georgia will build steel bridges at this place, at Chickamauga, Big Talapoosa and Little Talapoosa and two a Rome, Ga.

——The Chattanooga Company Ltd., and others, are agitating the question of building a railroad bridge over the Tennessee river.

Plans are being made for a bridge to be built over the Belt Line tracks at Eleventh street, for which an appropriation of $12,000 has been made.

CLARKSVILLE.—A bill was introduced in the Lower House of Congress on Feb. 12 authorizing a bridge across the Cumberland river at or near this place.

CLARKSVILLE.—Plans are under way for building a bridge over the Cumberland river at Franklin street, to cost about $150,000.

KNOXVILLE.—The Atlanta, Knoxville & Northern will build a bridge over Little River on its proposed line between this place and Wetmore.

——Plans are being made for building a viaduct over the railroad tracks at Asylum avenue. The proposed structure will cost about $35,000 and will be similar to the Clinch Avenue viaduct now nearing completion, which cost $80,000.

MARION.—A bill has been offered in the Lower House of Congress to amend the act for the construction of a bridge over the Tennessee river at this place. The amendment provides that the act shall be void unless work is commenced by January 1, 1906, and completed within three years.

MARYVILLE.—A committee has been appointed to determine when bids shall be asked for building a bridge over Little river, near Rockford, in Blount County, Tenn. C. F. Broady can give information. Clay Cunningham is County Clerk.

MEMPHIS.—The Illinois Central has plans ready for building a viaduct over its track at McLemore avenue at a cost of about $60,000.

NASHVILLE.—A bridge is to be built by Davison County, in the City of Nashville, over the Cumberland river at Jefferson street. The proposition will be voted upon by the residents in August to issue $300,000 in bonds to secure funds to start work at once. The proposed structure will have a channel span of 300 ft. with shore spans each 200 ft. long, with a west approach 700 ft., and an east approach 600 ft. long, making a total length of 3,000 ft. The roadway is to be 30 ft. in the clear, with sidewalks 6 ft. each. The proposed structure will be of steel with a reinforced concrete floor. No provision has as yet been made to lay tracks on the bridge. The cost of the bridge will be about $250,000.

——Davison County is planning to build a second bridge similar to the above in the southern end of the city. A bill has been introduced in the Lower House of Congress authorizing these two bridges. William W. Southgate is City Engineer.

OATES ISLAND.—The Southern Railway, it is said, is planning to build a bridge over the Tennessee river at this place. The work will take about two years to complete.

PARIS.—Two large bridges between this place and the Louisville & Nashville station, carried away by heavy rains and floods, may be rebuilt.

ROCKFORD.—The Nashville & Maryville Electric Railway Company will soon ask bids for putting up a combined highway and street railroad bridge over Little river in Blount. J. T. Anderson is Deputy County Clerk, at Maryville, Tenn.

TEXAS.

—The bill authorizing the Jasper & Eastern Railway Co. to build and operate a railroad bridge over the Sabine river, in Texas and Louisiana, has been passed by both Houses of Congress.

AUSTIN.—The International & Great Northern is putting in a number of bridges along the line of its road, including a steel bridge at this place.

BEAUMONT.—The Texas & New Orleans and the city will jointly build a steel bridge over the railroad tracks, probably at Archer street, to cost about $30,000.

——The Southern Pacific is planning to build a viaduct over its tracks, to cost $50,000. The company agrees to put up the structure if the city will build the approaches.

BROWNSVILLE.—Announcement has been made that the St. Louis, Brownsville & Mexico will build a bridge over the Rio Grande river, connecting this place with Metamoras.

BURNET.—This county, it is said, has voted to build three steel bridges.

DALLAS.—The long bridge leading to Oak Cliff will be repaired, at a cost of $10,000.

According to reports, the Missouri, Kansas & Texas is planning to put in about 10 new steel bridges on its Dallas division.

SA E MONEY

. can save your Company

$25,0 .00 TO $100,000.00

or more in

ONE MINUTE



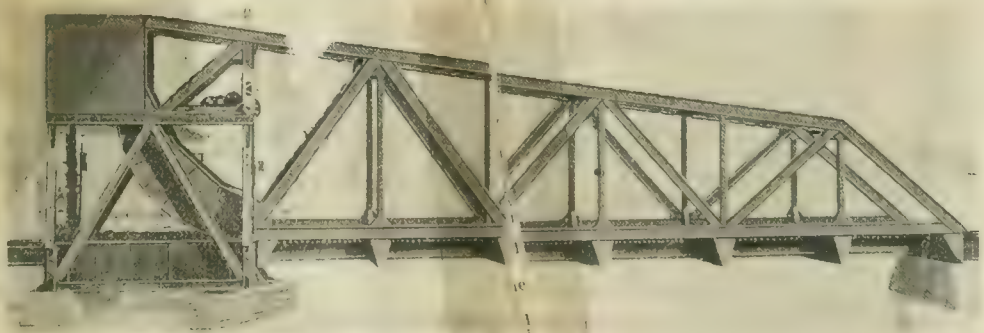
Highway and Electric Railway Scherzer Rolling Lift Bridge across Chicago River at State Street, Chicago, in the open position.

of your time when **deciding** upon the type of bridge your Company will build if you **decide** for the **MODERN, Scientific, Safe, Simple and Economical**

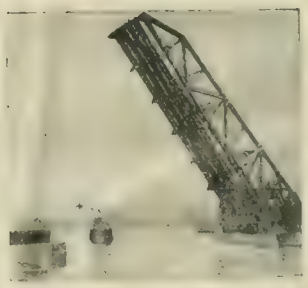


Six-Track Railroad Scherzer Rolling Lift Bridge across Fort Point Channel, Boston, for the N.Y., N.H. & H. R. R., in the open position.

SCHERZER ROLLING LIFT BRIDGE



Scherzer Rolling Lift Bridge over Cuyahoga Riv Cleveland, Ohio, for N. & S. S. Railway
160-foot Span, Single Track
Longest Simple Truss Span Bascu Bridge in the World
This Bridge is Being Duplicated for the Baltimore & Ohio Railroad at Cleveland



Double-Track Scherzer Rolling Lift Bridge, over Cuyahoga River, Cleveland, O., for N. & S. S. Ry., in partly open position.

More tha **70** center-pier

swing bridges have already been **superseded, discarded, scrapped,** and **replaced** by **modern SCHERZER ROLLING LIFT BRIDGES** for **Railroads, Electric Railways** and **Highways** in the United States and abro



Highway and Electric Railway Scherzer Rolling Lift Bridge across Chicago River at North Halsted Street, Chicago, in the closed position



Single Track Railroad Scherzer Rolling Lift Bridge across Cuyahoga River, Cuyahoga, O., for C., C., C. & St. L. Ry., in partly open position

HIGHEST AWARD, WOR IR, ST. LOUIS, 1904

Write us for Information. ches and Estimates

The Scherzer R ft Bridge Co.

Cable Address "Scherzer, Chicago"

MAIN OFFICES: MONA . U. S. A.

DENISON.—Plans are being made for building bridges on Burnett, Crockett, Houston and La... avenues; also at Nelson street.

EAGLE PASS.—The Galveston, Harrisburg & San Antonio, it is said, will at once rebuild its trestle bridge 750 ft. long, which was destroyed by fire last fall.

EL PASO.—The El Paso & Southwestern has decided to put up a new steel bridge over the San Pedro river.

HENRIETTA.—Bids are wanted March 19, by C. L. Kaufman, County Clerk, for building a steel bridge 240 ft. long over the Big Wichita river in Clay County, to cost about $5,400.

KINGSVILLE.—The St. Louis, Brownsville & Mexico will build a new bridge over the Arroyo Colorado.

MARLIN.—The Commissioners of Falls County have authorized the building of a steel bridge over Deer creek to replace a structure carried away by high water.

—Two iron bridges will be built over the Brazos river in Falls County.

SEQUIN.—An iron bridge will be built over the Guadalupe river at McQueeny.

SHERMAN.—An officer writes that the Houston & Texas Central will build, with its own forces, the following steel bridges, at an aggregate cost of $50,000, between the towns of Palmer and Trumbull, over Red Oak creek, 100 ft. long; one between Howe and Sherman over the east fork of Trinity river; one over Post Oak creek and one about 120 ft. long over Choctaw river.

TEMPLE.—The City Council is considering the question of building a viaduct to be built over the Santa Fe tracks on South First street. The cost of the work will be about $24,000.

UTAH.

OGDEN.—The Oregon Short Line is planning to build a viaduct over its tracks at this place.

VIRGINIA.

ALEXANDRIA.—The Board of Supervisors of Alexandria County and the Washington Southern may jointly build a viaduct 30 ft. wide and 640 ft. long over about 56 tracks.

APPALACHIA.—Bids will be asked by S. F. Porter, Chairman, at Wise, for putting up a small steel bridge in Wise County at the mouth of Powell's river. C. A. Johnson is Clerk, Wise, Va.

BRISTOL.—The Norfolk & Western may build bridges over its yard at Mary and Edmund streets.

CULPEPER.—A steel bridge 224 ft. long over the Rapidan river between Culpeper and Spottsylvania Counties is to be built.

DANVILLE.—Residents have petitioned for a bridge over the Dan river, to cost about $30,000.

GILMERTON.—The Norfolk & Western may widen its bridge over the south branch of the Elizabeth river, and put in a new street draw, at a cost of about $90,000.

McKENNEY.—Bids are wanted by George R. Stone, at Ordsburg, for building an iron bridge 140 ft. long over the Nottoway river for the joint account of Brunswick and Dinwiddie counties.

MAIDEN.—The Chesapeake & Ohio, it is reported, will build a bridge over the James river at this place.

NORFOLK.—The Norfolk & Western plans have been approved by the Harbor Board permitting it to build two steel bridges over the Elizabeth river. The one over the southern branch is to be a drawbridge with an opening of 75 ft., with two tracks, to replace the present single-track structure, and the one over the eastern branch is to be a similar structure, also to have an opening of 75 ft., to replace the present structure, which has two 75 ft. openings.

—The War Department has granted the application of the Norfolk Viaduct Corporation for permission to build a cantilever electric car bridge over the Elizabeth river between this place and Berkley to be 175 ft. above low water and 600 ft. long. The cost of the work will be about $350,000.

RICHMOND.—The Joint Committee of the City Councils of Richmond and Manchester have taken measures to have a site selected for the proposed bridge over the James river. The cost of the new bridge will be about $377,000.

—The Richmond & Chesapeake Bay has been granted permission by the Board of Supervisors of Henrico County, to build a viaduct 2,900 ft. long over Oak, Bacon, Shield and Henrico streets.

ROANOKE.—The Tidewater Railroad will build a large number of bridges and a long trestle on its proposed road west from this place. The cost of the work will be about $650,000.

SCOTTSVILLE.—A steel bridge is proposed to be built over the James river here. The bridge will have four spans, each 150 ft. long, 16 ft. wide. J. P. Blair, Scottsville, is Clerk.

WASHINGTON.

—A bill has been introduced in both Houses of Congress authorizing and directing the Secretary of War to build a bridge across the Spokane river in the Gate of Washington.

BELLINGHAM.—Plans have been completed for building a drawbridge over Nooksack river. They will have to be approved by the Secretary of War. R. L. Kline is County Clerk.

KELSO.—A project is under foot to build a bridge 900 ft. long, with an 80 ft. draw, over Cowlitz river.

ASCO.—The Northern Pacific, local reports state, has decided to build a new steel bridge over the Columbia river to replace the present structure, and will also put up about 20 others on the Washington & Idaho division.

SEATTLE.—An ordinance it is said has been passed by the City Council for building the Alvarado street bridge.

? ? ? ? ? ? ? ?

SPOKANE.—The Spokane International will build two large bridges over the Spokane river with a total length of 1,000 ft. E. G. Taber is Chief Engineer.

A viaduct may be built over the tracks of the Oregon Railroad & Navigation Co. at Washington street.

Plans of the Northern Pacific for a new bridge over the subway at Washington street have been submitted to the Board of Public Works.

TACOMA.—The County Commissioners are considering a plan to replace the present bridge over Touchet river, with a 200 ft. bridge; also to build a bridge 500 ft. long over Walla Walla river.

VANCOUVER.—On December 13 both Houses of Congress passed a bill authorizing the Portland & Seattle to build a bridge over the Columbia river. Construction must commence within one year, and the bridge be completed in three years from the date of approval of the act.

WALLA WALLA.—Plans are ready for building the proposed bridge over Dry creek. L. W. Lochr is County Surveyor.

WENATCHEE.—The bill authorizing the Washington Bridge Company to build a bridge across the Columbia river, at or near Wenatchee, Wash., has been passed by both Houses of Congress.

A steel bridge will be built over the Columbia river at this place. Work is to be commenced as soon as material can be delivered. The Wenatchee Development Co. and the Wenatchee Canal Co. will furnish $100,000, and citizens of Wenatchee the remaining $20,000. The bridge will carry an inverted syphon connected with the present pipe line and ditch system. Water will be furnished for the irrigation of 20,000 acres of land on the east side of the Columbia.

The bill authorizing the Washington Bridge Company to build a bridge across the Columbia river, at or near Wenatchee, Wash., has passed by both houses of Congress.

WEST VIRGINIA.

CLARKSBURG.—The County Commissioners will build a steel bridge over West Fork river; cost about $11,000.

FAIRMONT.—A contract has been given by the Baltimore & Ohio to F. H. Clements & Co., of Philadelphia, for the stone work on the bridge which it is building over the Monongahela river at Hoult. The bridge, which is to replace the present structure, will cost, when completed, nearly $400,000.

GRAFTON.—Two bridges may be built over the Valley river. L. Kitzmiller is Clerk.

HOULT.—The Baltimore & Ohio, it is reported, is planning to build a bridge over the Monongahela river at this place.

HUNTINGTON.—The Chesapeake & Ohio, according to local reports, is planning to build a bridge over the Ohio river.

NOLAN.—The Lower House of Congress has passed a bill authorizing the Borderland Coal Co. to build a bridge over Tug Fork of Big Sandy river, about two miles east of this place, where the boundary line between West Virginia and Kentucky.

PARKERSBURG.—Bids are being asked by H. H. Shattuck, President of the Parkersburg, Marietta & Interurban Railway, for building an iron bridge 2,500 ft. long, to carry street car tracks over the Little Kanawha river. W. [illegible] out is County Clerk.

WHEELING.—A stone bridge over Wheeling creek is proposed.

WILLIAMSON.—A bill has been introduced in the Lower House of Congress authorizing William Smith and associates to bridge the Tug Fork of the Big Sandy river near this place, where it forms the boundary between West Virginia and Kentucky.

WISCONSIN.

CLEVELAND.—A bridge is proposed between this place and Arthur over the Chippewa river, to cost about $10,000.

CUSHING.—A bridge may be built over the Trade river in Polk County. James Peterson Cushing, Wis., can give information.

DARTFORD.—Bids will be asked by H. Janes for building a steel bridge over the outlet of Green lake.

EAGLE POINT.—The town has voted to bond itself for its share of the cost of a new bridge to be built jointly with the town of Anson, at a cost of about $7,500.

EAU CLAIRE.—The City Council will build a steel plate girder bridge at N. Barstow street, to cost about $25,000, or a steel concrete arch bridge, to cost about $30,000.

FOND DU LAC.—The Town Board will probably build a steel bridge over Fond du Lac river to replace the present wooden structure near Mihill's Corners.

GREEN BAY.—The city will probably build a bridge over the East river, to cost about $10,000.

LA CROSSE.—Plans are being made by the city authorities to build a steel bridge over the La Crosse river, to cost $30,000, also a steel viaduct on Rose street over railroad tracks.

It is reported that a bridge will be built across [illegible] at Hokah.

MANITOU.—[illegible] has authorized the [illegible] to put up a bascule bridge [illegible] plans which are being [illegible] structure call for [illegible] and 22 ft. roadway [illegible]

[illegible] foundations for a bridge [illegible] Green Bay extension of the [illegible] has been let to Adolph [illegible]

MEN[illegible] ... [illegible] ... [illegible] ... [

BINDING SECT. JUL 2 1980

TF
1
R2
v.40

Engin.

Railway age

ENGIN STORAGE
PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY